

Student Perception of an Online Multimedia Library for Construction Education

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Modern information technology, such as digital multimedia and the Internet has made a great impact on people's lives, especially today's undergraduate student who grew up in the digital world and is more comfortable in image-rich environments than with text. This new generation of students is both information and multimedia literate, and has learning expectations, styles and needs different from past generations. Educators are faced with the challenge of adapting their teaching styles to accommodate this new generation of learners. In an attempt to enhance teaching and learning about construction and to experiment with a new tool to motivate students, faculty members in an ACCE accredited construction management program have developed an online construction multimedia library. This paper presents the utilization of this online multimedia library through lectures, homework assignments and projects in two courses within the curriculum: 1) Construction Materials, Methods and Equipment, and 2) Reinforced Concrete. The paper also summarizes student perceptions of the library as an aid for visualizing and understanding construction processes and building components.

Key Words: Construction Education, Digital Library, Multimedia, Construction Materials and Methods, Reinforced Concrete

Introduction

The nature of construction is visually oriented, and as such traditional teaching methods are at a great disadvantage compared to those that furnish the student with additional sensorial information (Senior and Miura, 1996). Existing research has shown that visual input contributes to learning significantly; therefore, it is paramount to use visual tools when possible to help demonstrate concepts. One of these tools is digital images. In a study by Aydilek on digital image libraries, he found that students believe that the use of digital images provides an active learning environment (Aydilek, 2007). When digital media has been integrated into the coursework of other disciplines such as Art History, students have demonstrated increased productivity and the ability to absorb more information (Pitt, Updike and Guthrie, 2003).

As faculty members in construction education, we are constantly looking for ways to enhance our students learning experience. When planning started for a new building to house the McWhorter School of Building Science at Auburn University, faculty members envisioned the building process itself providing learning opportunities for many years into the future. The 30,000 ft² (2787m²) three story steel, concrete, brick and glass building would house on any given day over 200 students and 20 faculty and staff, while conducting classes, meetings, interviews, and computer and lab projects. Also this building was unique in that it was the first LEED gold facility on campus. The school has long been involved in exploring multimedia to bring the classroom closer to the jobsite (Hein & Liu, 2009). As construction began faculty members were determined to capture as many construction activities as possible using digital images, video, and documents with the intention of making them readily available to the school's faculty and students. Over a period of two years, construction meetings, concrete pours, steel erection, truss bracing, temporary structures, finishes, construction documents and many other construction events were recorded digitally. "The result was a large amount of data, including approximately 3,000 digital images, more than 30 hours of videotape, and more than 100 scanned images of plans, specifications and other relevant documents. The task of storing, organizing, editing, enhancing, and cataloging this large amount of information was challenging, requiring much more time and effort than the media capture itself. An internal grant was awarded to two faculty members in the school for development of a online digital library to host these construction media. The project team

selected a commonly used cataloging software platform named CONTENTdm™ to manage the media nightmare and make the media available to all who wished to learn from the construction project.” (Hein & Liu, 2009).

This online media library of building construction features many functions that support teaching, such as advanced search and sort, side-by-side comparison of media, slideshow viewing of selected images, generation of and sharing a list of selected items, and download and export of selected media files with desired data directly to other software applications. This collection has been introduced to faculty and students in the program through presentations, training sessions and class demonstrations. This collection is also totally free of access to the public, all construction programs and industrial professionals. Although developed mainly for construction education, the authors believe this media library can help anyone visualize a real world construction project in all of its aspects.

Although a proven learning tool, online media libraries have not been completely trouble free during their implementation, faculty utilizing the libraries have had complaints including image quality and the variety of images available. (Paling, Miskiewicz, Abbas and Zambon, 2003) Faculty members have expressed a desire for higher quality images that would allow for easier and more effective manipulation of the images (for example, by increasing their size for projection or viewing small sections of an image close up). These same faculty members also found fault with the number of images available and with the annotations coupled with those images or lack thereof. (Paling, Miskiewicz, Abbas and Zambon, 2003) For the students often times digital media can be complex and obscure, so faculty must be careful in how the media is presented to properly convey its meaning. (Flannery, 2008) Modern media cataloging software like the one in this study has solved many of these user interface problems,

The library, which is still under construction, is beginning to be used as a resource by faculty and students through lectures, homework assignments and projects. This paper summarizes student perceptions from some of the first structured learning exercises that utilize the online media library. Examples are presented from two courses within the curriculum: 1) Construction Materials, Methods and Equipment, and 2) Reinforced Concrete.

Methodology

The objective of this research is to identify students’ perception of how an online construction multimedia library impacts the teaching and learning of specific construction management classes. The methodology consisted of three stages. First, two construction classes, a Construction Materials, Methods and Equipment class and a Reinforced Concrete class were selected as the subjects in which the online library would be introduced and tested for the study. Secondly, a project requiring students to use the online multimedia library to study a specific topic was developed for each class and assigned, followed by a brief demonstration to the classes on how to use the library. In the last stage, a survey was developed and conducted in both classes to collect student perceptions of the impact on their learning experience.

The first implementation of this online library in the construction management curriculum was in a course in reinforced concrete. This course is the third in a series of structures courses and is taught to first semester juniors who have matriculated into the professional program. The objectives of this course include review of materials and methods of constructing with reinforced concrete, and introduction to structural design of reinforced concrete beams, columns, slabs, footings, retaining walls, and prestressed members. Course instructors created a homework assignment that required students to search the library for visual evidence to support their answers to questions about construction of the building’s ground floor slab. A brief demonstration of the library use was given to the class when this homework was assigned. With only a little instruction students were able to use the keyword vocabulary to locate relevant videos and images when seeking the answers to those questions. Following is the assignment in brief, one of the seven questions, and one of the student’s answers to that question (Figure 1).

Assignment: *“In order to better understand the process of building a slab on grade, visit the Auburn University digital library cataloging the building of withheld. Millr Gorrie Center Collection and do the following:”*

Question 2: *“Search through the still images of this library to find an example of a major problem with the slab on grade.*

a. Use no more than three images (2”maximum thumbnail) to tell the story of the problem.

- b. *What do you think was the problem? What is a plausible reason for it? How was the problem corrected by the contractor?"*

Student Answer: *"The frame blew-out. The contractor reacted quickly and pushed the frame back vertical using a backhoe. The machines held the frame work in place while the concrete dried and set. The slab turned out fine, but it was not the best way to pour a slab."*



Figure 1a: The Frame Blew-out during the Pour



Figure 1b: The Backhoe-loader pushed the Frame Back Vertical to Hold Concrete



Figure 1c: The Machines Held the Frame up while the Concrete Set

The next testing of this online library was conducted through a mid-term project in a Construction Materials, Methods and Equipment course. This course is a first semester sophomore level class taught to non-matriculated pre-professional students. This project asked students to demonstrate a construction process through the use of media including: drawings, models, pictures and videos available via the online library. The goal of this assignment was for the students to demonstrate a basic knowledge of construction sequencing and to identify materials and equipment used in construction processes. Examples of appropriate subject matter include: 1) erecting the structural steel; 2) pouring the slab on grade; 3) installing the precast concrete; and 4) installing the roofing structure and membrane. The students were expected to produce a short PowerPoint presentation related to their selected topic. Students were graded on their PowerPoint presentations alone and were expected to be prepared to present them in class. Due to the large number of students (81) in the class and limited class time, only ten students were selected at random to present their projects to the class. Prior to collecting the assignment, the training provided to the students was limited to a brief in class demonstration of the library and a sample mid-term project.

A follow-up questionnaire was given to students in both classes to collect their perceptions of the effectiveness and impacts of the online media library. The questions included in the questionnaire were divided into four categories based on the objectives. They were:

1. Effectiveness of the online media library to enhance student learning
2. Students' experience of the technical aspects and ease of the library
3. Students' overall experience
4. Written comments

Results and Analysis

A total of 25 valid responses of the questionnaire on the use of this online multimedia library were received from the Reinforced Concrete class. A total of 48 valid responses were received from the Construction Materials, Methods

and Equipment course. The response rate of the survey in both classes was 100% since every student who attended the class on the day of survey participated. Some of the key questions and students' responses (and short analysis) to these questions are presented in two sections in this paper: 1) results and analysis of the course specific questions; and 2) results and analysis of the common questions that were used in both questionnaires.

Results and Analysis of the Course Specific Questions

Reinforced Concrete Course

Students in this course have used this online library for a homework assignment on construction of the building's ground floor slab. One question in the questionnaire asked students whether this online media library helped them understand the process of this specific construction activity. On a scale of 1 to 7 (1 = Strongly Agree; 2 = Agree; 3 = Sort of Agree; 4 = Neutral; 5 = Sort of Disagree; 6 = Disagree; 7 = Strongly Disagree), the average of 25 student responses to this question is 2.33, which is between "Agree" and "Sort of Agree", with 84% of the responses positive (see Figure 2 for the distribution of responses to this question). This result indicates that the online media library has positive impacts for students to study and understand this construction topic.

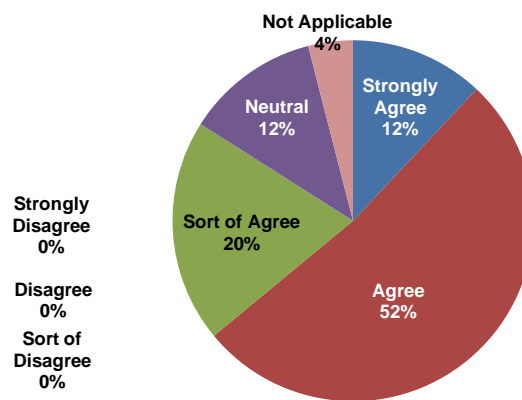


Figure 2: Distribution of students' responses to Question-2 on whether online media library helped them understand the process of building a concrete slab on grade.

Construction Materials, Methods and Equipment Course

Students in this course have been required to choose a construction process and then demonstrate this process through the use of media available via the online library. One of the questioned in the questionnaire significant to this course was if "the media in the library helped students understand the sequence of their project topics". On a scale of 1 to 7, the average of 48 student responses to this question is 2.73, which is between "Agree" and "Sort of Agree", with 75% of the responses positive (see Figure 3 for the distribution of students' responses to this question). This result also indicates that the online media library and its organization have positive impacts for students to visualize and understand construction sequencing.

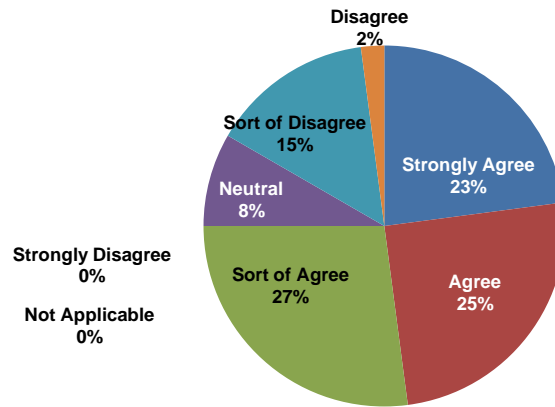


Figure 3: Distribution of students' responses to Question-2 on whether online media library helped them understand the sequence of their project topics.

Results and Analysis of Common Questions on Both Courses

Most of the questions asked by the questionnaire in each class are identical. Based on the objectives, these common questions were divided into three categories: 1) the effectiveness of the online media library for students' learning; 2) students' technical experience of the online library; 3) students' overall experience of the library; and 4) general comments at the end.

Effectiveness for Student Learning

Students' perceptions of the effectiveness of the online media library as a learning tool for construction topics are shown in Figure 4. All the averages of students' responses to the questions in this subject area fall between "Agree" and "Sort Agree", which indicates that this online media library has positive impacts to help student study and understand construction operation sequences, materials, methods, and equipment operations. The results also reflect that most of the students agree that this online library is more informative than conventional construction textbooks.

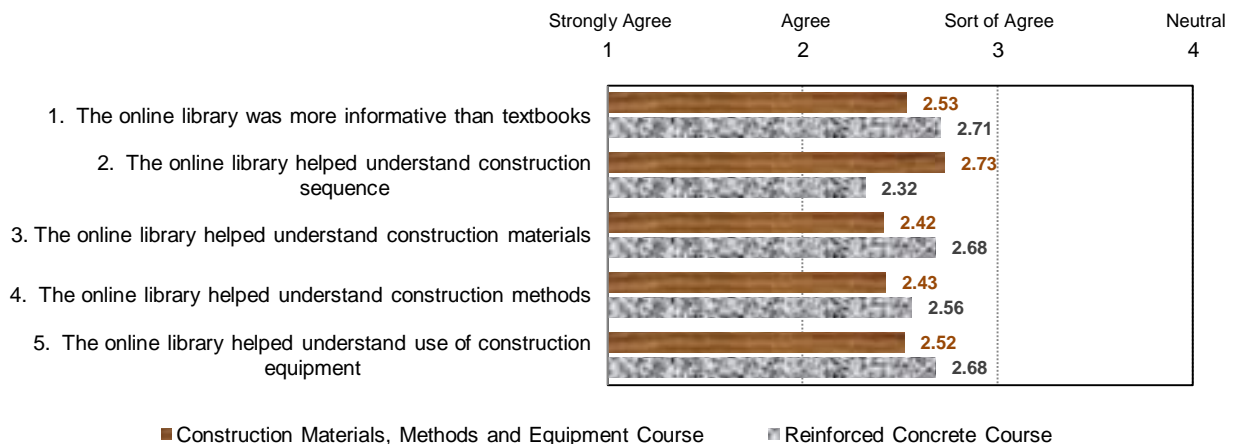


Figure 4: Students' perception of the effectiveness of the online media library as a learning tool for construction students.

Note: Students rated perceived differences in the subject areas with a scale from 1 to 7, with 1 as "Strongly Agree", 4 as "Neutral" and 7 as "Strongly Disagree".

Students' Experience of Technical Aspects

Students' experience on the technical aspects and ease of use of this online library was also positive (see Figure 5). All the averages of students' responses to the questions in this subject area fall between "Strongly Agree" and "Sort of Agree". In average, students in the Construction Materials, Methods and Equipment class had significantly better overall technical experience (2.00) with the online library than the students in the Reinforced Concrete class (2.60). The results also indicate that the photos in the online library are the most appreciated media by students in both classes. The second most appreciated media is construction plans for students in the Construction Materials, Methods and Equipment class while it is videos for students in the other class.

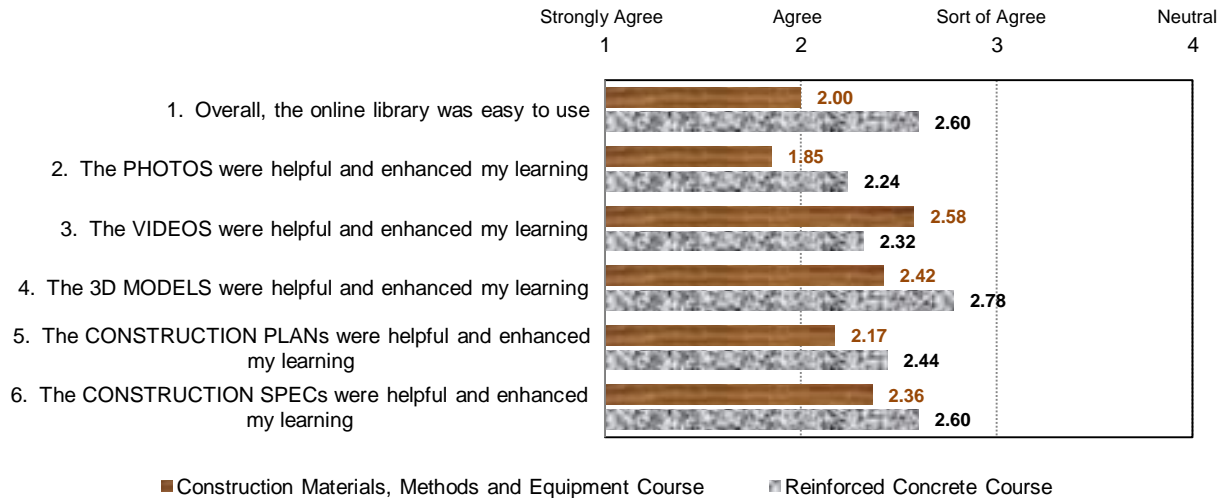


Figure 5: Students' experience of the technical aspects of the online media library.

Note: Students rated perceived differences in the subject areas with a scale from 1 to 7, with 1 as "Strongly Agree", 4 as "Neutral" and 7 as "Strongly Disagree".

Students' Overall Experience

The overall perception students have had with this online library was also positive (see Figure 6). Most of the averages of students' responses to the questions in this category are in the range between "Agree" and "Sort of Agree". Students in both classes agree that this online media library "*is an effective learning tool for construction students*" and "*can be used in other construction classes*", which is implied by students' 2.08 average rating in the Construction Materials, Methods and Equipment class and 2.38 in the Reinforced Concrete class. Students in both classes also have similar level of willingness (2.25 of average rating by the materials class and 2.48 by the concrete class) to see this type of teaching/learning tools to be applied in other classes in the curriculum. However, the data also show that students in the materials class prefer to use this online media library in other construction classes to learn (average = 2.56) and students in the concrete class do not (average = 3.42).

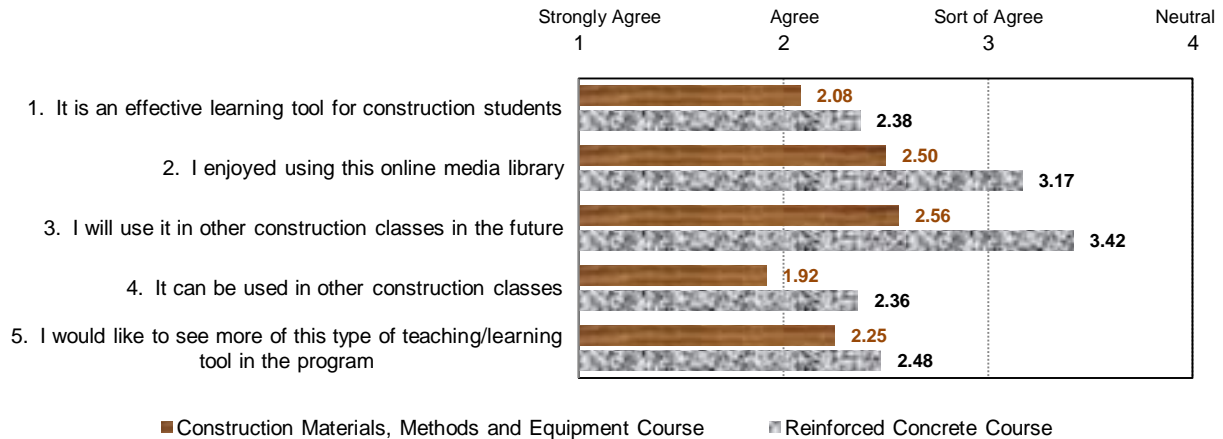


Figure 6: Students' overall experience of the online media library.

Note: Students rated perceived differences in the subject areas with a scale from 1 to 7, with 1 as "Strongly Agree", 4 as "Neutral" and 7 as "Strongly Disagree".

Students' Comments

Three open-end questions were used in both questionnaires to gather students' opinions of this online library.

Question 1: "If you think you benefited from this online media library, please describe how it helped you in learning."

The main advantage provided by this online library as a learning tool is that its media helps students visualize building components and the sequence of construction activities, which was mentioned by most of the students. "Pictures are worth a 1000 words" was quoted by a student. The library's organization of its media, powerful search feature, and allowing students to interact with the building they are learning in were also addressed by many students. Other comments made by multiple students also include:

- "More informative than text books with being able to see actual footage of how the construction activities are done."
- "Seeing the videos was similar to being on site as the process took place."
- "The search results were on point and informative. Finding the information was easy."

Some students learn best by example so the videos helped them out the most and the sequential order was also beneficial.

Question 2: "Do you have any problems or concerns with the use of the online library in this course or in any other educational setting?"

Only few of the students experienced problems with this library while completing their homework assignment. These problems include:

- The search feature sometimes is not as easy to use.
- The server was down one day.
- Some types of the media, such as videos and plans, were difficult to directly transfer into other application programs like Microsoft PowerPoint.
- Not enough photos towards the end of the project.
- Some of the files were mislabeled.

Question 3: "If you were the developer of this online library, how would you make it a better tool for construction education?"

Suggestions on how to improve this library were made by students. Some of them are listed below.

- Add more videos.
- Provide captions in the videos explaining the construction process.
- Provide complete explanation describing what's actually happening on the photos.
- Group the photos more logically.
- Improve the interface.
- Improve the search feature.
- Make it is easier to transfer the media to other applications, such as Microsoft PowerPoint.
- Include other building projects.
- Advertise it better.

Conclusions and Future Development

In an attempt to use information technology to enhance teaching and learning about construction and to experiment with a new tool to motivate students, faculty members of the McWhorter School of Building Science at Auburn University have developed an online construction multimedia library. This online library provides faculty and students the capability to visualize building components and the sequence of construction activities of a building that houses their activities. Students in a Construction Materials, Methods and Equipment course and a Reinforced Concrete course in the program have used it to complete a homework assignment. The results of a study on these students' experience indicate that this online construction multimedia library is highly appraised by construction students as a new learning tool.

Some problems of the online library have also been discovered by the users. The future development of this online library will focus on solving these problems and increasing its educational value, for instance adding more media files of the same building or other construction projects, improving the narratives of the media, improving the organization of the media, and improving the search feature, etc.

Faculty and students who have used this digital media library believe that it has significant positive impacts on construction teaching and learning. Furthermore, they believe that it can be a tremendous teaching aid for construction education in the years to come.

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