

A COMPARISON STUDY OF THE USE OF PAPER VERSUS DIGITAL TEXTBOOKS BY UNDERGRADUATE STUDENTS

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Purpose of the Study

- This study examined the effectiveness of using digital textbooks compared with traditional paper textbooks in undergraduate courses.
- Student performance comparisons were used to see if the digital versions have any significant influence on students' achievement scores versus paper books.
- Moreover, regardless of performance outcomes, features of software and devices will be explored to determine if these influence use of digital texts.

Statement of the Problem

- There is a need to reduce cost associated with college expenses
- Provide easier access to information that is up-to-date for students
- Provide resources for libraries to provide digital content

Significance of the Study

- This study will provide information concerning the effectiveness of using digital textbooks as compared with the effectiveness of paper textbooks.
- The rising cost of textbooks for students and university libraries will also help to determine the future use of paper versus digital textbooks.
- This study also provides insight as to whether undergraduate students prefer to use digital textbooks.
- This study discusses possible differences in preferences in regard to the use of digital textbooks as related to gender, textbook preference, and past experiences in using tablet computers.

Research Questions

1. Are there any significant differences in reading comprehension test scores of undergraduate students when using paper texts versus digital texts?
2. Are there any differences in reading comprehension test scores of undergraduate students with regard to gender?
 - a. Is there any relationship between text formats and gender?
3. Is there any relationship between the hours of experience using tablet computers and reading comprehension test scores among study participants?

Null Hypotheses

1. There is no difference in reading comprehension between students using digital texts and those using paper texts.
2. There is no difference in reading comprehension with regard to gender when using digital texts or paper texts.
3. There is no relationship between past experiences using tablet computers and reading comprehension test scores.
4. There is no relationship between gender and format of the text.

Methodology

- Students were randomly split into 2 groups, one reading text in print and the other group reading the text in digital format on an iPad tablet computer.
- Both groups read a chapter of a textbook and took a comprehension reading test on what they read.
- A follow-up survey collected basic demographic information and answers to questions about the students' experiences and perceptions of using paper and/or digital textbooks.
- Two focus groups were formed for each text format to gain further insight from the participants.

Study Sample

- The study confined itself to the undergraduate student population at Indiana State University. The university currently has an enrollment of just over 12,000 students in the undergraduate programs.
- The population that participated in the study was predominately students majoring in education.
- The study only used one chapter of a textbook and data was collected in one single class period with several classes.

Study Participants

- Total number of participants: 233
 - Female: 163
 - Male: 70
- Paper Text Group: 114 participants
- Digital Text Group: 119 participants
- 62 (26.6%) of participants were 21 years of age
- 52 (22.3%) of participants were 22 years of age
- 41 (17.6%) of participants were 20 years of age
- 34 (14.6%) of participants were over 25 years of age

Comprehension Test Results

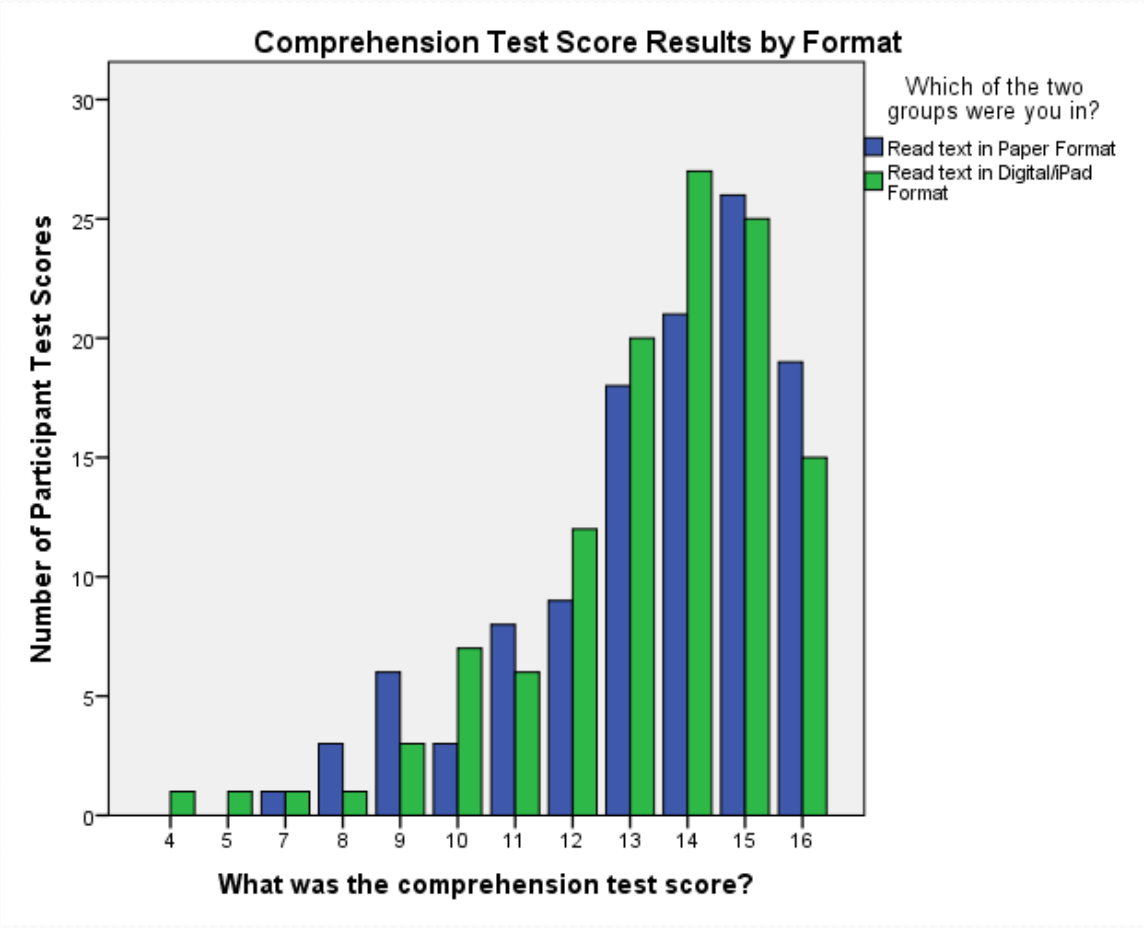
Comprehension Test Scores by Gender and Textbook Format (N=233)

Which of the two format groups were you in?	Gender	N	Mean Score	Standard Deviation
Read text in Paper Format	Man	35	13.06	2.44
Read text in Paper Format	Woman	79	13.62	2.08
Total of Paper Format	Both	114	13.45	2.20
Read text in Digital Format	Man	35	12.69	2.87
Read text in Digital Format	Woman	84	13.57	1.92
Total of Digital Format	Both	119	13.31	2.26
Total of both formats	Man	70	12.87	2.65
Total of both formats	Woman	163	13.60	1.99
Grand Total	Both	233	13.38	2.23

Findings

- Research Question #1
 - Are there any significant differences in reading comprehension test scores of undergraduate students when using paper texts versus digital texts?
- Participants 21 years of age scored a mean of 13.87
- Participants 25 and up scored a mean of 13.50
- Participants 22 years of age scored the lowest mean of 13.04 out of 16.
- The lowest score of the digital text was 4 and the highest was 16.
- The lowest score on the paper text was 7 and the highest was 16.
- There was no significant difference $F(1, 229) = .440, p > .05$.
- This accepts the null hypothesis of there being no difference in reading comprehension between students using digital texts and those using paper texts.

Graph of Comprehension Test Results



Findings

Research Question #2

- Are there any differences in reading comprehension test scores of undergraduate students with regard to gender?
- The mean score of men in both formats was 12.87, $SD=2.65$ and the score of women in both formats was 13.6, $SD=1.99$.
- There was no significant difference $F(1, 229) = .259, p > .05$.
- This accepts the second null hypothesis of there being no difference in reading comprehension test score and gender when using digital texts or paper texts.

Comprehension Test Scores by Gender and Textbook Format (N=233)

Which of the two format groups were you in?	Gender	N	Mean Score	Standard Deviation
Read text in Paper Format	Man	35	13.06	2.44
Read text in Paper Format	Woman	79	13.62	2.08
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Findings

- Secondary Question to Research Question #2
 - Is there any relationship between text formats and gender?
- There was no significant relationship between gender and format of the text.
- There was significance between the groups with gender.

Factorial ANOVA Summary of Gender and Textbook Format Relationship

Source	SS	Df	MS	F	Sig.
Gender	25.69	1	25.69	5.23	.023
Text Format	2.16	1	2.16	.44	.51
Gender x Text Format	1.27	1	1.27	.26	.61
Error	1124.61	229	4.91		
Total	42851	233			

$p < .05$

Findings

- Research Question #3

- Is there any relationship between the hours of experience using tablet computers and reading comprehension test scores among study participants?
- There was no significant result $F(1, 231) = .533, p > .05$.
- This outcome accepts the null hypothesis of no relationship between past experiences using tablet computers and reading comprehension test scores.
- The delivery method did not have a significant impact on the comprehension scores so students were able to achieve high scores overall.

Tablet Computer Experience

- Top devices used by participants
 - iPad, iPhone, or iPod Touch – 119 (51.1%)
 - Laptop, Netbook or Desktop Computer – 207 (88.8%)
 - Cell Phone – 84 (36.1%)
- Devices participants would like to use
 - E-book Reader (Kindle, Nook, etc.) – 112 (48.1%)
 - iPad, iPhone, or iPod Touch – 161 (69.1%)
 - Laptop, Netbook or Desktop Computer – 160 (68.7%)

Tablet Computer Experience

- Top ratings of digital textbook reader options
 - Cheapest price – 146 (62.7%)
 - Ability to use multiple e-reader applications (apps) -118 (50.6%)
 - Ability to read email – 164 (70.4%)
 - Ability to browse the Internet – 174 (74.7%)

Tablet Computer Experience

- Top prices students are willing to pay for a digital textbook reader
 - \$100-149 – 47 (20.2%)
 - \$150-199 – 47 (20.2%)
 - \$200-249 – 39 (16.7%)

Tablet Computer Experience

- The major themes that came out of the survey feedback questions included:
 - Possible or perceived eye strain due to reading from a digital device (iPad.)
 - The cost of paper textbooks versus the digital textbooks.
 - The heavy weight of paper textbooks and the convenience and portability of the digital device.
 - The desire to hold and read from a physical textbook.
 - The potential distractions of using a digital device when trying to read their books.
 - The concern for reliable technology (the reader hardware) and support for the devices. Battery life and software availability was important as well.

Tablet Computer Experience

- Focus group feedback
 - Feedback centered on comments about digital devices
 - Cannot resell digital textbooks
 - Cost of paper and digital textbooks still too high
 - They did not like the idea of renting textbooks
 - Limitations of digital devices – battery, screen, etc.
 - It was easy to read text on iPad
 - Prices for digital devices was a concern (too expensive)

Research Discussion

- Students can perform the same on comprehension tests no matter the delivery format.
- The usage of digital textbooks should not affect student performance
- Gender did not matter in tests scores.
- Even participants who were not assigned the text format they preferred, scored well on the test.
- Undergraduate students are interested in using digital e-readers if:
 - The devices are not too expensive (under \$400)
 - The books offer more content and are of good value
 - The device helps the student interact with the content, their peers, and their instructors

Recommendations

- Adding more digital textbooks and resources should be encouraged
- Costs for digital textbooks and resources need to be discussed & addressed to help keep college costs down
- Encourage faculty to write and create their own digital textbooks and resources (customization)
- Further development of publishing frameworks for faculty and other authors
- Provide training and development time for faculty to create new digital resources

Future Research

- Perform tests on eye-strain when using digital devices
 - determine how to address physical discomfort
- Perform this study over an entire semester/ multiple semesters and use the entire textbook
- Conduct a study with multiple e-readers and software applications to see if screen size as well as device features make any significant differences

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