

## **Supporting students in an increasingly digital information environment:**

### **a literature review**

A literature search was carried out to find recent research and evidence on students' use of ebooks and how they engage with online texts for academic learning. There are many well-documented advantages to ebooks including convenience, ease of access, 24/7 availability, remote access, search functionality, accessibility to multiple users, ability to print, copy and paste information (Goertzen and Bakalbasi, 2016; Mulholland and Bates, 2014; Ashcroft, 2011). However, the literature also revealed a number of different challenges arising from ebooks that not only impact on students' learning, but can also affect their health and wellbeing. This literature review focusses on these challenges and identifies areas to explore further as part of the Future Library project.

One of the main themes identified in the literature surrounds reading comprehension. It is reported that when reading ebooks, students only get a general understanding of the text as opposed to a detailed, deeper understanding (Singer and Alexander, 2017; Wastlund, Norlander and Archer, 2008). Studies also show that students read quicker online, which could mean that the information isn't absorbed properly, in turn leading to reduced understanding (Singer, Alexander and Berkowitz, 2017; Cull, 2011). In Marques de Oliveira's 2012 study of one hundred and eight students, only twenty-three answered the question about whether etextbooks affected their learning experience and, of these, ten felt that they influenced it negatively. It is, however, acknowledged that electronic or digital text is suitable for understanding the overall gist of something, but not for specific or detailed information (Singer and Alexander, 2017).

Furthermore, there are studies showing that students don't fully immerse themselves or cognitively engage with digital text (Potnis, Pino and Deosthali, 2017). Instead, they tend to browse, skim or scan the text online, and therefore process the text in a very shallow or superficial way (Dobler, 2015; Foasberg, 2014; Ackerman and Goldsmith, 2011). In fact, students often scan the digital text because they are looking for keywords or facts to use as citations (Goertzen and Bakalbasi, 2016; Nicholas, Rowlands and Jamali, 2010). As a result, it is argued that students simply "use rather than read" ebooks (Potnis, Pino and Deosthali, 2017, p.324) and that these are more appropriate for "power browsing" (Mizrachi, 2016, p.594). Concerningly for educators, it appears that students are so intent on searching for quotations, they do not read the full text in order to understand the wider argument or context. As Walton rather bleakly points out "In a cut-and-paste world, critical thinking is lacking" (2008, p.27).

In contrast, the literature shows that print is better suited for deep, serious or long-form reading (Keller, 2012; Liu, 2011; Nicholas, Rowlands and Jamali, 2010) as knowledge is better assimilated on paper (Mangen, Walgermo and Brønneck, 2013). Students also believe that print "enables greater focus and more active and efficient learning, especially for longer and more complex material" (Mizrachi, 2016, p.593). As a result, they prefer print when reading important material for their coursework (Mizrachi, 2016), when they want to

achieve a better learning outcome (Mizrachi 2015; Keller 2012; Jeong, 2010) or when “effortful learning” is required (Ackerman and Goldsmith, 2011, p.29).

In the context of health and wellbeing, there is evidence that reading online requires more concentration and is therefore more mentally taxing, which leads to a certain physical tiredness and stress (Jabr, 2013; Wastlund *et al.*, 2005). Moreover, the difference in lighting conditions between reading on a screen and reading in print can also cause problems. It is reported that light-emitting screens (LCD computer screens) can cause visual fatigue which may in turn affect reading comprehension (Mangen, 2013). Other studies also report health-related problems such as eyestrain and headaches (Mennenga, 2016; Mulholland and Bates, 2014; Keller, 2012; Jeong, 2010; Mizrachi, 2010). Summarised by Jabr (2013, p.51) “prolonged reading on glossy, self-illuminated screens can cause eyestrain, headaches and blurred vision”.

There are also some significant navigational issues associated with ebooks that can create cognitive barriers to managing and using information (Myrberg, 2017). In Potnis, Pino and Deosthali’s 2010 study, they investigated the adverse effects of sixty barriers to using information in ebooks. The navigation problems are explained in detail and are said to be particularly frustrating for students who store and retrieve information visually. Muir and Hawes also describe ebooks as having “awkward navigation tools” and “interfaces that are not intuitive to use” (2013, p.272). Other authors report similar issues: Berg, Hoffman and Dawson’s participants claimed that “moving through ebooks was cumbersome and slow” (2010, p.522) and Nicholas, Rowlands and Jamali’s students were “confused by the myriad navigational routes and display options” (2010, p.274). This is further exacerbated by the fact that students encounter a variety of navigation systems in ebooks from different publishers (Walton, 2013).

Scrolling is identified as a further concern because it means that students have to focus on moving through the text rather than focussing on the text itself. This is said to break their concentration and drain more mental resources (Potnis, Pino and Deosthali, 2010; Wastlund, Norlander and Archer, 2007). Mizrachi found that students prefer “linear progression as opposed to [vertical] scrolling” (2014, p.740) as this makes it easier to concentrate. Keller concluded that “the scroll bar was simply not a satisfactory replacement for the experience of turning a page” (2012, p.11).

Having to scroll through ebooks page by page also affects students’ mental picture of the text and whereabouts they are in it because they are unable to see the book in its entirety (Myrberg and Wiberg, 2015; Mangen, 2013; Berg, 2010; Kerr and Symons, 2006). This is heightened by the fact that there is a reported relationship between turning pages and remembering where something appears in a text and reading comprehension:

“Scrolling is known to hamper the process of reading, by imposing a spatial instability which may negatively affect the reader’s mental representation of the text and, by implication, comprehension” (Mangen, 2013, p.65).

Interestingly, turning the page of a print book also seems to have a motivational effect on students because “it marked progress, conveyed a sense of achievement, broke down texts

into manageable “chunks” and provided orientation” (Keller, 2012, p.11) none of which can be replicated satisfactorily in an ebook.

Print textbooks on the other hand, do provide those navigational landmarks missing from ebooks and which are so vital for students with visual memory. The fixed nature of printed text is clearly advantageous because it provides “unequivocal and fixed spatial cues for text memory and recall” (Mangen, 2013, p.66). So it appears that having access to a complete text helps you remember whereabouts the information was written (Singer and Alexander, 2017) and this in turn, it is suggested, is related to reading comprehension (Kerr and Symons, 2006).

A large number of studies report on students’ overwhelming preference for the physical, tangible and tactile properties of print books (Berg, Hoffmann and Dawson, 2010; Gregory, 2008), particularly in long-form reading. It is evident that students like being able to touch and hold a book, turn pages, and flick or thumb through pages (Mizrachi, 2014; Keller, 2012). In their 2010 study, Berg, Hoffman and Dawson found that “participants essentially used the tangibility of the print book as an information-seeking aid” (p.522). Conversely, it is the very intangibility of digital text that makes students lose their “sense of place” within the book (2010, p.523). This problem is further exacerbated when students are using multiple sources at the same time as it involves having lots of different tabs or windows open on your computer and moving between them (Estelle, 2016). There is also similar, student-related evidence from Kelly Goodfellow, SpLD advisor at UWE.

A number of authors have investigated the lack of or difficulty in using note-taking tools in ebooks (Myrberg, 2017). In Li *et al*’s 2011 *Academic Ebook usage survey*, the authors found that “dissatisfaction with ebook annotation tools is frequently mentioned as a stumbling block to ebook adoption” (p.15). Worryingly, respondents in Carroll *et al*’s 2016 study felt that “e-books’ lack of highlighting and annotation tools stymied scholarship” (p.150). Cassidy, Martinez and Shen found that nearly 70% of their respondents rated note-taking capabilities as either very important or somewhat important (2012, p.329). This is significant, because the ability to highlight and annotate text is key to allowing students to physically interact and engage with their reading and therefore absorb information (Mizrachi, 2010; Gregory, 2008). Moreover, these “active learning strategies” (Mizrachi, 2016, p.592) or “responsive reading” (Foasberg, 2014, p.713) can “assist with a reader’s critical engagement with a text and improve reading comprehension” (Cassidy, Martinez and Shen, 2012, p.329).

Finally, there is abundant evidence that students are too easily distracted when reading online as they cannot block out external stimuli (Sandberg, 2011). Whilst distraction is not peculiar to an ebook environment, much of the literature confirms that reading online presents users with too many distractions and options for multi-tasking, thus making it much harder to focus and concentrate on the text (Dobler, 2015; Larson, 2012; Li *et al*, 2011; Sandberg, 2011; Gregory, 2008; Liu, 2005). One participant in Liu’s study explained that “his/her concentration is interrupted by other tasks (e.g. email) when multiple windows are open” (2005, p.707). In Larson’s 2012 study of trainee teachers, one participant said “because I was reading on a laptop, I kept checking Facebook and other stuff, and I had a hard time concentrating on the book” (p.287). Hamer and McGrath’s study of two hundred

and thirty-seven undergraduates found that 71.3% were more likely to be distracted or their mind wandered when reading on screen (2011, p.34). Nicholas, Rowlands and Jamali found that readers were easily distracted due to “the ability to move out of the ebook environment with ease and at will” (2010, p.274). Keller concluded that “the distraction caused by the computer was a persistent and serious problem” for almost all students (2012, p.12).

Naturally, print is less distracting and preferable for serious study because “paper keeps me focused and away from distractions that may arise from computer usage” (Li *et al*, 2011, p.11). In Gregory’s 2008 study, her students preferred print because they were “less likely to be distracted by other aspects of computing, such as email or instant messaging” (p.270). This is clearly significant and an area for further investigation.

Finally, one of the clear messages to come out of the literature review is that librarians need to be aware of both the advantages and disadvantages offered by print and digital reading and that we should provide a balanced or hybrid collection where both forms can co-exist and complement one another (Durant and Horova, 2015; Mulholland and Bates, 2014; Walton, 2013; Jeong, 2010; Gregory, 2008). We should not underestimate the importance of print collections and continue to ensure access to print textbooks that require deep or long-form reading. We need to respect student choice and the diversity of students’ preferences and learning styles, especially those students who are at a disadvantage, as it is clear that one size does not fit all (Singer and Alexander, 2017; Mizrachi, 2016; Dobler, 2015; Durant and Horova, 2015; Mizrachi, 2010; Gregory, 2008).

## **Recommendations**

Firstly, librarians should work with publishers and encourage them to make ebooks easier to view and address technological barriers such as (lack of or difficult to use) note-taking tools. Importantly, this functionality would also enable students to be able to critically engage with ebooks in much the same way as they do with print (Cassidy, Martinez and Shen, 2010). Carroll *et al* (2016) suggest that ebooks might be more popular if a “DRM (digital rights management)-free e-book application that provides intuitive annotation tools” could be developed (p.150). This theme is further explored by Myrberg (2017, p.120) who states that “the main issue when it comes to accessibility and e-books is digital rights management (DRM). We have already purchased some DRM-free ebooks (e.g. from Edward Elgar) and need to build on this approach.

It would also be ideal if all ebooks functioned in a similar fashion providing a uniformity of interface and functionality. Mulholland and Bates believe that “improved user-friendly design with consistent, standardised features across all e-book platforms” would improve ebook usage (2014, p.497). Walton argues that “understanding the impact of students’ frustration with navigating disparate systems might encourage publishers to adopt a uniform e-book system” (2013, p.268).

Myrberg and Wiberg (2015) agree that developers should make ebooks more user-friendly, that publishers need to maximise the full potential of ebooks and emphasise that people will continue to prefer print and only adopt ebooks when “the shortcomings of screens

regarding spatial landmarks” are addressed (2015, p.50). One suggestion would be to try and imitate print books and make the pages flip over instead of having to scroll vertically. Wastlund, Norlander and Archer (2008, p.1243) conclude that “in order to minimize mental workload, the layout of documents must be optimized for onscreen viewing”. In short, according to Mulholland and Bates, “E-books need to be fit for purpose” (2014, p.497).

Accessibility is an important issue, especially for students with disabilities. Specific recommendations from a SpLD advisor at UWE Bristol include a toolbar which allows students to manipulate the text in such a way that suits their learning style e.g. change size of font or type face. This is expanded on by Cassidy, Martinez and Shen who recommend that:

“e-book publishers and platform designers attempt to provide as many options as possible for visually adjusting a text’s display, as well as options for printing and converting text to speech, in order to provide the best possible experience to the maximum number of users, regardless of abilities” (2012, p.330).

It is therefore suggested that a task and finish group has responsibility for identifying any ongoing research or working groups who are currently working with publishers to try and address these problems so that we can support all students to make better use of ebooks. There should also be an explicit mechanism with UWE Library Services to ensure that we keep up-to-date with all future evidence and developments through identification of relevant literature.

Secondly, further research should be carried out through usability testing in order to “understand the end user’s learning experience, behaviour and interaction with e-books” (Mulholland and Bates, 2014, p.497). We need to investigate what happens when students read and process information in ebooks, so that we know more about the cognitive impact of reading online and the effect on reading comprehension (Mizrachi, 2014). It would also be useful to conduct a qualitative study of students, possibly using one of the surveys accessed as part of this review.

Thirdly, and rather surprisingly, it seems apparent that students “do not intuitively know how to navigate and use ebooks effectively” (Berg, 2010, p.593) and that in many cases ebooks are “unchartered territory” (Dobler, 2015, p.489). It is therefore vitally important that we teach students how to develop and enhance their “ebook literacy skills” (Muir and Hawes, 2013, p.272), make effective use of ebooks, and fully utilise their additional or advanced features in order to achieve the best learning outcomes (Ross *et al*, 2017; Cassidy, Martinez and Shen, 2012; Berg, Hoffman and Dawson, 2010). This support could either be through an enhancement to our existing suite of workshops or via 1:1 provision. We could focus on helping students acquire practical reading skills to manage and organise their online reading (Hamer and McGrath, 2011). It is clear that students need effective strategies to deal with all the issues outlined above and therefore reduce any barriers to effective use (Ross *et al*, 2017; Muir and Hawes, 2013; Hamer and McGrath, 2011). Ultimately, evidence-based techniques need to be developed so that we can overcome the barriers and maximise the benefits and ultimately the use of ebooks (Singer Trakhman, Alexander and Berkowitz,

2017). This could potentially feed into the work currently being undertaken via Mark Shand's digital capabilities project and build on the ebook training organised by Ted and Rhiannon.

Finally, students need to learn how to concentrate better when reading digitally in order to avoid and/or manage online distractions. Myrberg (2017) suggests that students simply turn off notifications or turn on flight mode. Experts in the field could also teach techniques such as learning to read more slowly online (Singer Trakhman, Alexander and Berkowitz, 2017), to focus on the content, to be more present in the moment and be more cognitively engaged (Dobler, 2015; Keller, 2012). Explicitly, "strategies must be developed, taught, and modelled to minimize distractions and maximize concentration" (Hamer and McGrath, 2011, p.34). These online reading techniques could include elements from wellbeing, mindfulness or resilience training.

In conclusion, this literature review has identified a number of challenges which students encounter when using ebooks and has made some practical recommendations for future practice and further research. It is hoped that these findings will contribute to the physical collections strand of the Shaping the Future UWE Library project and help determine the way forward in an increasingly digital information environment.

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