

# Going Digital: Literature Review on E-textbooks

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**Abstract.** Digitising textbooks is becoming an increasingly important practice in formal education. While higher education has been the main focus of research on e-textbooks so far, the topic is also gaining attention in other areas of formal education. This paper reports on an initial attempt to review and synthesise research and development literature on e-textbooks - mainly in the context of K-12 education. While the project is still work in progress, some provisional findings, main demarcation lines, and visible directions in the field are reported and discussed.

**Keywords:** e-textbooks, literature review, digitisation, K-12 education.

## 1 Introduction

Digitising textbooks is becoming an increasingly important practice in formal education. While higher education has been the main focus of research on e-textbooks so far, the topic is also gaining attention in K-12 education. In recent years academic and educational publishers have started to follow the phenomenon of extensive digitisation by converting printed textbooks into digital formats that can be read on a computer screen, a special e-book reader, a personal digital assistant (PDA), or even a mobile phone [1].

This paper reports on an initial attempt to review and synthesise research and development literature on the use of e-textbooks mainly in K-12 education. In the literature the terms e-textbook, digital textbook, electronic textbook are used interchangeably and were thus included into the search and selection of material for our literature base. While collecting literature we noticed that some authors have used the more general term e-book to refer to instructional materials in educational settings. Literature in which e-book is clearly used in the sense of “textbook” in an educational setting was included in our literature base. For consistency and clarification we have decided to use one term - e-textbook throughout this paper. We attempt to provide an overview of what are considered to be the main research problems related to e-textbooks in the context of formal education and to delineate the evolution of research trends in this field. It must be noted here that the majority of contributions deals with problems and challenges related to e-textbooks in higher education. Though our current interest is primarily in the context of K-12 education, we found it useful and informative to also include literature into our review that reports on challenges and empirical findings regarding the use of e-textbooks in

higher education. While our review project is still work in progress, we want to take the opportunity to report and discuss some provisional findings and insights in the following paragraphs.

## 2 The Role of Textbooks

Textbooks have been used and still are used as the main reference tool and primary means of delivering course content in K-12 education since the widespread availability of the printing press [2]. Textbooks are often seen as the central tool in instructional settings providing input into classroom lessons in the form of texts, activities, explanations, and so on [3]. Many proponents of the textbook culture in education believe that “no teaching-learning situation, it seems, is complete until it has its relevant textbook” [3, p. 315]. For teachers textbooks are an instructional aid. They save time, give direction to lessons, guide discussion, facilitate homework assignments, thus making teaching practice better organized and somewhat more convenient and easier to handle. For students textbooks in their traditional sense are meant to be as a framework or guide that helps them organising and supporting their learning activity in the classroom and at home. Most of all the role of the textbook is to provide structure, confidence and security [3]. Textbooks reflect the academic standards, specific objectives, and ideologies commonly found in public curricula. Thus, problems of availability of up-to-date, governmentally approved, textbooks are generally considered to severely impair teaching practice. Without a doubt, textbooks have played, and still play, an enormous role in K-12 education as the most convenient means for providing structure for guiding through an instructional event.

## 3 Rationale for Going Digital

It is of little surprise that the ever-growing expansion of digitisation in different spheres of our society shows an increasing impact on educational practice in recent years. Digitising textbooks has become – and appears to remain for the foreseeable future - one of the popular issues of research, debate and discussion. How should an e-textbook look like in the first place? What is the added value and challenges of implementing an e-textbook? are typical questions raised in this context. Maynard and Cheyne [4], for example, simply define e-textbooks as “educational materials that have been electronically published to assist both teaching and learning methods” (p.104). This general and commonly accepted definition has been taken as a basis for many e-textbook implementation initiatives in K-12 education. The aforementioned definition reflects a basic replication of a printed textbook within a different medium. It is quite likely that this type of understanding is somewhat nurtured by the commercially successful and constantly growing market for “e-books” in general.

E-books have been around for quite some years by now and educational publishing companies have started to follow the same road, carrying the assumption that the added-value of e-textbooks is in principle perceived along very similar lines. The mere digital re-production of formally printed textbooks allows for the continuation of

educational practices that had developed around printed texts [5]. In addition to its presentation as an innovative medium in education, the e-textbook is very often demonstrated as an entertainment technology or an instrument to raise students' motivation of digital age. The current status of our ongoing literature review seems to indicate that the main driver for "going digital" with textbooks is regularly purely economical considerations. Although, most of the studies we reviewed refer to cost reductions through the introduction of e-textbooks in higher education, it seems reasonable to assume that a similar claim should be also valid in the context of K-12 systems. For those interested in numbers and cost models we recommend for example the following papers: [6-11].

There is little doubt that digitisation is transforming a wide range of human activity systems. While this inevitably creates tensions and contradictions, it also provides a wide variety of new potentials for action and interaction and its mediation. In fact, the potential for increased levels of interaction has been acknowledged and promoted as one key added-value of digital textbooks. It is becoming a rather common belief among publishing companies, educators, instructional designers and policy makers that e-textbooks need to (and can) be redesigned in a way that enables somewhat richer and more variable opportunities for interaction with their content. McFall [2], for example, claims that "in order for electronic textbooks to be widely accepted, they must be designed with a goal of transforming the way students interact with a textbook to significantly enhance student learning" (p. 74). In a similar vein Tezak [12] offers an interactive model of an e-textbook supplemented with a workbook. It contains inner and outer links providing access to additional resources on the Web. Severin and Capota [13] report on a South Korean initiative to replace traditional textbooks with interactive e-textbooks. These interactive and customisable e-textbooks include the content of existing textbooks, reference books, workbooks, glossaries, and so forth, and integrate them with additional digital audio-video material such as video clips, animations, and elements of virtual reality.

Turning e-textbooks more interactive in comparison to their printed counterparts is a step further in terms of technical and conceptual development. However, the bulk of e-textbook solutions and implementations models currently available are not making use of the full potential of digital media and technology in educational use contexts.

## 4 Students' Performance and Experiences with E-textbooks

Aside from research on economical and interactivity issues, another prominent strand in the field of e-textbook research is related to students' experiences, perceptions and performance with e-textbooks. This research strand is dominant in higher education settings (see for example 14-21], however, a few studies can be found also in the context of K-12 education (see for instance [22-24]).

Typical research questions in this strand are for instance: *How do students experience and perceive e-textbooks in comparison to their printed versions? Do e-textbooks enhance or influence students' performance and overall learning activity? ... and so forth.* The findings are mixed. Shepperd et al. [17], for example, found that

students using e-textbooks spent less time on reading for class compared to students using printed texts. In addition, they were not interested in a continued use of e-textbooks (as a replication of the printed version). Similar conclusions are made by McGowan et al. [14] who claim that an overwhelming number of students prefer paper based textbooks.

While some authors emphasise that the experience of reading e-books is not equivalent to reading e-textbooks [25], studies on reading capability and behavior in respect to e-textbooks demonstrate that students do not prefer them over printed textbooks regardless of their gender, level of computer use, or comfort with computers. E-textbooks are regularly perceived as even more time consuming than working with paper based texts (see for example [26, 27]). Thus, some authors conclude that paper based textbooks should not be readily abandoned. Simon's [18] study, however, demonstrates quite the opposite. He explored students' e-reading habits and reported that students who volunteered using e-textbooks were happy about the experience, mainly because e-textbooks allowed some additional functions such as glossary look-up and bookmarking features to be used [18].

With respect to improved student performance there are rather incompatible research results reported. They range from claims that learners do not perform differently, or significantly better, with current e-textbooks (e.g. [27]) to claims that students who engage with e-textbooks show higher motivation and better learning outcomes (e.g. [4]).

Sun et al. [19] studied how an e-textbook can facilitate college students' learning, how well it promotes student's involvement in learning, and how much it improves learning outcomes. Their results indicate that e-textbooks are perceived as enhancers of student learning outcomes and involvement. Positive findings were also demonstrated by [16] who claim that textbooks can be extremely popular and widely used - mainly for obtaining snippets of information and for fact-finding. The main reason for using e-textbooks among the students apparently was ease of access and convenience [16].

In the context of K-12 education system, Luik and Mikk [23] designed a study that explored which characteristics of electronic textbooks correlated with knowledge acquisition by learners of different achievement levels. They concluded that not only the content of e-textbooks but also the design of the e-textbook software should be adapted according to the different achievement levels of students [23]. Lau [22] reports that e-textbooks should be seen as an extension of printed textbooks - not a replacement but an enhancement. Lau also suggests that younger students adopt e-textbooks a lot easier, while adult learners seem to be more reluctant.

## **5 The Limited Popularity of E-textbooks**

Whenever a new tool or technology comes along there is the potential for disruption to the existing order of activity and practice [28]. According to Smith et al. [28] disruption comes mainly in two forms: "e-[text]books can enable us to do the same things but in different ways, but they can also enable us to do different things – things

that we were not able to easily do before they arrived or even do at all” (p. 50). While we are not denying the importance of economical considerations and the examination of new affordances for interaction that e-textbooks provide, we want to suggest that it seems crucial to raise some fundamental questions regarding educational practices mediated by digital texts and their further development:

*In what ways is digitisation transforming our current teaching and learning practices and the use of textual artefacts?*

*How can we re-conceptualise the textbook and textbook-like procedures in the context of the ongoing digital transformation?*

*What kind of digital artefacts might be better suited to mediate individual and collaborative knowledge construction in an increasingly networked environment?... and so forth.*

From our perspective, not addressing these type of questions and issues constitutes the main underlying weakness of the current use of e-textbooks in education. The continuous attempt to replace printed textbooks with their digital copies - without rethinking the educational practices that underpin the use of these resources – seems to be an important reason why electronic textbooks have not grown in popularity so far [2]. Resnick [29], among many others, believes that “teachers will continue to look for and use print materials because they like to teach with books, and books still do work when used correctly” (p. 176). On the other hand, contrary to Resnick [29], Warlick [30] and others suspect that in some cases teachers are dropping their traditional textbooks and exclusively use their digital materials that they curate or design themselves. Salpeter [31] even claims that good teachers stopped using textbooks years ago. In addition, as lessons and subjects become more and more interdisciplinary in nature - a demand that is explicitly formulated in some contemporary curricula - it is increasingly difficult to find a textbook that effectively covers all topics for a particular lesson. Many teachers already supplement or entirely replace their lessons with informational resources found and customised from the Internet.

To conclude this section, e-textbooks in their current form have not made a proper entrance into K-12 education. What seems to be missing is an examination of current and evolving educational practices and their mediation with digital texts [28]. What seems to work in the context of general e-book consumption, for example, does not necessarily work for using e-textbooks in an educational setting. While simply turning traditional books into e-books has been a relatively successful practice, there is some evidence that this might not hold true for e-textbooks. After all, textbooks provide specific types of content and structure, and cater to different purposes.

## **6 Re-conceptualising E-textbooks**

The textbook is an evolving instrument: from papyrus scrolls to illuminated texts of monastic libraries to mass-produced, richly appointed books [30]. In the midst of the unfolding digital transformation the textbook will most likely go through more thorough changes over time. After all “...the textbook is constantly updated right

before our eyes” [30, p. 29]. Our literature review has produced so far only a small number of contributions that attempt to re-conceptualise the e-textbook altogether. Park et al. [32], for example, propose a digital textbook, which is built on a problem-based learning model. Smith et al. [28], on the other hand, propose that e-[text]books can be (re-)conceptualised in numerous ways:

- As stand-alone resources to be consulted by individual learners, for convenience or for reasons of preference;
- As part of an ecology or abundance of resources;
- As a bridge between informal and formal learning;
- As new cognitive tools that exploit multimedia capabilities to engage and reinforce learning;
- As social tools enabling community-building through sharing or collaborative annotation;
- As a further step towards greater inclusion and accessibility;
- As part of an emerging industry of self-publishing and disaggregated content.

Their conceptualisations of e-textbooks are seemingly close to the notion of *open (-access) e-textbooks* – a concept that has gained attention and popularity in recent years. Although this strand of thinking carries a strong economical connotation, it also opens up some new pedagogical opportunities. Some hold the view that open e-textbooks are indeed the future [33] and hold the potential to change the way textbooks are used, produced, and sold. Kanter et al. [34] define an open textbook very generally, and somewhat medium-independent, as “a body of educational content made openly available via the Internet, by mail, or in a bookstore with a copyright license that permits reproduction and distribution by the user” (p. 2). Among other characteristics, open textbooks are “protected by the creative commons license by which content may be copied, shared, or changed so long as the original author is attributed; they are developed by a community of authors or users and intended for educational purposes; and they are free” [35, p. 69]. Some authors maintain that being “open” makes it possible to keep content current, timely, and fresh; personalise, customise and localise it for a lesson [36]; marry the content with pedagogy and curriculum for a richer experience; break the textbook into granular pieces for instructors to bring in local context; and make the content portable and adaptable [35].

There are many initiatives for open-access textbooks (see for instance [35]). One good example comes from the CK 12 Foundation (<http://ck12.org>) which provides open-access content through what they call FlexBooks, allowing teachers to author, modify, customize, and assemble existing content into books that fit the needs of the classroom or an individual student. They have established a community of educators and students who create, access, share, rate, recommend and publish. Subject matter experts and practitioners review the content produced. In addition it is ensured that the content is aligned to state and national curriculum standards. “The collaborating experience introduces an element of peer-review and in that way contributes to the authority of the information presented” [33, p. 3].

This type of e-textbook approach is a step further in the overall e-textbook evolution in an economical and pedagogical sense because open-access textbooks emphasise a crowd-based co-authoring approach and the formation of a community enabling anyone to contribute and modify the textbook. This type of “model” stresses the teacher as an important and necessary contributor to the creation of e-textbooks. It demonstrates the fact that textbook authors and publishing companies cannot expect to be anymore the sole authors and owners of content. Open e-textbooks allow teachers the freedom to choose and compile their own resources to cater to particular curriculum objectives [33].

Warlick [30] pondered already in 2006: “If teachers are beginning to construct the online digital textbook for their students, might there be some value in asking students to assemble their own textbooks? Is there some relevance in the 21st century to make students producers of their learning resources rather than mere consumers?” (p. 29). He continued his line of thinking in the following words:

“...Think for a minute about learning environments where one of the jobs of the student is to research, select, collect, organise, and adapt content from various resources and assemble that information into a growing and evolving digital textbook, supervised both directly and digitally by the teacher. The student’s textbook would be crafted for his or her learning style, special interests, and personal sense of visual preference. Teachers would monitor their students’ textbooks by suggesting additional resources, questioning others, and supporting the ongoing assembly” [30 p. 29].

A few years later Rampell [37] talks about online, peer-reviewed, interactive, user-editable e-textbooks as “social learning” sites, where students can chat and share notes while reading and instructors can edit the authors' words without permission. A similar vision (students as textbook generators) is proposed also by Smith et al. [28] and Sharples et al. [38]. They continue that “a logical extension to this mass sharing of comments is for students to write additions to textbooks, offering their own interpretations, explanations and examples, which they can then publish alongside pages of the book. Book publishers would need to set up a simple system of publishing and reward for such ‘book extensions’ [38 p. 9]. Because of the emergence of e-textbooks Moorefield-Lang [39] imagines students to become contributors of knowledge. They can read the book, take notes, add and share those notes, and contribute to the body of knowledge at large [39]. Her ideas are aligned with Scardamalia and Bereiter [40], who see students as a resource that has been largely wasted and that can be brought into play through pervasive technology. Students can construct and build their own knowledge by incorporating artifacts, which are professionally developed by instructional designers, teachers, and others. Students as creators are expected to gain more profound knowledge and become part of the collective intelligence [39]. In that way, e-textbooks are not anymore only representations of political, cultural, economic and political battles and compromises of small expert groups, but interlaced with students views, artifacts and knowledge. From this perspective the next generation e-textbooks will become information artefacts that need to be explored and co-created, rather than a road to be walked [30].

## 7 Breaking Down the Textbook and Textbook Procedure

While going through the current e-textbook literature we have also come across a few position papers that argue for a more drastic kind of change. Their authors want to do away with textbooks and the “all done by the textbook”-approach entirely - no matter if based on printed or digital material. They claim that textbooks are becoming less and less useful, both to students and instructors [2]. They see it as increasingly problematic that both textbooks and e-textbooks are generally designed to be read from beginning to end [41] as a coherent and predefined whole that learners and teachers need to work through in a linear fashion. For instance, Salpeter [31] in her article refers to Matt Federoff, director of technology for the Vail School District (Arizona), who claims that “the textbook delivery model is out of gas. No job in the world says read the chapter and answer the questions at the end of the book... Why should we take pre-packaged bulky content and try to shoehorn it into what we need to teach?” The possible alternative could be “the iTunes model” which allows for buying individual songs rather than the whole album. Similarly, instead of acquiring the whole textbook, a teacher might want to access only a small part of it. Since such a system of provision is already available for video and music content, some think it could easily be transferred to the field of learning and teaching [39].

A rather similar stance is also taken by Davy [42], a progressive publisher who suggests to cluster professionally authored content items around a specific learning objective, rather than providing a complete textbook. In this model the textbook becomes a resource, which is broken down into its components that can be accessed in a number of different ways. Butler [41] envisions a practice in which teachers can customise e-textbooks as aggregations of various materials, not just what a single publisher has already aggregated in a particular textbook. However, the report delivered by MindCET [43] warns us that we are running “the risk of taking the digital textbook to become a collection of digital items, missing the main educational message of offering a meaningful educational learning environment” [43, p. 2].

## 8 Conclusions

We are well aware of the limitations that go along with reporting from an analytical work in progress, however, we were able to identify some initial strands and concerns related to the current state of e-textbook research. So far the evolution of the textbook is predominantly driven by economic considerations - from the printing press to digital production, and from digital production to digital distribution - often leaving untouched issues of educational practice in the context of a wider socio-technological landscape that is increasingly dominated by digitisation and networking. Our literature review has shown so far that despite of some occasional, positive results in terms of student performance, current e-textbooks mimicking their print counterparts do not seem to be an attractive proposition for students, regardless of the economic benefits, flexibility, accessibility, and alleged attractiveness that has been attributed to them (see [26, 44-46]. The simple content digitisation that forms the basis for many

contemporary e-textbook initiatives might serve as yet another example for the rather restricted and uninspired ways in which ICT is used in today's classrooms and schools, basically recreating traditional teaching and studying approaches with some digital means [47]. While we have found some promising examples of work that explicitly focuses on a more ambitious re-conceptualisation of the notion e-textbooks in formal education, the majority of published research doesn't seem to share such a progressive agenda. Apparently, it rather follows what Fischer and Scharff [48] had so aptly called the "gift wrapping approach" in which digital technology is merely wrapped around old frameworks for education. To overcome this state of affairs we need more analytically driven efforts that follow a research rationale that is based on a notion of systemic intervention into current educational practice (see for example, [49, 50]). While we are trying to develop our own project work (Learnmix) into this direction, we will continue our ongoing review project and hope to report a more differentiated analysis of our still expanding literature base in the near future. Up to now we have only been able to draw some main demarcation lines and to highlight visible directions in the field.

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