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Statistical Strategies: Meeting the Needs of Struggling Math Students through Self-Guided Interactive Multimedia

Nimet Alpay

Franklin University, nimet.alpay@franklin.edu

Natalya Koehler

Franklin University, natalya.koehler@franklin.edu

Carolyn LeVally

Franklin University

Tawana Washington

Franklin University

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Goals of our Research

- As part of the MATH 215 redesign, we developed weekly web-based interactive multimedia lectures, based on the 12 principles of multimedia learning (Mayer, 2001).
- The goal of our research study was to determine, using formative evaluation, if these multimedia pieces were useful and if they should continue to be used.

Media Components

The interactive multimedia lectures contain the following components:

- New information delivery:** In this section, there is visual and auditory information, as well worked examples.
- Information summary:** This section summarizes the new information learned in the media.
- “Check Your Learning” comprehension questions:** This section of the media provides questions over the material covered. Questions can be multiple choice, drag and drop, fill in the blank, and many other types of interactions.

The top left screenshot shows a 'Stratified Sampling Example' with a diagram of a population of 200 employees (50 females, 150 males) being divided into strata. The top right screenshot shows a 'Summary' screen with 'Cluster Sampling' and 'Voluntary Response Sampling' diagrams.

The bottom left screenshot shows 'Question 2' asking 'Which of the following three samples is the most reflective sample of the population?' with three different sample diagrams.

Top left: Example of an information delivery screen

Top right: Example of an information summary screen.

Bottom left: Example of a comprehension question screen.

Research on Media Use

We conducted a formative evaluation of student use of the multimedia lectures. Some of the evaluation details are as follows:

- Over 2 trimesters
- 86 student participants in Fall 2015
- 81 student participants in Winter 2016
- Data were collected from 3 sources for triangulation purposes. These sources were:

Student survey ratings of the media on a rating scale of 1 - 5 (5: strongly agree, 1: strongly disagree)

Themes from students' comments about the helpfulness of the media features

Instructor perceptions about the students' use of multimedia

Student Comments

Below are some student comments about the multimedia:

“The explanations break the material down in terms I can understand and relate to therefore making it easier to retain the information.”

“I had a terrible time in previous math classes and dreaded taking this one. As it turns out, this class has not been bad at all. The interactive lectures make a difference for me.”

“I have enjoyed these interactive multimedia lectures since I began using them at the start of the course. I think they would be very useful in other classes where topics tend to need more explanation than just written text.”

Conclusions

The 167 students who participated in the evaluation of the web-based interactive multimedia lectures over a period of 2 trimesters were overwhelmingly positive about their experiences. The lectures helped them understand challenging statistical concepts before performing statistical procedures.

The increase in student performance and retention was especially pronounced in online sections because the multimedia lectures provided systematic instruction to online students whose synchronous interaction with the instructor was limited to one hour per week.

We continue using this approach in other STEM courses.

For media demonstration, check out <http://tinyurl.com/z5vc7zg>.

Research Data Results

Survey Questions	Average ratings
1. I liked the layout of the sections in the lecture.	4.7
2. I liked the navigation in the sections in the lecture.	4.7
3. I liked the explanation and the examples used in the informational slides of the lecture sections.	4.6
4. I liked the summary slides used throughout the sections.	4.5
5. I found the transcript option useful.	3.6
6. The sections helped me understand this week's material.	4.6
7. The section design helped me retain the new information.	4.4
8. The section design helped me maintain my attention.	4.5
9. I found the self-assessment feature (Check Your Learning questions) helpful.	4.5
10. The answer feedback to the Check Your Learning questions (explanations of the correct answers) were helpful.	4.5
11. The answer feedback to the Check Your Learning questions was sufficient.	4.3
12. I liked the supplemental content (if any), such as calculator tips and topic videos.	3.9
13. The pace of the content was good.	4.6
14. I enjoyed my experience.	4.5

Instructor Perceptions & Responses to Multimedia

Below are some instructor comments about the multimedia:

These are highly recommended to view before class for my students. I ask them to take this little bit of time to view these lectures so they know what we will talk about in class as reading the text does take more time. I find these lectures hit the main topics of the content for the week and the explanations are very good. Keep these.

I would often watch the multimedia pieces, first out of curiosity, then in order to get a sense as to how I could approach topics during my meet sessions. I found them to be a helpful suggestion about what I could do during my meet session to help students understand the concepts we were discussing.

Themes from Student Comments	Number of Comments
Supports well self-paced learning.	25
The pace is appropriate.	17
The quality of narration is appropriate.	14
Lectures are easy to navigate.	44
Colors are visually appealing.	10
Color coding supports the information processing.	7
The length of mini lectures is appropriate.	16

References

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