



# CSOTTE 2012

## Does Instructional Technology Improve Learning?

### *Three Case Studies*

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# Research Issue

- The use of technology in the classroom is increasing.
- Some claim that technology may lead to improved learning; however, research confirming this claim is needed.
- This presentation provides three case studies of learning technologies with some surprising findings.



# Purpose of Study #1: E-Textbook

1. What student characteristics are associated with the decision to use a web-based e-textbook?
2. Do students who use the web-based textbook achieve different learning outcomes than those who use a traditional hardcopy textbook?



# E-Textbook Research Scenario

- Introductory Statistics course
- Students could choose to use Internet-based textbook (basically PDF format) or purchase a hardcopy textbook
- Instructor recommended hardcopy textbook, but left decision to students



# Sample Description

- N = 56 students
- Females – 61%
- Hispanic – 73%
- Mean age – 20.6 years
- Freshmen/sophomores – 71%
- Mean # of math courses completed – 1.52
- Mean SAT Math – 508
- Mean HS GPA – 3.59



# Student Characteristics by Text Format

| Student Characteristic         | Hardcopy Group | E-book Group | p-value         |
|--------------------------------|----------------|--------------|-----------------|
|                                |                |              |                 |
| Student Age, Yrs               | 20.4 ± 5.7     | 20.8 ± 3.3   | NS <sup>b</sup> |
|                                |                |              |                 |
| Lower Class (Fr/So)            | 27 (71)        | 11(29)       |                 |
| Upper Class (Jr/Sr)            | 6 (40)         | 9 (60)       | .036            |
|                                |                |              |                 |
| Female                         | 22 (69)        | 10 (31)      |                 |
| Male                           | 11 (52)        | 10 (48)      | NS              |
|                                |                |              |                 |
| Hispanic                       | 26 (67)        | 13 (33)      |                 |
| Non-Hispanic                   | 7 (50)         | 7 (50)       | NS              |
|                                |                |              |                 |
| High School GPA                | 3.63 ± .18     | 3.50 ± .39   | NS              |
|                                |                |              |                 |
| SAT Math                       | 511 ± 76       | 512 ± 86     | NS              |
|                                |                |              |                 |
| College Math Courses Completed | 1.73 ± 1.0     | 1.25 ± 1.0   | NS              |

33 hardcopy, 20 e-text, 2 withdrew from class, 1 did not participate



# Learning Outcomes by Group

| Outcome              | Hardcopy Group | E-book Group | p-value |
|----------------------|----------------|--------------|---------|
| Homework score       | 81.7 ± 14.4    | 68.1 ± 23.4  | .027    |
| Exam 1 score         | 86.3 ± 10.3    | 76.0 ± 16.6  | .018    |
| Exam 2 score         | 77.7 ± 12.8    | 63.8 ± 18.5  | .006    |
| Exam 3 score         | 79.7 ± 14.9    | 76.7 ± 16.2  | .517    |
| Final Course Average | 82.2 ± 9.7     | 71.6 ± 16.4  | .015    |
| Final Grade          |                |              |         |
| A                    | 8 (24)         | 2 (10)       |         |
| B                    | 14 (42)        | 5 (25)       |         |
| C                    | 7 (21)         | 5 (25)       |         |
| D                    | 4 (12)         | 5 (25)       |         |
| F                    | 0 (0)          | 1 (5)        |         |
| Withdrew             | 0 (0)          | 2 (10)       |         |
| Completion Status    |                |              |         |
| Passed with A-C      | 29 (88)        | 12 (60)      |         |
| Did not pass         | 4 (12)         | 8 (40)       | .039    |



# Key Finding

After controlling for group differences at baseline, students *who used hardcopy textbooks* are estimated to earn about a letter grade higher (9.5 points) than those who use e-textbooks.

## Limitations:

- Not a randomized (causal) design
- Relatively small sample
- Applied to two sections of one course
- Only considered one e-textbook format
- Did not include variables like student affect/motivation
- Did not determine why students chose a specific format





## Purpose of Study #2: Blended Courses

1. The Efficacy of Blended Course Modality -V- Fully Online Traditional and Traditional Classrooms: Why are students resistant to blended learning?
2. What are students' perceptions of and experiences with blended learning courses?



# Methods

- Qualitative Descriptive/Multiple Case Study Design;
- Participants – Three groups of Master's and PhD students participating in three blended courses in a three-year period;
- Role of researcher: Instructor



# Methods

- Data collection methods:
  - Observations of students while in class
  - Student reflection journals
  - Post-class interviews
- Analysis: pattern matching, linking data to propositions, explanation building, time-series analysis, logic models, and cross-case synthesis (Yin, 2003)



# Themes

- **First theme:** Students struggled in the online/blended learning environment due to a sense of an artificial community.
- **Second theme:** A lack of proficiency among students in using the technology had a negative impact on their learning experiences.
  - Not as well supported in the literature



# Themes

- **Subsequent themes:**
  - Generational – Age can be a factor.
  - Sense of feeling overwhelmed –
    - Students struggle with feeling overwhelmed when dealing with multiple technologies in the class (course management system, synchronous format, discussion board format – Facebook, using electronic resources, and online collaboration technology).



# Themes

- **Subsequent themes:**
  - Students struggle with the self-directed nature of using online modalities.
  - Faculty must be proficient with related technology.



## Purpose of Study #3: Clicker Technology

1. To determine if student learning outcomes differ based upon in-class review versus no in-class review.
  - In other words, does review make a difference?
2. To determine if student learning outcomes differ based upon the method of review.
  - Does review method (clicker vs non-clicker) make a difference?



# Methods

## Quantitative Component

- 13 PPR Competencies
- 9 scenarios for each competency
  - 3 questions answered with clickers (reviewed)
  - 3 questions answered with paper/pencil (reviewed)
  - 3 questions not reviewed





# Methods

- Mid-term exam—Competencies 1-7 covered
  - Reviewed questions (both clicker and non-clicker) asked again
  - Non-reviewed questions added
  
- Final exam—Competencies 8-13 covered
  - Reviewed questions (both clicker and non-clicker) asked again
  - Non-reviewed questions added



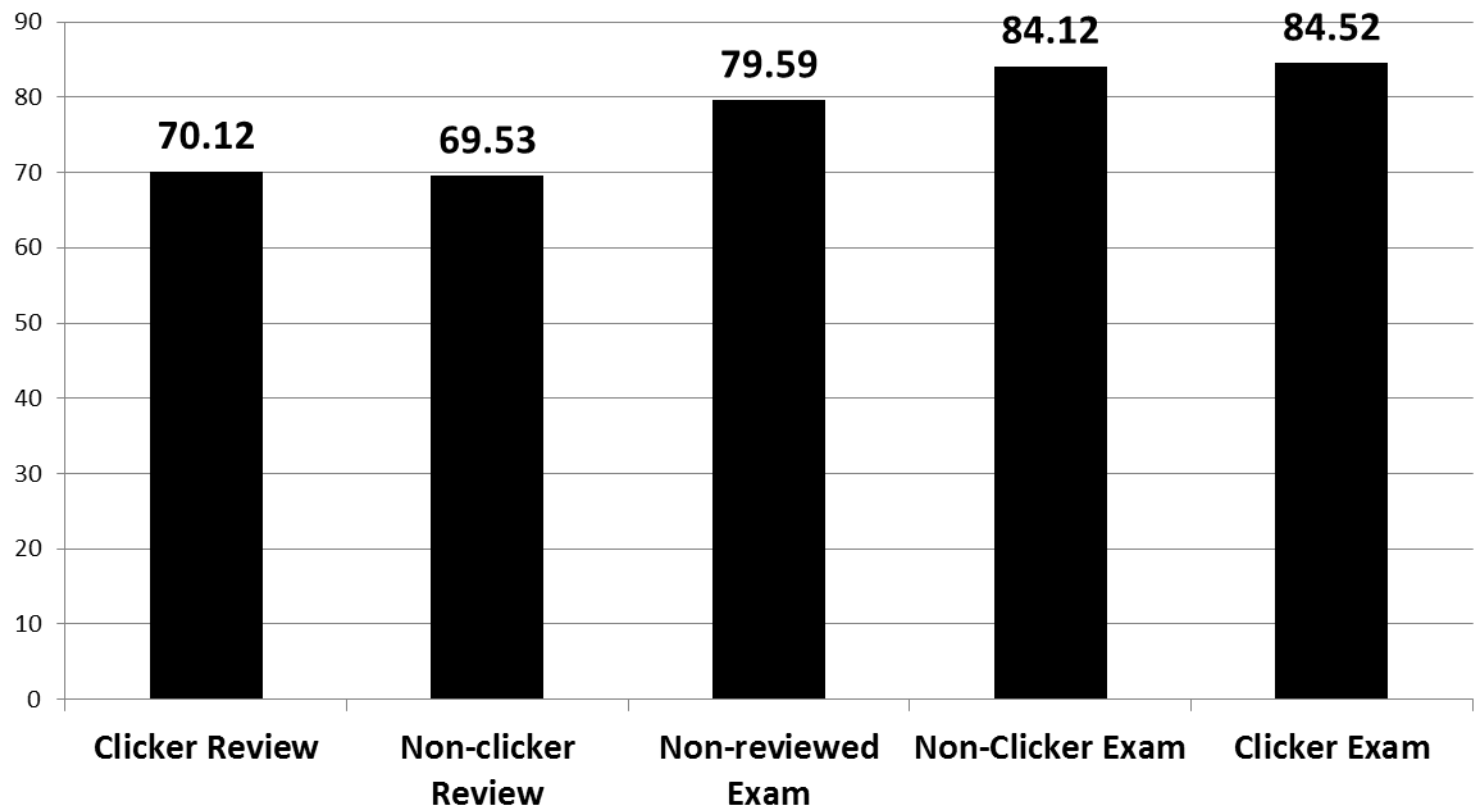
# Methods

## Qualitative Component

- Student survey
  - Given the last day of class



# Learning Outcomes





# Findings

## Quantitative Component

### 1. Does review make a difference?

Yes.

Students scored significantly higher (half a letter grade) on exam questions when comparing reviewed to non-reviewed material.



# Findings

## Quantitative Component

2. Do students achieve better learning outcomes when clickers are used?

No.

The use of clickers for in-class review did not provide greater benefit than review using a traditional paper/pencil format.



# Findings

## Qualitative Component

- Are students satisfied with the use of clickers in instruction?

Yes.

Students stated that they were more engaged when clickers were used for review.



# Key Finding

- While the use of clickers may contribute to in-class student engagement, *the benefit from the use of clickers does not extend to better student learning gains when compared to a traditional review method.*
- Fike, D.S., Fike, R. & Lucio, K. (2012). Does clicker technology improve student learning?, *Journal of Technology and Teacher Education*, 20(2), Spring 2012, 113-126.



# Summary

- Findings from these three studies suggest that educators should:
  1. Evaluate the effectiveness of the use of technology.
  2. Allow time to prepare/train both the faculty and students before implementing technology.
  3. Use data to influence your technology choices.





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