Measuring the Teaching Effectiveness of 3-Dimensional Digital Learning Objects

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Introduction

George Brown College is working with Arius 3D on applied research to assist Arius3D in establishing an evidence-based educational use case for its patented 3-D scanning technology. The project was an educational usability study designed to determine whether the 3D learning objects were educationally useful, and how best to implement their use in teaching and learning.

Problem

Through the use of its patented 3-dimensional scanning technology, Arius 3D has compiled a database of high resolution 3-D digital images of a variety of rare artifacts and objects. Until now, however, Arius 3D had no data to support an educational use case for its 3-D images. This use case demonstration would help Arius 3D in pursuing other business models.

Study Design

The research study was conceived as a five-stage project:

1. Selection of Participants

Open information sessions were held so faculty and staff could find out more about the research study, and about Arius 3D’s scanning technology. Attendees were asked to complete a questionnaire about their use-to-date of education technology. Applications to participate were then invited from those who felt themselves suited to this project.

Sample

156 student participants - 7 faculty participants

Methods

A standard usability survey was used to measure faculty and student satisfaction.

Analysis - Student Survey Results

Post-use surveying of 156 students revealed very positive impressions of the 3-D digital images as learning tools. Below is a partial results report, including agreed/disagree responses to directed questions and open-ended survey comments.

Using 3-D images enhanced my educational experience.

- 92.9% of students strongly agreed or agreed with this statement.
- 83.3% of respondents strongly agreed or agreed. The remaining 16.7% were neutral.

I liked the 3D images I used in my course.

- 92.2% of students strongly agreed or agreed with this statement.
- 83.3% of respondents strongly agreed or agreed. The remaining 16.7% were neutral.

The interactive 3D images helped me in following and understanding content.

- 88.7% of students strongly agreed or agreed.

I believe that 3D images helped my students learn topics more effectively.

- 85.4% of students felt a lot of effort was required to use the technology. 73.3% of students disagreed or had no opinion.

I would like to use 3-D images in my course again.

- 92.7% of students strongly agreed or agreed.

Using the 3-D images requires a lot of effort.

- 26.5% of students felt a lot of effort was required to use the technology. 73.3% of students disagreed or had no opinion.

2. Scanning of Objects and Rendering of 3-D Images

Following selection of participants, an object was collected from each participant and sent to Arius3D for scanning. The participants chose a medium in which to present the 3-dimensional learning object to students: courseware, MS PowerPoint, or MS Word.

3. Use of 3-D Image During In-class Lesson

In either the spring or fall 2008 school term, participants used their 3-dimensional digital learning object as a teaching tool during a live in-class lesson.

4. Data Collection & Analysis

Immediately following use of the 3-D image in class, faculty participants surveyed their students on their impressions of its value as a learning object. Faculty participants were also surveyed individually for their impressions of the teaching effectiveness of this tool.

5. Analysis

Data were analyzed by Sandra Neill and shared with Arius3D. A website was built to publicize the study and its results.

Analysis - Faculty Survey Results

Post-use surveying of participant faculty showed similar positive results: professors found the images to be effective, easy-to-use teaching tools and exemplary instances of high-value education technology. Professors using the animated 3-D image files were especially enthusiastic about the results. Six of seven faculty study participants completed the survey; the following is a sampling of survey results, including agreed/disagree responses to directed questions and open-ended survey comments.

I would recommend the use of 3D images to my colleagues.

- 100% of faculty strongly agreed or agreed with this statement.
- 83.3% of respondents strongly agreed or agreed. The remaining 16.7% were neutral.

Using 3D images enhanced my students’ educational experience.

- 83.3% of respondents strongly agreed or agreed. The remaining 16.7% were neutral.

My students liked the 3D images I used in my course.

- 100% of faculty respondents strongly agreed or agreed.

I liked the 3D images I used in my course.

- 83.3% of respondent strongly agreed or agreed. The remaining 16.7% were neutral.

I found it difficult to use 3D images for educational purposes.

- Most respondents—83.3%—strongly disagreed or disagreed with this statement

The 3D image(s) provided my students useful visualizations for otherwise abstract concepts.

- 83.3% strongly agreed or agreed.

The interactive 3D images helped my students in following and understanding content.

- 100% strongly agreed or agreed.

Results

Three dimensional digital learning objects have significant pedagogical value. There is a strong relation between student and faculty perception of this tool’s educational efficacy. Interestingly, nearly 10% more students (92.9%) than faculty (83.3%) reported that the 3-D digital learning objects enhanced the educational experience. While faculty participants were enthusiastic, students were even more so, perhaps reflecting the increased propensity of students toward the use of learning technology. Faculty unanimously (100%) reported that their students liked the 3-D learning object, whereas only 92.2% of students agreed with this statement, further underscoring a difference that is perhaps a result of experience with technology.

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