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Relationship between academic discipline and user perception of the future of electronic textbooks

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Abstract

In the past, research on electronic textbookhas been conducted in hindsight and influenced by the technologyused. This paper aims to add to the current research by shifting the focus to the future and student perception. It outlines component desirability,identifies relationships between the desirable or undesirable components and discipline, and ranks the components.The study used an internet survey to propose seventeen components which students could chose to be included or excluded in their future textbooks and rankbased on perceived usefulness.The responses from three academic disciplines of Engineering, Medicine, and Business were analyzed in detail. Results showed that the components in electronic textbooks should be tailored to the discipline. Interactive Equations,HideUnimportant Aspects, and Manipulatable and 3-D images were some of the components that showed association with a discipline. By including student input, designers will be able to meet the students' exact academic needs.

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*Keywords:*Electronic textbooks; Interface design; User experience; Human computer interaction; Interface tools

1. Introduction

Electronic textbooks have maintained their popularity as a global research areafor the past few decades. The abundant research has tended to focus on the technology available and the features examined were influenced by the

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academic industry withinadequate input from the student users. Most of the research is focused on the business side of academic textbooks, their consumer potential, or the available technology [1].

Many of this field's lab based studies reliability and longevity may be questioned based on the focus on technology which becomes outdated quickly. Past research on student preferences in electronic textbooks has found that short blocks of text [2,3,4], inclusion of complimentary graphics, and hyperlink navigations [3] were preferred. A different study found that some components can create a negative perception such as navigation controls, the way the text is displayed, and the implementation of search functionality [5]. These studies show that the perception of an electronic textbook can be influenced by the smaller components of that textbook.Most of the dissatisfaction with electronic textbooks can be related to the impression that printed textbooks are better for learning [6] and the preference of the physical version [7] yet use has risen more than fifty percent and around 40 percent wish for more electronic textbooks [8].The prediction of two models of electronic textbooks has already emerged from the rise of electronic textbook usage: the native digital and the enhanced print [9]. Enhanced print takes advantage of the textbook metaphor, simply presenting the digital version of the physical text with the inclusion of a few components, such as collaboration tools and supplementary materials, and a change in layout. Native digital textbooks would operate on the other side of the spectrum and would instead operate as an interactive set of applications. Both of these models would rectify many student complaints but would create a new problem of constructing supplemental materials [10]. While both of these electronic textbook models are trying to revolutionize the textbook, they are still adhering to a one type of textbook fits all needs mentality. Some well-known universities have already begun to realize that this mentality towards electronic textbooks is not appropriate for their students and are instead designing individual textbooks for some of their courses [11,12,13].

The research that has been undertaken in the past on electronic textbooks and perspectives of the student users is focused on the current technology, is limited, and does not identify which components are needed by students to succeed in their academic endeavors. On the contrary, the research undertaken for this paper will approach this gap in research by presenting the components chosen by studentsin different disciplines they believe will support theirstudies without linking it to the current technology.

2. Method

This project utilized an Internet survey hosted on Google Forms, which was disseminated through the university listserv,as the main method to identify student perceptions ofsome possible components which could be included in the electronic textbooks of the future. This method was chosen because it has the ability to quickly gather quantitative data with diverse questions, is free, convenient for students who are easiest to reach online, and saves the researcher from potential recruitment issues [14,15].The short survey was developed to question student perceptions of seventeen components identified through literature and open discussions with students. The components presented to respondents were Text; Multi-media (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.

The inclusion or exclusion of the components was identified through two questions that asked the students to disregard current technologies. The first question required students to identify which, if any, components they wished to have in their future electronic textbook while the second asked which, if any, they did not wish to be included. Between these two questions was a question that asked the students to rank the components from one to seventeen, one being most vital and seventeen being the least vital. Some classification data was collected related to student gender, age, nationality, education level, and academic discipline. Classification questions were not required and about nine percent of students did not answer one or more of the questions, but no student avoided all of the classification questions. Students were also asked two questions regarding their prior usage of electronic textbooks and the percentage of time they use them.

3. Results

3.1. Respondent description

More than 500students filled out the survey.The total of the three disciplines provided enough results (292 valid responses) to conduct an analysis on. These three disciplines of Engineering, Business, and Medical are also the three most common disciplines at The Hong Kong Polytechnic University [16]. 149 (29.0%) respondents identified themselves as Engineering students, 80 (15.0%) respondents identified themselves as Business students, and 63 (12.0%) of respondents reported themselves as Medical students. Breakdown by gender showed that percentage of males and female respondents was almost equal with 53.1% reporting as male and 46.9% as female.

3.2. Reported components students perceived as desirable

The differences in the frequency of the components students perceived as desirable for their future electronic textbooks based on the three disciplines can be found in Figure 1. As illustrated in the figure, Engineering students choose Text (83.2%), Highlighting (81.9%), Multimedia (77.2%), and Bookmarks (75.2%) as their top four components. Medical students rated Text (87.3%), Highlighting (82.5%), Bookmarks (81.0%), and Multimedia (81.0%) as their four most desirable components. Business students have replaced Multimedia with Translation, Dictionary, and Encyclopedias (81.3%) but still frequently chose Text (85.0%), Bookmarks (80.0%), and Highlighting (78.8%).

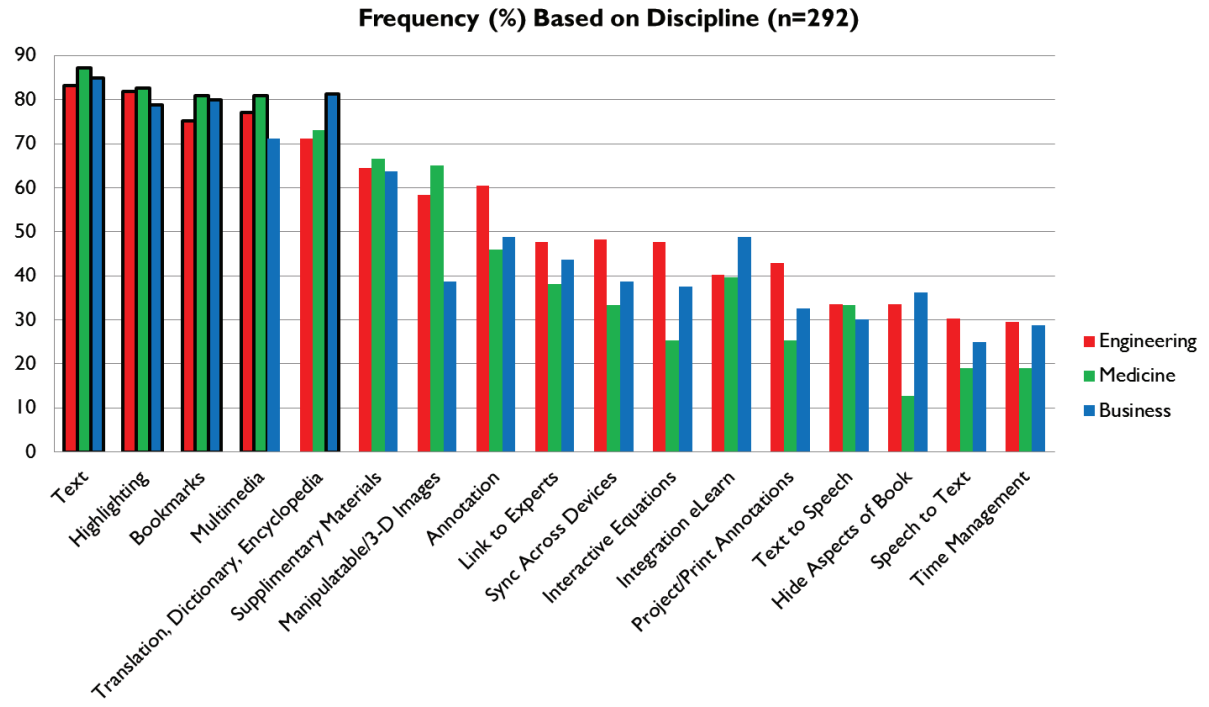

Fig. 1. Components students reported as desirable based on discipline

3.3. Correlation between the components students perceive as desirable and discipline

Examination of each component using Pearson's Chi-Squared Test (x2) was undertaken to identify if there was any significant association ($p<0.05$) between the preference for inclusion of components and the disciplines. By using this test, a relationship between the variables ofdesirable components and discipline can be identified in a way which shows that the findings are reliable and not random chance. Although not many components were shown to be correlated, discipline was shown to have a significant positive association with the preference of Interactive Equations ($p=0.009$); Hide Unimportant Aspects of the Book ($p=0.003$); Manipulatable and 3-D Images ($p=0.003$); and Project or print annotations ($p=0.037$). This correlation shows that the inclusion of these components should be tied to the discipline the textbook is written for and that these supplemental components may not need to be included in all textbooks.

3.4. Reported components students did not perceive as desirable

The variationsin frequency of components students perceived as undesirable based on the three disciplines can be found in Figure 2. As shown in the figure, Engineering students choose Hide Unimportant Aspects of the Book (22.8%); Time Management System (23.5%); Speech to Text (13.4%); and Text to Speech (13.4%) as the top four components to exclude from their future electronic textbooks. Medical students rated Time Management System (27.0%), Hide Unimportant Aspects of the Book (25.4%), Text to Speech (23.8%), and Speech to Text (20.6%) as their four components to exclude. Business students replaced Text to Speech with Manipulatable and 3-D Images (18.8%) but still commonly reported Hide Unimportant Aspects of the Book (25.0%), Text to Speech (15.0%), and Time Management System (15.0%).

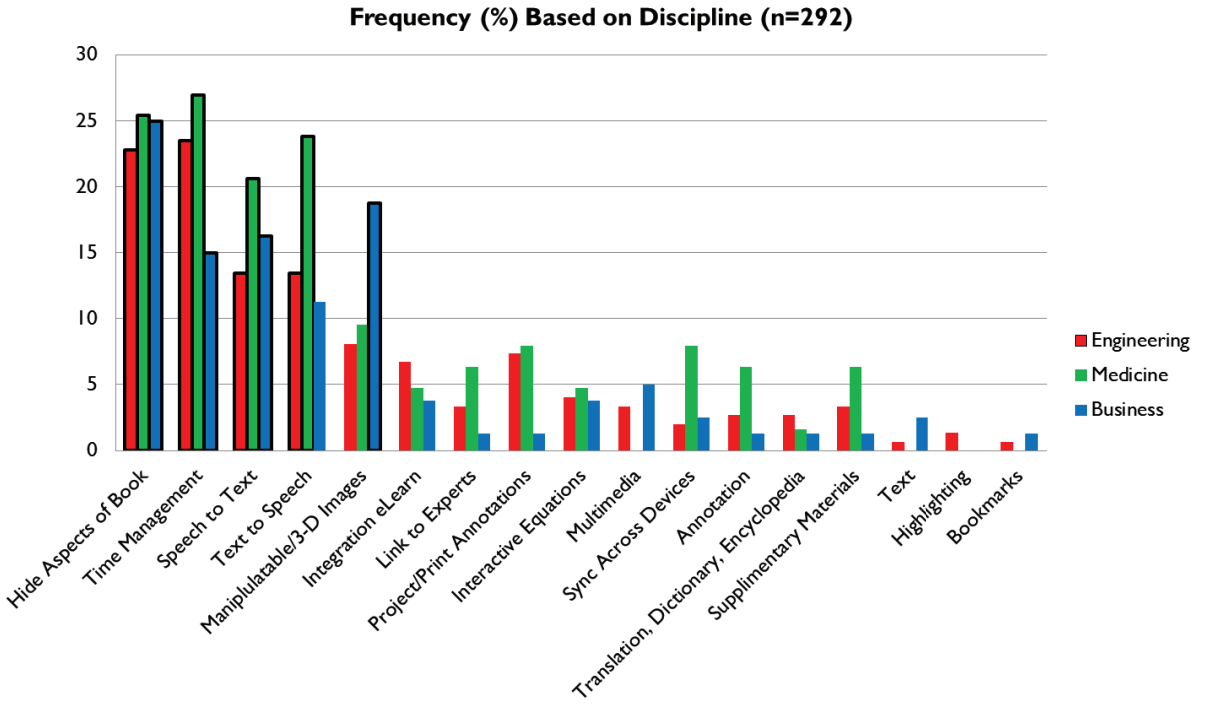

Fig. 2. Components students reported as undesirable based on discipline

3.5. Correlation between components students perceive as undesirable and discipline

Once again, every component's undesirability was examined with discipline using Pearson's Chi-Squared test, where significant association is identified as $p<0.05$. The only component chosen for exclusion to show significant association with discipline was Manipulatable and 3-D Images ($p=0.045$). Thus showing that, unlike desirability, only the component of Manipulatable and 3-D Images can be statistically supported forexclusion from some discipline specific textbooks.

3.6. Rank of components

Discipline had a noticeable effect on thecomponent rankings (Table 1). The top five positions were given to Text; Highlighting Tool; Bookmarks; Multimedia; and Translation, Dictionary, and Encyclopedia by Business students. While Engineering studentsplaced Text, Highlighting Tool, Multimedia, Bookmarks, and Annotation Tool as their top five components. Finally, Medical students thought Text; Multimedia; Highlighting Tool; Manipulatable and 3-D Images; and Translation, Dictionary, and Encyclopedia were the most important components,respectively.

Table 1. The ranking of components by Business, Engineering, and Medical students based on means.

	Business Students	Engineering Students	Medical Students
Rank	Components (Mean Ranking)	Components (Mean Ranking)	Components (Mean Ranking)
1	Text (2.25)	Text (2.99)	Text (2.46)
2	Highlighting Tool (5.36)	Highlighting Tool (5.76)	Multimedia (4.54)
3	Bookmarks (6.45)	Multimedia (6.36)	Highlighting Tool (4.94)
4	Multimedia (6.54)	Bookmarks (7.15)	Manipulatable and 3-D Images (6.89)
5	Translation, Dictionary, and Encyclopedia (7.56)	Annotation Tool (7.45)	Translation, Dictionary, and Encyclopedia (6.97)

4. Discussion

The three different disciplines investigated were shown to have association with the selection of components. These findings substantiate the movement of tailoring electronic textbooks to better suit the course as seen at universities such as California State University and Oxford [11,12]. This trend should not be surprising as it has long since been accepted that different academic disciplines are diverse in their norms, values, ideas on how to research, teaching and learning techniques, and terminology [17]. While this is a known fact and physical textbooks attempt to include these differences, electronic textbooks are currently not taking advantage of these different content requirements. There is no set standard in which all university students will interact with and learn from textbooks [18]. For example, the survey described in this paper found that Engineering students reported interactive equations as desirable for inclusion in their future electronic textbooks. Engineering textbooks already rely on equations to convey the necessary aspects to students, such as the textbook Modern Control Engineering [19], so it cannot be consideredshocking that this component was found to be important to this field. Similarly, Business students wished for the ability to hide unimportant aspects of their electronic textbooks, which may be related to the fact that their textbooks may not be as specialized as those in the other two disciplines. In the medical field, manipulatable and 3-D images were requested most often. Images are understandably vital in medical textbooks, like Clinical Anatomy: Applied Anatomy for Students and Junior Doctors by Ellis and Mahadevan [20].

The practice of tailoring electronic textbooks to the specific courses may seem to be an appropriate response that would better support student learning, but it is happening on too small of a scale and would be a waste of time and resources to do this for every class across the world. Instead, development of a new design framework for the various disciplines would be more appropriate. Of course, it is too soon to completely change the way electronic textbooks are designed because students are still approaching their electronic textbooks the same way they approach the physical counterpart. This can especially be seen in the desire for inclusion and ranking of text and highlighting tools. This approach may differ in a few years as students become acclimated to using electronic textbooks and the

technology changes, but it would be useful to embracethese components and approaches so that students feel more comfortable using the new technology.

5. Conclusion

The survey described in this paper supports the tailoring of electronic textbooks for various academic disciplinesso that students may be better supported when approaching their studies. The inclusion of this tailoring will allow for designers to create better academic tools and by following a standardized tailoring framework, they would be able to save resources. The lack of technological restrictions of components in this study will allow for better flexibility in applications of the findings and longevity of the research. In the future, research is necessary to gain better insight into why certain components are more necessary for some academic fields and how students will interact with the components in a real world situation. The findings through these studies can be used to create a design framework which will provide academics and publishers with a simple understanding of what needs to be placed in the electronic textbook based on discipline.

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