The Future of Electronic Textbooks from a User Perspective

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Abstract. Electronic textbooks have been a popular research topic for decades. Yet, research on student perspectives in this area has been conducted in hindsight and focused on the existing technology. Still, future features are decided by publishers, universities, and academics with limited input from the actual students who would use them. This article identifies the components that university students feel facilitate their studies without linking them to a specific form of hardware and presents a general overview of the perception of textbook components. An online survey was designed to collect students' opinion on each component outside of the constraints of technology. The survey found that university students believe that future electronic textbooks should include text, highlighting tools, bookmarks, supplemental multimedia content, language translation capabilities, dictionaries, and encyclopedias. By including the input of students in the design of the textbooks, a better educational tool could be designed.

Keywords: Education/training · Electronic textbooks · User perspective · Human computer interaction · Interface tools

1 Introduction

For decades, electronic textbooks have remained a popular research area globally. Yet, the research has been grounded in the past and current technology. In addition, design of the future features are influenced heavily by publishers, universities, and academics with inadequate input from the actual users, students. Instead, design focus of electronic textbooks has been on the market potential, current technology, and the business surrounding education [1].

Since the current and past research conducted focuses so heavily on technology and tends to be lab based, the longevity and reliability of the research may be questioned. On the most part, the current incarnation of electronic textbooks is similar to those that were used with the archaic technology. Most electronic textbooks still follow the textbook metaphor, remaining a digital version of the physical textbook with the addition of a few additional components. Yet, in contradiction to this very design, students are shown to prefer reading from short blocks of electronic texts [2–4]. Past research has

found that interface components such as search functions, text displays, and components that control navigation through pages create a negative student perception of electronic textbooks [5]. A similar study found that students prefer graphics to compliment content and favored following hyperlinks when browsing [3]. Some of the dissatisfaction found by students when using electronic textbooks may be attributed to student engagement remaining with the printed medium [6] and the perception that their learning is better supported by a physical medium [7]. While true that students perceive aspects of their electronic textbooks as dissatisfactory, statistics show that use of these textbooks is only rising. It has been reported that between 2010 and 2012, use has increased from less than a quarter to 70 % with 40 % of students desiring more electronic textbooks [8].

The future of electronic textbooks is in its infancy, but the emergence of two distinct models of textbooks, native digital and enhanced print, have been predicted [9]. Enhanced print will follow the textbook metaphor more closely than the native digital with a few changes to layout, inclusion of collaboration tools, and limited additional materials. Alternatively, native digital textbooks would operate as a collection of related software, creating interactive applications. Both models of textbook negate student complaints regarding text and page layout, yet they will introduce the problem of creating supplemental material [10]. Publishers are already integrating some of these design changes in eLearning platforms [1].

While some research has been conducted into the future of electronic textbooks and student perspectives of these textbooks, there is a distinct lack of research into what components the students feel they need included to properly approach their studies. Much of this research is tied closely to current technology, forgetting that technology is a fast moving field which at times revolutionizes user experiences. Whereas the research outlined in this article aims to advance the current debate by identifying components that could be implemented in electronic textbooks to better support the study habits of students without a link to hardware or software. This article gives a general overview and ranking of components perceived as most useful and not useful during university level readings.

2   Method

The main method employed in this research was a survey hosted on the Internet. It was utilized to ascertain student views on conceivable components. An online survey was chosen as it can gather quantitative data quickly, allows for varied questions, has a low cost, and is convenient for students and the researcher alike [11, 12]. The survey was chosen because it also has the benefits of an inherent ability to reach diverse populations and quickly gain a general understanding a subject. The survey was designed to be short and highly targeted, eliciting responses on components students found desirable, those they found undesirable, and ranking them for inclusion in electronic textbooks through a mixture of nominal and ordinal scales. Several students from different departments piloted the survey for question clarity and terminology before it was released.

Prior to the development of this survey, an extensive assessment of the surrounding research and literature was conducted. It was through this review of the literature that the deficiency in this research was identified. The review also allowed for a better understanding of how the future of electronic textbooks is being approached by the industry and scholars. After this information was gathered, informal small group discussion sessions with university students from various departments was undertaken to identify students' thoughts and perceptions on the future of electronic textbooks and which components they believed would assist them in reaching their academic goals. The components that came to light during these sessions and components identified through the literature were then grouped into the seventeen components that were eventually presented to students in the online survey.

2.1   Survey Design

Student perceptions of the desirability, undesirability, and ranking of the seventeen components were gathered using a ten-question survey. The components presented to respondents are as follows: Text; Multimedia (videos and podcasts); Manipulatable and 3-D Images; Interactive Equations; Highlighting Tool; Annotation Tool; Bookmarks; Integration with eLearning Platforms (Blackboard or Moodle); Synchronization Across Devices; Project or Print Annotations; Translation, Dictionary, and Encyclopedia; Link to Experts for answers to questions; Text to Speech; Speech to Text; Time Management System; Supplementary Materials (PowerPoints, chapter summaries, and quizzes); and Hide Unimportant Aspects of the book.

Inclusion and Exclusion of Components. Two questions were used to measure the students' perception of whether components were desirable or undesirable for inclusion in future electronic textbooks. Students were reminded to consider both questions outside of technology currently in use and any future technology they may have read about. The first question requested that respondents check all check boxes of the components they desired to be included in future electronic textbooks. Later in the survey, students were asked to select any components they felt were undesirable in their future electronic textbooks. The reverse order question offered validation to the previous question. Invalid responses were easily identified, as answering the question with the same components was impossible. While using reverse order wording, the question also recognized that students may not want a component excluded but that did not imply that they wanted said component included in their future electronic textbooks, with the converse being true.

Ranking Components. In addition to providing their perception of the seventeen components, respondents were asked to rank those components from one to seventeen. Each component was required to be assigned a unique rank. This ranking question was also used as an additional validation of the student perceptions regarding desirable and undesirable components. The question anticipated that students would rank the components they deemed desirable in the previous question highly while they would rank

components that they regarded as undesirable in the exclusion question lower. The question was designed to uncover the general popularity of the components among university students.

Classification and Prior Usage. Five questions of the online survey were utilized to document the nationality, age, gender, education level, and discipline being studied of the university students who responded. These classification questions were not required to obtain the generalized findings and roughly nine percent of respondents refrained from answering one or more of these question. No respondents opted to skip these questions completely. Age was requested by the following categories: Under 18, 18–24, 25–34, 35–50, and 50+ years old.

Following the classification questions were two questions regarding prior usage of electronic textbooks. The first question asked if respondents had used electronic textbooks for their studies previously. The second question inquired into the percentage of time students employed electronic textbooks during their studies.

2.2   Dissemination and Data Protection

The online survey was developed and hosted using Google Forms. It was circulated to all current students at The Hong Kong Polytechnic University via email. Before distribution, ethical approval for this study was obtained. No identifying information, such as email addresses or names, was solicited from any respondents.

3   Results

3.1   Respondent Description

There were 637 students who completed the survey, representing all of the age categories. Male respondents accounted for 51 % of responses while female respondents accounted for the other 49 %. As expected, the majority of respondents (86 %) identified their nationality as Chinese. Prior experience with electronic textbooks was reported by 83 % of students and only 16 % reported that they had no prior experience using electronic textbooks. The majority of respondents were studying at an undergraduate level (60 %), followed by those studying at a masters level (22 %), doctoral level (11 %), and higher diploma (7 %). Students from over thirty different disciplines responded to the survey with the top three being Engineering (27 %), Business (16 %), and Medicine (11 %). A substantial number of student responses also came from other disciplines such as various hard science disciplines, design, tourism, linguistics, and architecture.

3.2 Reliability of Data

During the verification process outlined in Sect. 2.1, 119 survey responses out of the original 637 were found to contain data that was invalid. Further analysis of data only took place on the remaining 518 surveys. Percentages reported in the previous section changed very little. Reported genders remained the same and the percentage of respondents who reported prior usage of electronic textbooks increased to 84 % while those who claimed unfamiliarity fell one percent to 15 %. The main three disciplines percentage of response fluctuated slightly. Engineering responses rose 2 %, respondents that studied Business fell one percent, and the percentage of those studying Medicine rose one percent. Reported levels of education followed a similar trend with only the percentage of those studying for higher diplomas remaining the same. Undergraduates remained the largest group represented (61 %) while masters responses fell slightly to 20 %, and PhD responses rose slightly to 12 %.

3.3 Components Perceived as Desirable

The frequency of components reported as desirable by the university students that responded is displayed in Fig. 1. As shown in that graph, the four components chosen most often were Text (84 % of the population), Highlighting (82.6 % of the population), Bookmarks (79 % of the population), and Multimedia (75.5 % of the population).
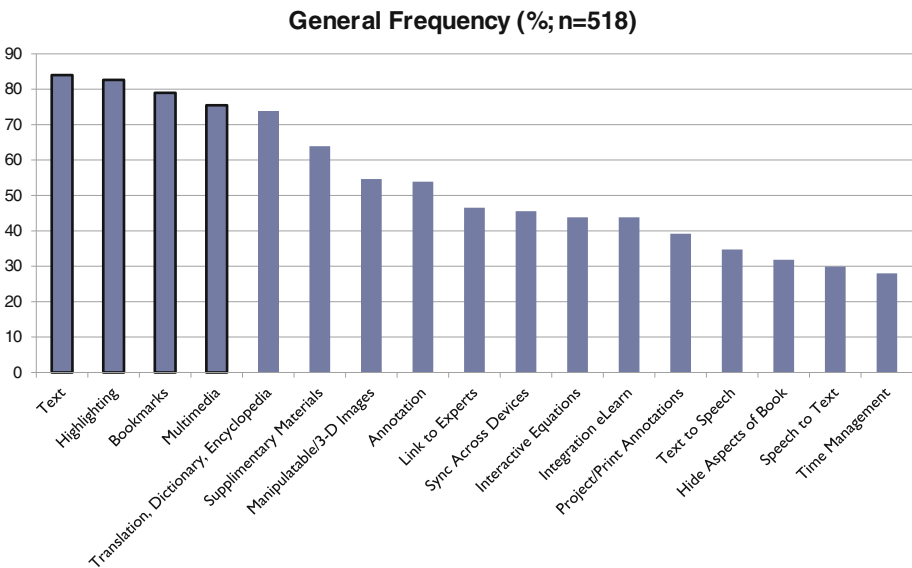

Fig. 1. Graph of desired components (n = 518)

3.4   Components Perceived as Undesirable

The frequency of components perceived by university students as undesirable are found in Fig. 2. As demonstrated in the bar graph, the four components students reported as undesirable are Hide Unimportant Aspects of the Book (22.8 % of the population), Time Management System (22.4 % of the population), Speech to Text (18.5 % of the population), and Text to Speech (16.2 % of the population). The bottom three components found to be undesirable correspond with the three components found to be most desirable in Sect. 3.3 and vice versa.
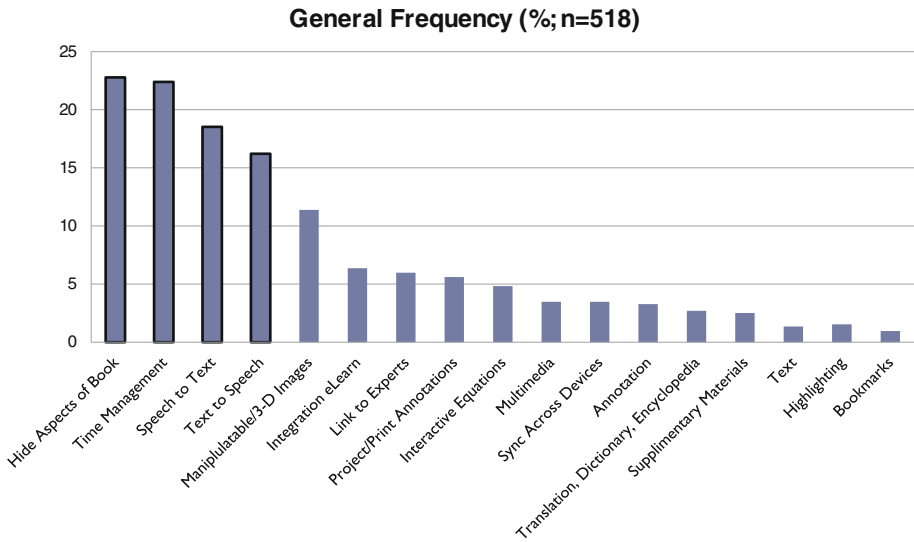
General Frequency (%; n=518)

Fig. 2.   Graph of undesirable components (n = 518)

3.5   General Rank of Components

In addition to categorizing components as desirable or undesirable, respondents were requested to assign a rank, from one (most desirable) to seventeen (least desirable), to the various components. After identifying the mean rank of each component, an overall ranking of the students' perception of components was established. This ranking is found in Table 1. Text; Highlighting; Multimedia; Bookmarks; and Translation, Dictionary, and Encyclopedia were found to be the five most highly ranked components with a much higher margin than the components following them. Thus, supporting the previous results outlined in Sect. 3.3 on desirable components. The five components that received the lowest ranking were Time Management System, Hiding Unimportant Aspects of the Book, Speech to Text, and Text to Speech. This ranking also supports the earlier findings in Sect. 3.4 regarding the components students selected as undesirable.

Table 1. Rank of the components based on general respondent population (n = 518)

Rank	Components	Means
1	Text	2.676
2	Highlighting tool	5.656
3	Multimedia	6.046
4	Bookmarks	6.923
5	Translation, dictionary, and encyclopedia	7.668
6	Annotation tool	7.861
7	Manipulatable and 3-D images	8.992
8	Interactive equations	9.158
9	Sync across devices	9.164
10	Supplementary materials	9.255
11	Integration in eLearning platforms	9.450
12	Link to experts rank	9.903
13	Project or print annotations	10.349
14	Text to speech	11.971
15	Speech to text	12.394
16	Hide aspects	12.685
17	Time management system	12.828

4   Discussion

4.1   Sampling and Bias

When attempting to evaluate results from surveys, bias related to nonresponse rate must be assessed. Past research related to response rates of university students has found that internet surveys have had a lower response rate among students than paper based surveys [13], but the increased anonymity allowed by online surveys does increase the likelihood for students to report their genuine perceptions [14]. With only 637 responses, the response rate can be considered low but the demographics of the respondents who submitted surveys was similar to the general makeup of the university population. Similar to what was found in the survey respondent demographics, the three main disciplines at the university are Engineering, Business, and Medicine. Percentages of students studying at the various education levels were similar as to those found in the survey results with only a marginally higher percentage of doctoral students and undergraduate students responding and a

somewhat lower percentage of masters degree students responding [15]. With a student population of approximately 32,000 students, 400 valid responses are necessary to achieve a five percent error rate necessary to draw appropriate conclusions based on statistics [16]. Since this survey received 518 valid responses, it can be presumed that the amount of responses garnered were acceptable to propose conclusions from the data.

4.2   General Student Perceptions of Components

The desired components recounted by the student respondents varied among the surveys. In the past, researchers have emphasized that students do not engage with their academic materials in the same manner as each other and may use varied support activities to support their studying such as highlighting or taking notes [17]. The results of the survey found that there were many components which could assist in engagement such as highlighting tools, bookmarks, and translation capabilities, dictionaries, and encyclopedias. These findings are supported by similar studies which found that the physical book metaphor, which includes features like bookmarking and highlighting, are understood and embraced by users [18].

While this metaphor is important, employing different components in the design of textbooks may combat the long reported complaint that textbooks are unable to support the two main approaches to studying [19]. These two approaches are the surface approach and the deep approach [20]. The surface approach provides a student with limited understanding of the subject and only allows them to ascertain information which they anticipate being questioned on. While the deep approach allows students to focus and understand the information presented to them. Many of the components students desired in their electronic textbooks support the second approach to reading which allows the student to search for more information on what is presented in the text and relate it to their existing knowledge [19]. The inclusion of dictionaries and encyclopedias, especially, would assist students in expanding their knowledge and finding connections they may not have previously realized.

Overall, the majority of the components listed for inclusion are close to the activities that students utilize to support their readings in physical textbooks while those identified as undesirable are impossible to include in a physical textbook. In addition, some of the components suggested are more related to specific disciplines, such as interactive equations, which accounts for a lower general ranking and preference in those specific components. As electronic textbooks take the place of physical textbooks these support activities may change with the technology; but to currently support students' mental models and assist in their adoption of the new technology, it would be beneficial to continue with the textbook metaphor for the time being.

5   Conclusion

The electronic survey outlined in this study found that students believe that text, highlighting tools, bookmarks, supplemental multimedia content, language translation capabilities, dictionaries, and encyclopedias should be included in future electronic textbooks

over the other components available for selection. By including the input of students in the design framework of the textbooks, content and interface designers may create a better educational tool. In addition, examining the components most commonly desired outside of the restrictions of the current physical technology, as this survey did, allows for more flexibility in future applications as technology evolves.

Future research is necessary to identifying the reason students are choosing specific components when using academic texts and the reason they believe one component is more essential in their electronic textbooks than the others. Also, research needs to be undertaken to ascertain how students interact with the components they identified as desirable. Using this research in conjunction with one another, a design framework for use in the creation of electronic textbooks can be developed.

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