Work in Progress: Creating an Active Learning Classroom with an Engaging Online Platform

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Introduction:
This work-in-progress focuses on a first year engineering computing course, required for all engineering students at the University of Houston, which became common for all engineering disciplines in Fall 2016. In this course, students learn how to problem solve using MATLAB, a coding language free to students. The course is traditionally taught face-to-face in a lecture hall with a mix of instructor-led problem solving examples and tutorials and students working individually, in pairs, or in groups on in-class work. In order to provide the illusion of small class sizes for our students, academic support assistants (also called undergraduate teaching assistants, UTAs) are utilized to assist students both in and out of class. These UTAs assist students with hands-on activities and course projects, as well as provide help during office hours on assignments outside of class. Interaction between the instructor, UTAs, and students is critical in engaging students during the process of problem solving with this new programming language.

Our university has many non-traditional students that commute and have professional and personal commitments off-campus that make scheduling courses difficult. In order to provide an alternate class option, an online version of this course was created. The significance of this work is developing online strategies so these students do not miss out on an engaging environment of a face-to-face class while still having the opportunity to succeed amidst the challenges they face outside of the classroom. In addition, for courses that are centered on active learning approaches, online platforms are not typically considered an alternative due to the traditionally passive approach to learning. This barrier needs to be elucidated so that students who benefit from flexibility of an online course can still have opportunity to thrive in an engaging environment. Therefore, the research question for this study is, how do engagement and achievement levels of first-year engineering students enrolled in this first year course differ between online and face-to-face offerings?

This work will describe how an active learning environment utilizing an online platform in our first year engineering course was created. The aim of this work is to develop an online delivery method that equally engages students in an online platform without negatively impacting grades. The research objective is to develop on online delivery that has the same student engagement and achievement as face-to-face delivery.

Anticipated Outcomes:
There is significant evidence in the engagement literature linking increased student engagement with increased academic achievement, and hence retention [1]. Often benefits are even greater for low socioeconomic (SES) students who often lack the social capital of their more privileged peers [2]. It is important to engage students in all courses, regardless of the delivery method used. However, engaging students in online platforms is especially challenging for many reasons. Asynchronous delivery systems deny students opportunity to receive immediate feedback, and make development of meaningful relationships with faculty difficult. Asynchronous delivery also makes hands-on learning challenging. Students are more likely to persist on challenging material with immediate assistance and feedback than those working on their own [3]. Therefore, this work

seeks to address the limitations on engagement in an online setting by offering convenience of an online course incorporating face-to-face engagement best practices.

There is also ample research on the benefits of small class sizes [4]. As limited instructional resources typically prevent departments from reducing class sizes to ideal numbers, the creation of small in-class groups led by peer mentors is often used as a means to simulate smaller classes [5]. This intervention proposes using undergraduate peers as UTAs to assist students both in and out of class. These UTAs will assist students with hands-on activities and course projects, as well as provide homework help outside of class. Both UTAs and instructors will hold virtual office hours, providing yet another level of social engagement for the online students.

The target population for this study is first-year engineering students enrolled in the computing course in the spring of 2018. Approximately 40 students were recruited into the online course (intervention group). By offering a synchronous course as opposed to an asynchronous course, the instructors will be able to have live interactions with students and will be able to monitor student engagement levels through quick online quizzes and polls, in-class activities and discussions, and student demonstrations. Use of webcams will also allow instructors to monitor student body language as one would in a face-to-face classroom.

Course Implementation:
A single section was offered as a synchronous online class in Spring 2018. Students were recruited to take the course using a google survey, then provided the course information to register after being deemed eligible (first attempt at the course) for the pilot section. While over 20 students were deemed eligible to enroll in the course, only 8 students ended up registering for the pilot section. The total enrollment of the Spring 2018 pilot was 8 students with a section capacity of 40 students.

The most unique part of this intervention was the use of a co-instructor during live lectures. The second instructor acted as a moderator for the lectures in a webinar style delivery. The secondary instructor was been able to monitor student engagement and interact with individual students without interrupting the main lecturer. This instructor also gathered questions to present to the lecturer and monitored comments to gauge the level of understanding in the class. It was the role of this second instructor to monitor both the academic engagement (attentiveness, attendance, assignment completion) and cognitive engagement (asking questions, task persistence, thought processes) in real time. This course also utilized a ratio of 1 UTA to 4 student to help support students during class and through online office hours.

Based on an extensive review of online platforms, Zoom© was selected as the platform to deliver the online course because of its ability to screen share and interact with other screens, grouping, nonverbal interaction ability, and stability. A recurring meeting was set up with a link through the course blackboard site which students accessed during the course time. An emphasis of delivering this course was to provide an environment that fostered interaction between students, UTAs, and instructors. Peer-lead breakout groups were extensively used along with verbal interaction using microphone, the chat feature, and nonverbal cues (within the participant window) that allowed students to address issues with their understanding of the content in a variety of ways.

Method for Evaluation and Preliminary Results:
A survey using both quantitative and qualitative measures was given midway through the semester and an expanded survey was given again at the end of the semester to all students enrolled in both the face-to-face and online sections of the computing course.

Following the conclusion of the semester, survey data will be analyzed using pairwise comparisons of the group of students from the two different course offerings. Due to the limitations in sample size, the statistical analysis will be extremely limited. Therefore, qualitative methods and interviews may be used to inform a larger pilot in future semesters.

Due to a small sample size of the online section, results to the mid-semester survey are summarized below to show specific responses to the quantitative questions. Qualitative questions focused on why students selected the online section, should it be offered again and why, and feedback and suggestions for platform features, functionality, and future implementation. We specifically asked students enrolled in the online section to rate the platform and course features including feedback and instructional delivery mechanisms of the course. The questions were rated on a scale of 1 = not helpful at all to 6 = very helpful. The results indicate that most of the students were pleased with many of the features of the platform and the different ways both the instructors and UTAs engaged with them during the course. Based on these results and free responses, helpful course features included the ability to see what the instructor was coding up close, online office hours, screen sharing, and breakout rooms. Verbal cues and lecture recording were aspects that need improvement.

Additional sample questions that relate to student engagement (student perception) were given and are shown below. Analysis of these responses will be addressed as the work continues.

- Using a likert scale, does your instructor care about your success in this course?
- Using a likert scale, does your Undergraduate Teaching Assistant (UTA) care about your success in this course?
- Using a likert scale, how helpful were the lectures in learning the material?
- What is one word you would use to describe the course?
- What is one word you would use to describe your instructor?
- What is one word you would use to describe your UTA?

Conclusions:
Overall, the pilot section of the first year engineering computing course has proven that material can be delivered at the same rate and with the same efficiency as the normal, face-to-face course. Students seem to be as engaged, if not more engaged, which could be due to the extremely small class size. We expect that course achievement will be similar to normal sections by the end of the semester, based on assessments so far in the course.

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