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# An Empirical Evaluation of a Broad Ranging E-Text Adoption with Recommendations for Improving Deployment Success for Students

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## ABSTRACT

*Electronic course materials have several advantages over printed materials. While these advantages create an enticing argument for the adoption of electronic textbooks, there are disadvantages that may hobble e-text adoption. This case study investigates the e-text adoption process for 50 class sections across 8 business disciplines with 27 different instructors. It explores interventions that can be pursued to ameliorate important challenges and effect a more successful e-text adoption. It provides faculty, publishers, and university administrators with actionable advice for improving student response to e-text implementations. A wide variety of feelings were expressed about how e-texts are implemented, ranging from strong dissatisfaction to strong satisfaction. The results indicate that great care should be taken to ensure that as many students as possible have a positive experience during an e-text adoption. Several variables were identified as important to students and can readily be influenced and improved by faculty, administrators, and vendors. These include: 'how effectively professors use the material', 'price', 'quality of the sign-up process', and 'how useful the e-textbook platform training was'. Finally, two factors, technical and functional satisfaction, should be considered when implementing e-text solutions.*

**Keywords:** Business education, e-texts, cost of higher education.

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**PsycINFO Classification**: 3550
**FoR Code:** 1302; 1503
**ERA Journal ID#:** 35696

## Introduction

As laptops and tablets become more ubiquitous, students are becoming more comfortable reading online and more online course materials, including electronic textbooks, are being used in universities. As educators, it is important to understand what factors lead to effective e-text adoptions and how faculty and vendors can better meet the needs of students.

Electronic course materials have several advantages over printed materials that create an enticing argument for the adoption of electronic textbooks. Electronic materials, for example, promise reduced costs by obviating the need for printing, storage, and shipping expenses. Reducing the costs of textbooks can be very important for students that struggle financially as textbooks can account for a significant portion of education costs (Miller, Baker-Eveleth, 2010). Beyond the benefits of lower costs, electronic textbooks can also provide functions not found in printed books. For example, highlighting and bookmarking an e-text can be more flexible than printed texts, e-texts can be searched by keywords, text can be easily copied and pasted, and adaptive quizzes can adjust to each student's needs (CourseSmart 2014). In addition, without the costs and constraints of setting up printing, new editions can come out each year for fast changing fields such as Technology (Miller, Baker-Eveleth, 2010). This ensures that content is always up-to-date and relevant. Further, farsighted publishers are experimenting with enhancing electronic textbooks with interactive elements (videos, audio, adaptive quizzes, games, etc.) that are impossible with static printed books. Also, in other research, our team found initial evidence that in at least some courses, these interactive elements lead to higher student performance (Bowman, Adams, Adams, & Glenn, 2014).

However, there are also several disadvantages to electronic course materials that lead many students to prefer using printed materials and may hobble e-text adoption. Immature technology is one example. Electronic textbooks are currently available in a wide variety of platforms and modes with major interface and bookmarking system variations (Young, 2009). This can be confusing to students and professors alike. In addition, the technology used to display e-texts is a rapidly shifting landscape. Most laptop and tablet displays do not match the size of an open textbook. Further, reading digitally becomes fatiguing much sooner than when using a printed book (Kang, et al., 2009; Jeong 2010; Miller, 2015).

While there is a broad range of known challenges for why students prefer printed texts over e-texts, this study specifically investigates a subset of those challenges related to adoption processes. It also explores interventions that can be pursued to ameliorate those challenges. To better understand what factors influence student experience during an e-text adoption, we conducted a case study of 1094 students in the Utah Valley University (UVU) Woodbury School of Business. These students were taught by 27 faculty who shifted 50 course sections from printed textbooks to electronic texts. This case study is an attempt to understand the factors that lead to a more successful e-text adoption and provide faculty, publishers, and university administrators with actionable advice for improving how students respond to and perceive e-text implementations.

## Literature Review

When purchasing an e-book, most students have the option of buying either a printed or electronic format. However, some for-profit institutions such as the University of Phoenix have mandated that all courses use electronic texts, and some public schools are considering similar requirements (Kolowich, 2010). The main driver behind these

moves is to reduce the cost of textbooks to students, which can easily reach $1,000-$2,000 per year (Miller, Baker-Eveleth, 2010).

Early studies have shown that students prefer printed textbooks to electronic ones or, at best, are neutral to the delivery method. In 2004 the National Association of College Stores conducted a survey of more than 4,000 students at 21 colleges and universities in the US and found that only 11 percent preferred electronic textbooks (Carlson 2005). In 2005, McFall found that students' opinions vary greatly toward electronic texts, but that the overall impressions were neutral. In a 2007 study, researchers at the University of Maryland Eastern Shore surveyed 261 students about their preference for hardcopy versus electronic texts. They found that less than 12 percent of students preferred electronic material with about 56 percent preferring hardcopy and the rest neutral (Buzzetto-More, Sweat-Guy, and Elobaid). Further, a study at Northwest Missouri State University found that 40% of their students not only disliked the electronic texts, but agreed with the statement "I study less because the e-textbook makes studying more difficult" (Young 2009).

Later studies found that discomfort with e-texts continued (Li et al, 2011). In one study (Robinson, 2011), students were offered a free electronic version of the textbook and the option to purchase a copy of the textbooks for $30-$40, or to print it out themselves. Despite the extra cost, a third of the students purchased a copy of the textbook and another 9.5 percent printed out a copy. In a longitudinal study, Weisberg (2011) found that between 2009 and 2011 student attitudes towards electronic textbooks had slightly improved, but at best less than 30% of students preferred using an electronic textbook as their primary source of content. Falc (2013) surveyed a public speaking class that used an e-textbook and found that 47% did enjoy using the electronic text, with 44% "not sure about liking the eBook," and 18% being very frustrated. In another 2013 study conducted in Croatia at the University of Zagreb, Vlahovic and Brekalo surveyed 328 students about their attitudes to electronic texts and found that only 14% of students said that they would prefer e-books if available. As recently as 2015, Miller and Schrier found similar results when they surveyed 190 university students and found that 57.4 percent preferred a printed copy of the textbook. Their research indicated that the primary reason for preferring printed texts was "I simply prefer print to digital" at 49 percent and print is "more convenient" coming in second at 34 percent. Beyond uncovering student preferences, some research has begun to explore the reasons for this discomfort with e-texts, though this research is quite limited. Since electronic textbooks are relatively new, many students may not like electronic versions of their textbooks as they are not yet familiar with how to use them and still have ingrained habits from using printed textbooks (McFall, 2005; Berg, et al, 2010).

From an adoption process standpoint, most studies survey students who are using electronic texts for the first time. Woody, Daniel, and Baker (2009) separated those students who were new to electronic texts from those that had experience with them. Their findings show that although students with previous experience with electronic texts liked them more, they still preferred printed textbooks, as did their inexperienced classmates. The University of California did an extensive survey of 2410 students related to the use of electronic texts. The preferences for e-books peaked with postdoctoral researchers (at 49%) and steadily declined to 35% for graduate students and 27% for undergraduate students (Li et al, 2011). This seems to imply that as students gain more experience, they are more tolerant of e-texts.

**Purpose of the Study**

This study adds to the existing literature by examining the electronic textbook adoption process. We seek to uncover those factors that lead to improved student satisfaction, e-text usage, and perceptions of effectiveness. First we explore the initial

student experience with accessing and learning to use e-texts and course materials, including a) communication about the need to purchase the e-text, b) the sign-up and access process, c) training for using the system, and d) satisfaction with the price of e-texts. Second, we explore the student experience while using electronic materials to complete the course, including a) how well they felt their professor used the e-texts and course materials in class, b) how often they used the materials, c) a comparison with traditional textbooks, d) how students felt electronic materials impacted their own and their peers' performance, and e) how comfortable students felt using them. Our goal is to come to a deeper understanding of the adoption process and how to facilitate it more effectively once an e-text is chosen. A secondary research focus is whether there has been a shift in student preferences for electronic texts versus printed texts over the last few years.

## Method

### Context

In 2013, we conducted a study of 1094 students at the Utah Valley University (UVU) Woodbury School of Business. These students were taught by 27 faculty who shifted 50 course sections from printed textbooks to electronic texts. Students did not have a choice between an e-text and a printed text as the e-text was integrated into the learning management system used for all classes. Through this integration students had access to the material on the first day of class and the cost of the electronic texts was significantly less than that of traditional textbooks, sometimes less than half. Students were not involved in purchasing textbooks or other materials as payments were made through an automatic fee charged to all students. The publisher then received payment from the university shortly after the last day that students were allowed to drop classes.

### Participants

Participants in this study were drawn from students taking one or more of 50 courses that used electronic textbooks and/or electronic course materials. Eight of these courses were conducted online while forty-two were in a traditional, face-to-face format in a classroom. Course topics included Business Calculus, Economics, Human Resources, Legal Studies, Operations Management, Organizational Behavior, and Finance. Students were asked to respond to the survey for each course they participated in that used e-texts and electronic materials. The result was a population of 2105 possible responses, including duplicates where students took multiple classes. Of the possible 2105 responses, 1094 surveys were collected. 990 face-to-face participants responded out of 1747 or 57%, and 117 online participants responded out of 358 or 32.6% of the online population. Of these, 76.3% of respondents were male and 23.7% were female and 4% were younger than 20 years old, 60% were 20-25, 23% were 26 to 30, 10% were 31 to 40, and 3% were 41 or older. Of participants, 15% were not employed, 43% worked part-time, and 42% worked full-time and 85% attended school full-time, 15% attended part-time. These proportions are consistent with student populations within UVU's Woodbury School of Business.

### Assessment Design

Two focus groups were held with students to identify their attitudes regarding their experiences with the e-texts. The first focus group included eleven participants and the second included seven. Each group had both male and female participants and were comprised of both traditional and nontraditional students. Two research assistants moderated the focus groups while a professional transcriber recorded the discussions; faculty researchers also were in attendance observing the focus groups.

Students participating in the focus groups were asked a few general questions regarding their experiences with e-texts and were given the liberty to talk openly about each question. The moderators were trained in an open-ended focus-group format that began by asking a series of broad questions to establish the focus-group context and then continued in a series of open-ended questions that narrowed the participant discussion to specific areas of interest regarding e-texts.

Results from the focus-group content analysis, and questions proposed by the research team, were then used to develop a survey to collect participant data and evaluate their attitudes regarding a variety of constructs related to e-texts, electronic materials, and their implementation in their course. Demographic data was collected regarding employment status, age, major, student status, gender, and course taken. Experience data was collected regarding frequency of e-text use, type of e-text used, when students became aware the course was using an e-text, whether or not they purchased a paper copy of the e-text, and how quickly they were able to access the materials. Finally Likert scales were used to evaluate students' attitudes regarding the usefulness of the materials in learning, the effectiveness of e-materials training and tutorials, the importance of keeping a copy of the text after the end of the semester, how well the e-texts were implemented, comfort level with e-texts, future preference for paper or e-texts, satisfaction with price, preparation level for class, preparation level of peers, professor's effectiveness in using electronic materials, and satisfaction with resolving implementation problems. In addition some students were given four open-ended questions asking what they liked most and least about the e-text implementation, any problems they had accessing the materials, and any suggestions for improving the experience.

**Procedure**

Researchers administered surveys to face-to-face participants during class time. Participants were instructed to fill out a Scantron sheet for the class they were currently sitting in. Many participants retook the survey in each course they were enrolled in that was participating in the e-text program. Scantron sheets were read digitally and, where necessary, cleaned up by hand so that they could be read by the scanner. Online students were sent a link by email from their professors and given instructions to fill out the online version of the survey. In addition, 88 online and 360 face-to-face participants completed a series of open-ended questions regarding their experience with e-texts.

**Design**

Variables measured included a) how often participants used the electronic course materials, b) how useful they felt the materials were, c) whether or not they bought a paper copy of the text, d) how important they thought it would be to have access to the materials after the course ended, e) how comfortable they were using e-texts, f) whether they preferred e-texts or printed texts more in the future, g) how well they felt prepared for class, and h) how well they thought their peers were prepared for class. Independent variables measured included a) the usefulness of materials training, b) how easy it was for students to sign up for access to materials, c) satisfaction with the electronic materials price, d) their perception of the professors' effectiveness in using the materials, e) how quickly they were able to access materials at the beginning of class, and f) their satisfaction with the resolution of technical problems by the vendor. Survey results were compared demographically by age, working status, school status, and gender.

Correlation was used to identify variables with strong relationships. Multiple regression was used to identify which independent variables accounted for significant levels of variance in each dependent variable. Principle component analysis was used to

investigate underlying latent variables, and cluster analysis was used to identify the impact of specific demographics on student satisfaction with e-texts.

## Results

### Students' E-text Implementation Experience

Of the students, 61.8% reported that they first became aware of the need to purchase the e-text by the first day of class and 82.3% of students reported that they first became aware by the first week. An additional 17.7% became aware of the need to purchase the e-text after the first week of class. By the first day of class 23.9% were able to access the course materials online, 47.9% by the first week, and 28.2% after the first week. Participants rated the sign-up experience as neutral with an average score of 3.08 out of 5, s = 1.08. On average, those students that had technical issues signing up had a slightly positive experience resolving their issue with an average score of 3.44 out of 5, s = 1.30. Participants felt neutral about the tutorials and training provided to teach them to use the system with an average score of 2.92 out of 5, s = 1.25; 27. 7% reported that they did not know there were tutorials or training. Finally, on average, students felt slightly positive about their professors' effectiveness in using the e-texts and electronic materials with an average score of 3.37, s = 1.21.

### Students' Experience with E-texts and Electronic Course Materials

Of the participants, 45.0% used the electronic course materials more than once a week, 28.9% used them once a week, 20.2% used them less than once a week, and 5.9% reported never using the electronic course materials. Students were neutral regarding whether or not the electronic course materials were useful with an average score of 3.06 out of 5, s = 1.2 and they expressed a slightly positive level of comfort with electronic textbooks with an average score of 3.29 out of 5, s = 1.27. By comparison, they were slightly more comfortable with printed textbooks with an average score of 3.48 out of 5, s = 1.41. Students felt that they and their peers were slightly less prepared for class using electronic texts and course materials with an average score of 2.67, s = 1.04, and 2.78, s = .81, respectively out of 5. Of the students, 11.7% bought a paper copy of the text in addition to the e-text and on average students indicated that it was less important for them to keep a copy of the text after the semester is over with an average score of 2.27 out of 5, s = 1.33. Finally, on average, students were neutral regarding their satisfaction with the e-texts price with an average score of 3.06 out of 5, s = 1.23. It is important to note that while the averages of the scores reported above were typically somewhat neutral, the spreads of scores were larger with standard deviations typically above 1. This indicates almost 1/3 of the observations were found below 2 and above 4 on a 5 point scale, demonstrating a broad range of opinions among participants. In other words, we found that a large percentage of students had a negative, neutral, and positive experience with e-text.

In reviewing these results, it should be noted that the study occurred only in business courses at a single university. This raises the question of the generalizability of the results. In particular, UVU students are recognized as being somewhat generous in their survey responses. As a result, it may well be that their neutral to slight positive general response may not represent a significant difference from previous research. On the other hand, this potential bias would not influence differences between items within the sample itself.

**Table 1:**
*Correlation matrix of variables*

| | Your pre | How use | Comfort | Classma | Future p | Process | Profess | Useful tr | Price | Problem | How oft | Time to | First awa | Importar | Hard co | Status | Age | Work? | Gender |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Your preparation | 1 | 0.5253 | 0.5329 | 0.6614 | 0.5521 | 0.3568 | 0.3607 | 0.2693 | 0.3298 | 0.2568 | 0.2697 | -0.1731 | -0.0675 | -0.0398 | 0.0349 | 0.0411 | -0.0087 | -0.0325 | -0.1028 |
| How useful | 0.5253 | 1 | 0.436 | 0.4168 | 0.3969 | 0.3827 | 0.4657 | 0.3724 | 0.3118 | 0.266 | 0.503 | -0.1353 | -0.058 | -0.0241 | 0.0724 | 0.0618 | 0.0155 | -0.0689 | 0.0119 |
| Comfort with online content | 0.5329 | 0.436 | 1 | 0.4202 | 0.6031 | 0.3424 | 0.256 | 0.2657 | 0.2962 | 0.2386 | 0.1867 | -0.1848 | -0.0877 | -0.1836 | 0.1245 | 0.006 | 0.0143 | -0.0107 | -0.109 |
| Classmate's preparation | 0.6614 | 0.4168 | 0.4202 | 1 | 0.4196 | 0.335 | 0.3544 | 0.2643 | 0.3048 | 0.239 | 0.2186 | -0.1598 | -0.0579 | -0.0727 | 0.0494 | 0.0333 | -0.0037 | -0.0304 | -0.0541 |
| Future preference | 0.5521 | 0.3969 | 0.6031 | 0.4196 | 1 | 0.276 | 0.2227 | 0.2017 | 0.305 | 0.1717 | 0.1853 | -0.1369 | -0.0205 | -0.2673 | 0.1738 | -0.0052 | -0.0028 | -0.0012 | -0.1255 |
| Process quality? | 0.3568 | 0.3827 | 0.3424 | 0.335 | 0.276 | 1 | 0.3151 | 0.2911 | 0.2977 | 0.3907 | 0.2256 | -0.2972 | -0.1462 | -0.0802 | 0.0791 | 0.0035 | -0.003 | -0.0289 | 0.0083 |
| Professor effectiveness | 0.3607 | 0.4657 | 0.256 | 0.3544 | 0.2227 | 0.3151 | 1 | 0.2891 | 0.1879 | 0.2422 | 0.2635 | -0.1425 | -0.0838 | 0.0126 | 0.0133 | 0.0252 | 0.0023 | -0.064 | 0.0768 |
| Useful training? | 0.2693 | 0.3724 | 0.2657 | 0.2643 | 0.2017 | 0.2911 | 0.2891 | 1 | 0.1946 | 0.3614 | 0.1409 | -0.1285 | -0.071 | -0.018 | 0.0249 | 0.0248 | -0.0266 | -0.0592 | 0.0753 |
| Price | 0.3298 | 0.3118 | 0.2962 | 0.3048 | 0.305 | 0.2977 | 0.1879 | 0.1946 | 1 | 0.1948 | 0.2046 | -0.1022 | -0.1041 | -0.1044 | 0.1057 | 0.0197 | 0.0007 | 0.0615 | 0.0077 |
| Problem Resolution | 0.2568 | 0.266 | 0.2386 | 0.239 | 0.1717 | 0.3907 | 0.2422 | 0.3614 | 0.1948 | 1 | 0.0618 | -0.2094 | -0.171 | -0.0138 | 0.0553 | -0.0196 | -0.0011 | -0.0201 | 0.0359 |
| How often used materials | 0.2697 | 0.503 | 0.1867 | 0.2186 | 0.1853 | 0.2256 | 0.2635 | 0.1409 | 0.2046 | 0.0618 | 1 | -0.114 | -0.0598 | 0.0665 | 0.1165 | 0.0628 | 0.0979 | -0.0054 | -0.019 |
| Time to access content | -0.1731 | -0.1353 | -0.1848 | -0.1598 | -0.1369 | -0.2972 | -0.1425 | -0.1285 | -0.1022 | -0.2094 | -0.114 | 1 | 0.2668 | 0.0263 | -0.0015 | -0.0322 | -0.0733 | -0.0258 | 0.0164 |
| First aware | -0.0675 | -0.058 | -0.0877 | -0.0579 | -0.0205 | -0.1462 | -0.0838 | -0.071 | -0.1041 | -0.171 | -0.0598 | 0.2668 | 1 | -0.0479 | -0.0924 | -0.0361 | -0.0809 | 0.0189 | 0.0033 |
| Importance of keeping copy | -0.0398 | -0.0241 | -0.1836 | -0.0727 | -0.2673 | -0.0802 | 0.0126 | -0.018 | -0.1044 | -0.0138 | 0.0665 | 0.0263 | -0.0479 | 1 | -0.1717 | 0.0244 | 0.0594 | -0.009 | 0.035 |
| Hard copy? | 0.0349 | 0.0724 | 0.1245 | 0.0494 | 0.1738 | 0.0791 | 0.0133 | 0.0249 | 0.1057 | 0.0553 | 0.1165 | -0.0015 | -0.0924 | -0.1717 | 1 | -0.1292 | -0.1198 | 0.0025 | -0.1082 |
| Status | 0.0411 | 0.0618 | 0.006 | 0.0333 | -0.0052 | 0.0035 | 0.0252 | 0.0248 | 0.0197 | -0.0196 | 0.0628 | -0.0322 | -0.0361 | 0.0244 | -0.1292 | 1 | 0.258 | 0.2203 | 0.0519 |
| Age | -0.0087 | 0.0155 | 0.0143 | -0.0037 | -0.0028 | -0.003 | 0.0023 | -0.0266 | 0.0007 | -0.0011 | 0.0979 | -0.0733 | -0.0809 | 0.0594 | -0.1198 | 0.258 | 1 | 0.1091 | 0.0167 |
| Work? | -0.0325 | -0.0689 | -0.0107 | -0.0304 | -0.0012 | -0.0289 | -0.064 | -0.0592 | 0.0615 | -0.0201 | -0.0054 | -0.0258 | 0.0189 | -0.009 | 0.0025 | 0.2203 | 0.1091 | 1 | -0.1724 |
| Gender | -0.1028 | 0.0119 | -0.109 | -0.0541 | -0.1255 | 0.0083 | 0.0768 | 0.0753 | 0.0077 | 0.0359 | -0.019 | 0.0164 | 0.0033 | 0.035 | -0.1082 | 0.0519 | 0.0167 | -0.1724 | 1 |

Several strong correlations are observed among variables (see Table 1). These relationships are typically intuitive. For example, students' own feelings about how electronic materials impacted class preparation have a significant positive correlation with how useful they felt the materials were, how comfortable they were using online materials, how effective they thought their professor used the materials, their satisfaction with the e-text price, and how much they prefer to use e-texts in the future. Similarly, this same list is positively correlated with how useful they felt the materials were.

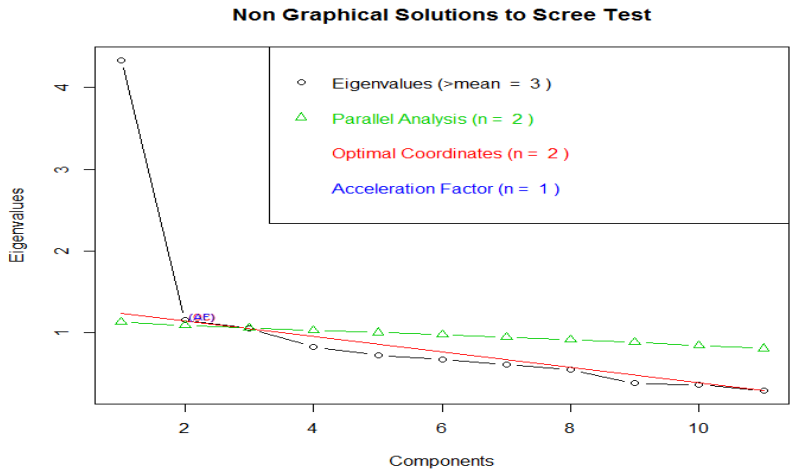
### Multiple Regression

Using multiple regression, five dependent variables were found to have significant relationships with independent variables (see Table 2). These dependent variables include a) how useful the student found the electronic materials, b) how well students felt prepared for class, c) how comfortable students felt using electronic materials, d) students' preference for using e-texts in the future, and e) how often students used the electronic materials. It is theorized that supporting these five variables will contribute to stronger course outcomes for students. Four independent variables were significantly correlated with all five of the dependent variables: a) the professors' effectiveness in using the materials, b) satisfaction with price, c) ease of the signup process, and d) useful training on how to use the electronic course materials. These four independent variables provide some insight into ways both the faculty and publisher can improve the student experience. First, faculty need to focus on effectively developing their course and training students to use electronic materials to support learning objectives, and second, publishers need to ensure that professors have the tools they need to be successful, that the sign-up process is easy to understand and use, and that training materials for students are easy to find and effective. Also, publishers need to ensure that the price for course materials meets expectations. This likely means prices near to those that students can find in secondary markets for printed texts.

**Table 2:**
*Summary of Significant Multiple Regression Results*

| | profEffect | price | signupProcess | usefulTraining | problemResolution | quickAccess | Adjusted $R^2$ |
|---|---|---|---|---|---|---|---|
| howUseful | 0.33 | 0.17 | 0.21 | 0.14 | | | 0.36 |
| studentPrep | 0.20 | 0.17 | 0.16 | 0.06 | 0.04 | | 0.26 |
| howComfortable | 0.14 | 0.19 | 0.23 | 0.11 | | 0.11 | 0.21 |
| futurePreference | 0.13 | 0.26 | 0.17 | 0.08 | | | 0.14 |
| howOften | 0.17 | 0.12 | 0.13 | 0.04 | -0.05 | | 0.12 |

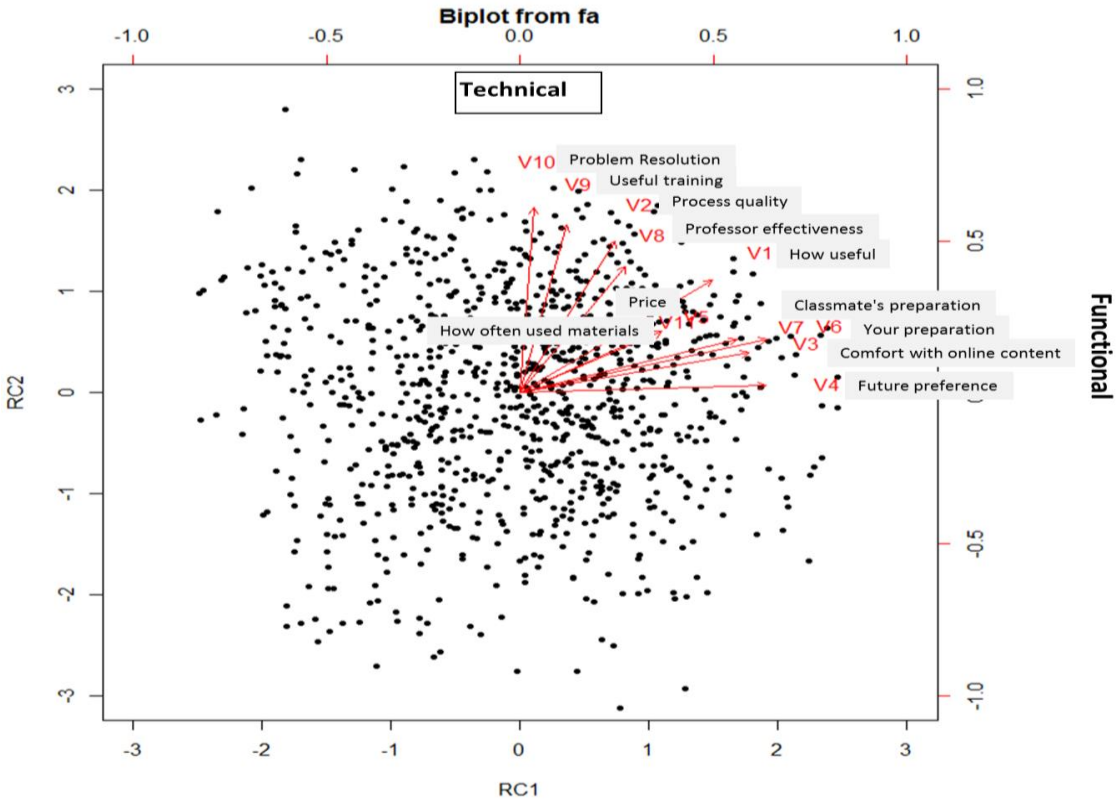
**Figure 1:**
*Factor Analysis*




Principle components analysis (PCA) is a statistical method used to identify underlying latent variables which influence measured variables. A scree plot is used to illustrate the eigenvalues for each factor (Figure 1) and a solution with two factors was identified that captures much of the variability in the data; additional factors added minimal insight in the analysis.

By analyzing the locations and definitions of the measured variables within the two-factor space, we propose the following titles and descriptions of the two latent variables (Figure 2).

**Figure 2:**
*Two Factor Space Analysis*



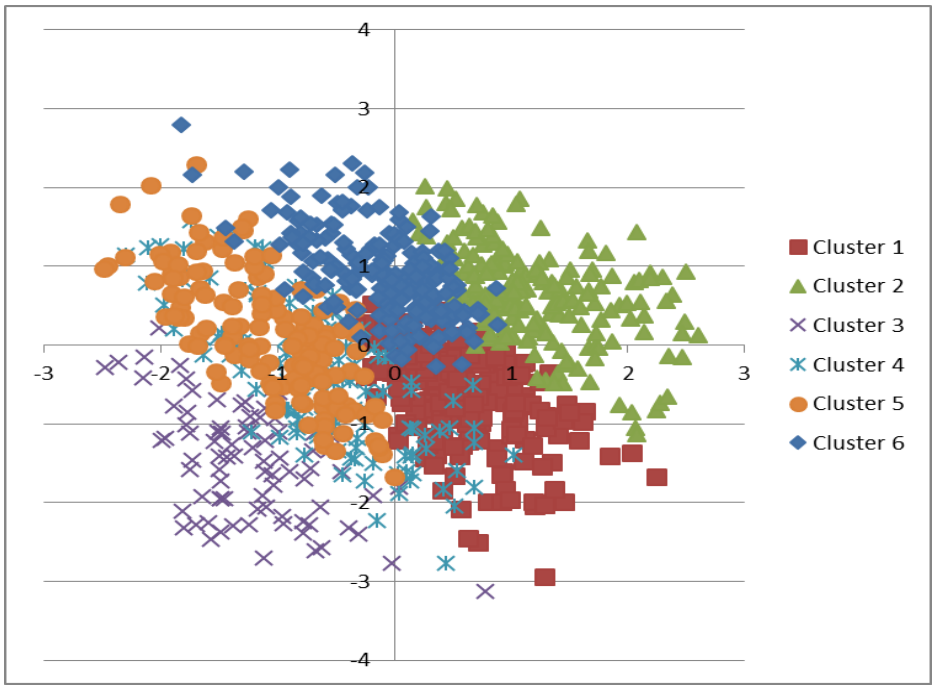

First is technical satisfaction: This vector describes the degree to which students were satisfied with the technical aspects of using e-texts including resolving technical problems, the online training modules, and the process of signing up for and accessing e-texts. The second is functional satisfaction: This vector describes the degree to which students were satisfied with the functional aspects of using e-texts like the degree of one's own and peer's preparation for class, how useful the e-text is, and how comfortable students are with online content. Both of these vectors range from high levels of satisfaction to high levels of dissatisfaction. Plotting each individual participant in this two factor space (illustrated using dots in Figure 2) shows a great deal of variety in student perceptions towards e-texts. This is consistent with the standard deviations reported above. However, visually it can be seen that the centroid is slightly positive, as reflected in neutral and slightly positive average scores described above for most measured variables.

## Cluster Analysis

Cluster analysis is a statistical tool used to group participants who responded similarly to each other in an assessment tool. Figure 2 shows the results of a cluster analysis resulting in 6 clusters. Participants in the 6 clusters have been plotted in the two-factor PCA space described above. Participant age and gender for 5 of the clusters is a relatively even distribution. That is to say, neither seems to influence the level of both technical and functional satisfaction for these 5 clusters. However, the sixth cluster shows a disproportionately high level of less than 20 year old participants; 39% of the less than 20 year old participants can be found in this cluster. The location of this

cluster indicates a neutral to high level of technical satisfaction and a neutral to low level of functional satisfaction. This suggests that a large portion our youngest participants could technically navigate the system well, but were unsatisfied with the actual experience of using e-texts in a course.

**Figure 3:**
*Cluster Analysis*




**Open-ended Questions**

In addition to the survey, 448 students responded to open-ended questions about their experience using the e-text and additional learning materials. Overall, students exhibited more positive responses than negative. Perhaps the most useful and telling responses were the comparison of what students like the most versus what students like least about using the e-text and electronic course materials. Table 3 contrasts students' open-ended comments about their likes and dislikes of e-texts. It is interesting to note that the features that students liked the most generally had to do with the content of the e-text and additional materials, while their dislikes were comprised mostly of difficulties with devices, software navigation, and other technical issues. These findings are consistent with those findings described above from other researchers in the literature review and suggest that the technical platforms and processes used to deliver e-textbooks still lack maturity.

**Table 3:**
*Likes and Dislikes of e-texts*

| **What students *liked* the most about e-text and additional course material:** | **What students *disliked* about the e-text and additional course materials:** |
|---|---|
| • Ease of Access/Convenience<br>• Not having to carry a hard-copy textbook<br>• "Search" feature within the text<br>• Online Quizzes<br>• Teaching videos<br>• Price<br>• Availability of additional learning materials<br>• Instant feedback on assignments<br>• Environmentally friendly | • Need a computer/tablet/laptop in order to use the text<br>• Difficulty reading on a computer screen for long periods of time<br>• Dashboard and navigation of the software<br>• Unable to access on certain tablets<br>• Unable to physically write on or mark the textbook<br>• Technical difficulties and browser problems |

A summary of comments regarding what participants liked and disliked about e-texts and electronic course materials

## Discussion

When observing the central tendencies of the data, participants in this study generally exhibited neutral to slightly positive feedback regarding their experience using e-text and the electronic learning materials. This contrasts to most research that indicates neutral to negative feelings toward electronic texts. While this may indicate a shift in student perceptions in e-texts, it may also simply be an artifact of the population used in the study. Further research will need to be performed to confirm this finding.

It is important to note that while the central tendencies of the data tended to be neutral, there were a wide variety of feelings expressed, ranging from strong dissatisfaction to strong satisfaction across a variety of variables. In other words, neutral feelings were far from universal. A large portion of students either "loved" or "hated" the experience. While it is gratifying to know that the majority of students range from neutral to strongly positive feelings, care should be taken to understand and meet the needs of those students who are having a moderate to strong negative experience with electronic textbooks and course materials. To that end, this section includes suggestions that administrators, faculty, and publishers can use to improve the process for adopting e-textbooks.

Measures of how successful e-textbook adoptions are can include student satisfaction, how often the materials are used, and students' perceptions of their effectiveness. In this case study, these factors were evaluated by asking students a) how comfortable they were using e-textbooks, b) if they would prefer to use them in future classes, c) how often they used the electronic textbooks and course materials, d) how useful they believed these materials were, and e) how well they believed the materials prepared them for class when compared to traditional textbooks. Multiple regression demonstrates that a large percentage of the variability in all five of these factors can be explained by four independent variables: a) how effectively professors use the material, b) price, c) quality of the sign-up process, and e) how useful the e-textbook platform training was. Note that none of these variables is related to the e-textbook content. This suggests that many of the areas that students feel are important can readily be influenced and improved by faculty and vendors.

Perhaps the most important finding is the mandate that the technology should not get in the way of the learning. The technical tools should be designed to be easy to use, allowing students to quickly and painlessly access course content and learning materials. In addition, special care should be taken to ensure that our youngest students see the advantage of using e-texts and electronic course materials in their education. We found a high level of technical competency in the 20 years or younger group of students and a low level of functional satisfaction. These students have grown up in a world where, by and large, technology "just works". They can quickly be disaffected when technology does not live up to their expectations whereas older students may expect to have problems with technology. This disconnect is especially problematic for electronic textbooks and course materials because most vendor platforms are still developing and working out issues.

The findings suggest that two factors, technical and functional satisfaction, should be considered when developing e-text solutions. This study makes it clear that opinions regarding e-texts vary widely, thus care should be taken to understand the interests and ideas of those who find e-texts dissatisfying either technically, functionally, or both, and take steps to remedy their concerns. Specifically, vendors should ensure that navigation through the software is consistent and easy, interfaces are clear and effective, that important information is readily available and transparent, that the software has been designed to work on a variety of technical hardware and platforms, and that note-taking and bookmarking is supported and easy to accomplish. In addition, pricing that more closely matches that of the secondary market of printed textbooks would likely have a significant positive influence on student perceptions. Finally, the research seems to indicate that student perceptions of electronic texts could be improved with better student training in its use.

Finally, this study shows that if students feel that their professors are effectively using the electronic learning materials as a part of their curriculum, they also find materials to be more useful. Knowing that some professors use electronic materials ineffectively, if not awkwardly, helps publishers and faculty alike recognize that by improving the functionality of online course materials, these tools will be more beneficial to more students. Successful professors will need to fully embrace this idea and alter their teaching styles accordingly to make the transition effective. It is important to note that publisher approaches can vary significantly. As a result, faculty members may require additional training to be successful with different texts.

**Future Implications**

When electronic texts were first introduced, the technology was poor and many predicted that they would never supplant printed books (Crawford 2006). But the technology for electronic textbooks and supporting technologies such as tablets, laptops, smart phones, Wi-Fi, and cellular data connections are advancing rapidly. The technological wave of the digital world has rapidly replaced what before required paper and pencil and other "traditional" ways of getting things done. This makes for a constantly changing landscape for the world of electronic textbooks. We expect that issues related to the ease of reading on a screen and the ubiquity of devices to access materials will improve with time as technology improves. While vendors will undoubtedly resolve some of the technology issues found in this study, faculty training remains an important factor in facilitating positive student experiences. Professional development support in the use of electronic textbooks and their platforms would likely improve the adoption and learning experience.

In addition, improving technology means that each year students are more experienced and comfortable using electronic learning materials. More time and experience with this technology may, by itself, improve perceptions and cultural

acceptance. It is reasonable to assume that those who understand and feel more comfortable navigating electronic materials will find them more useful.

While many of the problems with e-text adoption may simply improve over time through the efforts of vendors and increased student and faculty experience, ongoing research in this area should test that assertion. Additionally, future research needs to seriously address the issue of efficacy in achieving learning outcomes as e-text usage becomes more prevalent. It is suspected that the additional functions made possible through online materials will enhance learning but only to the extent that those functions are used effectively by faculty members and students.

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