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Ebooks and reading comprehension: Perspectives of Librarians and Educators

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Academic libraries are currently questioning whether or not to invest in Kindles (or other mobile EBook readers, in this paper referred as "ereaders") to increase access to electronic books (EBooks). The decision making process is influenced by monthly subscription costs, limited resources for academic libraries, maintenance costs, and license agreements—as well as demand for online reference books and textbooks. While academic libraries decide how to increase access to EBooks, and where to build EBook collections, the focus on "convenience" often overrides a deeper conversation on how a fast, large-scale replacement of paper books with EBooks may affect student reading comprehension or retention of information. In addition, similarly to academic librarians' consideration of taking "diversity" into account when building subject collections, it is also necessary to take the "diversity" of reading styles and user behaviors into account when developing collections.

This paper will present a bibliographical overview of the literature on EBooks and short historical overview of EBooks. Therefore, the authors of the paper, an educator, a librarian and information specialist, intend to establish the foundation for a future research on the importance of EBooks for education, reading comprehension in particular.

Literature Review

Definition of Ebook

An EBook (also spelled Ebook, ebook, eBook, e-book, or e-Book) is electronic text (also known as etext or e-text) that is available in a digitally encoded format readable via an electronic device. Etext itself is a digital version of a published work such as a book. For this reason, the terms EBook and etext are sometimes used interchangeably. What distinguishes an EBook from etext, however, is that the Ebook exists in a specialized, often proprietary, file format that must be read using a particular program and/or electronic device. Etext, on the other hand, is distributed in ASCII (plain text). Etext also does not include hyperlinks, images, or audio, while an EBook can include all of those features.

Unlike etext, an EBook must be read using a particular program and/or an electronic device. Early EBooks were originally published in plain text format for ease of file storage and the ability

to read them as plain text documents. Plain text can also be incorporated into HTML files for web publishing. EBooks published as HTML files can be read using a web browser, but storage capacity is limited. As of June 2009, there are 28 different EBook file formats, most of which are proprietary. Proprietary file formats can only be read using specific software programs, with or without the use of a specific electronic device. For example, an EBook published in Portable Document Format (PDF) can be read or printed from any computer or electronic device that can run Adobe Acrobat Reader, which is a freely available application. Amazon Kindle Format (AZW), however, can only be read through a Kindle device. Currently there is no consensus among writers, software developers, hardware engineers, publishers, or vendors regarding a standard for packaging and selling EBooks. Thousands of classic works are available as free eBooks through public domain websites, but EBook versions of newer works must be purchased like traditional print books. Libraries that purchase EBooks also must comply with a license agreement, which requires them to pay an annual fee to continue making the EBook available to patrons.

The Emergence of Ebooks in Academic Libraries

NuvoMedia released the Rocket, the first hand-held EBook reader, in 1998. The Rocket revolutionized ereading by allowing EBooks to be downloaded from a PC into its system for mobile storage and access. It was the first handheld EBook reader that was reviewed by librarians interested in increasing the circulation of their first EBooks. Due to its cost ($499 for a Rocket Ebook reader in 1999), many librarians did not want to circulate an Ebook reader to the public. In 1999, EBooks were also priced much higher than traditional paper copies, and many libraries were highly selective about EBooks added to their collection.

In 1999, netLibrary was developed with the assistance of academic librarians in order to provide academic and reference books online for students and faculty. At the time, netLibrary could only be used with Knowledge Station software, downloaded onto a PC. The Knowledge Station software "develop[ed] mechanisms for controlling copying and printing of EBooks from both the Internet and Knowledge Workstation" (http://www.thejournal.com/magazine/vault/a2168.cfm). Many readers who prefer reading print cite such mechanisms that control copying and printing as deterrents to their EBook usage. To date, academic Ebook providers such as ebrary and SafariTech, as well as large academic publishers such as Sage, GaleCengage, and others that provide EBook platforms and collections, do not give users the ability to print or download their EBooks. These limitations cause students and faculty to question the use of an EBook that cannot be read anywhere other than a library PC.

EBook Usage in Academic Libraries

Although EBooks appeared on the academic library scene in 1999, few if any libraries had adopted Rocket EBook readers for general use. Typically, individual libraries analyze their own EBook usage statistics to further develop their EBook collections, and compare EBook usage to print circulation statistics. To date, there are no known libraries that have traced their EBook use statistics over the past ten years in which EBooks have been available. EBook companies and individual academic libraries have also conducted studies to find out which academic users would be most likely to use EBooks, as well as how those users employed EBooks for their research.

In 2008, Springer conducted a study on EBook usage. in five academic institutions in the United States, Europe, and Asia, academic library. According to the study, users primarily access EBooks for "research and study purposes.",The types of EBooks most frequently used in academic libraries are reference works and textbooks. According to the Springer study, users perceive the benefits of EBooks to be convenience, accessibility, and enhanced functionality. At the same time, users who prefer e-versions of reference books and textbooks for research prefer print books for the perceived "ease and enjoyability" of reading. When asked "What do you expect to happen with EBooks in 5 years time?" 53% of users surveyed responded "For some books I will prefer to read the print books, for others I prefer the Ebook" while 35% responded "I will mostly read print books", and a mere 7% stated that they would mostly read EBooks within five years' time (springer.com).

In the spring of 2008, ebrary surveyed 6,492 students on their EBook usage from nearly 400 colleges and universities from around the world. 50% of the students stated that they never used EBooks, and 30% stated that they use EBooks less than 1 hour per week. Of the students who stated that they never use EBooks, 60% said that they do not know where to find EBooks, and 45% stated that they preferred printed books. Other students who never use EBooks gave reasons such as "Ebooks have not been required by my professors as part of my program", "I have not had a need for ebooks", "I cannot print, annotate, highlight, or underline text in ebooks", "Ebooks are not portable", "I primarily use journals as a main source of information", and "I do not know how to use ebooks". Although some students indicated that lack of portability was a factor in their reluctance toward using EBooks, when asked to rank the importance of EBook features, 87% of students surveyed rated "Searching" as the most important feature for EBooks; 42% rated "Downloading to a handheld device" as most important. Students also indicated that it was very important to them for EBooks to be available in multiple formats, as well as have the ability to link to and search other databases and reference books.

In the United Kingdom, the Joint Information Systems Committee (JISC), a national e-books observatory project board and members of the Centre for Information Behavior and the Evaluation of Research (CIBER)e-team at University College constructed an online survey asking British university students and faculty about their academic usage of EBooks in 2008. The researchers collected data from 20,000 surveys, primarily focusing on students and faculty in Business, Engineering, Media, and Medicine. According to the survey results, 91.6% of users consulted EBooks "for work or study". When asked "How many EBooks have you used in the past month?" roughly half of students and faculty stated that they used one or two titles that month, with students being heavier EBook users than faculty. According to this study, regardless of level of education or gender, EBook usage decreased with age. Engineering students and faculty were the most likely to read EBooks; 43.3% responded that they consulted three or more titles in the past month for their research.

While EBooks appear to be popular research materials in the CIBER study, 87% of students surveyed indicated that they go to the physical library primarily to borrow books, and over 70% of students surveyed visit the physical library once a week. While the CIBER study did not gather data on whether or not students preferred EBooks to text, the number of surveyed students who borrow books and visit the physical library frequently show that print books are still valued by students. In the ebrary study, traditional print books were still perceived by students as "the most trustworthy resource for research".

As shown by data from the available surveys concerning the use of electronic readings in academic settings, patrons are aware of electronic readings. It becomes also visible that the usage and application of electronic readings will vary across disciplines, age groups, possibly through demographic factors, e.g., gender. It is also obvious that a comprehensive study and survey is needed to draw firm conclusions.

Popularity of EBooks in Different Academic Disciplines

Comparison studies have been conducted in regard to rates of EBook usage or perceived EBook "popularity" among faculty or students of different disciplines. Results from these studies have not always been consistent, for many reasons. First of all, course requirements for different majors in each college and university vary, as does the ability or desire of each institution to support those requirements. Second, each college and university has access to a different number of EBook collections. Usage of EBook collections will often vary depending on how well EBooks are advertised, whether through the library catalog or a link from a course management web page, and how usable the EBook platform, the e-reader, or the EBook itself is to the users.

Popularity of EBooks among college students and faculty varies according to the academic discipline to which they belong. Popularity of EBooks among academic disciplines may vary due to the nature of the discipline rather than the availability of EBooks themselves. Literature students, for example, may have access to free EBook classics through Project Gutenberg or other EBook collections, but many still prefer reading print books as they may experience discomfort reading an EBook from beginning to end on an electronic device (Rowlands & Nicholas, 2008). According to the CIBER study, students from disciplines that use books as ready reference resources may have a stronger preference for EBooks, especially if the EBook platform includes search capability (UCL: CIBER, 2008).

In the attempt to cut textbook costs and make them more accessible for students, Northwest Missouri State University almost became the first public university to provide e-textbooks in place of traditional print textbooks for all academic disciplines (Young, 2009). The university ran a pilot study using the Sony Reader, a Kindle-like device, which would be provided to students who wanted the convenience of reading from a mobile device. Students with Sony Readers quickly asked for their print textbooks back because they did not have sufficient experience or training with the Sony Readers to have a smooth reading experience. Students who chose to keep their Sony Readers had to troubleshoot the new technology in order to relearn how to annotate and highlight text, scan text, and open multiple windows at a time on the device. They also struggled with having to recharge the device every few hours, thus limiting its true mobility. During this pilot study, students and faculty discovered that for many disciplines EBooks were of less value than print books. For example, after using the e-textbooks for their courses, accounting students and faculty stated a preference for print textbooks due to the illegible pop-up versions of dense numerical charts that would be easier to read in print. Science or medical students who wanted to use their Sony Reader to study color illustrations also had a difficult time, as the Sony Reader only handled black and white.

It is possible that, in the near future, advancements in e-reader technology may improve the reading experience for students and faculty in all disciplines, thus increasing the popularity of EBooks over print, but at this time one style of EBook, e-platform, or mobile devices does not fit all.

Use of EBooks to Enhance Instruction

There is limited evidence yet to show that incorporating EBooks into instruction has greater pedagogical value than using traditional print books. Educators have stated that using EBooks familiarizes students with the technology that they will use as adults, and that reluctant readers are often more motivated to read from EBooks than traditional print books. Most of the literature dealing specifically with the pedagogical value of EBooks has addressed the K-12 student population.

In today's schools, K-12 teachers are being trained to integrate EBooks and hypermedia into language arts instruction in order to familiarize students with changing information resources and technology. According to some studies, K-12 teachers are adding EBooks to the curriculum in order to motivate emerging readers while promoting comprehension, literacy development, and personal "meaning making". Larson (2008) incorporated an Electronic Reading Workshop (ERW) into a Language Arts methods course to introduce pre-service teachers to EBooks, online discussion, and blogging. Larson found that pre-service teachers liked the simple downloading procedures, access, and convenience of storing EBooks on their computer hard drives. While the pre-service teachers found the technology behind EBooks easy to manipulate for the language arts projects geared toward middle school students, the teachers themselves did not actually enjoy reading the EBooks. Negative comments about EBooks included "reading on the computer often proved to be restricting and time consuming", "It was a struggle for me to sit at the computer and read the book without being on the Internet, and listening to music and the other 10 things I am usually doing while on the computer". All of the pre-service teachers also commented on the lack of a physical bond with an EBook.

Weber and Cavanaugh (2006) accentuate the convenience of having an EBook library available at the click of a mouse in order to provide new, challenging reading material on various subjects with difficult vocabulary and concepts for gifted readers. They make the claim that gifted readers "may lose sight of their schools as the place to find challenging books because they don't find and interact with appropriate materials". Not once do Weber and Cavanaugh mention public libraries in this article, or the fact that a great number of gifted students can also obtain special borrowing privileges at college libraries. Instead, Weber and Cavanaugh do not seem to know what is available in public libraries when, in justifying EBooks for gifted readers, they state: "For example, most libraries have the children's favorite The Wizard of Oz, but how many of the other books in the series are available?" The article also misinforms readers about text-to-speech capability for EBooks; they state that "Many of the eBook formats, such as MS Reader and Adobe Reader, for the desktop or laptop have text-to-speech capabilities". An EBook will only have this capability if the writer and publisher agree to it when their book is published in EBook form. They also state that "most eBook programs provide the ability to highlight text sections, and take notes". This is not the case for eBook programs provided by academic libraries, which may be the reason why some college students with dyslexia have complained about them. At the same time, Weber and Cavanaugh do mention that all students may benefit from reading a larger text size on the screen, which can easily be adjusted when reading an EBook.

Are EBook Users Really Reading?

CIBER as well as Springer studied patterns of user behavior in virtual libraries. They found that users often engage in "non-traditional" reading activities like "horizontal information seeking" and "power browsing". People who use EBooks or online journal articles tend to skim, bounce

from source to source, and hunt and peck for information. When CIBER asked survey respondents "How much of that e-book did you read online," 55% of users responded "I dipped in and out of several chapters" while only 19% responded "I read several whole chapters", and a mere 6% responded "I read the whole book". According to the CIBER study, users spend an average of only four minutes on a particular EBook site, "leading CIBER to conclude that in a virtual environment, users are not reading in the traditional sense".

Coiro (2009) proposes that Internet-based reading assignments require students not only to prove their comprehension of the text, but also to "generate appropriate search requests, sift through disparate sources to locate their own texts, synthesize the most reliable and relevant information within those texts, and respond with online communication tools such as e-mail message or blog post" (Coiro, p. 58). Coiro also stated that scores on some online reading tasks correlate weakly with scores on standardized tests of traditional reading comprehension skills.

Grimshaw, Dungworth, McKnight and Morris (2007) investigated the differences in children's reading comprehension and enjoyment of storybooks according to presentation medium. Using a total of 132 children as participants they had twenty fi ve children read a print version of an extract from The Magicians of Caprona, and twenty six children read an electronic version of the same passage. These 51 participants also had a dictionary available in the same medium as the text read. Findings showed no difference in children's' reading comprehension or enjoyment of reading based on the different mediums, however, children who read the electronic version of the text made significantly more use of the dictionary than those who read the print version. Another 81 children read an extract from The Little Prince in either an electronic format, an electronic format with narration, or a standard printed format with no dictionary provided. Results show that only the children who were in the electronic text plus narration group did significantly better in reading comprehension.

Current Challenges in Reading Ebooks

A survey of 1,818 staff and students at the University College London (Rowlands & Nicholas, 2008) showed that traditional print books were favored over EBooks for perceived ease of reading. Men rated the features and functionality of EBooks much more highly than women. Approximately 10% of students in this study had difficulty reading their EBooks from the screen, especially if they were dyslexic. Students who had trouble reading for long periods of time on the screen requested solutions such as changing the color of the background or the text, allowing for editing and printing texts, or adding a filter to their glasses to reduce brightness. An English major student reported that the predominant reason why they did not use EBooks was because they found the information "harder to absorb" from the screen, and that reading from a computer screen for long periods of time would cause migraines. Students with visual impairments, however, praised EBooks and did not report problems with them.

To increase reading comfort, the Kindle was given a flat screen without backlighting in order to reduce glare. Readers can also adjust font size on the Kindle. The flat screen without backlighting may also help to increase reading speed, as industrial psychologist Charles Bigelow had determined that people read 35% slower on computer monitors than they do from traditional print (Legge, 2007).

Diversity of Reading Behavior

In the CIBER study, of those who stated that they read the whole EBook, 50% were male. Men were also more likely to read at least a whole chapter online (36.5%) than women (30.0%). Evidence that men were more likely to read from a computer screen also appeared in a Chinese study on the e-reading preferences of college students; female students in all academic disciplines were more likely to print out electronic text to read than males (Liu & Huang, 2008). This gender difference in EBook usage and preference appeared in all age groups and all disciplines. As more colleges and universities are making the commitment to address and embrace diversity on their campuses, and academic libraries are addressing the needs of increasingly diverse student populations, more research would be necessary to justify how to address the diversity of reading behavior in academic library collections.

Historical Background of the EBook and EBook Reader

A Brief History of the EBook

In 1968, computer scientist Alan Kay met Seymour Papert, inventor of the Logo programming language designed to teach children problem solving and critical thinking skills. This collaboration led Kay to study the work of Piaget, Bruner, and Vygotsky, as well as the theory of Constructionist Learning which proposes that learning happens most effectively when people are actively making things in the real world. During his exploration into educational theory, Alan Kay first developed the idea for "a book-sized computer that the user, especially children, could use in place of paper." By 1972, Kay's engineers developed the Dynabook, "a personal computer for children of all ages" and the precursor for a laptop computer or tablet PC. The Dynabook had a long battery life, and was invented to give children access to digital media.

While Alan Kay dreamed of the ideal digital media teaching tool, University of Illinois student Michael Hart was given a user account for the university computer system. Aware that the account was connected to a network (the precursor to the Internet), Hart chose to use his computer time for information distribution. Hart typed the text of the Declaration of Independence into a teletype machine but could not transmit it via email without crashing the system. Instead Hart had to upload the entire text file to the server where people could download the file individually. Thus, on July 4, 1971, Project Gutenberg was born. Since that Independence Day, Hart has uploaded thousands of classics to Project Gutenberg, making them available for free to the entire world. The mission statements for Project Gutenberg included "Encourage the Creation and Distribution of eBooks", "Help Break Down the Bars of Ignorance and Illiteracy", and "Give As Many eBooks to As Many People As Possible".

The first EBooks were etext and hypertext versions of short stories, novels, and classic literary works. None of the early EBook publishers had released figures on how many EBook versions of their publications were viewed or sold over time, so little record exists of the popularity of EBooks from the late 1980s through early 1990s. In 1987, Microsoft released the first EBooks to appear on CD-ROM. Microsoft Bookshelf, a collection of ten electronic reference books including The American Heritage Dictionary of the English Language, The Original Roget's Thesaurus of English Words and Phrases, The Chicago Manual of Style, and Business Information Sources, demonstrated the great storage capacity of CDROM technology. The CDROM electronic book files could be accessed using any one of thirteen different word processor programs. Originally DOS-based, the Ebooks on Microsoft Bookshelf were converted to Windows compatible editions

in 1992. By 2000, The Concise Columbia Encyclopedia, the Hammond Intermediate World Atlas, and The People's Chronology, and the Encarta Suite were added to the package. In the same year, Bookshelf was completely replaced by the Encarta Suite, still available today on CDROM, DVDROM, or annual Internet subscription. EBooks on CDROM or ROM cards began to lose popularity as operating systems advanced faster than software upgrades, and as more people gained access to the Internet.

In 1985, Aldus Corporation (named after the 15th century Venetian printer Aldus Manutius) invented PageMaker, the software that built the desktop publishing industry. In 1994, Aldus merged with Adobe to develop Adobe InDesign, a major competitor with QuarkXPress. PageMaker, QuarkXPress, and InDesign are all used for the production of print and e-books. Due to its popularity and the increasing functionality of web pages, by 1994 the format in which most EBooks were published changed from plain text to HTML. EBooks were first made available on floppy disks, web sites, or special ROM cards to insert in an electronic reading device.

Since Alan Kay's Dynabook concept, development of an EBook reader did not progress until 1990, when Serendipity Systems founder John Galuskza created the EBook display system called PC-Book which featured numbered pages and bookmarks. In 1991, Sony unveiled the Sony Bookman, which could play full-length audio CDs and CDROMs. Franklin bought the Bookman from Sony and continues to market various hand-held products, primarily translators and electronic reference collections stored on tiny ROM cards, based on that model.

Only in the mid-1990s, however, did the evolution of EBooks and e-reading accelerate. In 1993, BiblioBytes became the first Internet-based financial exchange system to buy and sell EBooks over the Internet. Today BiblioBytes is considered the oldest commercial e-publisher. In 1995, Sony unveiled the first plasma, a flat screen monitor for computers. This helped reduce glare and began to make text on a screen mirror text on a page. After the release of the first mass-marketed hand-held computer called the Palm Pilot in 1997, NuvoMedia released the Rocket, the first hand-held EBook reader, in 1998.

The Emergence of Ebooks in Academic Libraries

NuvoMedia released the Rocket, the first hand-held EBook reader, in 1998. The Rocket revolutionized ereading by allowing EBooks to be downloaded from a PC into its system for mobile storage and access. It was the first handheld EBook reader that was reviewed by librarians interested in increasing the circulation of their first EBooks. Due to its cost ($499 for a Rocket Ebook reader in 1999), many librarians did not want to circulate an Ebook reader to the public. In 1999, EBooks were also priced much higher than traditional paper copies, and many libraries were highly selective of the EBooks that they would add to their collection.

In 1999, netLibrary was developed with the assistance of academic librarians in order to provide academic and reference books online for students and faculty. At the time, netLibrary could only be used with Knowledge Station software, which would be downloaded to a PC. The Knowledge Station software "develop[ed] mechanisms for controlling copying and printing of EBooks from both the Internet and Knowledge Workstation" (http://www.thejournal.com/magazine/vault/a2168.cfm). For many readers who prefer reading print, this was often a deterrent for their EBook usage. Other academic EBook providers such as ebrary and SafariTech, as well as large academic publishers such as Sage, GaleCengage, and

others that provide EBook platforms and collections, still do not give users the ability to print or download their Ebooks. Today's students and faculty often ask, what is the good of an EBook if it cannot be read anywhere other than the library PC?

The Amazon Kindle and similar ereaders

In 1995, when the federal government made the Internet available to the general public, young entrepreneur Jeff Bezos moved his start-up bookstore Amazon online. In no time Amazon.com became a megastore; the convenience of purchasing a book online caused the gradual demise of local bookstores in the United States. As EBooks became more accessible to libraries and library patrons at the turn of the century, Amazon.com decided to sell EBooks to individual consumers through its website as well. In 2001, Amazon.com sold its first EBooks online, and provided free Adobe Acrobat eBook reader downloads for free. In 2005, Amazon also began selling short stories as e-texts in HTML, PDF, or plain text email, dramatically reducing publishing costs. In the same year, Amazon purchased Mobipocket, a French EBook company. Mobipocket created a proprietary EBook format which would prohibit ereaders from competing companies to download them. Amazon capitalized on this EBook format by launching its own light, portable ereader, the Kindle, in 2007. Unlike other ereaders at the time, the Kindle had its own wireless network ("Whispernet") to access online newspapers, magazines, Amazon itself (to purchase more EBooks), and Wikipedia. It also has a battery with a long life, as well as an E Ink screen that made it easier to read for long periods of time, as well as in bright sunlight. With ebestsellers generally costing $9.99 per book, many leisure readers opted for a Kindle, even at the steep initial price of $399. Readers interested in accessing magazines, newspapers, and blogs through the Kindle must pay subscription prices that range from 99 cents per month for a blog to $14.99 per month for an international magazine. It also has a text-to-speech feature which allows users to listen to Ebooks if the author and publisher allowed that feature to be added to their work. In 2009 the Amazon Kindle (as of June 2009, upgraded to Kindle 2 and Kindle DX) became the most popular mobile ebook reader on the market.

Parallel to Kindle, several other companies (Sony, iRex, Barnes & Noble, etc.) are entering forcefully the market of ereaders, which contributes to an accelerated acceptance and use. At this moment, these devices are capable of "acquiring, storing, reading, and annotating digital books," and logistics, such as battery life, portability, wi-fi connection, etc. improve (Horizon report, 2010, p,6).. According to the just released Horizon report, the new generation of ereaders promises to "reduce costs, save students from carrying pounds of textbooks, and contribute to the environmental efforts of paperconscious campuses" and according to the same report, it is a matter of 2-3 years for their adoption (Horizon report, 2010, p. 17).

Conclusions

Based on the historical background and development of ebooks, as well as the social changes accompanying wide acceptance of electronic media and devices, as well as the bibliographical review, the authors of this article can safely conclude that further detailed study of the habits and perceptions of students toward EBooks is highly desirable. For the authors of this paper it is of a great interest to investigate if there is a difference between reading comprehension based on EBooks versus print books and if these difference[s] will affect their choice of medium. Moreover, the authors are also reaching out to the international community to establish is these differences are based on a cultural peculiarities and unique for difference culture or are rather ubiquitous for the Millennial generation across the planet.

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