Peer and Student Review of an Online Construction Management Sustainability Course

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This paper presents the delivery system for an online construction management course in sustainability and the built environment at a major university. Information about the course layout, assignments, discussions, and assessments are provided in this paper. The course provides a systems approach to green building science that includes sustainable site development, water use efficiency, renewable energy, improving material use, indoor environmental quality, and design innovation. The authors conducted surveys to obtain the students’ perspectives about the course. This study compared students’ perspectives about the online course using a Likert-type survey from two different quarters and a peer review of a sustainability and the built environment course at a four-year university. The paper presents and discusses the results of these student surveys. A quality online learning and teaching peer assessment was also performed. Results provided insight on areas to improve the online course for future users. Preliminary findings suggest the primary area for improvement centered on the ways in which to improve the discussion forums and to enhance the course delivery. This paper aims to provide information and guidance to assist educators in enhancing online education in the area of sustainability and the built environment.

Introduction

The process of what is defined as construction is expanding in the ever-changing global market\(^3,5\). Construction management programs are changing their teaching methods in order to properly prepare graduates for the changing pace of industry. Construction professionals now have to do more than just problem solve. They must be able to be innovative both in design and in execution, utilizing creative thinking alongside mathematical and building science principles. They must also be able to work within multidisciplinary teams of other industry professionals and communicate effectively across those disciplines. The construction industry continues to transform as both economic conditions and a growing interest in sustainability are shifting its focus. There has been a push by many universities to incorporate sustainability in the built environment into their curriculum\(^13\).

Individuals walking around school campuses often see today’s students engaged with technology such as smart phones and laptops for both social and educational purposes. Higher-education students have been classified as “21st-century learners” or “digital natives.” These students multitask and use images to convey content whenever possible, are digitally literate and mobile, and assume computers are part of the life experience. They also crave interactivity, read images well, prefer visual and kinesthetic activities over reading and listening activities, and desire random access. Today’s students want to be challenged to reach their own conclusions, and need practical applications in real-world contexts\(^12\). Traditionally, learning in an institutional setting has taken place in a classroom, but this is starting to change with the increased use of technology\(^2\).

In an effort to enhance the quality of educational experiences for 21st-century learners, educators have started to adopt a blended learning approach. Numerous models of blended learning are
designed to integrate both face-to-face and online learning in order to recapture the traditional values of higher education, while also meeting the demands and needs of the 21st century.

Classes are beginning to transfer from an in-class setting to a more online setting. There are many different types of online learning: Traditional, which is 0% online, Web Facilitated, 1% to 29% online, Blended/Hybrid, 30% to 79% online, and Online, which is more than 80% online.

Educational institutions have adopted learning management software to host the online interface. Classes then have their own specific webpage to facilitate assignments, discussion, assessments, and other interactions with students. Students and teachers can access this webpage anytime and anywhere. All interactions between the students and instructor, as well as between students themselves, occur in these online environments.

Online classes are very convenient for students since the work can be completed on their own time. Online learning is also asynchronous, meaning that it can be conducted without the constraints of time or place, and through a network of people. Essentially, online classes can be completed “anytime, anywhere.” This allows students to access and view the course material on their own time, instead of being constrained to traditional class times. Students are busy, whether it be with other classes, jobs, or extracurricular activities, so having the flexibility to “attend” class anytime helps them stay on top of a full load. Another big advantage to online learning is the fact that students have the ability to work at their own pace.

Since online learning is still considered a relatively new concept that many students have not been exposed to, there are some criticisms of the method. Research has recognized a common error of designing a new technology that attempts to mirror older ones. For example, one main criticism is that there are no face-to-face interactions between the students and instructor. Due to the limited interactions between the students and instructors, educators are worried that students can feel disconnected from the learning environment. Concerns such as these were the impetus for this paper.

On-line delivery system for a sustainability construction management course

California Polytechnic State University, San Luis Obispo recently launched an online Sustainability in the Built Environment course. This course offered a systems approach to green building science, including sustainable site development, water use efficiency, renewable energy, improving material use, indoor environmental quality, and design innovation categories. This was the first time that an online class was offered in the Construction Management Department at California Polytechnic State University, San Luis Obispo. This study was conducted on the students who took the class during Spring and Fall quarters of 2015. Offering this online class in the summer allowed students who normally have off campus internships to continue working toward degree completion. To many busy students trying to graduate on time, this is very appealing. This course was not only a required major class for construction management students, but is also a general education course option, which allows students from various majors to enroll.

The average class size was 38 students. Since also a general education course, there are seats available for non-major students. Online class formats are relatively new for students at
California Polytechnic State University, San Luis Obispo. Their resulting perspectives on online learning will be discussed in this paper.

Research questions

This study attempted to answer the following questions:

How did students rate this online course meet the your expectations for the course learning objectives?
How did students rate the organization of the class and ease to understand?
How did students rate the instructor effectiveness?
How did students rate the technology used for this online course help you learn the material?
How did students rate the technology used for this online course help you to communicate with the facilitator and other participants?
How did students rate the effectiveness of having an online course that you could access on your own schedule provided an effective way to learn the concepts?
Would students recommend this course to other students?
What constructive comments did the peer review reveal?

Course organization

This course used the “Course Chunking Approach” when developing its organizational layout. Course Chunking was utilized by setting a repetitive schedule, meaning that each week the students had to complete the same type of assignments, discussions, and quizzes. Also, as this course was an asynchronous, the material changed each week, but the type of deliverables remained similar. These methods allowed the students to create a routine and accurately keep track of the course. For example, each week the students were required to complete one discussion, one assignment, and one quiz. Since this class did not physically meet during the week, it could be difficult for the students to understand what is due when. To address this, each week a folder labeled “What’s Due This Week” was made available, allowing students to view when assignments were due. The goal was to have an asynchronous course that provided the students with the freedom to complete the assignments, discussions, and quizzes at any time within a given time period. This posed a good chance that a student could forget to turn in an assignment or participate in a discussion. The course chunking organization and having the “What’s Due This Week” folder eliminated most student confusion and late assignments.

Course material

There were many different types of material sources that this course pulled from. Since there were no physical meeting times to make the material less dry, this course needed to possess material that encouraged students to participate and complete assignments. The main source of information was derived from the two required course textbooks, which were sponsored by the U.S. Green Building Council. Additional references such as white papers and articles were selected to expand on the textbook. To accommodate the different learning types, the course material had to vary enough to appease all students, while also being presented correctly. This course offered many different types of course material, including videos for the students to
watch, online-based games to solidify the material, as well as different case studies to explore. In both surveyed classes, a majority of the students agreed that the activities (i.e. mind map and water game) helped them learn and retain the material the most. These online activities are meant to simulate activities that are conducted in a traditional classroom setting.

Assignments

Each week there was an assignment due on Friday by 11:59pm. These assignments were usually related to the assigned readings and videos, and consisted of general questions to be answered in paragraph form. Unlike the discussion assignments, once turned in, students could not see each other’s responses. The assignments were designed to check the students’ comprehension of what they read and watched.

Discussions

Each week there was a discussion in which the students were required to participate. The students are required to post a response to the assigned topic by Tuesday of that week, in addition to two other students’ posts by Thursday. Requiring that the students respond to others’ posts involved reflecting upon the ideas of fellow students. Since a variety of majors are enrolled, this offers a unique, interdisciplinary aspect to the class. Students’ perspectives are influenced by their areas of study, and, as there was no one right answer to the forum questions, it allowed them to synthesize and reflect on different viewpoints.

The class consisted of four different types of discussions:

1. Case Study based discussions: The majority of the discussions that the students participated in were based off of them finding a building that excels in a particular LEED, or Leadership in Energy & Environmental Design category (i.e., Sustainable Sites, Water Efficiency). In each of these discussions students are required to include pictures of the building. For this students were given access to the U.S. Green Building Council (USGBC) website where they can look up LEED certified buildings. On this website they were able to access pictures, a brief narrative of the project, as well as the LEED scorecard for the building. Students were then required to discuss how this building excelled in that particular category. Requiring students to research and complete this discussion allowed them to discover ways in which buildings are made sustainable.

2. Evaluate a current building discussion: For these types of discussions, students are to evaluate current buildings in their community and discuss how the building was inefficient. For each of these discussions, the students are required to include pictures of the building they are discussing. Many times, students chose to write about the houses they currently live in, as the majority of the houses in the area are old and inefficient. Having students look at a building and discuss how it is not efficient and what could be done to improve the building helps solidify the concepts and objectives of this class.

3. Activity-based discussions: These discussions are meant to incorporate and accommodate different types of learning styles. The goal of these activities was to deviate from the
standard writing-based activity. An example of one of these activity-based discussions is the mind map activity. This discussion takes place early in the course and allows students to illustrate connections between different aspects of sustainability. This also allows students to utilize their creativity, as this mind map was either hand drawn or made using a digital design program. Since sustainability and, even the built environment, was new to some students taking the class, it was interesting to see how they created and analyzed connections. Students’ mind maps tended to cater to each one’s field of study, as the class was comprised of a variety of majors. This gave students the opportunity to understand viewpoints other disciplines may have on a particular subject.

4. Game-based discussions: There was only one type of discussion that incorporated some type of game and, as a result, it fosters competition between the students. For this discussion, the students complete an online game based on water efficiency. This game was the Environmental Protection Agency’s Watersense game that was found on the internet. The game was set up like a PacMan game, and, throughout the game, questions come up regarding water efficiency. At the end of the game, the students are scored based on the amount of questions they answered correctly. The students were not required to post a write up, but instead post a screenshot of the score they received. Since all of the students can see the posts, it created a competition to see who can get the higher score.

Self check questions and final exam

Each week the students had the opportunity to check their understanding of the material by completing self check questions. These questions typically consisted of 10 multiple choice questions and did not count as part of their grade. The questions were derived from the reading assigned for that particular week, and, at the end of the course, there was a 50 question multiple-choice cumulative final. These questions were similar to the weekly self check questions and the students had three hours to complete the final once they had started.

Instructor assessment of students

In terms of when assignments, discussions, and quizzes were due, this online class took a different approach. For example, the initial discussion posts were due at 11:59 pm every Tuesday and the students were required to respond to at least two other students’ posts by 11:59 pm every Thursday. The assignments were due every Thursday by 11:59 pm and the self check questions were optional. The grading policy for late assignments was fairly strict. If the assignment was not submitted to PolyLearn in time, a zero was given for that particular item. Some students thought this policy was extreme, but they had a full week to complete these tasks and submit them any time before the deadline. Also, this type of policy was similar to how bids are read in the construction industry. If a bid is late, then typically the bid will not be read.

The following criteria were used to assess the students’ performance:

- Discussions: 40%
- Assignments: 40%
• Final Exam: 20%

Peer review of the online class

A graduate student of architecture with an emphasis on sustainability completed the peer review. The peer reviewer used the Quality Online Learning and Teaching Faculty/Peer Assessment rubric\textsuperscript{10} to make the following recommendations for improvement:
\begin{itemize}
  \item Provide more samples of student work
  \item Create a survey of student feedback for halfway through the quarter
  \item Often too much agreement in discussions: Divide students into Pro / Con for some discussions
  \item Provide a short description of the purpose / value of additional references
  \item Create Weekly Introduction Videos
\end{itemize}

Students’ perspectives of the online class

A survey of the student’s perspectives of the course was conducted in the Spring Quarter and in the Fall Quarter of 2015. The survey was created to obtain student feedback and ensure this online class was effective, as well as to identify potential areas of improvement. The class size was 38 students in Spring Quarter and 29 students answered the survey. The class size was 38 students in Fall Quarter and 29 students answered the survey. The survey was anonymous. The results of the students’ perspectives are in Table 1. A questionnaire was developed by using Olbina’s\textsuperscript{9} questionnaire. It was put through a peer review process that customized it for the purposes of this study. The students answered on a rating scale of 1 to 5, with 5 being the highest. The results are posted as the percent of students that scored each question in the corresponding column. No changes were made to the class between quarters.

Table 1

Results of student perspectives

<table>
<thead>
<tr>
<th>Questions</th>
<th>Scale for Student Responses</th>
<th>Mean Response</th>
<th>Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 How well did this online course meet the your expectations for the course learning objectives?</td>
<td>0.0% 3.4% 0.0% 37.9% 58.6%</td>
<td>4.52</td>
<td>S15</td>
</tr>
<tr>
<td>2 How would you rate the organization of the class and ease to understand?</td>
<td>0.0% 3.4% 3.4% 65.5% 27.6%</td>
<td>4.17</td>
<td>F15</td>
</tr>
<tr>
<td></td>
<td>0.0% 0.0% 3.4% 55.2% 41.4%</td>
<td>4.38</td>
<td>F15</td>
</tr>
<tr>
<td>Question</td>
<td>Spring</td>
<td>Fall</td>
<td>Mean Response</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
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<td>---------------</td>
</tr>
<tr>
<td>How would you rate the instructor effectiveness?</td>
<td>0.0% 13.8% 0.0% 24.1% 62.1% 4.34</td>
<td>0.0% 6.9% 0.0% 79.3% 13.8% 4.00</td>
<td>S15</td>
</tr>
<tr>
<td>How well did the technology used for this online course help you learn the material?</td>
<td>0.0% 3.4% 0.0% 51.7% 44.8% 4.38</td>
<td>0.0% 3.7% 25.9% 48.1% 22.2% 3.89</td>
<td>S15</td>
</tr>
<tr>
<td>How well did the technology used for this online course help you to communicate with the facilitator and other participants?</td>
<td>0.0% 0.0% 0.0% 44.8% 55.2% 4.55</td>
<td>0.0% 3.4% 10.3% 48.3% 27.9% 4.21</td>
<td>S15</td>
</tr>
<tr>
<td>How did having an online course that you could access on your own schedule provided an effective way to learn the concepts?</td>
<td>0.0% 0.0% 0.0% 10.3% 89.7% 4.90</td>
<td>0.0% 0.0% 13.8% 34.5% 51.7% 4.38</td>
<td>S15</td>
</tr>
<tr>
<td>Would you recommend this course to other students?</td>
<td>0.0% 0.0% 0.0% 20.7% 79.3% 4.79</td>
<td>0.0% 0.0% 13.8% 34.5% 51.7% 4.38</td>
<td>S15</td>
</tr>
</tbody>
</table>

Discussion of survey results

The authors performed the following tasks to analyze the survey results:

- Evaluation of the frequency of responses.
- Evaluation of the mean response value.
- Comparison of the frequency of responses for Spring and Fall.
- Comparison of the values of the mean response for both Spring and Fall. (Based on Olbina⁹, p.55)

Ratings with “values of 4 and 5 were considered positive, 3 neutral, and 1 and 2 negative⁹.” The following results were derived from the student evaluations using the methodology stated above:

1. 97% of the students in Spring and 93% of the students in Fall felt that this course met their expectations as outlined in the Course Learning Objectives. The mean response was 4.52 and 4.17 in the Spring and Fall quarters, respectively. Although there was a lower
frequency of positive responses in Spring, the mean response is still very high. The high level of response showed that the students’ expectations were well met.

2. 97% of the students in Spring and 97% of the students in Fall felt that the course was well organized and easy to understand. The mean response was 4.66 and 4.38 in the Spring and Fall quarters, respectively. Although there was a lower frequency of positive responses in Spring, the mean response is still very high. 3% of the students in Fall were neutral; the Spring survey did not have a neutral option. The high level of response showed the students overall agree that the format of the class is good. The mean decreased by 0.28 in Fall compared to Spring. The decrease in the mean is something to be addressed, and there may need to be adjustments on how some of the information is organized and presented.

3. 86% of the students in Spring and 93% of the students in Fall agreed that the instructor was effective. The mean response for Spring was 4.34 and the mean response for Fall was 4.00. The mean did decrease by 0.34 from Spring to Fall. Since this is an online class and there is no in class meeting time, there might need to be more instruction or examples given to demonstrate what is expected. The instructor must therefore present the material well to be an effective teacher, which the instructor did as is shown by the survey results.

4. 96% of the students in Spring and 70% of the students Fall felt that the technology used for the online course helped them learn the material. The mean response for Fall was 4.38 and the mean response for Spring was 3.89. There were 26% of the students in Fall that were neutral regarding this question. The large amount of neutral responses shows that the online technology neither helped nor hindered a quarter of the students in learning the course material.

5. 100% of the students in Spring and 86% of the students in Fall thought the technology used helped them communicate with the facilitator and other participants. There was a decrease of 0.34 in the mean between the two quarters. The discussion forums are a very unique and important part of this class, as they allow students to share and discuss their thoughts on a particular topic. Also, it facilitates different viewpoints on topics since there are non-majors in the class.

6. 100% of the students in Spring and 86% of the students in Fall felt that having an online course they could access on their own schedules provided an effective way to learn the concepts. The mean response was 4.90 and 4.38 for Spring and Fall, respectively. There was a decrease in the mean of 0.52 between the two quarters. Students could learn the concepts on their own time, thus creating an environment conducive to their specific learning methods.

7. 100% of the students in Spring and 86% of the students in Fall would recommend this course to other students. The students who would not actively recommend the course were neutral about the question. The mean response was 4.79 and 4.38 for Spring and Fall, respectively. Students would overall recommend this course to other students.
Conclusion

This online sustainability and the built environment course was still relatively new for the Construction Management faculty and students at California Polytechnic State University, San Luis Obispo. There have been some modifications made to the class based off student and peer input. Every quarter there has been a student survey sent out. The survey and peer review has allowed the instructor to gather feedback both positive and constructive regarding this course.

There were a few questions that particularly highlighted the strongpoints of this class. They were the question regarding the course organization, ability for students to access the course on their own schedule, and the course met the students expectations for achieving the learning objectives. Because the topic of sustainability is a complex one with many aspects, having almost all the students between two quarters agree the course met the learning objectives is an accomplishment.

The question about how well the technology used for this online course helped students learn the material stood out as an area for improvement. This question correlated with the peer reviewers recommendation to use videos to introduce each week. The peer reviewers also recommended sending out a survey during the middle of the quarter to get feedback from the students. The results of the survey could allow the instructor to modify the course to enhance the technology and student learning. Both the introduction videos and student survey could increase the scores related to the instructor’s effectiveness.

As with many university classes, consistent improvements must be made. Much additional work is required to continue the development of undergraduate online education in sustainability and the built environment at California Polytechnic State University, San Luis Obispo. Continued input from the students and peer reviews is necessary to enhance online delivery of material. Additional surveys and peer reviews may be performed in order to analyze the results of future improvement to the course. A potential area of further research would be to have peers assess the course based on the Quality Online Learning and Teaching Faculty/Peer Assessment rubric10.

References


