e-Books for Educational Uses

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Abstract

An e-book is a publication in an electronic format that users can read with an electronic device such as an e-book reader, a tablet, a computer, or a smartphone. Although research in this domain is fairly new and little of it has been published in the educational technology literature to date, that which has been published reveals issues important to educational technologists. Some of these studies have focused on hardware, including ones for the development of electronic ink and paper. Other studies have explored specific applications of e-books in various environments of interest to educators. Libraries have studied various programs to provide e-books to patrons, the challenges in administering these programs and related reactions. Although interest exists, participants in these studies often still prefer traditional printed books. In classrooms, researchers have explored different applications of e-books to traditional learning activities. Other research has explored uses of e-books in learning contexts outside of the classroom, the impact of digital publications on the market for books and periodicals, consumer perceptions and acceptance of e-books and unique issues of copyright and intellectual property arising from digital texts. Several other areas of research contribute to our understanding about e-books, such as research on tablet computing, software and processes related standards for publishing content digitally, and provide initial guidance in designing and developing e-books.

Keywords

e-Books • Electronic books • Digital texts • Textbooks • Usability

Introduction

The Horizon reports in 2010 and 2011 suggested that e-books are one of the six most important trends affecting higher education (Johnson, Levine, Smith, & Stone, 2010; Johnson, Smith, Willis, Levine, & Haywood, 2011). Although it does not explicitly name e-books, the 2011 Horizon report on technology in K-12 contexts (Johnson, Adams, & Haywood, 2011) predicted the rise of two related technologies affecting e-books: open content (which covers open textbooks, which are often distributed online) and personal learning environments (which include a variety of resources tailored to learners' needs, including networks with other people and, more germane to this discussion, resources for learning, such as e-books). That e-books would be predicted to play such a pivotal role in education was difficult to imagine just a few years earlier, when e-book advocate Gall (2005) tried to dispel the myth that e-books presented a new idea that had already failed.

E-books are the most recent in a long history of publishing revolutions that also affect education, revolutions like writing systems of writing to the invention of the printing

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J.M. Spector et al. (eds.), *Handbook of Research on Educational Communications and Technology*,
DOI 10.1007/978-1-4614-3185-5_57,

press (Baber, Bradley, & Childress, 2008; Lewin, 2008). Because it has the potential to go beyond merely publishing the written word, but also incorporating audio, full-motion video, and animation sequences (Wonderfactory Inc., 2009), e-books also have the potential to blur the line between textbook and instruction, especially online instruction. As of the writing of this chapter, the digital transformation of books and periodicals is still a work in progress, providing only partial clarity on the resulting forms that these publications will take when they become fully digital. The only thing that is clear is that e-books are expected to have a profound effect on education (Johnson et al., 2010, 2011).

This chapter presents current research relevant to e-book use in educational contexts. Because the field is just emerging as this Handbook is being written, the first part of this chapter provides an overview of the current state of e-book technology and the anticipated applications of this technology in education. The second part of this chapter summarizes the nascent body of empirical research on e-books. Note that much of this research has been conducted outside of educational technology, but it has applications and insights for our field. At the end of this synthesis of the existing literature, we offer a model to shed light on the various research avenues of e-books in education and we mention several research opportunities emerging from the literature as well.

The Current State of e-Book Technology

An e-book is a publication in a digital format that users can read with an electronic device such as an e-book reader, a tablet, a computer or a phone. Although the name e-book suggests that the publications are books, for the purpose of this discussion, e-book is a broader term that encompasses any type of publication, including books, periodicals, reports, and references. Although the technical definition of e-books refers to publications read on digital devices, in the vernacular, the term has also come to encompass some of the devices on which people read those books. This section describes the components central to the use of e-books: (1) e-book hardware, the devices for reading the publications; (2) e-book software, which renders content on the screen; and (3) e-book content, which includes text, graphic, audio and video.

e-Book Hardware. The device on which people read electronic publications is called an *e-book reader*. Any device that can recognize the file format in which the book was produced can be considered an e-book reader. Several types of devices serve as e-book readers, including:

- Computers, both desktop and laptop. The advantage of these devices is that they offer the largest screen sizes and an easy way of annotating pages. The primary disadvantage of these devices are their size and bulk—even laptop and netbook computers are considered cumbersome devices, and their screens can only be read well under certain conditions.
- Mobile devices, such as smart phones and music players, like the iPod®. The primary advantage of these devices is their portability; the primary disadvantage is their tiny screen sizes, which makes reading difficult for some.
- Tablets, such as the iPad® and Samsung Galaxy®. These devices provide larger screens than smart phones and music players and almost as many capabilities as computers—without their bulky size. The screen quality, however, often fails to provide a comfortable brightness for reading under certain conditions.
- Purpose-built devices, such as the Kindle® and Nook®, also called e-book readers. These technologies have a screen size similar to many tablets and use a display technology called *digital ink* to ensure the sharpest contrast and easiest reading under a variety of lighting situations. The disadvantages of these devices, however, are that most can only display books and periodicals; they have few, if any, additional capabilities.

e-Book Software. Specialized software renders digital content for reading on the screens of the devices described above, especially e-book readers and tablets, like the iPad. In nearly all instances, the software itself can work on many or all of these platforms, but each prefers to display content in its own format. Specific software includes software iBooks® from the Apple, Kindle from Amazon, Nook from Barnes & Noble, and Acrobat®, which displays content in the long-popular portable data format (PDF). Different software can render documents in different file formats on the screen. Among the most popular file formats are PDF, ePub, MOBI, AZW, TXT, HTML, and DOC.

e-Book Content. The third component of e-books is the content with which people interact. This content includes text, graphics, audio, and video. Most e-book hardware has the capability of displaying text and audio, and some also has the ability to provide an interactive experience with the content, including educational content. Rockley (2011) incorporates these capabilities into her definitions of different types of e-book content: a basic e-book is one that "includes text, images, table of contents, but no additional functionality" an enhanced-book is one that "includes audio, video, and internal and external links" and an e-book app is "software that looks and acts like a printed book, but provides an interactive experience" (Rockley, 2011, direct oral quote). She emphatically adds that "a PDF is not an e-book" (Rockley, 2011, direct oral quote). In practice, however, some e-book providers like Barnes & Noble have had much success selling PDFs for their e-book readers (Peters, 2011), and the dominant types of e-book content are digital versions of print

publications, including books, periodicals, reports, references, brochures, and similar types of materials. However, businesses like Apple hope that authors of content specifically intended for publication as e-books not only include text and graphics, but also reused and re-purposed video and audio content, such as news stories, documentaries, as well as video and audio content specially produced for e-books.

Several authors have proposed specific applications of e-books in educational contexts. The first is as textbooks (Lewin, 2008; Wieder, 2011) for courses at all levels. Some of these textbooks are merely less costly digital versions of printed texts. Electronic versions of books can cost between 30 and 60 % less than printed ones, significantly reducing costs for students who must purchase their own textbooks like university students as well as school systems, like the State of California, which provide textbooks for all students in the system. To accelerate this process, Apple launched a major push in January 2012 to encourage instructors to prepare and publish textbooks through its iTunes® store (Apple, 2012). The second educational application of e-books combine features of textbooks and how-to videos (Rockley, 2011), such as an electronic users guide for a car that includes brief video sequences demonstrating simple car repairs. The third proposed educational application is as a research tool, especially as a means of easily and quickly locating literature on a given field for a paper or to locate resources for a webquest activity. A fourth proposed application of e-books is to provide online instruction integrated with the content of the digital textbook. This is similar to the second use, but would include exercises and tests. Such a use of e-books—while technically feasible—goes beyond informing and provides instruction and feedback; it is e-learning on an e-book device.

The next section explores insights from the empirical research on the likely success of these applications under real-world conditions.

Research on e-Books in Educational Contexts

This section of the chapter summarizes the research on e-books, specifically focusing on four areas of particular interest: research on the hardware used for e-books, on the applications of e-books, on attitudes towards e-books, on issues of intellectual property arising from digitizing books, and research from other areas of educational technology and professional communication and publishing. But first, it provides some perspective on the research.

About the Research on e-Books

Despite enthusiasm for e-books, the extent of research is actually limited, especially in the field of educational technology. For example, between 2009 and the first quarter of 2012, *Educational Technology Research and Development* published only two articles on the subject (Huang, Liang, Su, & Chen, 2012; Lim, Song, & Lee, 2012). The *British Journal of Educational Technology* published no articles on the subject.

Relevant research does exist outside of our field, however, in other branches of education, library science, and fields associated with publishing, such as professional and technical communication. Additional relevant though non-peer-reviewed research comes from industry associations in publishing and technology. We identified relevant studies through a search of the ERIC and Academic Search Premier, using the keyword e-book, ebook, electronic book, online books, and research.

Research on Hardware Used for e-Books

One area of research on electronic books has focused on the devices used to read them. Although people can read e-books on a variety of devices now—personal and laptop computers, tablets, iPods, smart phones, and purpose-built e-book readers—our search of the literature suggests that much research has focused on purpose-built e-book readers E-book readers differ from the other devices. They use a different technology (electronic paper and electronic ink) that more closely mimics the features of paper than is possible with traditional computer screens.

Despite the ability of users to read electronic texts on other devices, research continues on purpose-built electronic books because some researchers and publishers believe it offers a reading experience that is closer to traditional books than is possible with other types of devices. Much of this research focuses on electronic paper (or e-paper), a type of screen used to read electronic texts using e-ink, especially newspapers (Graham-Rowe, 2007). Ideally, electronic paper visually resembles a newspaper as that was one of the first applications for which it was intended (eInk Corporation, 2012), but features of electronic paper are integrated into the screens of e-book devices. In his review of research and development in this area, Graham-Rowe (2007) comments that electronic paper is a type of display that resembles a real paper. It uses less energy than the LCD technology commonly used for the screens of computers, tablets, iPods, and smart phones. In addition, electronic paper offers better brightness and contrast than LCD screens. As noted in some of the advertisements for the Kindle—a device used for reading textbooks—this glare-free screen makes it possible to read e-books at the beach, where the glare from the sun renders the screens of LCD displays all but unreadable. As of 2007, electronic paper could not yet display color (Graham-Rowe, 2007), a challenge that researchers started to overcome

by 2009 (Kroeker, 2009). By 2010, technological development led to color versions of e-book readers like the Kindle and Nook, which extends the capabilities of e-book content, including e-textbooks and similar educational materials.

Research on Applications of e-Books

As discussed in this section, many studies have explored specific applications of e-books in various environments of interest to educators: in libraries, in classrooms, and among publishers. The following sections explore the applications studied in each of these situations.

e-Books in Libraries. School and university libraries have explored various ways to provide e-books to patrons, the challenges in administering these programs and the reactions to them. Some studies have reported on efforts by university libraries to increase the accessibility of e-books by lending e-book devices to patrons. Patrons in these pilot programs generally had positive reactions to these efforts. For example, in a case study of lending e-books through the library at the Technical University of Catalonia, Clavero, Codina, Pérez, and Serrat-Brustenga (2009) reported that participants appreciated the convenience of the service. Other school and university library projects have focused on offering electronic content to patrons, including books, journals, reports, dissertations, and similar types of texts. By digitizing books and other texts and making them available online through the Web, libraries hope to make these materials more accessible to patrons. Estelle and Woodward (2009) reported that patrons found these digital materials to be more accessible than printed ones.

Studies have differed, however, in their conclusions about who makes the most use of e-books. For example, Anuradha and Usha (2006) concluded that students are more likely to use e-books than faculty and staff. Similarly, Schoch, Teoh, and Kropman (2006) found that students had either positive or indifferent attitudes towards e-books; they did not hold negative views. Nariani (2009) found that students were more aware of e-books and related services than instructors. Shelburne (2009) added that students are enthusiastic about e-books because of their practicality. However, the eBrary study (Shelburne, 2009) contradicted some of these findings, reporting that a higher percentage of faculty had used e-books (55 %) than students (50 %).

Chu (2003) identified barriers to further use of e-books by patrons, including the difficulty of reading them online and the need in many instances for special equipment to do so. Shelburne (2009) noted that some of these issues are probably temporary ones; technology under development should address them.

e-Books in the Classroom. Researchers have explored a variety of ways e-books might be applied to traditional learning activities, both directly in the classroom as well as other types of contexts in which learning occurs. Some of the studies have focused on students, others have focused on instructors, and some have focused on the design process.

Studies Focused on Students: Most activities focus on the implementation challenges and results of using e-books in colleges and universities. Some of the earliest studies explored the availability of e-books on the study habits of university students. For example, Williams and Dittmer (2009) reported on a 2003 study of nursing students who had access to e-books through handheld devices. The researchers found that some students used both digital information returned by online searches as well as more conventional printed materials. Those students who used digital materials strengthened their information retrieval skills, increased their use of digital information resources, and showed a preference for e-books over print materials.

Waycott, Jones, and Scanlon (2005) explored several uses of personal digital assistants (PDAs) in different learning contexts, including the use of PDAs as e-book readers (which is why it is of interest here). One use was in a university-based distance education environment, where researchers found that students had difficulty reading materials and encountered difficulties with navigation, and reported a preference for printed texts. A second use was in a workplace learning context, where researchers found that workers used the PDAs to perform tasks *other* than learning. A third use was in a museum context, where researchers explored the use of PDAs in informal learning: more specifically, as an aid in interpreting exhibitions. In the museum context, researchers found that the multimedia capabilities enhanced the visit but could not emulate the verbal communication that often occurs among visitors to museums, thus limiting its effectiveness in learning.

Many of the studies that have been conducted to date have isolated various characteristics of e-books that affect their use in the classroom. Some characteristics confirm advantages that e-book proponents had earlier proposed. For example, instructors for distance education sections found that using digital materials simplified distribution to distance learners, who are often in several locations and many of them out of reach by traditional delivery services like postal services (Williams & Dittmer, 2009). Lower cost, too, is a benefit. In their study of an initiative to publish and integrate an e-book into a university-based accounting course, Schoch et al. (2006) noted that the online text was less expensive than a comparable printed one.

Several studies also found several practical issues arising with the use of e-books. Schoch et al. (2006) found that some

students had some reservations about using e-books. Other students experienced problems with readability and screen issues, difficulty with—and slow speed of—turning pages, an inability to take notes and highlight passages of interest, and problems with Internet connections to the books. Nariani (2009) reported similar issues, finding that students and instructors had problems reading from the screen and that students still preferred printing materials, writing on the printouts, and sharing comments with others.

Shepperd, Grace, and Koch (2008) found that students who used e-books reported studying less for class each week than those who used printed books, although actual grades did not differ between the two groups. Other studies have explored the use of e-books in the primary school context. For example, Korat, Shamir, and Arbiv (2011) studied the impact of e-books on the emergent literacy of 5- and 6-year-old children found that it supported the development of phonological awareness and emergent word writing when assisted by adults.

Studies Focused on Instructors: In addition to studies with students, some of the research on the use of e-books has explored the willingness of instructors to integrate e-books in their courses and the extent to which they do so. Corbeil and Valdes-Corbeil (2007) noted that, despite their use of mobile technologies outside of the classroom (including e-books and other e-texts), many instructors had not integrated e-books into the classroom. Carlock and Perry (2008) reached a similar conclusion, adding that some faculty who tried using e-books in class reported negative experiences, such as a loss of access to the server containing a textbook e-book the day before an exam and the fact that students could only access the textbook through the server.

Other researchers found that instructors used e-books for research and class preparation (Rowlands, Nicholas, Jamali, & Huntington, 2007) and that they integrate sections of e-books into the readings or link to them as references (Anuradha & Usha, 2006). In these situations, faculty perceptions of e-books are similar to those of students (Chu, 2003; Ismail & Zainab, 2005).

Carlock and Perry (2008) found that the extent to which instructors integrate e-books depends on the discipline. Instructors in history and design integrate e-books the most. Other factors affecting the likelihood that instructors would adopt e-books include age, rank, and past experience.

Studies Focused on the Process for Designing e-Books for the Classroom

Two other studies in the literature to date have explored ways to design usable e-books for the classroom. Huang et al. (2012) explored an e-textbook system with elementary school students and found that the students found the system usable, though patterns of usage by elementary school students differed from those of students at other levels, such as the extent of jumping among sections within the text. When comparing performance on the e-book system and printed books, Huang et al. (2012) found no significant difference, meaning students performed equally well with both types of books.

Reflecting on their experience designing an e-textbook for schools and that employed several usability evaluation methods, Lim et al. (2012) proposed nine design elements affecting the usability of e-books: "agreement with user expectations, consistency, convenience of operation, minimization of memory load through screen design, error prevention, advice and help information, feedback, aesthetic satisfaction, and user control" (p. 170).

Table 57.1 summarizes this nascent body of research on e-books presented in this section and presents an emerging list of issues that affect the success of e-textbooks.

e-Books in Other Contexts

e-Books and Publishers

News accounts (such as Streitfeld, 2012) suggest that publishers now see that e-books could have a significant impact on the publishing industry. Although different parts of the publishing industry are affected differently, some of the changes directly affecting educational publishing include a focus on open source textbooks by government education agencies and research publications by researchers, sometimes at the expense of established publishers (Lewin, 2009), an emphasis on self-publishing by Apple and other online publishers (once again at the expense of established publishers) (Apple, 2012; Tugend, 2011), changes to editorial practices and production processes to encompass e-book publication, and a reduction in the sales of books and other media. Some of the most visible to the academic community are the closing of university presses (Howard, 2012).

However, as recently as 2007, publishers did not anticipate any immediate concerns. In a 2007 interview-based study of American and British publishers, Towle, Dearnley, and McKnight (2007) found that publishers did not foresee the impact of e-books—yet. Participants felt that the technology for e-books at the time was still in its infancy. When the technology did become ready, some of the issues they anticipated included the right to publish content in digital format and the costs of doing so. Publishers also expressed concern whether readers would spend extended periods of time reading screens. Last, publishers were concerned about customers' perceptions of e-books, specifically wondering how customers would accept digital texts, an issue that later research has validated.

Table 57.1 Issues affecting the success of e-textbooks

Category	Specific issues affecting the success of e-textbooks
Price	• Comparison to printed text
Formats	• Ability to print electronic texts and read them offline • Readability on the screen – Contrast and brightness of the screen – Readability under different lighting conditions (such as natural sunlight) – Fatigue from prolonged viewing
Support for different types of uses	• Conducting research with e-texts • Providing entire texts • Linking to specific articles and book chapters
Note-taking ability	• Ability to highlight text • Ability to annotate text
Features for special learning needs	• Sound capabilities to help young children with language learning • Visual capabilities and interactivity to help young children verify language learning
Navigation	• Clarity of the navigation scheme to users • Scheme for referencing specific passages in the e-book so others can find them • Ability to easily jump to different parts of the e-book
Distribution of e-books	• Persistent link to the Internet (for resources read online or referred to online) • Quality of links (that is, a link in a course continues to work when students reach that point in the course) • Ease of distribution to distance students • Number of pages students can read in a given online session (some publishers restricted this)
Usage patterns	• Tendency of students using e-books to spend less time on class preparation
Attitudes towards e-books	• For newer users, willingness to forgo relationship with printed books • Past experiences that shape current impressions of e-books

Research on Attitudes Towards e-Books

Because issues about acceptance has arisen in other areas of research on e-books, one area of research about e-books has exclusively focused on acceptance by readers. The studies began in the early 2000s.

Some early studies explored whether consumers would be interested in reading e-books (Henke, 2003) and found a general openness to the idea among participants. Other early studies were conducted by libraries and explored both perceived acceptance of e-books and actual usage of them. Several studies found slow acceptance and low usage, except for electronic journals (Levine-Clark, 2006; Lonsdale & Armstrong, 2001).

More recent studies have had similar findings. For example, Nariani (2009) concluded that e-books had not yet been widely used. In a specific pilot of the Kindle at Reed College, Marmarelli and Ringle (2009) concluded that "students and faculty in Reed's Kindle study were unanimous in reporting that the Kindle DX—in its current incarnation—was unable to meet their academic needs" (p. 11). According to the authors, the Kindle's limited note-taking capability, concerns about digital rights, and file formats that are incompatible with other readers, meant that students might not be able to read all of the assigned readings for a course. Furthermore, Marmarelli and Ringle (2009) predicted that, even once these technical problems are resolved, the adoption of e-books on campus would more likely follow a cell-phone model in which students choose their own device and devices lack proprietary file formats, rather than a computer model, in which institutions sanction a particular device, make sure that it reads all content that would be distributed, and require students to purchase the preferred devices and models.

Research on Issues of Intellectual Property Arising from Digitizing Books

Rao (2003) noted that the digital content of e-books raises significant concerns about digital rights management. Having content in proprietary digital formats might make it inaccessible to those who do not have the software to read it, but it might also prevent future generations from using that content.

The popular press has also reported on other issues of rights that have arisen with e-books. Because of the ability to easily cut and paste text, someone might create a new original work consisting exclusively of repurposed content from other authors (Kennedy, 2010), much like hip-hop musicians create new songs from bits and pieces of other songs. Another concern is that authors of older printed books might prevent or limit publishers from publishing digital versions of their works, as the estate of author William Styron has done (Rich, 2009). As a result, some older works might be delayed or never become available in a digital format.

Limits on digital rights prevent users from exchanging electronic texts like printed ones, which could limit dissemination of works. For example, although users can read the

digital materials they purchased on several of their own devices such as purchasing a Kindle book and reading it on a Kindle device or on an iPad or computer using Kindle software, only users of Nook can lend those books to others to read on their own devices.

Research from Professional Communication and Publishing

In addition to these areas of direct study, several other areas of research contribute to our understanding of e-books, and provide guidance in designing and developing them.

Some of the research focuses on the software and related standards for publishing content digitally. Some of the research effort focuses on the design of standard formats for digital texts, so the content easily works as intended on several different types of devices. Rao (2003) proposed an open reader initiative, although, as of this publication, device manufacturers still favor closed formats. No single format dominates nor does a single format exist that all devices can use.

Other software such as specialized content management systems let publishers go through a single process to create an e-book while producing content in a variety of formats for a variety of reading devices (Rockley, 2012). This process of producing content once and publishing it on many different platforms is called *single-sourcing* in the publishing industry. Other content management systems let publishers produce material "on the fly" so publishers can tailor e-book content to the profiles of their readers. To do so, authors write topic-based prose and the system assembles the product when presenting the content to readers online, a process called *dynamic publishing*. Between the implementation of electronic work flows from these content management systems and the preparation of individual topics rather than complete books, these systems have affected the processes and work products of people who produce content (Hart-Davidson, Bernhardt, McLeod, Rife, & Grabill, 2008; Rockley, 2012). Emphasis has shifted from creating entire documents (like a user's guide) to writing individual topics; emphasis has also focused on reducing the time needed to formally publish content.

Other research has focused on the end product of e-books. Some research has focused on emerging genres of content used in e-books, such as Frequently Asked Questions and online help (Carliner, 2009). Other research focuses on conventions of designing content for viewing online (such as van der Geest & Spyridakis, 2000) and writing content to be read online (Redish, 2007). Much of this research primarily focuses on the computer screen but some of it focuses on the screens of mobile devices. And other studies focus on the ways that readers view and process information online.

Some research has generally found that reading accuracy and speed on a computer screen are degraded from the similar experience in print (Price & Price, 2002) and that readers tend to scan more and only read in-depth the content of interest (Redish, 2007). Yet studies conducted with e-book readers have found comparable patterns among readers of printed and e-books (Levine-Clark, 2006).

Suggestions for Future Research: Emerging Framework for Considering the Production and Use of e-Books

Although the research presented in this section explored isolated aspects of the production and use of e-books, these activities do not occur in isolation. Rather, they occur in a system of activity that transforms ideas into publishable content for use in learning contexts. Some aspects of this process are similar to those for printed texts; others are unique to e-books. Figure 57.1 presents a model of this system and suggests the transformation that content that goes through in the process of becoming an e-book. These steps align with the categories of research just presented.

Consider this example of a transformation process. When writing a book that will be published electronically, an author makes decisions regarding content. One pertains to length of the book. Some e-books are shorter than books, but the primary constraint of the book—the number of pages—is no longer an issue with e-books as the number of pages, which is often used to calculate printing costs, plays a less significant role in publishing costs. Indeed, the length of pages on e-books varies, from 100 to 250 words (Ford, 2011) and, depending on the size of type a reader chooses, the length of a page presented to one reader might significantly differ from that presented to a second. Authors expect readers to access the content through a different medium than the traditional paper version of books, and recognize that the book that readers see might differ from the one that the author visualized when preparing the text. This corresponds to a content-production-decision transformation. Future research might explore how freedom from the restrictions of pages and page counts affects the content choices of authors.

Moreover, when the editors fit the content of e-books on the software that will format the e-book for various devices, another set of decisions is made. This formatting process is called "rendering" and corresponds to a content-production-decision-software transformation. Authors and publishers have complete control over rendering of printed texts; because e-book devices let users choose type size and other characteristics and, because devices differ, authors and publishers have less control over rendering of e-books. Future research might explore how this loss of control over the rendering process affects decision making among authors.

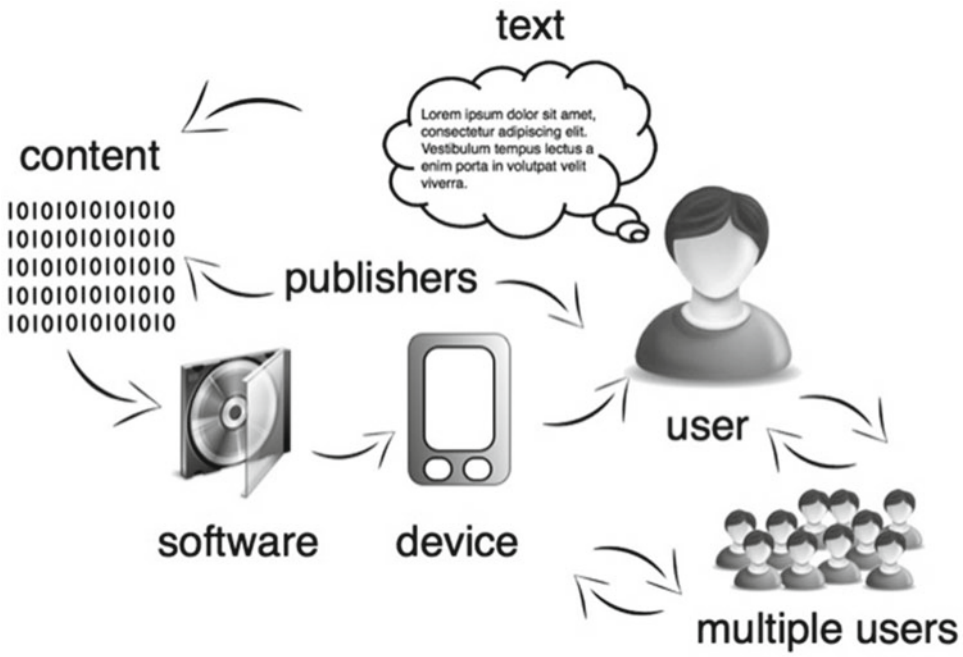

Fig. 57.1 The system of e-books

Once the content has been rendered into the publishing software, it is distributed and downloaded to various devices. The device affordances also play a role depending on the software they use to read the e-books and the physical capabilities (affordances) of the e-readers. This corresponds to a content-production-decision-software-device transformation.

Once the e-book is uploaded to an e-reader, users can read it and grasp the ideas that are being conveyed by the author of the book. This corresponds to a content-production-decision-software-device-user transformation. However, we must look at this transformation more deeply because user particularities are more complex than that. First, users can pick up any e-reader and think that this is how e-books are read. Second, users can be more critical and require various functions of the e-reader or require a particular access to the e-book that demands certain affordances from the e-reader. Or users can bypass the e-reader and access the e-book from another device such as a computer. Future research should explore the impacts of these different user interfaces on the reading experience, specifically considering issues such as the types of features that users want, how they use them, and whether users felt that the e-book device presented the content as users expected.

Moreover, we must remember that e-books are a marketable commodity and publishers are in the middle of this system. Fundamentally, they are the ones who give the users (readers) access to the content. Future research should explore the impact of e-books on the publishing industry and how they affect the work processes of individual publishers. For example, Estelle and Woodward (2009) suggested that researchers study the formats and structures of e-books themselves and also suggested that researchers explore various business issues in publishing e-books. They suggested exploring user behaviors to help identify appropriate business models for publishing e-books and the different segments of the e-book market. Such research would open new avenues for educational technology, which has traditionally focused on educational products and their production, and not as much on the marketing and financial aspects of those products.

And speaking of users, they are at the end of this system. Future research might explore the impact of e-books on users. For example, Levine-Clark (2006) suggested conducting research into the habits of people who read e-books. The author recommended research identifying which types of books people read electronically and which ones they read in print, as well as usage patterns of electronic books.

Related to reading habits, an issue strikingly absent from the research on e-book is studies about the use of the annotation capabilities that many devices now have and the possibility of adding exercises in textbooks. This is where general interest e-books and educational e-books might differ. Knowledge about how to best use interaction in educational e-books and how readers might better construe the meaning of the content if they are able to comment and share their comments, highlight passages and share their

highlighted passages remains embryonic because up until now, this area of research remains largely unexplored. Future research might explore these types of interactions about knowledge construction and e-dialogue about e-content through e-readers.

Most significantly, researchers need to continue exploring proof-of-concept projects that define what e-books are and how they integrate with other learning activities, the impact of e-books of all types on learning (especially those produced as proof-of-concept projects), improvements to the technology and interface of e-books so users can have the most satisfying experience with them, and the impact of e-books on the work of instructors, librarians, and publishing professionals. Such studies would explore what happens when books go digital and the physical space devoted to them might no longer be necessary.

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