

Learning of Environmental Engineering - On-line, Hybrid, or Face-to-Face: A Case Study

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Abstract

The course, 'Introduction to Environmental Engineering', was taught as a hybrid for several semesters. In this course set up, all of the quizzes and homeworks were on-line and only the midterms and final were in-class. At the very end of the semester, an on-line anonymous survey was conducted with six questions to compare the students' learning environment in the environmental engineering course, with 50% in-class lecture and in-class midterms and final, with the traditional complete lecture-centric course. This setup was found to be suitable for studying the process undergone by the students, mainly because they didn't need to come to the class two or three times a week, they can study the materials by themselves at their own pace, take the quizzes on-line, and submit the homeworks on-line. Students' perceptions and attitudes about hybrid approach appeared to be favorable and acceptable as a learning environment for future environmental engineering courses.

Keywords

Environmental engineering, Hybrid learning, Students' perception

Introduction

Web-based teaching and learning such as on-line or hybrid is becoming popular and time-demanding. The relatively recent advent of Learning Management Systems (LMS), such as blackboard, eCollege, Moodle, and Web CT, in the undergraduate setting in educational institutions has made it easy to provide on-line user education, that is, web-based augmentation to traditional (face-to-face) classroom instruction¹. This hybrid or mixed delivery approach lets instructors combine the advantages of online class learning with the benefits of face-to-face interaction with relatively limited technological sophistication on their part². Preliminary reports suggest that the hybrid approach holds significant benefits for students and instructors, regardless of their level of technological expertise^{3,4} and regardless of whether the classroom is hard-wired for live Internet access⁵. Despite frequent use of an LMS for course administration purposes, the faculty do not appear to be harnessing the full pedagogical potential of web-based augmentation via LMSs such as blackboard. The possible potential of LMS tools to increase course administration efficiency and enhance learning in traditional settings is an important educational

issue that must be fully explored from both faculty and student perspectives⁶. However, combining multiple modalities of on-line content with a *pot pourri* of in-class learning exercises that appeal to a number of learning styles may precipitate higher overall learning outcomes⁷.

Although teaching hybrid or online courses may increase time demands and, in some cases, result in a loss of control, many faculty enjoy this approach because it allows for significant flexibility and benefits in instruction. A hybrid approach may improve the efficiency of classroom management, especially for large classes⁸, increase the degree of student-led learning⁹, improve student morale and overall satisfaction of the learning experience¹⁰, enhance information skills acquisition and student achievement¹¹, and may even reduce student withdrawals and absenteeism¹². In light of such positive effects, not to mention the cost efficiency of a hybrid approach—an attractive feature for institutions faced with shrinking budgets and classroom space—Brown¹³ posits that, in the future, institutions will design most courses by the 90–10 Rule Q (p. 22). In other words, a mix of face-to-face and online instruction (somewhere between 90% and 10% and 10% and 90%) will be superior to either 100% face-to-face or 100% online courses⁶. The findings of a study show that online learning can be as effective as face-to-face learning in many respects in spite of the fact that students in online programs may be less satisfied with their experience than students in more traditional learning environments¹⁴. In a study, participants who had more experience with the Internet indicated significantly higher perceptions toward the Web-based distance learning activities/assignments portion of the hybrid program¹⁵. This study focuses on the hybrid offerings of introductory environmental engineering course to understand the perceptions and attitudes of students as a learning environment for future environmental engineering courses.

On-line Survey

At the very end of the semester, an on-line anonymous survey was conducted with six questions to compare the students' learning environment in the environmental engineering course, with 50% in-class lecture (hybrid) and in-class midterms and final exams, with the traditional complete lecture-centric and fully on-line course. The questions are presented in Figure 1. The data were collected for four semesters, Fall 2013, Fall 2014, Summer 2014, and Fall 2015. There are a total of 170 students enrolled in the course during these four semesters and 131 students participated in the survey. Thirty nine (39) students did not take the survey due to the fact that the survey was not mandatory and no incentive/point was given to take the survey. The analysis of survey data are illustrated in Figures 2 through 6. Please note that some of the responses to questions, as seen in the Figures, might not sum up to 100% as a few students did not respond to all questions.

Q.1. Did you take any hybrid or on-line class before? Yes No

Q.2. Are you male/female?

<p><input type="radio"/> Male <input type="radio"/> Female</p> <p>Q.3. What is your class status?</p> <p><input type="radio"/> Senior <input type="radio"/> Junior <input type="radio"/> Sophomore</p> <p>Q.4. Do you like the hybrid class with on-line quizzes and homeworks and in-class tests (5 being the highest)?</p> <p><input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5</p> <p>Q.5 Do you like this course to be offered as</p> <ul style="list-style-type: none"> <input type="radio"/> Face-to-face that is meeting 3 hours a week in-class with all the quizzes, homeworks, and tests are in-class? <input type="radio"/> Hybrid that is meeting 1.5 hours once a week with all the quizzes and homeworks are on-line and all the tests are in-class (the way you are taking it now)? <input type="radio"/> Completely on-line that is no meeting in-class with all the quizzes, homeworks, and tests are on-line? <p>Q.6 Please provide any comments/suggestions/concerns about hybrid/on-line/face-to-face course offerings that you may have.</p>

Figure 1: Survey questionnaire for hybrid offerings of Environmental Engineering

Data Analysis, Result, and Discussion

About 77% of the students that were enrolled in the course participated in the survey. Based on the responses to Q.1, overall about 47% took either a hybrid or on-line course before, 47% did not take any kind of on-line or hybrid course, and 6% did not respond before they took the environmental engineering (Figure 2). The participants were well distributed with and without any exposure of on-line or hybrid learning. Overall it was almost the same for both the group with and without prior exposure to the on-line and hybrid courses although some semesters are showing a little difference. This could be due to the fact that everyone now-a-days are familiar with internet either through computer or smart phone. This observation is supported in a study by Koohangand Durante¹⁵. However, the study did not separate the effect of prior exposure to hybrid or on-line courses in the hybrid learning because the survey was anonymous and on-line using learning management system (LMS) where the responses from different group cannot be separated without additional questions.

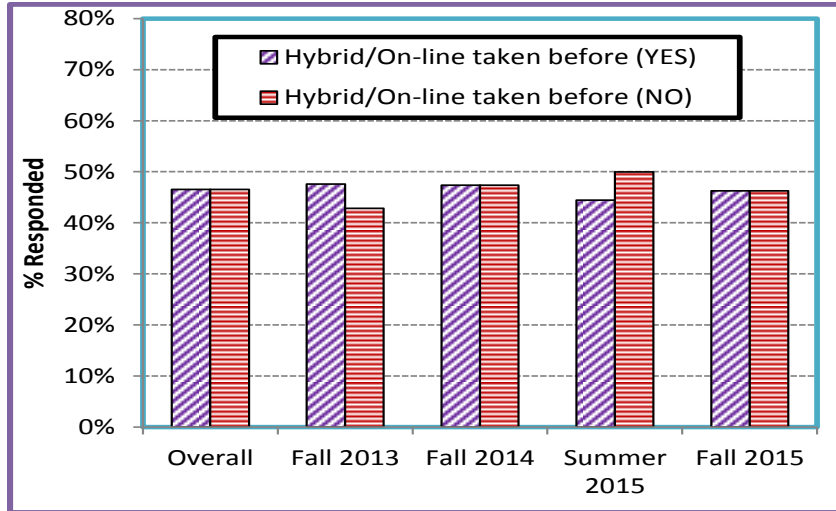


Figure 2: Distributions of response for prior exposure to on-line or hybrid course

As shown in Figure 3, overall about 81% of the students participating in the survey were male, 15% were female, and 4% did not respond. This is the typical distribution of gender in the classes that the university has now-a-days. Overall and semester by semester distributions are showing very similar patterns. Please note that the study did not look into the effect of gender in the hybrid learning due to the same reason mentioned earlier.

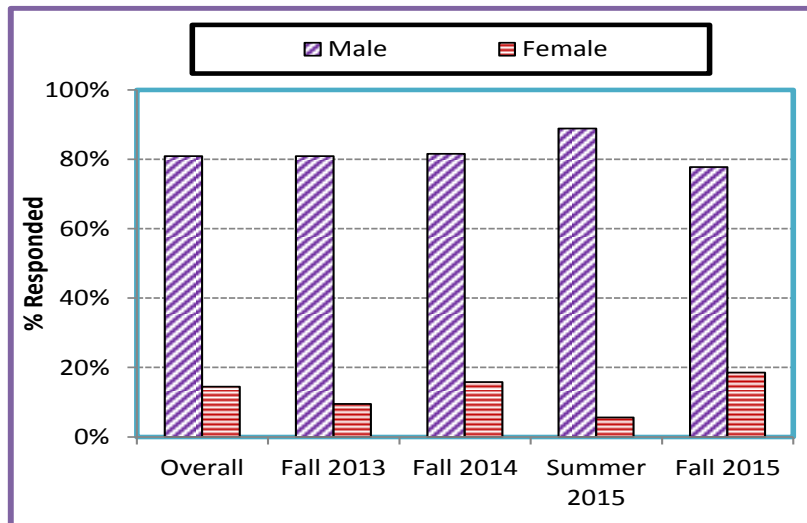


Figure 3: Distributions of male and female participated in the survey

Overall 51% were senior and 46% were junior with no sophomore taking this as they cannot not meet the prerequisite requirements at sophomore level (Figure 4). Since the fluid mechanics is the prerequisite for this course, most of the students earn enough credit to be designated either as junior or senior when it is time to take the first environmental engineering course in the civil engineering program. Similar to gender and prior exposure to on-line or hybrid courses, the study did not look into the effect of class status in the hybrid learning due to the same reason.

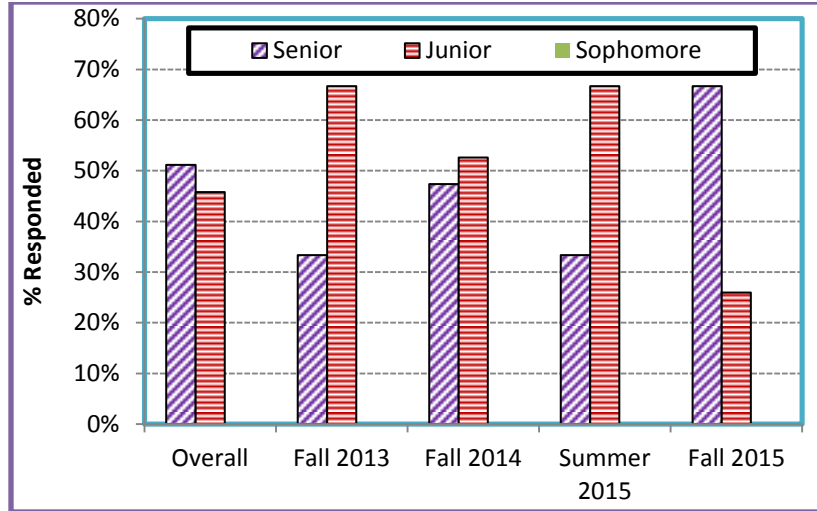


Figure 4: Distributions of class status for the survey participants

Based on the responses to Q.4 as to how the participants liked to take the course as hybrid , 58% of the participants chose “5”, 28% chose “4”, 8% chose “3”, 4% chose “2” and less than 2% chose “1”. The distribution of Q.4 responses is presented in Figure 5. Based on the choice distributions, it is obvious that maximum students would like to take the course as hybrid.

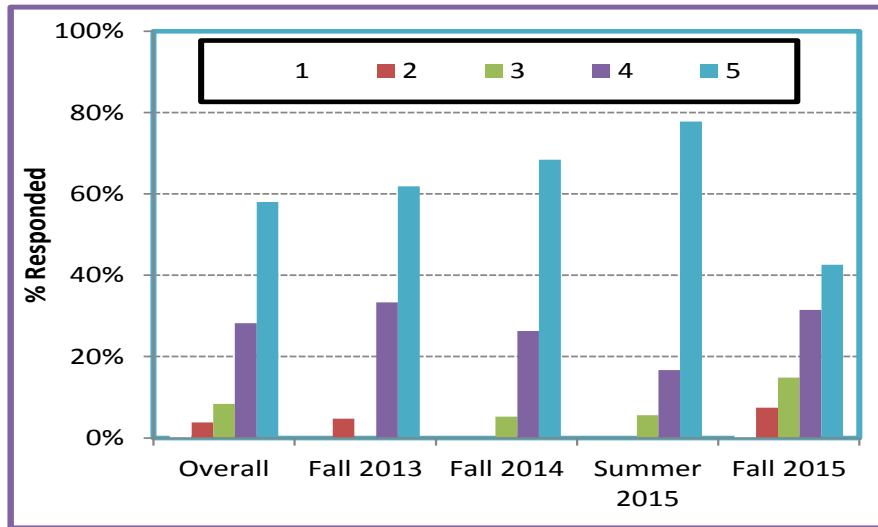


Figure 5: Distributions of choices of the participants who took the course as hybrid

Based on the responses to Q.5 as to the distribution of participants’ choices to take the course as face-to-face, hybrid, or fully on-line, 76% of the participants chose “hybrid”, 14% chose “face-to-face”, and only 11% chose “fully on-line”. The distribution of Q.5 responses is presented in Figure 6. Based on the choice distributions, it is obvious that hybrid option for environmental engineering course is more appealing compared to fully on-line or face-to-face option.

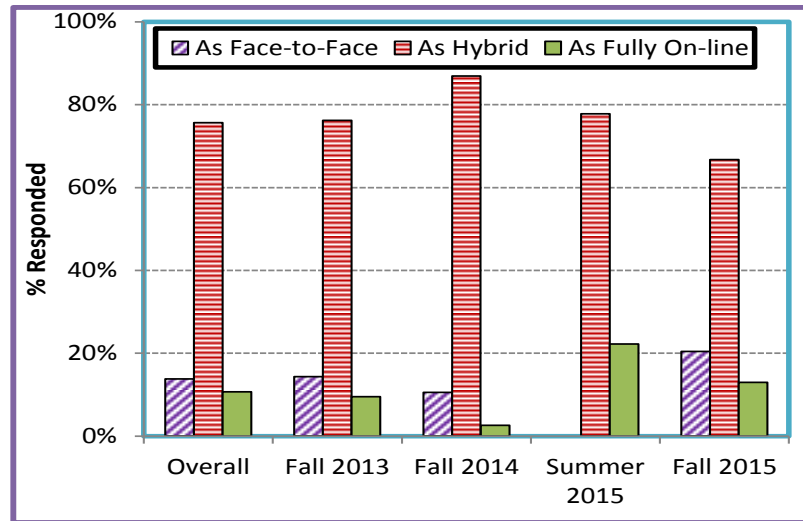


Figure 6: Distributions of choices of the participants who took the course as a hybrid

The typical comments received for Q.6 are quoted below. Most of the participants responded to these questions. However, only a few pertinent comments and one of the similar responses are quoted below for each question.

“Please don't go full online for this course. (for the sake of future students). Making this class hybrid was an incredible idea, it would get tedious learning everything in the class. I appreciate meeting to discuss examples and important concepts, then being able to look at it on my own later. Making it full online would be extremely overwhelming. There's a lot of material for this class, and without the direct guidance I feel that I would be lost in a sea of slides.”

“Face to face offers more teacher/student interaction as well as student/student interaction. It commits you to showing up, facing the professor, and being prepared for class. The hybrid classes have both advantages and disadvantages. Hybrid offers the student a little more versatility schedule wise and time management wise. It is more interactive with technology which can be helpful or hurtful at times. Purely on-line classes offer little to no student/teacher interaction, grades based purely on right or wrong answers with no partial work looked at, hold student less accountable therefore allowing the student to slack more and typically not put as much work or effort into the course and learning less. I do not prefer classes based solely online and would not recommend them, there only benefit is less time constraints.”

“Hybrid classes require a lot of outside study time.”

“Hybrid/on-line classes can work for introduction level classes such as economics or political science, but I don't think they work as well for more difficult classes.”

“Hybrid courses are good, because when we meet the professor, we are able to ask questions we don’t understand. I like the way the professor explain the entire subject when we meet, really helpful, I like it.”

Summary and Conclusions

On-line or hybrid offering of courses is a time-demanding approach to web-based teaching and learning that is designed to engage students in investigations of authentic concepts/problems without coming to the pre-set class rooms two or three times a week. In this paper, an effort was made to assess the perceptions and attitudes of students, which influence the learning environment, through the hybrid approach in environmental engineering. The course, ‘Intro to Environmental Engineering’, was developed and approved as a fully on-line and taught as a hybrid for several semesters. In this course, all of the quizzes and homeworks were on-line and only the midterms and final were in-class. At the very end of the semester, an on-line anonymous survey was conducted with six questions to compare the students’ learning environment in the environmental engineering course, with 50% in-class lecture and in-class midterms and final, with the traditional complete in-class lecture-centric course. Students’ perceptions and attitudes of hybrid approach appeared to be favorable and acceptable as a learning environment for future environmental engineering courses. Based on the data analysis and specific students’ comments, the lesson learned is that addition of hybrid approach to the existing in-class lecture-centric environmental engineering course would be welcomed by students.

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Dr. Karim spent about six years as a full-time faculty at Bangladesh University of Engineering and Technology (BUET) after his graduation from the same university in 1989. He came to USA in 1995 and finished his Ph.D. in Civil/Environmental Engineering from Cleveland State University in 2000. He worked about three years for ALLTEL Information Services in Twinsburg, Ohio as an Applications Programmer. Then he worked about eight years (in two different times) for the Virginia Department of Environmental Quality (VDEQ) as a Senior Environmental Engineer and taught at Virginia Commonwealth University (VCU) as an Affiliate Professor before he went to Trine University in January 2008, as a full-time Assistant Professor of Civil & Environmental Engineering. He taught part-time at Indiana University-Purdue University Fort Wayne (IPFW) while employed at Trine University. During his time at Trine University he taught an online course for VCU. He also taught at Stratford University, Richmond, Virginia campus as an adjunct faculty while working for VDEQ. Since fall of 2011, Dr. Karim has been working for Kennesaw State University, Marietta Campus, Georgia as a full-time faculty in Civil and Construction Engineering. He is a registered professional engineer for the State of the Commonwealth of Virginia and the state of Georgia. He has more than fifteen journal and proceeding

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