

PDF - "FLIPPING" THE CLASSROOM TO EXPLORE ACTIVE LEARNING IN A LARGE UNDERGRADUATE COURSE - researchcub.info

In traditional approaches to teaching engineering classes, the instructor plays the role of information conveyor, while the students assume a receiver role with primary responsibilities of listening and note-taking. Research into how students learn suggests that students need to be more actively engaged with the course material to maximize their understanding. The literature contains many examples of active learning strategies, such as teams solving problems in class and the use of student response systems with conceptual questions. Incorporating active learning strategies into a class means that there will be less time for delivering material via lecture. Therefore, instructors who choose to utilize active learning strategies must find ways to ensure that all required course content is still addressed. This paper discusses an instructional technique called the "classroom flip" model which was assessed in a larger, undergraduate architectural engineering class. In this model, lecture content is removed from the classroom to allow time for active learning, and the content that was removed is delivered to students via on-line video. This approach 'flips' the traditional use of lecture and more active learning approaches. Lecture occurs outside of class, and more active learning, such as problem solving, happens during class. Assessment data was collected to examine students' use of the video lectures and perceptions of the classroom flip. The students' feedback suggests that while the active learning and additional project time available in class improved their understanding, they would prefer that only about half the classes be flipped and some use of traditional lectures should be maintained.

Introduction Engineering instructors are often encouraged to try instructional techniques that encourage their students to be more actively engaged with course material. Active learning is defined by the engineering education community as the "involvement of students in their own learning."

1 Active learning encompasses a variety of instructional techniques, in which students participate in activities during class time that involve more than passive listening. Active learning techniques include in-class group work, think-pair-share, "clicker" questions using student response systems, and minute papers. Active learning is necessary in order to increase understanding and for enhancing problem solving skills. The National Research Council has stated that "...the new science of learning is beginning to provide knowledge to improve significantly people's abilities to become active learners who seek to understand complex subject matter and are better prepared to transfer what they have learned to new problems and settings" (p. 13)

2 However, many instructors still utilize class time for lecture and are concerned that active learning consumes valuable time that is needed to cover material. The lecture method is often used as the primary method to make sure Page 14385.2 that material is covered. However, the lecture method may not be the most effective way to ensure student understanding. As Felder (2003) states, "You have roughly 40 contact hours in a typical course. If all you do in them is lecture, you might as well just hand out your notes and let the students find something more productive to do with all that time."

3 Research has supported that active learning strategies result in higher student engagement and greater learning gains as compared to traditional instructor-centered methods such as

lecture. 4 Even with the mounting evidence on the effectiveness of active learning strategies, instructors still struggle with this balance of engaging students and covering important material, especially in larger classrooms. One method that allows instructors to include active learning elements without sacrificing course content is called the “classroom flip” or the “inverted classroom.” 5 The classroom flip utilizes the internet to place substantial amounts of class material online, often in video format as a “virtual lecture.” Students are then asked to use out-of-class time to watch the lectures. Recent technology has made inverting the classroom easier for faculty and more accessible by students. 6 Software programs such as Camtasia Studio, Adobe Captivate, Camstudio, and UltraVNC Screen Recorder, to name a few, allow instructors to record spoken voice and/or video while also capturing on-screen materials such as software demonstrations, worked problems, or PowerPoint slides. In addition, the use of classroom management systems, such as Web CT, Blackboard, and ANGEL, makes the uploading of the class materials easy and secure. By requiring students to access the “virtual lectures,” the instructor can spend valuable class-time leading students in engaging activities without sacrificing time that is needed to cover course content. In the classroom flip method, the role of the instructor shifts. No longer is the instructor the “sage on the stage” in which the primary role is to transmit information during class time. Rather, the student must take initiative during his or her own time to prepare for class. Class-time can then be devoted to other types of activities. 7 Particularly in the engineering domain, students need sufficient time to be able to practice problem-solving. Flipping the class provides additional time for the students to work out problems, while having the instructor there as a guide if needed. In order to ensure that students do indeed access the online lectures, instructors need to implement a sort of “gate-check” such as a pre-class quiz that tests students’ understanding of the material. These online quizzes serve multiple purposes. First, having online quizzing increases the likelihood that students will use out-of-class time to watch the videos in order to learn the material necessary to be successful in the quizzes. This helps to assure that students will be prepared for the in-class activities. Second, the instructor can use the results of the quizzes as a launching point for discussion and adjust the class plan as necessary to address any student misconceptions or lack of understanding, in a form of just-in-time teaching. 8 The classroom flip method may be perceived to be particularly beneficial to students who prefer certain types of learning environments. According to the Felder-Solomon Learning Styles Index, students may classify themselves along four dimensions as being a certain type of learner: active/reflective, sensing/intuitive, visual/verbal, and sequential/global. 9,10 The classroom flip allows for a more active engagement, which may be a more conducive learning environment for those students who consider themselves to be active learners. The use of more active methods in Page 14385.3 the classroom may also potentially expand the skills of other students who have other types of learning styles. This paper discusses the use of the classroom flip strategy in an architectural engineering course at Penn State University. Assessment data were collected to explore student perceptions of the classroom flip and to examine how students used the video lectures. Context of Study In the spring of 2008, the

classroom flip was used in a large undergraduate Architectural Engineering course entitled "Introduction to the Building Industry." The objective of the course is for students to be able to learn and apply methods for organizing and managing construction projects. The course combines business concepts, such as contracting methods and project organization, with problem solving topics like cost estimating and critical path method scheduling. The course enrolls approximately 100 students each semester that it is offered. It consists of two 50-minute lecture periods and one 110 minute practicum weekly. In 2007, the instructor of the course started using iTunesU to post video-records of lecture material so that students would be able to review lectures and supplemental content. Students were open to the use of the recorded lectures, as supported by preliminary assessment data shown in Figure 1. The instructor of the course wanted to take the next step and flip the course for a variety of reasons. First, the availability of online lectures would allow students to be exposed to theory-based content outside of class time. Taking the lecture out of class would allow greater time for in-class problem solving and increase the opportunity for increased teacher-student interaction. In addition, the use of the practicum period, which had previously been used to deliver course content, could be used for students to work on group projects, with the instructor available for assistance and guidance. Figure 1: Feedback regarding the interest in the use of iTunesU for posting lecture content. The classroom flip method was used for cost estimating, one of three main topics in the course. Having the iTunesU video content from the 2007 offering of the course enabled the instructor to take the previous year's lecture content, edit the video to provide specific course content, and Page 14385.4 post the videos for students to watch before attending class. To help ensure that the students watched the posted videos, online quizzes were utilized. The method was piloted with one lecture topic well in advance of the cost estimating topics to ensure students could access the video and to test the process of editing, posting, and providing access to the video. The first video was 50 minutes in duration; the other videos for the estimating topics were shortened to 25 to 30 minutes each based on feedback from students. The online quizzes and videos were made available to the students, who were then expected to watch the video and read any related materials from the text in preparation for taking the quiz and attending the class.

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