Preparing for Effective Adoption and Use of Ebooks in Education

JISC Observatory TechWatch Report
Final Report December 2012

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About this report

As ebooks become mainstream and the percentage of academic publications delivered as ebooks rises steadily, this report is a primer to help academic librarians, managers and members of faculty prepare for the increasing adoption and use of ebooks in education. Specifically, this report: 1) introduces the historical and present context of ebooks; 2) reviews the basics of ebook technologies; 3) considers scenarios for ebook adoption and usage; 4) addresses current challenges; and 5) considers the future. This report also provides a glossary and a 'References' section.

This report is informed by feedback gathered during an open commenting period from 27 September to 8 October 2012 as well from as other sources. The final version of this report has been made available in the TechWatch section of the Observatory Web site.

ABOUT THE COMMISSIONED AUTHOR

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HOW TO CITE THIS REPORT

JISC. (2012). *Preparing for Effective Adoption and Use of Ebooks in Education* (JISC Observatory TechWatch Series, Report No. 4, Final Version, December 2012). Retrieved from http://blog.observatory.jisc.ac.uk/techwatch-reports/ebooks-in-education/

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Foreword

Ebooks have been around for many years: their history can be traced back to initiatives such as Project Gutenberg in the 1970s or formats such as PDF released in the mid 1990s. Handheld ebook reader hardware has been available from the late 1990s. For much of that time, ebooks arguably had little impact outside a few areas of niche interest.

In the last few years, however, there has been an increasing stream of stories about ebooks outselling printed books by some measure or another. For example, in August 2012 it was widely reported that Amazon in the UK had sold more ebooks than hard- and paperbacks combined.[1] Although there is of course often an element of advertising hype in many of these stories, they do reflect a real shift in the popularity of ebooks.

The rapidly increasing access to ebook reading devices has again sparked the imagination of publishers and educators to the opportunities of using ebooks to provide a more interactive learning experience and access to content anytime, anywhere. One of the challenges facing Higher and Further Education is how to respond to these possibilities.

Various visions of ebooks

This shift has largely been prompted by two developments in ebook readers: the Amazon Kindle and Apple iPad, with associated apps. In technical capabilities neither is unique. Arguably, they are not even innovative as they both do no more than bring together pre-existing technologies. Nevertheless they do represent major initiatives that demonstrate their

[1] See, for example, this August 2012 report in *The Guardian* of Amazon's announcement that "for every 100 hardback and paperback books it sells on its UK site, 114 ebooks are downloaded": http://www.guardian.co.uk/books/2012/aug/06/amazon-kindle-ebook-sales-overtake-print . As noted below (see footnote 5, p. 1, and footnote 9, p. 3), publisher statistics show that sales of ebooks are starting to overtake sales of print books in both the United States and the UK. Some of this trend at present does seem to consist of a sharply expanding increase in sales of popular fiction ebooks (many self-published). Moreover, these statistics do not clearly account for sales of ebooks suitable for academic contexts. Nevertheless the upward direction of ebook usage in general is clear.

technical potential. Interestingly, they also represent somewhat opposing visions of what an ebook is.

The Amazon Kindle is by far the most successful representative of a range of devices that adopt the approach of trying to deliver the same content as a book, in as convenient a manner as possible while maintaining the ease of reading. The emphasis is on cheap, lightweight e-readers that allow owners to carry all they could desire to read without too much thought or effort. The minimal size and weight allow the Kindle to be no more of a burden to carry than a small paperback. The screen is designed so that the reading experience is similar to that of paper, rather than that of a computer screen. The memory capacity and network connectivity are designed so that owners need never run out of material to read and need never worry about syncing content with their computers. The battery life typically extends to days of use, so owners need rarely be worried about charging the device. The emphasis is on the text, so that design elements such as font, colour, and layout may be lost. This represents one of the potential drawbacks of the Kindle approach in education since the layout of many textbooks is carefully designed to enhance the explanation being presented through choice of colour, boxed explanations of concepts as asides, or (especially in technical subjects) complex tables and equations. It is important to recognise that many of the news stories concerning the explosion of ebooks relate to the Amazon Kindle and to linear texts (such as novels) read for pleasure, rather than complex material designed for study.

Not surprisingly (given Apple's history of an emphasis on good-looking, well-designed products and a target market of customers who appreciate such things), Apple's ebooks designed for the iPad (iBooks) place greater value on the appearance of the printed page. Apple's iBooks can support full-colour, high-fidelity representations of a printed original. The iPad is capable of displaying the original look of historical manuscripts such as mediaeval bestiaries or the original handwritten and illustrated copy of *Alice in Wonderland* (and other rare books held by the British Library)[2]. While maintaining some of the convenience of the Kindle approach, Apple's approach requires greater computing power, at a cost of increased weight and price – and decreased battery life. With this greater computing power also comes the opportunity to

[2] For more information about British Library eBook Treasures, see: http://www.ebooktreasures.org/

go beyond what can be displayed on the printed page. An image on a printed page has to be static, whereas hardware such as the iPad allows moving images and interactive 3D models to be displayed, offering a potentially rich educational experience.

Challenges of ebooks in academic contexts

One of the challenges facing Higher and Further Education is how to respond to these possibilities. Does interactive content that can be brought into the classroom by students change the role of the course textbook? Does the facility of even the modest Kindle for sharing comments and annotations among readers allow new ways of discussing a text? Are there deep-seated human factors surrounding the way that students study, which cannot be satisfactorily replicated by ebooks and could even impede learning when using them? For example, such factors include: making notes, annotations and bookmarks; jumping around a textbook rather than reading it sequentially cover-to-cover; having several books open at one time; or just the plain familiarity of the paper-based format as compared to software navigation that has to be learnt. It does seem clear from studies so far that students in general will not welcome ebooks unless there is some clear advantage to be gained by their use[3].

There are other challenges. The change in publishing brought about by ebooks represents a challenge to publishers. It is noticeable that none of the developments in ebooks (from Project Gutenberg through to the Kindle and the iPad) have come from publishers. They are challenged by the change in publishing that ebooks represent. Typically, publishers are challenged by the difficulty of producing content for novel and varied platforms. Such interoperability issues are accentuated by the desire of some to push the interactive capabilities of ebooks as far possible (and these capabilities are important to education). Publishers are also challenged by the way that digital content changes the way in which material can be distributed and copied. This is a problem that they pass on to libraries: in essence an ebook may be "lent" out by a library numerous times without degradation or loss of availability to others, whereas a paper book can only be lent out to one person at a time and will eventually fall apart. As a result, in order to protect their income, publishers seek to limit what libraries can do with books by limiting the rights that libraries buy when they purchase a book, and by enforcing those rights through Digital Rights Management technology.

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[3] For commentary on recent research into university student attitudes toward and usage of etextbooks, see this August 2012 article: "Students Find E-Textbooks 'Clumsy' and Don't Use Their Interactive Features" *The Chronicle of Higher Education*, online http://chronicle.com/blogs/wiredcampus/students-find-e-textbooks-clumsy-and-dont-use-their-interactive-features/39082. For more in-depth summary of this research, see also: *Internet2 eTextbook Spring 2012 Pilot Final Project Report* (1 August 2012) available at: http://www.internet2.edu/netplus/econtent/docs/eText-Spring-2012-Pilot-Report.pdf .

Alternatively, publishers will need to redefine what libraries purchase, moving from a transfer of ownership of a copy to something more akin to rental or subscription to a service. These changes impinge on libraries' scope for action in Higher Education.

As with any other technology in education, there are still many barriers and challenges that exist and these need to be overcome for ebooks to be adopted more widely in Higher and Further Education. This report introduces some key concepts related to ebooks in general and discusses the technical, cultural and legal challenges that need to be addressed for the successful adoption of ebooks in education. Furthermore, it also offers scenarios showing effective use of ebooks in libraries and in teaching and learning across institutions. It provides us with useful insights into the future directions of ebooks development.

Phil Barker & Li Yuan, JISC CETIS, September 2012

Executive summary

In the last few years, the use of ebooks by the general public has become mainstream. Driven by developments in ebook technologies as well as by surges in usage of ebooks generally, the scope for adoption of ebooks has steadily increased within Higher Education and Further Education institutions. As many institutions have started the process of adopting and using ebooks, however, they need to be aware of issues as they embrace and embed ebooks within classrooms, research, libraries, and various adoption and usage scenarios.

As ebooks become mainstream and the percentage of academic publications delivered as ebooks rises steadily, this report is a primer designed to help academic librarians, managers and members of faculty prepare for the effective adoption and use of ebooks across their institutions.

This report provides an overview of the most popular ebook technologies currently adopted within Higher Education and Further Education institutions as they start to embed the use of ebooks. It also takes into account consumer ebook technologies that have developed rapidly over the last few years, as these consumer ebook technologies have increased demand by learners for ebooks within academic contexts.

This report examines how ebooks are being adopted within academic libraries, how they are being used for learning and teaching, and their impact on research and publication. In this process, it addresses key technical and cultural issues that institutions face when adopting ebooks. In addition, it covers some of the key issues of authentication, authorisation and digital rights that arise when adopting ebooks.

Although ebooks have been around for some time, the current technologies and business models for the usage of ebooks in academic institutions can still be described as anything between archaic and embryonic. As ebooks have enormous potential for development over the next five years, technological changes will have an impact on the current business models that publishers are offering. Higher and Further Education institutions need to be in a position to respond.

The ebook landscape is changing, and in some cases changing very rapidly. Ebooks offer many opportunities for institutions to expand the supporting role of the library, to enhance learning and teaching, and to enrich research. In preparation for these opportunities, technical and cultural challenges need to be addressed so that institutions can successfully expand their adoption and use of ebooks.

Key priorities for institutions are:

1. Acknowledging that ebooks are not necessarily a replacement for printed books, but allow for more diverse reading opportunities for students. *It's not about choosing a preference, but choosing the format that best suits the reading and learning context*.

2. Planning for students arriving with a range of mobile devices and laptops from which they will want access to ebooks, and preparing for how this will affect the institution's choice of ebook platforms and formats. *As there is no agreed standard format amongst users, publishers and aggregators, institutions must consider increasingly diverse use cases.*

3. Considering how institutional policies should best approach the issue of intellectual property in relation to academic self-publishing, as it is becoming easier for academics to create and publish ebooks.

4. Focusing on the need for responsiveness and agility as they adopt and use ebooks, because ebook formats, standards and licensing are still in flux. *Institutions should recognise that the future landscape is subject to change, not just in terms of technical and copyright issues but also due to significant cultural transformations.*

5. Maintaining the institutional library as a key focal point for the adoption of ebooks, as academics and students look to their library for access and support.

6. Paying attention to the importance of cultural change, as the expectations and perceptions of academic staff and students are both challenged and accommodated. *As more people use and read ebooks in wider society, this will continue to have an impact on the expectations and perceptions of students and academic staff.*

These priorities need to be addressed if academic institutions are to benefit from the great potential of ebooks as 'cost effective content that can be easily discovered, delivered anywhere, at any time, to a variety of user friendly devices, for consumption and re-use"[4].

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[4]Quotation from the forthcoming JISC report (in press) entitled *The Challenges of eBooks in Academic Institutions*. When published online in early 2013, this publication will examine further some of the practical factors related to the creation, consumption, and curation of ebooks in academic contexts.

A note about the scope and objectives of this report

Using this JISC Observatory TechWatch report as a primer, academic librarians, managers and members of faculty involved with the adoption and use of ebooks in HE and FE institutions can prepare the groundwork on which to build effective technical and cultural support for ebooks. Without going into deep technical detail on any specific technology, this report aims to help readers better understand the entire landscape of ebook technologies (some well established and some new and fast-moving) so that informed decisions can be made by all parties involved with supporting and promoting ebook adoption and use.

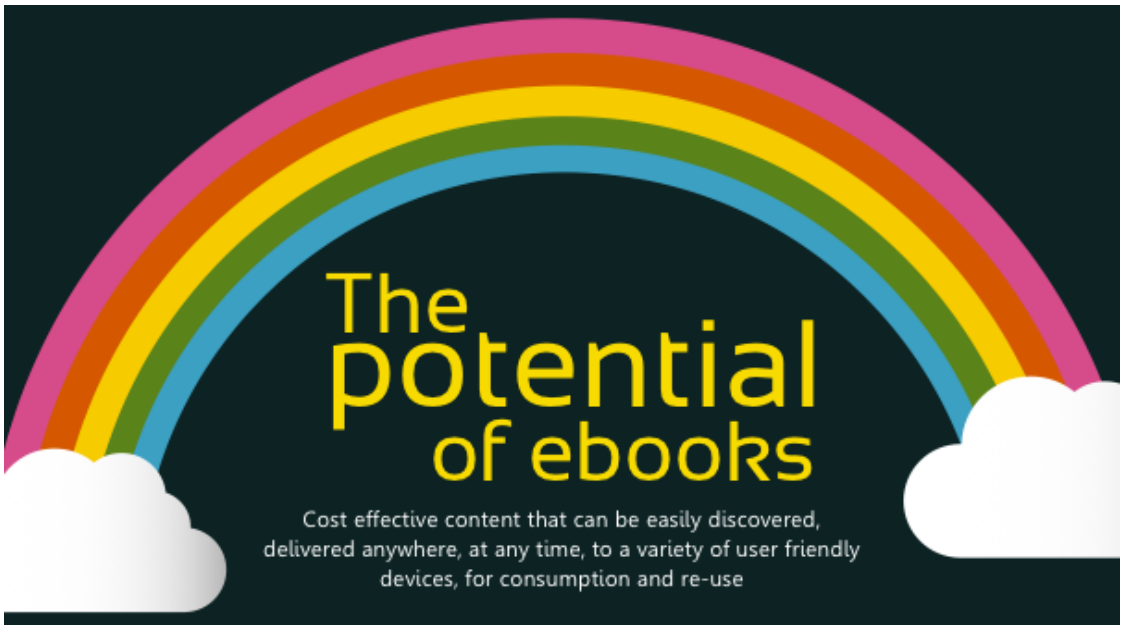

Figure 1: Preview graphic from forthcoming JISC report: *The Challenges of eBooks in Academic Institutions* (in press, to be published online 2013)

However great this *potential* of ebooks may be long term, as noted above, institutions need to acknowledge and work on cultural and technical *challenges* as a matter of priority now. This report aims to help academic librarians, managers and members of faculty recognise and respond to near-term challenges effectively. Its ultimate objective is to build a more widely shared, well informed understanding of ebook fundamentals, so that project teams and interdisciplinary groups as well as individual leading-edge innovators can proceed in a reasonably coordinated way to achieve the potential of ebooks in academic contexts.

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1. Introduction

Many academic institutions are already in the process of implementing the use of ebooks within learning and teaching. These institutions are using a range of devices and platforms to enable learners to access and use ebooks to support their learning. As the JISC National E-books Observatory Project notes, "Course text e-books enable students and staff to fit work and study flexibly into their busy lifestyles" (JISC Collections, 2009, p. 19).

In recent years, the ebook as a medium for delivering content has become popular and entered the mainstream consciousness of the general public. Sales of e-readers such as Kindles and iPads have been increasing rapidly.[5] Through this expansion of sales, the general public has gained better understanding of what an ebook is, the advantages that the ebook format can bring to reading, and the issues that can arise when using ebooks and e-readers. Furthermore, increasing usage of mobile devices such as smartphones and tablets has allowed more people to access and use ebooks beyond the traditional confines of the home- or work-based computer.[6]

This report examines recent developments that are shaping how academic institutions can respond to growing interest in ebooks. Explaining the main issues that Higher and Further Education institutions face, it considers how they can better prepare, not only in technical terms but also with regard to cultural issues.

[5] See, for example, this August 2012 summary by the Charted Institute of Library and Information Professionals (CILIP) of statistics including the "almost threefold increase between February 2011 and March 2012" of adults purchasing an ebook: http://www.cilip.org.uk/get-involved/policy/Documents/E-book%20acquisition%20and%20lending%20by%20libraries%20(August%202012).pdf . Pew Research survey results show that ownership of dedicated e-reader and tablet devices increased dramatically between November 2010 and early January 2012 across all age groups, including a 300% increase among 18-29 year-olds and among those with some involvement with Higher Education (see http://cms.pewresearch.org/pewinternet/files/2012/03/Pew_Tablets-and-e-readers-double-1.23.2012.pdf).

[6] According to a short online survey by New Media Consortium (NMC) in 2009, most users of ebooks during that period considered the desktop computer as their primary device for accessing ebooks (see http://archive.nmc.org/news/nmc/7317).

Providing an update to previous work researching the usage and adoption of ebooks within academic institutions[7], this report examines recent developments that are shaping how academic institutions can respond to growing interest in ebooks. This report outlines the technology behind ebooks and ebook platforms as well as the many types of ebook readers that are available. It explains the main issues that institutions face when adopting ebooks and considers how they can better prepare, not only in technical terms but also with regard to cultural issues.

Brief history of ebooks

The origin of ebooks is disputed, though the start of Project Gutenberg in 1971 can be seen as the earliest beginnings of a collection of what we now know as ebooks.[8]

Later use of electronic paper (see section 2 of this report for explanations of this technology) within ebook readers opened a new market for ebooks. The Sony Librié in 2004 was the first mainstream device to utilise electronic paper for ebooks. Sony followed the Librié with other ebook readers and worked with publishers to ensure that consumers had access to online stores selling ebooks. The vast majority of these ebooks were popular titles and few academic texts were released as ebooks.

In 2007 there was a revolution in the use and delivery of ebooks with Amazon's release of the Kindle in the United States. A different kind of ebook reader, Kindle was designed to work seamlessly with the Amazon Web site, allowing users to browse, buy and download ebooks with this dedicated e-reader device. Along with a free lifetime 3G connection, the Kindle provided easy access to a large online book store without the need for a separate computer.

A similar revolution occurred in 2010 with the release of Apple's iPad, which provided a device for accessing ebooks using a variety of proprietary and Web-based apps. Apple released its own iBooks app and iBookstore to allow iPad users to buy and read ebooks.

In June 2012 Amazon went on to release a Kindle App for the iPad, allowing Kindle users to read their Kindle books on the iPad. This Kindle App also opened up the wealth of ebook content on the Amazon site to Windows, Mac, Android and iOS users. With the availability of

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[7] See previous work listed in this report's 'References' section, including these in-depth reports: *Digital Monograph Technical Landscape: Exemplars and Recommendations* (Daly, 2012) and *National E-books Observatory Project: Key Findings and Recommendations* (JISC Collections, 2009).

[8] For example, see Marie Lebert's overview in *A Short History of EBooks* (2009), available at: http://www.gutenberg.org/cache/epub/29801/pg29801.html .

this Kindle App, consumers were no longer obliged to buy a Kindle e-reader to access and read Kindle books.

Alongside the growth of the ebook reader, publishers have been developing platforms for academic and public libraries, where collections of ebooks can be accessed both on-site and off. These platforms enable users to read ebooks and they can also allow users to copy and even print excerpts as well. With some platforms, books can be transferred to mobile devices or to dedicated ebook readers. As discussed later in this report (see section 4), these different platforms and capabilities can create problems in terms of usability, consistent user experience and multiple interfaces.

Present situation

Extrapolating from current trends, digital books are set to overtake print books in the global marketplace for trade books: unit sales of ebooks already exceed those of print in many segments, both in the United States and the United Kingdom.[9] Disintermediation of the publishing supply chain is occurring at all levels: from publisher, to agent, to authors.

Most academic institutions are now using ebooks in some form, and various pilots and projects over the last few years have researched the use of ebooks in Higher and Further Education:

- In 2003 the JISC-funded report entitled *Promoting the Uptake of E-Books in Higher and Further Education* found that 89% of HEIs at that time were subscribing to ebook collections (Bennet et al., 2003, p. 58).
- In 2009 the JISC National E-books Observatory Project[10] undertook a wealth of research,[11] including the analysis of log data from ebook platforms to learn how users discover and navigate through ebooks. This project explored the attitudes of academics and students as it assessed the impact on print sales of making course etextbooks available via university libraries to thousands of students.

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[9] See, for example, this June 2012 report of US ebook sales generating net revenue exceeding net revenue from print sales: http://www.mediabistro.com/galleycat/ebooks-top-hardcover-revenues-in-q1_b53090. See also this August 2012 commentary on Amazon's report that its sales of ebooks has surpassed its sales of print books in the UK: http://www.guardian.co.uk/books/2012/aug/06/amazon-kindle-ebook-sales-overtake-print

[10] For a brief overview of the scope and objectives of this JISC National E-books Observatory Project, see: http://observatory.jiscebooks.org/

[11] For a comprehensive listing of the research outputs from this JISC National E-books Observatory Project, see: http://observatory.jiscebooks.org/reports/

- In 2010, JISC Collections commissioned a report evaluating "the practicability of a migration to digital textbooks in UK Further Education (FE) and particularly the range of business models that will enable FE students to be provided with the etextbooks needed for their studies ... based on affordability, accessibility, equality of access and convenience" (Cox, Cox & Carden, p. 3) .

- In 2012 the *Digital Monograph Technical Landscape: Exemplars and Recommendations* (Daly, 2012) described the current ebook landscape and the growth in adoption of ebooks by consumers in the UK and North America.

When an institution is preparing to make more use of ebooks, its adoption and use of ejournals should also be taken into consideration. Digital publishing of journals and academic content has been part of HE culture for many years and the experience gained and lessons learned in this area can be used to inform the adoption and use of ebooks within HE.

With all these recent, fast-paced developments in e-reader devices and delivery platforms, as well as the steady increase in usage of ebooks in academic and professional contexts, one of the objectives of this report is to clarify the basics of current ebook technologies so that discussions of expanding adoption and use of ebooks in Higher and Further Education can be grounded in a good technical understanding. Before addressing important non-technical factors relevant to adoption and use of ebooks in academic institutions, planning discussions should be based on a solid grasp of technical fundamentals.

To help progress from a sound understanding of the basics in ebook technologies to a broader discussion of non-technical factors relevant to the adoption and use of ebooks in Higher Education and Further Education now and in the future, the remainder of this report is structured as follows:

- Section 2 provides an overview of some fundamentals in current ebook technologies, explaining the range of formats, dedicated e-readers, authoring tools and delivery platforms available for use in general as well as in academic contexts. This section will be of interest to all readers concerned with developing a solid understanding of ebook technologies, as a basis for informed discussion and decision-making when considering the adoption and use of ebooks in any context.

- Section 3 assesses the diverse ways that ebooks can be used in academic contexts and outlines a range of scenarios for adoption and use of ebooks in Higher and Further Education. This section also considers strategies for ebook collections, acquisitions, licensing, and access as academic libraries work on the curation and cataloguing of

academic resources. This section will be of particular interest to readers involved with planning institutional strategies or with the practical arrangements supporting the use of ebooks in libraries as well as across a range of teaching and learning scenarios.

- Section 4 explains some key challenges in expanding the adoption and use of ebooks in Higher and Further Education institutions. As it addresses issues related to cultural resistance and technical issues, this section will be of interest to all readers concerned with avoiding obstacles near- and long-term as institutions manage the effective adoption and use of ebooks.

- Section 5 considers how ebook technologies are likely to develop over the next years and recommends several ways that Higher and Further Education institutions can start preparing now.

2. Understanding the basics of ebooks

The term ebook is used to describe many different kinds of digital book, so what is an ebook? A simple definition of an ebook is an electronic book. A book that is in a digital format that is read on a ebook reader or application. Unlike other forms of digital textual content, generally the ebook follows the same conventions as a printed book. Comparison of electronic and printed copies of the same publication reveals few, if any, differences. The structure and content is usually identical, with the same number of chapters and the same text. The main differences are in the formatting and the display of pictures and diagrams.

This section explains the fundamentals of ebook technologies, describing the range of formats, e-reader devices, authoring tools and delivery platforms available for use in general as well as in academic contexts. It concludes with an overview of some key issues for academic institutions related to compatibility and digital rights management.

Formats

As with many other forms of digital content, there is no standard ebook format. Formats have largely evolved alongside the development of ebook readers. At the same time, application developers and publishers have employed different formats to operate on various platforms.

At a basic level, ebooks can be released in a plain text format, as was originally the case in 1971 at the start of Project Gutenberg.[12] As requirements have changed over time, however, new devices and increasing demands from publishers to protect ebooks digitally have brought about further development of new formats. From rudimentary ASCII to more advanced forms of HTML, PDF and EPUB, the increasing technical sophistication of ebooks has produced an expanding range of formats.

[12] For an overview of the history and scope of Project Gutenberg, see: http://www.gutenberg.org .

EPUB

Currently EPUB[13] would be considered by many organisations and publishers to be the standard format for ebooks. Deriving from HTML, EPUB is designed to allow content to reflow and be optimised regardless of factors such as: the device reading the EPUB format; the size of the device's screen; or the font size selected by the user. EPUB format also allows for images and the embedding of metadata. As a free and open format, EPUB can also be used by any publisher or ebook vendor.

Content in an EPUB file can be protected with Digital Rights Management (DRM) technology, but this does not form part of the specification and is an extra layer on top of the EPUB file. As this extra layer is not part of the specification, different publishers can use different DRM technologies.

This variety in DRM technologies can result in problems in use: an EPUB file protected by one type of DRM, and usable on one particular device, may not be readable on a different device, even though both devices fundamentally support EPUB. Apple, for example, uses FairPlay DRM to protect its EPUB publications on iOS devices whereas Adobe uses Adobe Content Server to protect EPUB publications in Adobe Digital Editions.[14] As a result, Apple-protected EPUB files cannot be read in Adobe Digital Editions and Adobe-protected EPUB files cannot be read in Apple's iBook app. Such conflict in DRM protection can cause confusion for users who may see that their device supports EPUB, but then wonder why some ebooks still remain inaccessible.

The current version of EPUB is EPUB3. At the date of this report, however, most ebook readers and applications only support EPUB2; for this reason, most ebooks are currently published to the EPUB2 format. EPUB3 differs from EPUB2 in that it is based on XHTML5 rather than XHTML 1.1. EPUB3 also has an improved and standing linking scheme and (probably of most interest to education) support for MathML, which can produce reliable representations of equations.[15]

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[13] For an overview of EPUB as standard developed by International Digital Publishing Forum (IDPF), see: http://idpf.org/epub .

[14] For an overview of Adobe Digital Editions, see: http://www.adobe.com/uk/products/digital-editions.html

[15] For a summary of changes in EPUB3 from EPUB2.0.1, see: http://idpf.org/epub/30/spec/epub30-changes.html

PDF

Another popular format is PDF, originally developed by Adobe as a proprietary format and then released as an open standard in 2008.[16] Originally envisaged as a file format that would allow documents to be read regardless of hardware, operating systems or applications employed, PDF has been embraced by many publishers as their preferred format for ebooks. The main reasons for this popularity with publishers include the ease with which DRM can be applied to PDF files as well as the efficiency of creating PDFs using the same file, software and formatting technologies that publishers use for the production of printed versions of their books. Publishers using desktop publishing software often use the same DTP software to produce both a high-resolution PDF used to print the book and a lower-resolution PDF that they use as the ebook version.

As noted by Zak Mensah, the fixed-width nature of PDF is sometimes beneficial: "Whereas the reflowable nature of EPUB is often viewed as a positive characteristic, it is worth noting that academic books with lots of tables and equations often work better in a fixed-width format given that reflowable formatting does not always display tables or equations correctly".[17] Both PDF and EPUB3 can allow for fixed-width formatting, though this can cause some viewing and zooming problems on devices with small screens.

HTML and other formats: Amazon, mobi, Apple and Microsoft

The Web standard, HTML, is also used to format ebooks and has the advantage that it will work with any device with a browser. However, HTML-formatted ebooks do not support DRM and (depending upon caching support in the device used) may require an open connection to the Internet to be read.

Amazon has its own proprietary ebook format for the Kindle which is DRM-protected. However, an ebook in AZW format will only be readable on an Amazon Kindle device or application.

The mobi format is still popular despite the fact that the original Mobipocket software is no longer available or supported since it was purchased by Amazon in 2005.[18] Unprotected mobi

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[16] For explanation of PDF development and release as open standard as well as technical issues, see: http://en.wikipedia.org/wiki/Portable_Document_Format .

[17] See comment by Zak Mensah (3 October 2012) on the preview version of this TechWatch: http://blog.observatory.jisc.ac.uk/techwatch-reports/ebooks-in-education/#comment-1846 .

[18] For report of Amazon purchasing MobiPocket, see: http://bizjournals.com/philadelphia/stories/2005/03/28/daily32.html

ebook files are supported on the Kindle. As a work-around for lack of EPUB support on the Kindle, many users convert unprotected EPUB files into the mobi format so that ebooks originally in EPUB format can be read on the Kindle. The future of this work-around remains unclear, however, as Amazon moves to HTML5 and away from supporting mobi with the introduction of Kindle Format 8.[19]

Apple has released its own standard ebook file format, ibook, which allows for the addition of rich media and interactivity. The ibook format only works in the iBooks app on iOS devices.[20]

There are other lesser-known or legacy formats. One example is Microsoft Reader,[21] which was discontinued by Microsoft in 2011. Users with older or less well-known devices may find that it is difficult to find ebooks published in these less used formats.

Comparison table: functional capabilities of ebook formats

	EPUB (IDPF)	HTML	Kindle	Mobi-Pocket	Plain text	PDF
Filename extension	.epub	.html	.azw	.prc .mobi	.txt	.pdf
DRM support	Yes	No	Yes	Yes	No	Yes
Image support	Yes	Yes	Yes	Yes	No	Yes
Table support	Yes	Yes	Yes	Yes	No	Yes
Sound support	Yes	Yes	Yes	No	No	Yes
Interactivity support	Yes	No	Yes	Yes	No	Yes
Word wrap support	Yes	Yes	Yes	Yes	Yes	No
Open standard	Yes	Yes	No	No	Yes	Yes
Embedded annotation support	Yes / No	No	Yes	Yes	No	Yes
Book-marking	Yes / No	No	Yes	Yes	No	Yes

[19] For commentary on technical and political implications of Amazon Kindle's move to HTML5 (rather than to EPUB, "in enemy ranks") , see: http://techcrunch.com/2011/10/20/amazon-throws-a-minor-curveball-with-html5-kindle-8-format/

[20] For an overview of the iBooks iOS app supporting ebooks in EPUB or PDF format, see: http://en.wikipedia.org/wiki/IBooks

[21] For an overview of the discontinued Microsoft Reader, see: http://en.wikipedia.org/wiki/Microsoft_Reader

	EPUB (IDPF)	HTML	Kindle	Mobi-Pocket	Plain text	PDF
Video support	Yes	Yes	Yes	No	No	Yes
Magnification	Yes	Yes	Limited	Limited	Yes	Yes

Table 1: Functional capabilities of main ebook formats

Source: Adapted from Wikipedia[22], Digital Monograph Technical Landscape (Daly, 2012)

Readers

Various devices have been released that can be used to read ebooks. Over the last few years, as with a lot of consumer electronics, the availability of specific devices has changed and will continue to change. This on-going development creates challenges for learners and institutions trying to keep pace with the rate of technological change in relation to ebook readers. Advances in technology and devices mean that new ebooks may not work or function as expected on older devices; likewise older ebooks may not open on new devices if manufacturers decide not to support legacy formats or (in all likelihood) legacy DRM.

Electronic paper: key technology in many e-readers

Electronic paper (also called e-paper or electronic ink) is the display technology behind many ebook readers. In this technology, the screen displays tiny microscapsules containing positively charged white particles and negatively charged black particles. When an electric field is applied, either the white or black particles move to the top. By applying positive and negative electric fields in a particular pattern, this display technology can make bitmaps or images appear on the screen. These bitmaps can be used to form letters and so display the text of an ebook. This means that most devices using electronic paper are "black and white" only (though in reality the screens are more greyscale than pure black and white).[23]

The main advantage of this electronic paper technology is that the ebook display screen can hold its image without requiring additional power. This means that, unlike devices with conventionally powered screens, the power is needed only when the page is "turned" (thus refreshing the screen). This fact has a positive impact on battery life, which means that a

[22] See http://en.wikipedia.org/wiki/Comparison_of_e-book_formats#Comparison_tables

[23] Shortly before the release of this report, Amazon announced that new versions of Kindles supporting 'Paperwhite' electronic ink screens (initially available only in the US). For more details on support for white background on new Kindle screens with "25% greater range of contrast than the old device, with 62% more pixels", see http://www.huffingtonpost.co.uk/2012/09/06/amazon-announces-new-kindle_n_1861780.html

device using electronic paper can have a battery life measured in days or weeks (a distinct advantage compared to laptops or tablets, which typically have a battery life measured in hours).

Another advantage of this technology over the traditional LCD and other similar back-lit displays is that electronic paper has been designed to reflect light in a similar manner to ordinary paper, and this means that it can be read easily in sunlight or bright light. Without any form of back lighting, however, a device using electronic paper will be difficult to read in dark or badly lit situations. To compensate for this, some ebook readers have a light attached to illuminate the screen.

Currently development is on-going to create colour-enhanced electronic paper displays, which employ the same technology as the black-and-white screens.

Developments in e-reader technology

Physical buttons provide the interface for most ebook readers to allow users to navigate the device, select and read books. Some newer devices, however, are taking advantage of touch-based technology to introduce more flexible interfaces for navigation and reading.

In order to transfer ebooks to the ebook reader, manufacturers rely on a range of technologies and there is a lack of consistency among them. Older devices rely on either a USB connection or a memory card slot through which the users can transfer ebooks from a computer running an ebook application. Typically, the same computer-based application would also be used to access ebook stores where users could browse and purchase ebooks.

Newer devices often use (in addition to an USB connection or memory card slot) a 3G or wifi connection, through which they can connect directly to ebook shops without requiring a computer or separate computer-based application. This arrangement makes it easier for users to purchase ebooks whilst out and about, without needing to return to their computers. As noted in a section of the *Digital Monograph Technical Landscape* report entitled "Why digital publishing now?"(Daly, 2012), this enables far greater flexibility in some academic work as previously "portable reading devices required tethering to computers to make purchases, limiting usefulness 'in the field.'"

Dedicated ebook readers often have additional functionality built in to display other types of content such as PDF files, documents and images. Some readers can also play MP3 and other types of audio files, making it possible to listen to audiobooks or music whilst reading. Those ebook readers with 3G or wifi connectivity often have Web browsers; however, such browsers

are quite simple and not all Web sites work as expected (likewise the greyscale screen is not optimised for the modern Web).

Amazon's Kindle[24] was released in the US in 2007 and, unlike other dedicated ebook readers at that time, it came with a free 3G connection. This functionality allowed users of the Kindle to browse and, using their Amazon account, purchase ebooks direct from the device and download immediately to read the ebook straight away. With the 3G connection the Kindle came with a simple browser allowing users to access Web pages and RSS feeds. The initial constraint with the Kindle was the limit on the formats that it supported: it did not natively support the ePUB format; nor was it possible to transfer to the Kindle any DRM-protected ebooks purchased for use with other devices. Owners of other devices were also unable to read ebooks sold by Amazon for the Kindle on their devices.

In 2009 Amazon released the Kindle DX with a larger screen and support for simple PDF files. It was designed to be used with textbook and newspaper content, though it used the same interface as the original Kindle and offered similar functionality. The Kindle arrived in the UK in 2010 with the release of wifi-only and 3G versions.

At much the same time, Amazon released a Kindle application for Windows, Mac, Android and iOS. These applications allowed other devices to read Kindle ebooks. Amazon uses a synchronising server, named Whispersync, which allows the same book to be read on multiple devices whilst the syncing technology ensures that users are able to pick up where they leave off (even if they have re-opened the book on a different device). For example, users can start to read an ebook on a Kindle device, read some more pages on a mobile phone, and then finish reading the ebook on a desktop computer without ever having to search for where they left off.

In 2010, Apple announced its tablet, the iPad,[25] and it was obvious to many that it would be a suitable device for reading ebooks. At the same time, Apple launched the iBookstore and the iBooks app for reading ebooks purchased from their store.[26] Unlike the Kindle or other dedicated ebook readers, the iPad is a multifunctional device and can be used for much more than just reading ebooks.

Various multifunctional devices (such as smartphones, tablets, laptops and desktop computers) can be used to read ebooks, if these devices are set up with ebook applications.

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[24] For an overview of Kindle models and technologies see: http://en.wikipedia.org/wiki/Amazon_Kindle

[25] For an overview of iPad models and technologies see: http://en.wikipedia.org/wiki/IPad

[26] http://en.wikipedia.org/wiki/IBooks#iBookstore

Some devices come with a default ebook application for reading ebooks; for example, iBooks are the default on the iPad, and Google Play is the default on the Google Nexus 7.

On many devices, users interested in ebooks need to discover and download an application for downloading and reading ebooks. For example, users of Android devices can download the Aldiko[27] app supporting various ebook formats (including EPUB); in addition, this Aldiko app includes support for Adobe Digital Editions, which allows books protected with DRM to be downloaded and read. For Windows and Mac OS X users, various ebook reader applications are available. In cases where ebooks are protected by DRM on Windows and Mac computers, users may need a proprietary application for specific ebooks or else an application such as Adobe Digital Editions.

Some ebook readers, lacking built-in connectivity, require a special application to be installed on the user's computer. This application is then used to download ebooks from a store and to transfer them from the computer to the purchaser's ebook reader. This application often can also be used to read the ebooks.

Most ebook readers and ebook applications allow users to make annotations and add virtual bookmarks to copies, which can then be saved and (in some cases) shared with others.

Institutions may want to consider whether ebook applications need to be installed on computers connected to an institutional network to allow users to read and transfer ebooks.

Comparison table: e-reader support for ebook formats

	Plain text	PDF	ePub	HTML	Mobi-Pocket	Kindle	Open eBook
Amazon Kindle 1	Yes	No	No	No	Yes	Yes	No
Amazon Kindle 2, DX	Yes	Yes	No	Yes	Yes	Yes	No
Amazon Kindle 3	Yes	Yes	No	No	Yes	Yes	No
Amazon Kindle 4	Yes	Yes	No	Yes	Yes	Yes	No
Amazon Kindle 5	Yes	Yes	No	Yes	Yes	Yes	No
Amazon Kindle Fire	Yes	Yes	Yes*	Yes**	Yes	Yes	No
Android Devices	Yes	Yes	Yes	Yes**	Yes	Yes	Yes
Apple iOS Devices	Yes	Yes	Yes	Yes**	Yes	Yes	Yes

[27] For an overview of the Aldiko ebook reader application, see: http://www.aldiko.com

	Plain text	PDF	ePub	HTML	Mobi-Pocket	Kindle	Open eBook
Barnes & Noble Nook	Yes	Yes	Yes	Yes	No	No	No
Barnes & Noble Nook Color	Yes	Yes	Yes	Yes	No	No	No
Gnu/Linux Operating System	Yes	Yes	Yes	Yes**	Yes	Yes	Yes
Kobo eReader	Yes	Yes	Yes	Yes	No	No	No
OLPC XO, Sugar	Yes	Yes	Yes	Yes**	No	No	No
Mac OS X	Yes	Yes	Yes	Yes**	Yes	Yes	Yes
Windows	Yes	Yes	Yes	Yes**	Yes	Yes	Yes
Sony Reader	Yes	Yes	Yes	No	No	No	No
Windows Phone 7	Yes	Yes	Yes	Yes	No	Yes	No

Table 2: Comparison of e-reader support for main ebook formats
Source: Adapted from Wikipedia[28]
*Notes: *support requires third-party app **also includes support for HTML5*

In a relatively short timeframe we have seen the ebook reader market evolve, develop and (to a degree) mature. The devices available today allow users to access ebooks at a time and place to suit their needs. These devices have long battery life, very readable screens together with the capacity to store and access hundreds of books.

It is difficult to predict what will happen in the next five years with ebook readers. It may be that the dedicated ebook reader's time is limited and it eventually will be superseded by multifunctional devices, such as the iPad. However, the price of dedicated ebook readers has dropped considerably over 2007 – 2012, such that they are significantly cheaper than other devices. While the latter offer far greater functionality and so can be used for more than just reading ebooks, they do cost up to four or five times more than dedicated ebook readers. What may happen is that dedicated ebook readers may be given away or sold very cheaply in a similar manner to mobile phones and the costs recouped through ebook sales or subscriptions. We may also see dedicated ebook readers acquire more functionality. In September 2011, Amazon released (in the US) the Kindle Fire,[29] which is a simple

[28] http://en.wikipedia.org/wiki/Comparison_of_e-book_formats#Supporting_platforms

[29] For an overview of Kindle Fire models and technologies see: http://en.wikipedia.org/wiki/Kindle_Fire

multifunctional tablet with additional functionality and offers access to content such as music and films in addition to ebooks. Amazon is also developing improved Kindle Fire models that are bigger and contain more powerful hardware.

Google's entry into the tablet market with its own Nexus 7[30] gives users another choice of device and platform on which to read ebooks. As well as supporting Android ebook apps, the Nexus 7 has access to the ebook section of the Google Play store. The various ebook platforms also function on the included Chrome Web browser.

Comparison table: functional capabilities of e-readers

	Dedicated EPUB e-reader	Android tablet	iPad	iPhone 4	Nook Color	Kindle	Kindle Fire
Screen type	Electronic ink	LCD / AMOLED	LCD	Retina LCD	LCD	Electronic ink	LCD
Software stack	Adobe	Android	iOS	iOS	Android Nook Adobe	Linux Kindle	Linux Kindle
Colour support	No	Yes	Yes	Yes	Yes	No	Yes
Video support	No	Yes	Yes	Yes	Yes	No	Yes
Battery life	Excellent	Good	Very good	Good	Good	Excellent	Good
Sunlight readability	Excellent	Fair	Fair	Fair	Fair	Excellent	Fair
Text fidelity	High	Moderate	Moderate	High	Moderate	High	Moderate
Manufacturer	Various	Various	Apple	Apple	Barnes & Noble	Amazon	Amazon

Table 3: Comparison of e-reader functional capabilities

Source: Adapted from Table 7 in Digital Monograph Technical Landscape (Daly, 2012)

[30] For an overview of Nexus 7 technologies see: http://en.wikipedia.org/wiki/Nexus_7

Options for creation, delivery, and use of ebooks

Recently many new options have become available for creating, delivering and using ebooks. As this has become a very fast-moving area of development, the following sections examine key factors in each of these stages of production, delivery, and usage with a particular focus on the implications for academic contexts.

Ebook creation

The first stage in creating an ebook is to create the content. In many cases the content may have already been created for a print publication; in other cases, the content would have been created from the first instance to be published as an ebook. Content that originates in a digital form can be referred to as born-digital, as opposed to analogue content that has been digitised.

As noted by Colm MacCrossan of the Bodleian Libraries, University of Oxford, especially in cases where academic ebooks are not born-digital, the process of creating ebooks often starts long before the final conversion into a specific ebook format: "There is often a text-/content-creation process prior to conversion into an eBook wrapper. (This is particularly important in the realm of digital editions, which vary between the relatively-inexpensive re-purposing of existing resources such as the new Oxford Scholarly Editions Online, and the large-scale production of a whole new corpus such as the 40,000+ manually-keyed books currently in the Early English Books Online Text Creation Partnership collection.)"[31]

The process by which ebooks are created depends on the content of the book and the reader on which the ebook will be used. Though there are software applications that allow text documents to be converted into an ebook format, a publication frequently needs to be tweaked to ensure it flows properly when read on an e-reader or within an ebook application.

Proprietary formats usually have a dedicated application to support the creation of ebooks using that format. For example, Apple's iBooks Author package[32] is used to create ebooks using the ibook file format.

Whereas the provision of traditional paper books has invariably remained in the realm of the publisher, with ebooks it is now possible for individuals to bypass the publishing process and publish ebooks by themselves. As a result, institutions and even individual lecturers using

[31] C. MacCrossan, personal communication, 4 October 2012.

[32] http://www.apple.com/ibooks-author/

various tools can publish ebooks for use by students, often in shorter order than in conventional publishing.

Although the process of ebook authoring and production does not diminish the process of planning, writing and editing, it does remove the need to have a book printed.

Self-publication is making it much easier for academics to bypass traditional publishing business models. Consequently, we may see that the current business models of publishers may change to reflect actual usage by institutions and learners. These changing models will replace those based on historical printed-book models.

A range of tools is available to support the creation of ebooks. Making the right choice of tool is crucial, depending on the type of ebook to be produced and how and where it will be read. Most tools can take a word-processing document and automatically convert it into an EPUB format. Complex documents, however, may need to be tweaked within a text editor to ensure that they meet the EPUB specification.

In cases where PDF ebook creation is required, many different PDF-creation tools are available and in some cases PDF creation will be built into the word-processing application or the operating system.

With the increased use of ebooks, there has been demand for added interactivity in ebooks, embedded videos, 3D diagrams and quizzes. Publishers are looking at various ways of responding to this demand, and in some cases they are producing ebooks as apps that are limited to a specific platform (and which will not work on other e-readers). Unfortunately, these ebooks as apps would not work within the lending model that HE libraries adopt to manage other ebooks.

As some software providers are releasing software packages that can be used to create interactive ebooks, there are limitations associated with these kinds of packages. One example is Apple's iBooks Author software package, which produces ebooks that can only be read on an iPad or iOS device and do not work on a third-party e-reader.

Various Web sites now allow you through a single click to create ebooks of the content to be transferred to an ebook reader. For example, on 17 September 2012 Wikipedia added an EPUB export feature.[33] This feature allows a user to build a collection of Wikipedia articles and generate an ebook in EPUB format containing those articles. Various blog platforms

[33] See the explanation on Wikipedia of this EPUB export feature: https://blog.wikimedia.org/2012/09/17/new-e-book-export-feature-enabled-on-wikipedia/

likewise have plugins that allow blog authors and readers to collate blog posts from the Web and generate an ebook containing those posts, which can be transferred to an ebook reader.

Comparison table: ebook authoring tools

	Cost	Audience	EPUB 2 output	PDF output	Mobi-Pocket output	EPUB input	Notes
Apple Pages	Yes	Authors, consumers, businesses	Yes	Yes	No	No	Mac-only
Scrivener	Yes	Authors	Yes	Yes	Yes	No	Mac-only
Adobe InDesign	Yes	Publishers	Yes	Yes	No	No	Page-focused, expensive
Atlantis	Yes	Authors	Yes	Yes	Yes	No	Windows-only
oXygen Author	Yes	Authors, publishers, XML editors	Yes	Yes	No	Yes	XML-centric
Calibre	Free	Ebook hobbyists	Yes	Yes	Yes	Yes	Conversion tool
Sigil	Free	Hobbyists, micro-publishers	Yes	No	No	Yes	EPUB formatting tool

Table 4: Comparison of ebook authoring tools
Source: Adapted from Appendix of Digital Monograph Technical Landscape *(Daly, 2012)*

Ebook delivery

In the consumer market, most ebooks are supplied via dedicated readers or multifunctional devices running a dedicated app. Within education, the main delivery mechanisms for ebooks for students and staff are proprietary, dedicated platforms. These academic ebook delivery platforms provide the means by which users can browse and search for ebooks, and they also are used for displaying and allowing users to flick through the pages of an ebook. These platforms are either Web-based or accessed via specific applications installed on computers.

Problems may arise with some Web-based platforms that depend on using a specific Web browser (for example, Internet Explorer) and users for some reason do not have access to the

required Web browser. Web-based platforms (and some other ebook applications) also often require Internet access in order to perform most functions including ebook reading, so they are unable to provide off-line access to ebooks.

These delivery platforms are supplied in the main by aggregators who collate collections from publishers and use the platforms to deliver ebooks directly to users.

One criticism of many of these different platforms is that they can be unnecessarily complex and difficult to use. When encountering complex and diverse interfaces, learners often resort to using search engines such as Google and so remain unaware of the ebooks that their institution holds within its collection that Google does not reach. When faced with complex and complicated access methods and gateways, learners not only fail to comprehend the technology employed, but they also fail to see the need to understand it or why they should want to. Currently many platforms are, according to users, unintuitive and difficult to use. There are many reasons for this, but for many learners a key reason is that they do not use these platforms on a regular basis and do not have the time or the patience to learn how to use the platform in order to gain access to resources. The user interfaces of many platforms are designed by technical staff whose primary focus is often on technical features and who do not always consider the end-user or how new users to their platform engage with it. The final report of the JISC National E-books Observatory Project recommended that "publisher and aggregator platforms need to conform to a common set of standards that allow users to access all content, ebooks, ejournals, images etc. easily and intuitively.... Libraries, publishers, aggregators and users need to collaborate to make this vision a reality" (JISC Collections, 2009, p. 37).

Remote access is becoming more important to learners: they want to be able to access resources at a time and place to suit them, often on a device of their choosing. This places demands on platforms in terms of access, authentication and usability. As well as Web platform limitations on offline reading previously mentioned, some ebooks protected by DRM require online authorisation before the ebook can be opened.[34] This can be problematic if there is no connectivity for the authorisation process when attempting to read an ebook remotely.

[34] See comment by Zak Mensah (3 October 2012) on the preview version of this TechWatch: http://blog.observatory.jisc.ac.uk/techwatch-reports/ebooks-in-education/#comment-1846 .

Many publishers are starting to recognise one of the advantages of the ebook format is the potential to target and deliver to consumers directly. This allows publishers to bypass retailers and libraries and market to students individually.[35]

Ebook usage

There are many different ways in which books are read. Generally fiction is read in sequential order, turning from one page to the next. Most ebooks can be read in this fashion and ebook readers are designed for this reading pattern. Academic books and textbooks are used in very different ways and rarely are they read in completely sequential page order. As there are many different and complex ways of reading and using academic books, it can be difficult for an e-reader to support such diverse reading behaviour.

In the same manner that a printed textbook is used alongside writing paper, learners could employ an ebook reader alongside a computer, instead of using the same device for both reading the ebook and for writing.

Users of traditional printed books often bookmark pages and make annotations in the margins, in order to help them make sense of the text or for their future reference. Most modern ebook readers and applications support this functionality. Users are able to bookmark particular pages or add notes linked to a word, sentence or paragraph. One of the major differences between printed books and ebooks is the ability of users to share their notes and annotations with others. Users may share with other individuals, with groups, or even make their notes and annotations public. This form of sharing has implications for how learners use books to support their study. In the past, sharing notes would have been rare and restricted to the learner's immediate peer group. With ebooks, learners can share and access notes from other learners on their course or at other institutions. They can also access notes and annotations made by learners in previous years. This will change how students approach reading recommended texts and could alter their viewpoint because of the bookmarks, notes and annotations they can view as they read the ebook.

One of the dominant advantages of the ebook is also one of the main disadvantages. Most ebook formats allow the user to resize the text and as a result the text will reflow to match the changed size of text. In a similar way, the same ebook on different readers will reflow differently because of varying screen sizes. As a consequence, the text on page 143 of an

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[35] As noted by Sarah Stamford in response to the preview version of this report, this trend in marketing ebooks directly and bypassing libraries has practical cost implications for students (see http://infteam.jiscinvolve.org/wp/2012/09/28/jisc-guidance-on-ebooks/#commentblock).

ebook in one e-reader could be different to that on page 143 when the ebook is viewed on a different reader, or when the text is a different size. Referring to a quotation from a book requires the writer to note the page number. Whereas ebooks in PDF format often have page numbers, other ebook formats do not always display page numbers consistently. When quoting from an ebook on an ebook reader, it is wiser to use instead the chapter and (where possible) section[36] to indicate the location of a quoted span of text. To help address this problem, some ebooks provide an indicative page number for content so that it can be referenced consistently (even if the actual page number varies). Learners will need additional guidance on how to cite ebooks that are held by the institution.

Some basic issues for institutions

The current picture is one of publishers and others engaging in various paths to adoption of etextbooks, choosing among a variety of standards and formats now available. This has resulted in a complicated market and a series of difficult decisions for institutions wanting to adopt and embed the use of ebooks as a support for teaching and learning.

Compatibility

The main issue currently is one of compatibility: the variety of ebook formats means that they cannot be read by all e-readers, or supported on all devices or platforms. Sometimes these limitations arise from technical reasons. Other limitations are generated directly by a decision of a publisher or company, which sometimes involves forcing users to choose a particular format or platform.

It is not a simple process to convert different formats, and in some cases it is technically impossible. In some cases, however, limitations have been deliberately created in order to prevent conversion as a means of enforcing copyright protection.

Digital Rights Management

Publishers will use varied forms of Digital Rights Management (DRM) to protect their intellectual property. DRM is designed to ensure that the ebook is not copied and used by others or distributed to others.

DRM will generally work in two main ways, which have implications for legitimate use of the ebook. Firstly, DRM may stop the user converting the format of an ebook to a different ebook

[36] Colm MacCrossan (personal communication, 4 October 2012) notes that references to *sections* of chapters can often be useful as many academic ebooks have these finer-grained sub-divisions .

format, so that it can be used on a different device. Secondly, DRM may stop the user from transferring the ebook from a platform or a computer to a mobile device.

A well-designed DRM system should not interfere with transferring ebooks from a computer to a mobile device. Legally, circumvention of DRM should never be attempted, even if it is often technically possible. The National E-books Observatory Project recommended to publishers that they should " avoid over-restrictive digital rights management (DRM) technologies and harsh copyright warnings that simply frustrate and scare users, turning them off" (JISC Collections, 2009, p. 37).

Accessibility

Managers within institutions should be aware of the need to consider the position of staff and students with disabilities. "Accessibility is important for all partners. For the JISC partners it influences an institution's exposure under the Disability Discrimination Act (DDA)" (JISC TechDis, 2010a, p.1) . Early adopters are already discovering that ebooks can be a source of added support for students with print impairments. According to JISC TechDis (2010a, p.1), the situation where lamentably low numbers of print books are available in alternative ebook formats (about 5%) is undergoing a sea change with the advent of ebooks. While these alternative formats are still in need of development to extend their accessibility to readers with print impairments, they are already improving matters considerably.

The availability of a work in ebook form tends to empower many readers with print impairments, so these learners are less likely to request assistance in either large-print or personal form. This is a welcome development for learner independence as well as in terms of reduced demand on institutional support services[37].

It is important therefore to ensure that institutional procurement policies and planning in respect of ebooks and ebook platforms take proper account of the requirements of readers with print impairments. Consideration should be given to the capabilities of different systems and how well those systems can serve the needs of visually impaired readers. For example, in the matter of magnification (a key functionality for many) some e-readers support magnification greater than font size 30, whereas others fail to meet this basic requirement of some learners with print impairments.

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[37] A.McNaught (personal communication, 9 November 2012) suggests that the advent of ebook platforms has promoted more confident engagement among less academically proficient learners, who find it easier to interact with ebooks when seeking information .

Other technical points have to be addressed, including reflow and text-to-speech functionalities. Unsurprisingly, reflow is automatically downstream from font size since changing the magnification of text has an effect on the layout of an e-reader's page presentation. How the reflow functionality handles changes in font size selection is consequently important. Another example is the delivery of text-to-speech functionality, whether in-built or external, and in the latter case whether it is interoperable with the e-reader, and so forth.

While it is true that not all reading of ebooks is of the end-to-end reading variety, performed in a sustained and persistent manner, this will nonetheless be the case for a significant proportion of students. In such instances, it is recommended that maximum use of the display features be made (for example, in the selection of backgrounds, text colours, and so on), particularly in the case of readers with learning or reading difficulties such as dyslexia (JISC, 2009, p.21). Once again, therefore, institutional decisions in relation to choosing the best range of such features will have long-term consequences.

As noted by JISC TechDis (2010b), guidance on accessibility is available to institutions working on the adoption and usage of ebooks in education. Agencies involved in this area have published useful documentation to assist library and other departmental policy makers with key decisions[38].

[38] See, for example, the Royal National Institute of Blind People (RNIB) overview of 'Accessibility of eBooks', which includes material on text-to-speech (TTS) systems, magnification, Braille and other factors: http://www.rnib.org.uk/livingwithsightloss/reading/how/ebooks/accessibility/Pages/ebook-accessibility.aspx

3. Ebook scenarios and strategies in academic contexts

This section outlines scenarios for using ebooks in a range of academic contexts, depending upon the specific needs of students and characteristics of disciplines and institutions. It also explains the strategic role of academic libraries in the management of ebook resources as institutions make practical arrangements for supporting the use of ebooks across various disciplines.

As there is no single type of user or student, rigidly uniform and standardised approaches to the implementation of ebooks cannot meet the needs of all users. There are institutional differences: learners in one subject at one institution do not necessarily behave in a similar way to learners at a different institution studying the same subject. There are also differences across disciplines, with learners in one subject area behaving differently to those in others. There are differences between learners in Further Education, those in Higher Education, and those undertaking HE in FE programmes.

With the increase in non-conventional learners in HE, there are now many students who have neither the time nor the resources to visit the library building on a regular basis. They will not make relationships with the staff and will be unable to seek face-to-face help. They will be reliant on the support and access found in library portals and Web pages. Remote access is important to these students, they want to be able to access ebooks at a time and place to suit them on a device of their choosing. It is not just non-conventional learners who access resources remotely: a significant amount of access by all users occurred during evenings and weekends - outside the opening hours of many institutional libraries. According to the JISC National E-books Observatory Project (JISC Collections, 2009), almost a third of page views of ebooks were executed away from the institutional campus.

Scenarios for adoption and use of ebooks

Having found and gained access to the relevant ebooks, learners will want to use these ebooks to support their learning. As with access, there is a balance to be found between ensuring that ebooks are not re-distributed without permission and accommodating users who will want to print them, copy them and (in some cases) share them. Printing and copying restrictions are often implemented to protect ebooks, but on many occasions frustrate and annoy students who wish not to copy the ebook for financial reasons but rather to support their learning. Likewise learners may wish to print sections or chapters from ebooks for those times when connectivity is poor, non-existent or expensive. With restrictions on printing and copying, they may not be able to access ebooks in specific locations and at certain times. Although learners may want to share ebooks with others, most ebooks permit users to use them for their own use and for very valid reasons do not grant rights for distribution. Learners nevertheless may also want to copy ebooks to mobile devices to allow them to access these ebooks whilst they are at work, at home, or travelling. The ways in which learners want to use, share, copy and distribute ebooks generate new challenges for both publishers and institutions.

To demonstrate how ebooks can be used in HE and FE contexts, the next parts of this section describe a number of different scenarios. This is not an exhaustive list, but it is presented to provide ideas and inspiration on how ebooks can be used. Within each of these scenarios are some useful pointers on the implementation of ebooks.

It should be noted that virtually all ebook readers can also be used to read and view other documents as well as ebooks. It can make sense for learners to have access to other resources alongside ebooks on their devices. As the JISC National E-books Observatory Project recommends, "universities need to develop a strategy for raising awareness of all types of ebooks and developing information literacy." (JISC Collections, 2009, p. 27)

Library scenario 1: integrating ebooks into the catalogue

The traditional library allows learners physical access to a range of books and other learning resources. Not all libraries have the resources to operate 24-hour opening, and there remains the geographical constraint on some learners. Similarly there will be peak times when the library may be at full capacity and there may even arise problems with physical access.

Providing online access to resources can alleviate some of these difficulties, by offering students library resources at a time and place to suit them. The provision of ebooks through an online interface allows learners to access recommended reading and texts from any location using an Internet-connected computer or device.

It is considerably easier for students to gain access to books when their lecturers can provide them links to the relevant part of an ebook collection via an institutional platform.

It is useful if any ebook collection is integrated into the library catalogue so that when learners are searching for a book they can use a single interface for both books and ebooks. Adding respective links to the ebooks within the catalogue will ensure that, once a specific ebook has been discovered, a learner can select the link and gain immediate access to the ebook within the collection.

Library scenario 2: providing remote access routes to ebooks

When there is a single print copy of a book in the library, access will be restricted to those who reach the book first and, once issued to a reader, others will have to wait for it to be returned. It is possible to add extra copies or designate the book reference-only. Even with a reference-only copy, however, the book will only be accessible to those learners who can physically reach the library.

Providing an ebook copy ensures that access is possible even for those students who find it difficult or impossible to travel to the library.

Within this library scenario as well as the preceding one, the role of the library in supporting students should not be underestimated. As the JISC National E-books Observatory Project found, "there is a bewildering variety of e-content , and proliferation of ways to get to it. Users don't know how to get to what they want. Libraries face a big challenge in providing clear access routes to e-content" (JISC Collections, 2009, p. 28). As noted in *eBooks in Libraries: A Practical Guide*, this is compounded with the availability of free ebooks, which many libraries either ignore or are unaware of: "Today, there are millions of texts freely available online through myriads of small scale efforts right on up to the behemoth that is Google Books. However, few libraries are currently making full use of this fantastic resource." (Price & Havergal, 2011, p. 53).

Classroom scenario: integrating ebooks directly into group discussion

Providing access to ebooks in a classroom or seminar environment can bring directly into the classroom resources that previously would be restricted to the physical library. Within classroom activities the role of the book is often restricted to the core textbook for the course. It would be entirely possible for learners to be provided with complete access to the reading list for a course were they able to access the books from that list as ebooks during an actual

lesson. Having access within seminars will allow learners to find a particular reference or contextualise an argument or point during a group discussion.

This could provide greater depth to classroom activities and allow for differentiation as individual learners could be assigned varied tasks related to different ebooks, rather than all learners undertaking the same activity and being obliged to use the same core textbook. The JISC National E-books Observatory Project recommends that "teaching staff should also be encouraged to engage more actively in pointing out to students the range of high quality free and paid for e-book content that is available" (JISC Collections, 2009, p. 27).

Lecture theatre scenario: providing ebooks as core texts

Providing core texts as ebooks to support a lecture or series of lectures may enable students to prepare more easily, since they could consult introductory notes using a mobile device on the way to the lecture. Being able to refer to core texts during lectures may help learners gain an understanding of difficult topics or explanations.

Work-based learning scenario: providing easy, flexible access to ebooks

With the increase in delivery of degrees in vocational contexts, it is often easier for learners to have access to a computer or mobile device than to the physical library. In some situations, having a robust, waterproof or toughened device may be preferable to trying to read or use a printed book, whether in the field, laboratory or workshop. Furthermore, for non-traditional learners, the academic library can be intimidating despite the best efforts of the library staff!

The role of ebooks and access through an online platform can make the library appear to be less threatening. Access to ebooks can also enable learners to participate in Higher and Further Education who could find it difficult to attend regularly on campus due to working hours, dependents, or other obligations.

Social learning scenario: providing instant, informal access to ebooks

As with formal learning, ebooks can be used within an informal learning context. The role that ebooks can fulfil is one of immediacy, in providing near-instant access to texts within an informal environment. This may allow for more spontaneous informal learning, for example, within *ad hoc* discussions after formal lectures.

Accessibility scenario: preparing ebooks for students with special needs

The traditional paper book is for some students an inaccessible format that can hinder their learning. Providing ebooks can improve access to content through the use of text-to-speech (TTS) functionality for those with a visual impairment. Likewise reflowable text allows users to increase the size of the font without causing too many problems with how the text and structure of the page will appear on the screen. Often institutions may need to refer to the publisher for a non-protected version of an ebook to enable it to be converted to an alternative format or for use with text-to-speech systems.[39]

For reasons of accessibility you may want to convert an ebook protected by DRM. In these cases, the process is to contact the publisher or the ebook platform and ask for the ebook to be converted into an accessible format.

When faced with these issues, institutions may need to consider how they will meet the differing needs of their students who may arrive with a variety of requirements and a range of different devices capable of reading ebooks. In many cases alternatives may not be available, but it may be useful to be aware of what alternatives there are.

Strategic role of libraries in management of ebooks

There is a strategic role for libraries in the curation and cataloguing of ebooks into existing collections, to ensure that students can easily find and read ebooks using current systems and processes. Libraries also have a role in supporting students and staff in the use of ebooks and ebook platforms. The JISC National E-books Observatory Project (JISC Collections, 2009) found from its research that "the message is clear: as with e-journals, students and teachers are looking to the university library to provide them with access to course text ebooks to support their studies."

Managing ebooks in collections

One of the simplest ways of bringing ebooks into the library is through the purchase of a previously collated collection. Most traditional book suppliers who have worked with libraries for many years now offer ebook platforms for the delivery of ebooks within an academic library environment. Some suppliers will allow libraries to acquire individual copies of books; however with some titles they may only be available as part of a collection.

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[39] To find the right contact for such requests to have non-protected versions of ebooks, see: http://www.publisherlookup.org.uk

Suppliers may vary between offering outright purchase of an ebook, as with a printed book, or offering subscription deals for collections that need to be renewed on a regular basis.

When libraries hold both a print and ebook version of a publication, they will need to make a decision about duplication. There are cost implications, but libraries will need to balance the benefit of offering a choice of format to readers against the unavoidable increase in cost.

One aspect that often arises in discussion is the displacement of printed books by ebooks. At this stage in the evolution of ebooks, they are generally not replacing printed books, even though ejournals have replaced back copies of printed journals. Surveys of students have shown that, when asked to express a preference, students prefer using printed books over ebooks.[40] This implies that users are making a choice just on format; often context and environmental factors have more of a play when making an informed choice. Ebooks are providing choice and alternative ways of accessing books , which with printed books may not be possible.

With virtually all modern book and journal creation originating in a digital form (referred to as born-digital), there are now some ebooks and ejournals that have no printed equivalent and as a result choice for readers may not be possible. It is certainly possible that in the future digital may be the only choice open to institutions.

Managing limitations in lending and access

Depending on the platform in use, the collection, or the publisher concerned, limitations may have to be placed on how an ebook can be used. There may be a limit, for instance, on how many users can concurrently view an ebook on the platform: if one user "borrows" the ebook, then it may not be accessible to other users. If a user transfers the book to a mobile device, then it may then become inaccessible by others.

Some platforms apply the same limitations to copies of ebooks as apply to physical copies of printed books. Often multiple use of an ebook incurs additional costs, so libraries would need to balance cost against the degree of access they are prepared to offer.

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[40] For example, Sarah Stamford notes in a personal communication (5 October 2012) that a survey of students at a University of Cambridge college (conducted in February and March 2012) included these findings: "A majority of students dislike reading onscreen. Most use laptops for reading and a good number print out texts. A clear majority prefer to use ebooks only if a print copy is not available."

Managing acquisitions via patron-driven access (PDA)

Many libraries have listened to their users when deciding which books to acquire. One of the advantages of using an ebook platform is that it allows users to make requests for specific ebooks to be added to a collection. Various platforms allow for these user requests to be authorised and ebooks to be added immediately to the platform . In this patron-driven access (PDA) process, individual users can determine which ebooks are added to library collections.

Difficulties may arise with patron-driven access, however, if libraries employ multiple platforms: this can result in duplicate purchases. To minimise the risk of duplication, systems therefore need to be configured carefully.

Managing convenient access to etextbooks (including open etextbooks)

Many courses have a core textbook, which students are required to purchase. If this textbook is made available to students in ebook format, this arrangement can ensure that the students have easy and immediate access to the core textbook when needed. Research from the JISC National E-books Observatory Project found that "currently course text e-books are supplementary to print: electronic versions are used for quick fact extraction and if the user wants to read at length they may well still purchase the print edition" (JISC Collections, 2009, p. 35). The convenience of an etextbook as compared to a (possibly) heavy paper book will ensure that students are more likely to have the etextbook with them. There is a limitation, however, in ensuring that students have a means of accessing the etextbook. Institutions may want to provide learners with a choice.

Currently there is also a trend in producing free or open etextbooks, and this trend competes directly with publisher versions. These open etextbooks are written by academics and may have an impact in the future if they prove to be popular and successful and (more significantly) are adopted by academics for their modules and courses.

Publishers and ebook suppliers are also looking at tapping into the etextbook market; in the US, for example, Amazon has announced a Kindle textbook rental option. As noted in the SCONUL report entitled *libUX: Improving User Experience in Libraries within the Higher Education Sector*, this has implications for cost and long-term usage : "Amazon has announced a Kindle textbook rental with up to 80% savings over hardcopy purchase, and importantly the ability to access notes made on kindle.amazon.com after the rental period is over." (van Harmelen & Randall, 2011, p. 18). Similar initiatives are very likely to appear in the UK in the future.

4. Challenges in expanding the adoption and use of ebooks

There are many different issues to consider when an institution begins the process of adopting ebooks. These issues will vary, depending on factors such as whether any pilots or projects have already been undertaken and which collections have been subscribed to or purchased.

This section explains key challenges including cultural resistance and technical issues. It will be of interest to readers concerned with avoiding obstacles near- and long-term as institutions manage the effective adoption and use of ebooks in academic contexts.

Cultural resistance

In an academic culture that has used printed paper books for hundreds of years, the move towards the adoption of ebooks is a cultural challenge. Inevitably, users may show signs of cultural resistance and scepticism towards the use of ebooks.

Some users may express a preference for printed books, ignoring some of the advantages offered by ebooks. As the JISC National E-books Observatory Project (JISC Collections, 2009) found from its focus group research, in many cases the printed book is still the preferred format and this preference predominates for several reasons: the physicality of the printed book; a perception that a printed book facilitates greater concentration; belief that it is easier when reading to scan a printed book; and the expectation that a printed page is easier to annotate, highlight, and make notes from.[41] In most cases, these reasons arise as a result of people thinking that using ebooks is about making a choice *not* to use a printed book.

[41] The ethnographic survey carried out for the SCONUL report entitled *libUX: Improving User Experience in Libraries within the Higher Education Sector* revealed similar resistance: "the students we interviewed like paper as a medium, in part because of the easy note and annotation possibilities offered by paper and in part, we suspect, because those surveyed were not familiar as yet with the possibilities of tablets and e-book readers, including their (future) possibilities for single-user and social annotations" (van Harmelen & Randall, 2011, p. 18).

In reality, however, the adoption of ebooks is about providing an alternative: ebooks can be effectively used alongside rather than instead of printed books. As the JISC National E-books Observatory Project notes: "despite massive investment across the Higher Education community and society in general, we know very little about how electronic content is read (or viewed). Assumptions about information structure and design carry over from the print era and may or may not be valid for the digital consumer" (JISC Collections, 2009, p. 39). At this time, we do not know for sure how ebooks (and other electronic content) are being used and applying models based on the culture of printed books may not be the best way forward, or even a valid way forward.

Authentication and distribution

Technical issues in adopting ebooks depend on the platform and types of ebooks in use. The main technical issue that institutions face revolves around authentication and compatibility. In addition, many of the advanced technical features of ebooks may not even be used or known by users. According to the findings of focus groups consisting of UK academic staff and students (Armstrong & Lonsdale, 2009) , for example, "advanced searching and the expanding of the table of contents were almost never used."

Different platforms deploy different forms of authentication, and many platforms use more than one. Access processes need to be simple and, where possible, transparent: multiple logins should be avoided and, where possible, streamlined into a single login request (for example, via Single Sign-on (SSO) technologies). It is important to avoid the need for different authentication processes for off-campus versus on-campus usage of ebooks, as this difference can confuse and frustrate users: having learnt how to access a collection on campus in one particular way, many users may not understand why a different process is required off-campus.

In cases where DRM protection is important, however, it needs to be recognised that only authorised users should be granted access: a robust authentication process is required to grant access only to authorised users. In this situation multiple layers of authentication and different authentication processes for multiple resources can result in confusion for learners. Ironically, this may result in less security since readers may react by adopting weaker (though more memorable) passwords.

IP identification

IP identification is probably the simplest form of authentication and requires virtually no effort from the institution. In this arrangement, the institution merely specifies to the

publisher or platform provider its institutional IP address range, so that only users connected to the institution's computer network are granted access. IP authentication allows users to access an ebook platform freely when using a Web browser (usually on campus) that identifies itself with an institutional IP address. With this arrangement, however, users may still need to log in with an individual account to create personalised virtual bookshelves and to download, copy or print ebooks. Unless users can operate some form of VPN or virtual desktop solution, IP authentication cannot be used off-campus. In these circumstances an alternative process of authentication is unavoidable.

In the past, publishers could normally rely on IP authentication as virtually all users would access their ebook delivery platforms from campus computers. Today learners are more likely to be accessing the same platform from their home desktop computers, laptops in coffee shops, or on mobile phones in train carriages. With this increasing diversity in how users are accessing ebooks, learners are demanding a seamless and single approach to resource discovery and do not want to have to remember different authentication processes depending on their various locations or devices.

Though IP authentication is considered an easy process for authorising access, it should never be considered to be the sole process for authorisation.

Federated access

Federated access[42] allows users to authenticate at their home institution. Users can use the same username and password for both internal and external resources. The same authentication process can be used for resources from different publishers and from different collections. As a result, federated access can reduce significantly the burdens of user administration. Federated access also allows institutions to open their own resources to other institutions more easily.

OpenAthens[43] access gateways provide an alternative to this federated access technology; however, work has been undertaken to make these access gateways interoperable with federated access technology. If a publisher or institution uses either federated access or OpenAthens, institutional users should still be able to access the platform.

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[42] For explanations of federated access, see: http://www.jisc.ac.uk/whatwedo/themes/accessmanagement/federation/faq.aspx#2 .

[43] For an overview of OpenAthens and its relationship to federated access, see: http://www.jisc.ac.uk/whatwedo/themes/accessmanagement/federation/faq.aspx#openathens .

DRM and further layers of authentication

As discussed previously, publishers will often add a layer of DRM to their ebook publications. Where DRM is used alongside authentication for access, users may find that as well as entering their authentication credentials they then have an additional authentication process to perform as they pass through this DRM barrier. This usually happens if the user, having accessed a particular platform, then wants to transfer the ebook to a different device. In this case, what initially appears to users as a simple process can turn into a complex and confusing one. Giving users clear guidance on how to navigate these processes is of paramount importance.

When trying to access ebooks and ebook collections, users may encounter some limitations on where they can use the ebooks. Some collections, for example, can only be used whilst users remain on campus. Users unaware of these restrictions can be frustrated when attempting to access an ebook collection from home, the workplace, a satellite campus, or a partner institution. When signing up for an ebook collection, institutions should check the contract to ensure that all possible use case scenarios are supported within the licence agreement. If it is not practical to cover all possible uses, then institutions should ensure that, as part of the course induction process, all users are aware of these limitations when accessing the collection.

Licensing restrictions and withdrawals

A range of licensing models cover ebooks and how they can be used in reading, lending, copying, printing and transferring to mobile devices or e-readers. Users may often confuse "personal" licensing with "educational" licensing.

With traditional books, it is very easy to make and share copies using a photocopier. As might be expected, users often want to do similar things with ebooks. Different ebook licences allow users to undertake different kinds of copying, but there is an inconsistency in how these licences work and whether the copying is for personal use or for use with learners. Some ebook licences allow readers to make PDF copies of part of a book, which can then be distributed to others. However, some licences only permit users to make PDF copies for personal use. Copying an entire ebook and transferring it to a mobile device (or another computer) is another activity that may be prohibited by the ebook licence. Some ebooks can be transferred via a central service. Other ebooks can be downloaded to users' computers and then copied and transferred to their mobile devices.

In a similar vein, the printing of an ebook is covered by the particular licence for that ebook. Some ebook licences allow a user to print parts of an ebook; very few licences allow a user to print the whole book. As reported by focus groups exploring the attitudes of UK academic staff and students (Armstrong & Lonsdale, 2009), for many users the "preference is to print out material for many of the reasons associated with the participants' preference for reading the printed textbook". These preferences need to be taken into consideration when choosing the kind of licence for a specific ebook or a particular collection of ebooks.

Very occasionally publishers will withdraw an ebook. Unlike a paper book where purchasers retain their copies of the book, when a publisher withdraws an ebook it is removed completely from the system and becomes inaccessible. It has even been known for publishers to remove copies of ebooks from mobile devices (to which they were downloaded before the withdrawal of the ebook from the delivery platform). These withdrawals are made for a variety of reasons: they can arise as a result of the publication of a new edition, from publishers' concerns over errors in the content or in reaction to copyright violation.

Challenges of mobile learning

Printed books were the first to support mobile learning: readers can take printed books with them, carrying content, knowledge and information around with them. Printed books are portable, easily carried and require neither batteries nor charging. However, some printed textbooks can be heavy (particularly if more than one needs to be carried).

Using a mobile device and ebooks means that students can carry a range of books with them and possibly have access to many more through an ebook platform. Various mobile devices are able to read ebooks, either as native ebook devices, or as an app on an existing device. The increase in smartphone ownership and the increasing popularity of tablets means that many more learners have devices capable of reading ebooks. Many of these devices have wifi or 3G and, as a result of this remote connectivity, it has become easier to access ebook platforms and collections whilst on the move.

The how and where of learning is changing. Traditionally students would undertake formalised learning in lecture theatres, labs and seminar rooms, and they would carry on their learning informally within the library or study areas. Restricting access to books to the library was an obvious solution to demand from learners for texts and journals. While currently this model of learning still predominates, non-conventional learners are now accessing Higher and Further Education learning at a time and place to suit them. Such learning can take place in college, at home, in the workplace and elsewhere. As a result, learners need remote and mobile access to learning. Providing access to ebooks for learners through mobile devices can

help remote students make use of a collection of learning resources they may otherwise not be able to use.

Learners and staff are now more mobile than ever before, and access processes need to take account of this mobility. Authentication processes need to meet the demands of ever-increasing user mobility and to ensure a seamless experience for users. These processes need to be identical or similar, regardless of the device or browser used, or the location and type of connection employed by the user.

Proprietary apps vs. Web apps

With a proprietary app from an aggregator, publisher or mobile developer, a user can download and install this app onto a mobile device.

In most cases, the user can employ the app to browse through and buy ebooks and then use the same app for reading. This app is typically designed and developed to work on a specific mobile OS, so it does not function on another device.

Some aggregators of ebook platforms have also created proprietary apps that allow users to browse and search for ebooks and then to use the same apps to read these ebooks. Some proprietary apps and platforms also make it possible to download the ebooks for offline reading.

Some ebook readers are also available as Web apps. Web apps differ from proprietary apps in that they are usually independent of operating systems and require only a modern Web browser. Most Web apps have a similar level of functionality to proprietary apps and, in some cases, developers provide both proprietary and Web versions of their apps.[44]

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[44] For more in-depth discussion of technical development choices related to Web apps versus native or proprietary apps on mobile devices, see *Delivering Web to Mobile* (Power, 2012): http://observatory.jisc.ac.uk/docs/delivering-web-to-mobile.pdf .

5. Ebooks in the future

Although the future is difficult to predict and no one can be really sure where the future of ebooks is heading, ebook technologies are not going away in the near term. In the longer term, however, there could be a real challenge for users of ebooks who would like to continue accessing current ebook formats in the future. For example, will future devices support legacy formats?[45]

This section explains how ebook technologies could rapidly develop over the next years and recommends several ways that Higher and Further Education institutions can prepare for innovation now .

Likewise, the environmental sustainability of ebooks is a difficult question to answer, as one needs to weigh up the total environmental costs of reading ebooks versus the environmental costs of printing (and recycling or pulping) paper books. To assess the environmental sustainability of ebooks, you need to take into account many factors including the total impact of ebook reader production. To assess the environmental sustainability of printed books, you would also need to take into account extra factors (beyond the relevant print production and delivery costs) such as long-term storage expenses.[46]

Given that most ebooks collections used by Higher and Further Education institutions are based on Web platforms, the JISC National E-books Observatory Project recommended that "further user centered research on interface design is critical if screen-based e-books are to be as useful in practice as they are in theory. Considerable evidence exists that current designs are sub-optimal and, in all probability, a stumbling block that is holding back the

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[45] For an introduction to ebook preservation issues, as summarised in the NISO Webinar entitled *Heritage Lost?: Ensuring the Preservation of Ebooks* (23 May 2012), see http://www.niso.org/blog/?p=139. For discussion of ebook preservation in a broader context, see the entire NISO Two-Part Webinar series on *Understanding Critical Elements of E-books: Acquiring, Sharing, and Preserving* available here: http://www.niso.org/news/events/2012/nisowebinars/ebooks_preservation/ .

[46] Colm MacCrossan (personal communication, 4 October 2012) notes that a fair evaluation of environmental sustainability for printed books needs to take into account on-going requirements for "bookcases, rooms or even whole buildings needed for on- and off-site print holdings".

development of the market" (JISC Collections, 2009, p. 39). If this research is undertaken, then we can expect to see in the future platforms and interfaces that are more intuitive and easier to use whilst placing fewer barriers in front of users wanting to read ebooks. As the JISC National E-books Observatory Project observes, "users should not need to be trained to use an e-book platform, no-one receives training to use Amazon" (JISC Collections, 2009, p. 37).

Some possible futures

One possible prediction is that many ebooks may converge back into the Web or as Web-based apps, with the ebook as a format in itself becoming obsolete. A new format may appear on the landscape and make existing formats redundant. This has happened before, with other media formats such as VHS and Laserdisc.[47]

This may cause difficulties for institutions that have invested in ebook platforms and ebook readers. Publishers and aggregators may decide to shut down platforms or authentication services, making ebook collections inaccessible.

On a similar note, the sustainability of ebooks has to be considered by institutions, both in the short term and the long term. Publishers or aggregators may close down; as a result, access may be denied or have to be renegotiated in order to retain access to the ebook collection. Unlike a printed collection, once denied access, an ebook collection is gone; this radical change would require far-reaching adjustments to curriculum delivery or reading lists so as not to affect learners adversely. In cases such as this, institutions may need to replace ebook collections with printed versions or to invest in a different ebook collection.

The JISC National E-books Observatory Project notes the pressures on publishers: "staying still is not an option. The pressure to find viable and sustainable business models for course text e-books is likely to intensify as consumer expectations for immediate access to digital content continue to rise" (JISC Collections, 2009, p. 32). Although publishers may worry that this level of access could reduce print sales, the JISC National E-books Observatory Project found in its research that "there are no short-term indications that free at the point of use e-books made available through the university library impact negatively on print sales to students." As the *Digital Monograph Technical Landscape* (Daly, 2012) notes, however,

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[47] See Price & Havergal (2011) for discussions of the future of ebooks as compared to video: "If we look at other sectors we can see that digital versions of traditional media often result in new and exciting ways of consuming those products. YouTube, iTunes, Freeview and BBC iPlayer show how the format and delivery of audiovisual media has fundamentally changed the film and television viewing experience. We now access video at a time and place to suit us, download it, and play it back on a range of devices." (p. 257).

exposure to ebooks is growing steadily : "as print retail locations flounder and increasingly close altogether, buyers are driven to the web to make purchases. Since most major online retailers sell both print and digital books, even print buyers become progressively more exposed to the idea of reading digitally."

A more likely short-term scenario is that ebooks evolve as connectivity and technologies improve, enabling the ebook experience to be enhanced. The *Digital Monograph Technical Landscape* (Daly, 2012) recommends that "to remain relevant to an audience increasingly consuming media in digital format only, scholarly authors and publishers must facilitate digital-first publishing techniques that are open, aid in discovery, and are highly accessible and device-independent."

There may be a move from static to dynamic content. Currently ebooks contain content that remains the same once the ebook is published (this is a similar process to printed books). Publishers may be able to offer updated and new editions of ebooks faster and more frequently than printed books (but again this a similar process to printed books). In the future the provision of ebooks with dynamic content, however, would allow authors and publishers to update ebooks whenever the need arises and to provide updated data or information at the point of reading. Whereas an economics ebook, for example, may currently contain static historical data on the economy, in the future a dynamic economics ebook could (once the reader reaches a specific page) retrieve a dynamically updated dataset and display it on that page. In this scenario, the reader would continually have access to the most up-to-date information available (and this would have implications for referencing sources).

Future ebooks could dynamically change according to who is reading the ebook, where and when the ebook is being read, and even where a reader is in the learning process. Making ebooks aware of the context in which they are used creates new ways of reading and extends considerably how books can be used for learning.

There are currently apps on smartphones and other devices that send notifications about upgrades; similarly, apps have been developed that are location-aware. It would be relatively simple to embed these technologies into a future ebook format.

In scenarios such as these, errors and mistakes would be easily corrected and users could be confident that they are reading the latest edition. However, these scenarios do create their own issues: someone has to update the book and if this is happening all the time then that represents an additional cost to the publisher, which may result in higher costs to institutions. There are also referencing problems, so access dates would need to be added to citations.

Dynamic ebooks open the possibility of collaborative authorship among academics. This collaboration could take the form of academics creating and jointly writing ebooks for students that could be used at multiple institutions and updated as requirements changed. These ebooks could be "forked" to enable custom versions for the different institutions using them. As with Wikipedia and similar crowdsourced content, issues of authenticity and accuracy could arise and these issues would need to be addressed by those using such ebooks.

Already on devices such as the iPad we are seeing how "publishers are beginning to explore richly visual interfaces that include multimedia and collaborative elements" (Johnson et al, 2011, p. 8) . As noted in the *2011 Horizon Report* (Johnson et al, 2011), the successes of apps for the 'social magazine' *Flipboard*[48] and digital magazines such as *Wired*[49] are extending their readers' experience of textual content. Over the next few years, we are going to see more kinds of books echoing the *Flipboard* social magazine format as well as greater use of interactive graphs and (as might be expected) more richly integrated use of video and audio. Research shows these aspects "can genuinely add value" as "students [find] them invaluable" (Armstrong & Lonsdale, 2009).

The linking, embedding and integration of ebooks with the institutional virtual learning environment (VLE) is one area not currently exploited fully by institutions. Whereas most courses have required and recommended reading lists that students can use to access the relevant texts in the institutional library, what ebooks allow is immediate access to those texts from the confines of the module within the VLE. With this closer integration of ebooks to the VLE, it will be possible to hyperlink a specific reference to a source, allowing students to follow links within ebooks to find a specified passage within a source and to see how the specified passage fits within the context of a chapter or book as a whole.

As noted in the JISC National E-books Observatory Project (JISC Collections, 2009), "our understanding of a whole range of issues needs to be clarified: the interface between libraries, technical staff and academics is often unclear." The integration of ebooks and VLEs does not just happen; planning between different parts of the institutions is required. Within institutions, stakeholders with different needs and expectations tend to produce complex solutions, so discussions to clarify fundamentals are necessary .

The JISC National E-books Observatory Project also notes the lack of clarity of "appropriate business models and licensing arrangements" (JISC Collections, 2009, p. 2). Academics and, more importantly, students may like and prefer the potential opportunities that

[48] http://flipboard.com/

[49] http://www.wired.com/

embedding ebooks into the VLE may represent, but unless there are flexible licensing models and cost-effective solutions this may remain an unfulfilled dream. The gap may be filled by commercial VLE vendors; as the *2011 Horizon Report* noted, "Blackboard has partnered with McGraw-Hill and two booksellers to enable members of faculty to assign and students to buy, electronic texts within the Blackboard system" (Johnson et al., 2011, p. 9). This is certainly different to the arrangement promoted within the JISC National E-books Observatory Project report, which designated free access to ebooks within the VLE as the preferred model.

Many within the education community would prefer an ebook model based on open access. The *Digital Monograph Technical Landscape: Exemplars and Recommendations* (Daly, 2012) found that the "emergence of open access as a preferred or even mandated distribution method" by some institutions was pushing academics and authors down the ebook route to ensure that their publications were open access.

The ebook landscape is an evolving model with rapid changes in technologies and formats in recent years; however, it is still early days compared to other media such as music and films.

The surge in interest in ebooks and ebook readers may have caught many Higher and Further Education institutions by surprise. They may not yet be in position to exploit to the full the potential that the format can bring to education.

Recommendations

As with any emerging technology, technical issues in terms of standards and formats can cause problems and frustration to learners. Cultural barriers to the successful adoption of ebooks also need to be overcome. As the JISC National E-books Observatory Project (JISC Collections, 2009) observes, "we know very little about student purchasing behaviour with regard to course texts in either print or electronic forms."

Higher and Further Education institutions can start to prepare and ensure that processes and systems are in place to take advantage of the benefits that ebooks can bring to education whilst minimising the potential problems that adopting new formats and technologies can bring.

Looking to prepare for developments over the next five years, Higher and Further Education institutions should take into consideration these factors:

- Institutions should develop an explicit ebook strategy that complements existing strategies, or integrate the use of ebooks into those strategies.

- Institutions need to be responsive and agile as they adopt and use ebooks, because the ebook landscape is an evolving one: formats, standards and licensing are not yet in a stable position.

- Institutions need to prepare for new subscription, purchasing and licensing models as the current ones are in an embryonic stage (often following traditional printed-book business models). *If ebooks follow a similar pattern to music and films, these subscription, purchasing and licensing models will evolve and change.*

- Institutions should ensure that their users are fully aware of the possibilities and limitations with any collections or subscriptions, as many technical issues need to be overcome when adopting ebooks. *Specifically, incompatibilities between readers, devices and ebooks need to be identified and addressed whilst users should be made aware of potential issues. Ensuring that different stakeholders actively read and (where appropriate) create ebooks can support this process of understanding.*

- Institutions should consider the current devices their users have before deciding on or recommending a preferred format of ebook, and they should also take into account the range of ebook reader devices that future users are likely to have. *Institutional support for a single ebook format could exclude many users from institutionally provided ebooks. Conversely, providing multiple formats could require additional time and extra costs.*

- Institutions need to consider the importance of cultural change as they challenge and allow for expectations and perceptions of academic staff and students who are adopting and using ebooks.

Clearly, there are many challenges remaining for academic librarians, managers and members of faculty preparing for the effective adoption and use of ebooks in academic contexts.

As academic institutions need to navigate significant challenges in the creation, curation and consumption of ebooks, JISC is working actively with stakeholders to provide practical support in this area. In a forthcoming report (JISC, in press)[50], further guidance will be made available on key areas such as: licensing, budget, workflow, technology, and return on investment (see below the preview graphic from the forthcoming JISC report). Academic decision-makers involved with ebooks should keep a watching brief on this forthcoming report, to be released in 2013.

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[50] Entitled *The Challenges of eBooks in Academic Institutions*, this Digital Infrastructure Directions Series report (to be published online) builds on work by JISC Innovation, JISC Collections, and JISC Digital Media.

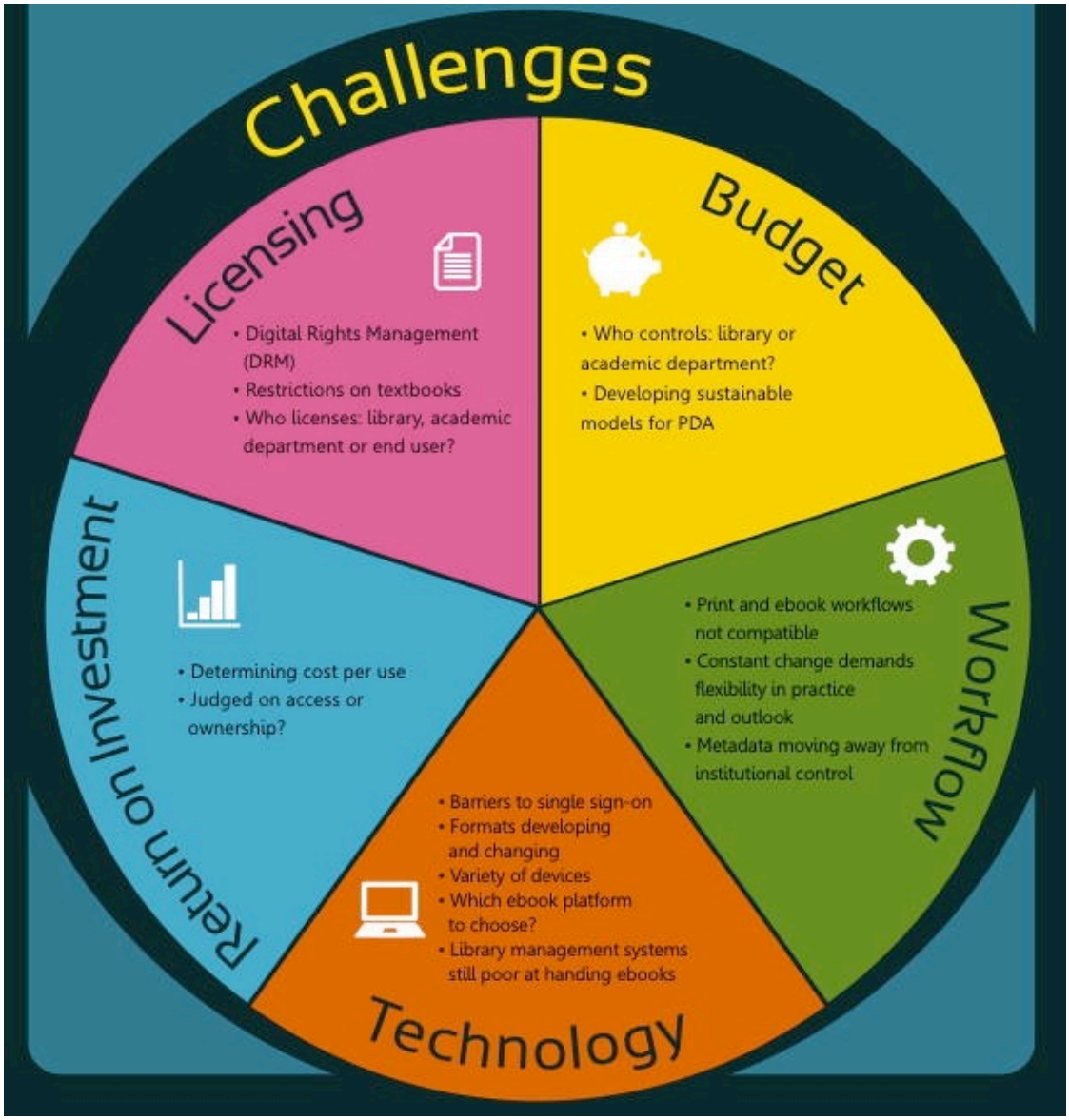

Figure 2: Preview graphic from forthcoming JISC report: *The Challenges of eBooks in Academic Institutions* (in press, to be published online 2013)

Glossary

Term	Description
3G	3G is a mobile wireless Internet service used by different devices for connectivity.
Adobe Content Server	Adobe Content Server is software developed to add digital rights management to ebooks distributed in PDF or EPUB format through Adobe Digital Editions.
Adobe Digital Editions	Adobe Digital Editions is a software application that can be used to manage a library of ebooks and devices, particularly ebook readers. It can also be used to manage access through DRM for protected ebooks.
Aldiko	Aldiko is an ebook reader application for the Android operating system. Supporting the EPUB format for digital publications, this application facilitates browsing and downloading books from online catalogues and provides many options for configuring ebook display. Aldiko does not support font embedding.
Android	Android is a Linux-based operating system developed by Google in conjunction with the Open Handset Alliance primarily for smartphones and tablet computers. Google releases Android code as open source, under the Apache License. Android has a large community of developers producing applications ('apps'), written primarily in a customised version of Java, that extend the functionality of mobile devices.
App	App is a commonly used abbreviation of application, often used to describe applications on mobile devices.

Term	Description
ASCII	The American Standard Code for Information Interchange (ASCII) is a character-encoding scheme widely used to represent text in computers and digital equipment. Most modern character-encoding schemes are based on and extend the 128 characters in ASCII, adding more characters to support non-English languages. ASCII was used in the earliest ebooks produced by Project Gutenberg and prevailed on the Web until late 2007.
AZW	AZW (probably acronym for Amazon Word) is a proprietary file format used by Amazon for the Kindle.
Born-digital	Born-digital is a term referring to content originally created and produced only in a digital format. In the context of ebooks, this born-digital content contrasts with more traditional content created for distribution via printed books. With the rise of ebooks (and digital music), born-digital content is becoming more common. Synonyms include 'digital-first' and 'digital-exclusive'.
Disintermediation	Disintermediation reduces intermediaries between producers and consumers (for example, between authors and readers).
DRM	Digital Rights Management (DRM) describes various technologies that support access control of protected content. DRM can be found in software and hardware and is designed to limit or inhibit the misuse of digital content and devices after purchase by consumers.
Ebook	Ebook is originally a shortened version of the term electronic book, now often used to describe a digital book.
Ebook reader	An ebook reader (also known as e-reader) is a single-function device used for ebooks.
Ejournal	An ejournal (also known as electronic journal and electronic serial) is a scholarly journal or magazine accessible via the Web (or other form of electronic transmission). Some ejournals are online-only journals; others are online versions of printed journals (in some cases, they provide the online equivalent of a printed journal with additional online-only material such as multimedia or extra data).

Term	Description
Electronic paper	Electronic paper is a term for describing the display technology on ebook readers that mimics ink on paper, sometimes inaccurately described using the proprietary term e-ink.
EPUB	EPUB is a popular open file format for ebooks, used by many ebook readers and the iPad. At time of writing of this report, EPUB3 is the current version (although most ebooks are currently published in EPUB2 format due to limited support for EPUB3 in e-readers at present).
E-reader	An e-reader is another term for ebook reader, a single-function device used for ebooks.
Etextbook	An etextbook is a type of ebook (typically assigned as required reading) that provides in digital format some or all of the key educational or instructional content related to an academic course.
FairPlay	FairPlay is the name for the proprietary DRM technology used by Apple for its iOS devices.
Federated access	Federated access is an open authentication technology used for identity management.
FE	Further Education (FE) in the UK is post-compulsory education distinct from that offered by universities (Higher Education). This can range from basic skills training to higher vocational education.
Google Play	Google Play (originally named Android Market) is a digital distribution service operated by Google for books, magazines, music, movies and Android applications. This service can be accessed over the Internet and via the Play Store mobile app (included with most Android and Google TV devices).
HE	Higher Education (HE) in the UK is a term describing academic work towards a university degree. Within the realm of teaching, it includes both undergraduate-level and graduate-level (or postgraduate) education.
HTML	Hypertext Markup Language (HTML) is the coding language used for displaying content in a Web browser.

Term	Description
HTML5	HTML5 is the fifth revision of the standard HTML markup language, still under development as of September 2012. Core aims of HTML5 are to improve its support for multimedia while keeping it easily readable by humans and consistently understood by and adaptable to a very broad range of computers and devices.
iBook	iBook is the proprietary file format used by Apple for ebooks sold in the iBookstore or created using the iBooks Author application.
iBooks Author	iBooks Author is Apple's ebook authoring application, which creates proprietary ebooks in the ibook file format that can only be read using the iBooks application.
iBookstore	iBookstore is Apple's ebook store, which can only be accessed from iOS devices. The same ebooks are sold in the iTunes Store on Macs and Windows PCs.
IDPF	International Digital Publishing Forum (IDPF) is a trade and standards association for the digital publishing industry, which defines the standards for ebook publishing.
iOS	iOS is Apple's mobile operating system used on the iPhone, iPad, and iPod touch mobile devices.
IP address	An Internet Protocol (IP) address is a label, in numerical format, that enables devices to be found on the Internet. IP addresses can be used to restrict access to protected content by only allowing access to content from devices with specified IP addresses.
iPad	iPad is a tablet device made by Apple, which runs iOS.
iPhone	iPhone is a smartphone made by Apple, which runs iOS.
iPod Touch	iPod Touch is small handheld device running iOS made by Apple.
iTunes	iTunes is Apple's desktop software for managing iOS devices. iTunes software is also the gateway to the iTunes Store, where ebooks can be purchased for use on iOS devices.
Kindle	Kindle is the brand name used for Amazon's ebook readers and used for their applications.

Term	Description
Kindle Format 8	Kindle Format 8 is a format for Amazon's Kindle, which will replace the Mobi format.
LCD	Liquid crystal display (LCD) technology uses the light modulating properties of liquid crystals to display text, images, and video in a wide range of devices such as computer monitors, televisions, instrument panels, and e-readers.
mobi	mobi is a legacy format created for the Mobipocket, which was bought by Amazon. Files in mobi format are compatible on Kindle devices and files in non-compatible formats are often converted to mobi format.
MP3	MP3 (also known as MPEG-1 or MPEG-2 Audio Layer III) is a popular, patented encoding format for digital audio that has become a *de facto* standard of digital audio compression for the transfer and playback of music on most digital audio players. Some ebook readers support MP3 and other audio formats.
Open standard	Although there is no single agreed definition, open standard is generally understood to mean a publicly available technical specification that has various rights of use (such as royalty-free usage) associated with it and sometimes may also be designed in an open process. For example, the World Wide Web Consortium (W3C) ensures that its specifications can be implemented on a royalty-free basis.
PDF	Portable Document Format (PDF) is a file format, originally developed by Adobe to display (and print) documents independently of the application software, hardware, and operating system on which they were created.
Project Gutenberg	Project Gutenberg, founded in 1971 as a volunteer effort to digitise texts in the public domain, is often cited as the oldest digital library of ebooks. According to its mission statement, it aims to "encourage the creation and distribution of ebooks" and to make these as free as possible, in long-lasting, open formats that can be used on almost any computer. As of July 2012, Project Gutenberg claimed over 40,000 items in its collection.

Term	Description
Proprietary format	A proprietary format is a file format controlled as the intellectual property of an individual or group asserting ownership over the format. Proprietary formats can be either open if they are published, or closed, if they are considered trade secrets. Proprietary formats are often contrasted with open standards.
Reflowable	A reflowable document can adapt its presentation to various output devices. Whereas typical desktop publishing outputs such as PostScript and PDF are page-oriented and generally not reflowable, HTML and EPUB are designed as reflowable formats (where, for example, line lengths automatically adjust to changes in widths of display areas).
Smartphone	A smartphone is a mobile phone built on a mobile operating system, with advanced computing capability and connectivity. Modern mobile operating systems (including Google's Android, Apple's iOS, and many others) can easily support the reading of ebooks, although the limitations on smartphone screen sizes are not conducive to lengthy reading sessions.
SSO	Single sign-on (SSO) is a property of access control enabling a user to log in once and gain access to multiple systems without being prompted to log in again at each of them.
Standards	There are open and proprietary standards. Open standards are published and and can be used by anyone, whereas proprietary standards are closed and their use is restricted.
Tablet	A tablet (or tablet computer) is a mobile computing device larger than a smartphone, typically operated by touching the screen rather than using a physical keyboard. Tablets such as the iPad (running iOS) or others running Android or Windows operating systems can easily support the reading of ebooks and are more conducive to longer reading sessions than smartphones, which are limited by smaller screen sizes.

Term	Description
USB	Universal Serial Bus (USB) is an industry standard developed in the mid-1990s to define how cables, connectors and communications protocols are used for connection, communication and power supply between computers and other electronic devices (including e-readers).
VLE	A Virtual Learning Environment (VLE) is an online platform for the delivery of courses and modules.
VPN	A Virtual Private Network (VPN) is a mechanism for connecting remote networks (or computers) to a single network through the Internet.
Whispersync	Whispersync is an Amazon service that enables Kindle ebook customers to synchronise reading progress, bookmarks and other information across Kindle hardware devices and other mobile devices.
XML	eXtensible Markup Language (XML) is a common and flexible markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.
XHTML	XHTML (Extensible HyperText Markup Language) is a family of XML-based markup languages that mirror or extend versions of Hypertext Markup Language (HTML), the language in which Web pages are written.
XHTML 1.1	XHTML 1.1 is a module-based XHTML markup language. An EPUB file (as of version 2.0.1) uses XHTML 1.1 to construct the content of an ebook.
XHTML5	XHTML5 is the XML serialisation (storable version) of HTML5, requiring XML's strict, well-formed syntax. EPUB3 uses XHTML5 (rather than XHTML 1.1) markup language.

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Acknowledgements

A note from this report's commissioned author

I would like to acknowledge Scott Wilson for recommending me to the Observatory project team as well as Dr. Thom Bunting for overall project management of this report, from initial commissioning to release of the final version.

Thank you also to Li Yuan, Scott Wilson, Scott Leslie and others who provided comments on an early draft of this report, providing valuable advice on moving this forward.

I would also like to thank all those members of the online community who took the time to read and provide commentary during the open commenting period (27 September to 8 October 2012). In particular, I would like to mention the helpful comments provided by Colm MacCrossan, Alistair McNaught, Zak Mensah, Virginia Power, Sarah Stamford and Mark van Harmelen. Many thanks also to Phil Barker and Li Yuan for writing their foreword to this report, which helps clarify the background and some of the key challenges of ebooks in academic contexts.

Finally, thank you to Richard Waller for his editorial guidance, support and skills in taking my draft to this published version.

James Clay, Gloucestershire College, November 2012

About other contributors

As the latest in the JISC Observatory's TechWatch series, this report benefited from the contributions of many people collaborating to monitor developments in technologies of relevance to Higher and Further Education. Many colleagues from UKOLN and JISC CETIS as well as JISC have contributed to this monitoring process and helped with the final selection of the topic for this report. In addition to those acknowledged above by the author, special thanks go to Rachel Bruce, Adam Cooper, Brian Kelly, Andrew McGregor, Tish Roberts, Ben Showers, Amber Thomas and Paul Walk for their various contributions along the way in the production of this TechWatch report.

Thom Bunting, Innovation Support Centre at UKOLN, October 2012

About JISC Observatory

JISC Observatory provides prioritised information, analysis, and recommendations regarding emerging innovations (technologies, standards) and their usage relevant to Higher and Further Education.

This work aims to ensure that sector institutions can plan interventions in enough time to sustain world-class education and research.

Observatory process

The JISC Observatory evidence-gathering process draws out tacit knowledge and informed experience of those working at JISC and its Innovation Support Centres (UKOLN and JISC CETIS) as well as throughout a broad range of sector institutions. Through a methodical scanning and sense-making process, this knowledge is made concrete in the form of TechWatch reports, briefings, and other deliverables associated with events.

JISC Observatory uses methods of consultation with others in the sector to inform its work. For objective analysis, it commissions external authors with relevant expertise for its major reports. Working across administrative areas and domains, it produces guidance of relevance to a broad range of roles.

Feedback on this report

JISC Observatory welcomes feedback on this TechWatch report. Please send detailed comments to Observatory Project Manager Thom Bunting (t.bunting@ukoln.ac.uk) or post your feedback on the page where the final version of this report is released on the JISC Observatory Web site: http://blog.observatory.jisc.ac.uk/techwatch-reports/ebooks-in-education/.