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## **e-Textbooks at Indiana University: A Summary of Two Years of Research**

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This research was supported by Indiana University and the National Science Foundation (#0945499). Dr. Dennis is a Professor of Information Systems, the John T. Chambers Chair of Internet Systems, and also the co-founder of Courseload, Inc. Courseload's goal is to develop a new model for e-textbooks.

## INTRODUCTION

A new generation of students is now arriving at universities -- the Millennials. This generation embraces new technologies and information sharing, and they are astute networkers. Yet, these “digital natives” are still greeted by pre-digital era paper textbooks and approaches to learning that their grandparents would recognize. No one seriously doubts that the paper textbook will be replaced by e-textbooks. It is only a question of when.

There is broad agreement that the market for textbooks and educational materials in higher education is broken. Costs have risen at more than double the rate of inflation, contributing to troubling escalation in the cost of a college education. The \$10 billion market for textbooks is ripe for the kind of reinvention that iTunes brought to the music market. While there have been many forays into digital course materials, the fear of piracy and the resulting restrictive digital resource management (DRM) features that limit the way content is used, re-purposed and shared, coupled with books that evaporate after a course is over, has led to lukewarm student adoption; about 97% of textbooks sold in 2010-2011 were paper books<sup>1</sup>.

In the fall of 2009, Indiana University began assessing a new model for e-textbooks and digital learning materials that has two key components. The first is shifting the market to a new way of buying and selling materials. Rather than asking students to buy textbooks at retail prices, IU is contracting with leading textbook publishers to buy e-textbooks at wholesale prices, with the cost of the book included as a course fee when students register. The e-textbook is provided to students (and faculty) through our Learning Management System (Sakai) and is available as long as the student is enrolled (rather than disappearing at the end of the course).

The second component is providing software and tools that enable new ways of learning. There is one standard set of e-reading software for all books regardless of publishers (including open source content) so students don't need to learn a new interface for each textbook. The software enables the instructor and students to highlight and annotate the materials and share those with others in the class, so it creates a learning community around the book. Faculty can easily embed videos, and other learning materials directly into the textbooks, creating a textbook customized for the unique needs of their students. Because faculty can markup up the books with their comments (e.g., read this section carefully, don't read this section, watch this video before you read this section), students feel like the “instructor is on your shoulder” as they go through the book.

## THE RESEARCH STUDY

As part of the assessment, we examined how students chose to use their e-textbooks, how they felt about them, and what the impact they had on learning. We studied 22 courses (some with multiple sections taught by different instructors) with just over 1700 students in business (management, marketing, finance, information systems, and operations), history, Italian, telecommunications, psychology, math and astronomy at the undergraduate and graduate levels.

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<sup>1</sup>Reynolds, R. (2011). Digital textbook sales in U.S. higher education: A five year projection, The explanation, [http://blog.xplana.com/wp-content/uploads/2010/04/DigitalTextbooks\\_Report\\_04-19-10.pdf](http://blog.xplana.com/wp-content/uploads/2010/04/DigitalTextbooks_Report_04-19-10.pdf).

We conducted surveys at the end of 12 of these courses. Of the 1037 students enrolled in these courses, we received survey responses from 738 (a 71% response rate), although not all students responded to all questions. We asked 447 of these students for permission to use their course grade in our research and received permission from 424 (95%).

## STUDENT BEHAVIORS

### Reading Behaviors

One question we always get is whether students are ready for a digital environment or whether students prefer to read on paper. The system logs show that 68% of students printed no pages; they went completely digital. Less than 19% of students printed more than 50 pages.

These numbers match well with our survey data. Most students (87%) reported reading the e-textbook primarily (50% or more of the time) on a computer or other digital device. About 63% primarily used a laptop, 11% primarily used their desktop computer, and 13% alternated between their desktop and laptop. Only 1% used a mobile device or e-reader (e.g., iPad). Across the entire sample, students read an average of 293 pages, with 10% reading no pages online (we defined a page to be read if a student paused for 10 seconds or more on the page). About 22% of students reported that they read more of the e-textbook compared to what they would have read in a paper textbook; 55% reported reading less.

### Annotating Behaviors

The e-textbook software enables students to highlight and annotate their textbook. Most students who participated in focus group discussions said they did not highlight or annotate their paper textbooks because doing so would impair the resale value of the paper books. Half the students (51%) made no annotations in their e-textbooks. About 18% made 1-20 annotations while 9% made more than 100 annotations.

Survey data show that 22% of students reported that they annotated more of the e-textbook compared to a paper textbook; 57% reported annotating less.

## STUDENT ATTITUDES

### Preference for e-textbooks

About 60% of the students surveyed said they preferred the e-textbook to a paper textbook, although this ranged from a high of 84% to a low of 36% depending upon the course. The 36% rating was from a course in which the instructor made no use of the textbook (i.e., students paid for the book, but the instructor never referred to it).

We conducted a GLM analysis of the factors influencing students' preferences for e-textbooks. Table 1 shows the factors, their influence (standardized beta weight) and their significance (F and p) (adjusted  $R^2 = .13$ ). There were no gender differences. Students who had used an e-textbook in a prior course were more likely to prefer e-textbooks, suggesting that students become more comfortable with e-textbooks the more they use them, which bodes well for the long term.

The extent to which the student perceived that the instructor made use of the e-textbook significantly influenced student preferences. This includes assigning readings, making

annotations, and referring to the textbook in class. The lowest scores were in courses in which the instructor made no use of the book, but rather treated it as a reference.

Students in the spring 2011 semester, when course fees were implemented for the first time, were less likely to prefer e-textbooks than students in the prior semesters, when the e-textbooks were provided for free, even though the question about textbook preference clearly indicated the price of the e-textbook.

Students in junior and senior level courses were more likely to prefer e-textbooks than students in freshmen courses. Students in freshmen courses may be making the adjustment to college life and an e-textbook may be one more adjustment in their lives – or it may be that students in large lecture hall courses are generally less satisfied than students in smaller upper division courses. Students in graduate courses were slightly more likely to prefer e-textbooks than those in junior/senior courses.

Contrary to expectations, students in information technology courses were *less* likely to prefer e-textbooks. We speculate that this is because they have higher expectations for software, and our pilot software that resembled Adobe Acrobat Reader in look and feel was less appealing than newer iPad-like software.

**Table 1: Factors Influencing Students’ Preferences for e-Textbooks**

Factor	Influence	F	P
Gender	ns	0.69	.551
Prior Course with e-textbook	.11	5.52	.019
Instructor Use of e-textbook	.19	22.82	.001
Semester	Varies	11.13	.001
Level of Course	Varies	12.38	.001
Technology Course	-.27	16.26	.001

### Self-Reported Factors Influencing Preference for e-textbooks

We asked students how important different aspects of e-textbooks were for their preferences for e-textbooks versus paper textbooks (see Table 2). About 69% said that the ability for instructors to annotate the e-textbook and share those annotations with the class was an important reason they would choose an e-textbook. Improving sustainability by reducing paper was a second important reason (67%). Cost was third (64%), which surprised us, because we expected it to be the most important factor. We should note that there were no significant differences among these top three factors.

**Table 2: Relative Importance of e-textbook Characteristics**

Factor	Percent Saying Important
Instructor Annotations	69%
Sustainability	67%
Cost	64%
Weight of Books	61%
Student Annotations	60%

Two other factors were also important, although significantly lower than these top three. About 61% of students said that reducing the weight in their backpacks was an important reason for choosing e-textbooks. About 60% said enabling them (i.e., the student himself/herself) to highlight and annotate was important.

## STUDENT LEARNING

### Factors Affecting Learning

We conducted a GLM analysis of the factors influencing the students' learning (as measured by their end of course grade). Table 3 shows the factors, their influence (standardized beta weight) and their significance (F and p) (adjusted  $R^2 = .38$ ). We included the course and semester in which the student was enrolled as control factors, because there were significant differences in mean course grades across both.

Self-reported prior GPA was the single most important factor in predicting course grade, which was not surprising. There were no gender differences. Having taken a prior course with an e-textbook was not significant, which is important, because it shows that students' initial performance is not impaired by adapting to a new environment.

Interestingly, the number of pages a student read did not significantly affect his or her grade (a student was defined to have read a page if he or she paused for 10 seconds or more on the page). However, the number of annotations made had a significant impact (measured as the square root because there are declining marginal benefits to excessive annotating). Prior research in a variety of education settings has shown that annotations improve grades, so this is not unexpected.

**Table 3: Factors Influencing Students' Learning**

Factor	Influence	F	P
Course	Varies	14.59	.001
Semester	Varies	13.39	.001
Prior GPA	.52	149.60	.001
Gender	ns	1.89	.170
Prior Course with e-textbook	ns	1.59	.208
Number of Pages Read	ns	0.40	.526
Number of Annotations Made	.09	4.91	.049

### Self-Reported Factors Influencing Learning

One important difference that the e-textbook software enables that paper textbooks do not is the ability to share highlights and annotations. We asked students about the value of sharing these annotations. About 84% of students reported that the instructor's annotations were useful in their learning. In contrast, only 23% said that the annotations shared by other students were useful to their learning.

## CONCLUSION

We believe that this new model for e-textbooks holds considerable promise. Most of our students (87%) abandoned paper and choose to read their e-textbooks on a digital device (usually a laptop). We believe that as tablet devices such as the iPad become more common, the use of paper will rapidly disappear.

Most of our students (60%) preferred e-textbooks to paper textbooks, although this was not unanimous. Students were more likely to prefer e-textbooks when the instructor actively made use of the book; our lowest approval rating (36%) came from a course in which the instructor did not use the book. Thus our advice is to use this e-textbook model (which includes mandatory purchase of the book through a course fee) only for courses in which the instructor intends to make substantial use of the book through reading assignments and annotations.

Preferences for e-textbooks averaged 11% higher (68% versus 57%) for the second course in which a student used an e-textbook, suggesting that once students had more experience with e-textbooks, they were even more likely to prefer them. We view this as a positive signal, indicating that student support is likely to increase as e-textbooks are more widely deployed.

We expected cost to be the most significant reason students preferred e-textbooks. Cost was among the top three reasons students mentioned, but students reported that the ability to read their instructors' annotations and improve sustainability were equally important reasons to adopt e-textbooks. Thus the ability to improve learning was as important to students as cost savings.

We found that the more students engaged with the e-textbook by annotating it, the more they learned. We believe that the digital world offers new ways to teach and learn that can improve student learning, and as e-textbooks become more widely deployed and as software becomes more advanced, student learning will improve.

In summary, we believe that the future is digital, and that this model is an important step towards that future.