An Online Instructor Training Course in Student-Centered Active Learning and Team-Based Learning (TBL)

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Abstract

Due to the success of various student-centered active learning strategies, an initiative is underway to encourage faculty throughout the college to increase the use of student-centered active learning in their courses, and to instruct them in how to do so. The purpose of this paper is to describe an online training course that is being developed to assist engineering instructors in learning to use student-centered learning, including predominantly group-based methods, in the classroom. Currently, the course consists of five units, each of which culminates in a quiz that the instructor-as-student must take successfully before being allowed to move on to the next section. The content sections of the course consist of Powerpoint slides plus detailed instructor commentary for further explanation. Also included are selected illustrative video clips taken during an exemplary classroom session. Results from an evaluative survey taken of faculty volunteers who agreed to pilot the course are being used to improve the course.

Introduction

Research has shown that traditional lecturing is a relatively inefficient way to facilitate conceptual learning [1], and that student-centered active learning can result in a deeper understanding of the concepts in question [2]. Furthermore, when active learning is conducted in an extensively group-based learning environment, students also develop various professional skills, such as problem-solving, written and oral communication, independent learning, team work, etc. [1]. One group-based learning strategy that is popular with the author and which has been used successfully in many academic settings both outside and within engineering is team-based learning TBL [3-9].

The author has been using various forms of student-centered learning, particularly TBL, successfully in various undergraduate courses for three years. The success of using TBL was determined using several subjective measures [8], including student grades from semesters when TBL was and wasn't used, and surveys of student perception of learning, taken at the end of each of several semesters when TBL was used. Because of this success, an initiative is now underway to encourage other engineering faculty to use more student centered learning generally, and TBL in particular, in their courses, and to provide some tutorial assistance in learning how to do so. Concerning TBL, experience has shown that TBL as described in the literature [3] ought to be modified somewhat in order to be used most effectively in engineering courses. Thus, engineering faculty unfamiliar with TBL must surmount a significant learning curve in order to successfully implement the strategy. To streamline the process of learning to use not only TBL

but other forms of student centered learning as well, an online training course has been developed [10]. An online delivery format was chosen over a live, face-to-face format in order to provide trainees greater scheduling flexibility and to permit inclusion of illustrative video clips and detailed instructional explanatory text. This paper briefly describes both the on-line course, including the delivery format, course content, and unit mastery quizzes; and results from an evaluative survey taken of volunteers who agreed to pilot the course. Some of those survey results are being used to improve the course.

Delivery Format

The course is accessed through the Blackboard™ course management system, and it is designed to be self-paced and self-explanatory. The home page contains introductory information and explains how to proceed through the course. It states that the course is self-paced, and that it consists of five learning units, each of which includes a textual content section based on Powerpoint slides with detailed instructor commentary, and culminates in a mastery quiz which must be passed with a score of at least 80% before the trainee may move on to the next unit. There is no limit to the number of times a quiz may be taken. The home page also directs the trainee to the learning units.

The mastery quiz for each learning unit is generated from a pool of multiple-choice questions. The software uses an instructor-defined algorithm to select a subset of those questions in order to generate a quiz. Thus, a trainee will see a slightly different quiz each time he or she repeats it. For example, the quiz for the first learning unit currently consists of twelve questions from a pool of fifteen. To satisfy the 80% requirement, the trainee must answer ten of those questions correctly. To provide prompt feedback and remedy incorrectly answered questions, the software refers the trainee to corresponding slides in the textual content section.

Course Content

Although the course emphasizes TBL as a teaching and learning strategy, it includes a comparison of TBL to other group-based learning methods, such as problem-based and project-based learning [11, 12], as well as descriptions and discussions of lecture-based student-centered learning strategies [1, 13]. Thus, the course consists of five learning units, which are described briefly below.

Unit 1: Introduction and limitations of lecture-based learning

The introductory portion of the unit states and discusses the four course aims and seven learning outcomes. The aims of the course are to provide trainees with: a) an awareness of and appreciation for student-centered active learning; b) knowledge of some lecture-based active learning activities; c) knowledge of the different group-based learning strategies; and d) practical ideas for adapting TBL to engineering courses. The learning outcomes are that at the end of the course, trainees should be able to:

- Discuss the limitations or shortcomings associated with the traditional lecture style of teaching.

- Define and describe student-centered active learning.
- Describe some teaching and learning activities for the lecture-based learning environment.
- State and discuss the principal shortcoming of lecture-based active learning.
- Compare some of the features of problem-based learning (PBL) and project-based learning (PjBL).
- Describe textbook-defined TBL and compare it to PBL and PjBL.
- Describe some recommended practices concerning the use of TBL in basic engineering courses.

The second part of the unit addresses some of the reasons why traditional lecturing is a relatively poor teaching and learning strategy. These include a) the natural decline in attentiveness that occurs during a passive lecture session; b) the use of relatively inefficient learning styles, e.g., listening; c) the lack of constructive alignment between learning outcomes and lecturing; and d) the inability to develop professional skills.

Unit 2: Student-centered active learning for the lecture

Short of converting to a group-based learning environment, the instructor can insert pauses in the traditional lecture to interrupt the inevitable decline in attentiveness and engage students in various learning activities. This unit discusses some of those activities, which include using short quizzes to check readiness for class, using guiding questions throughout the lecture, consolidation pauses for students to compare notes and prepare questions, short reflective essays, and "think-pair-share" exercises.

Unit 3: Group-based student-centered active learning

Extensive use of learning groups enables students to maximize use of high efficiency learning styles, such as doing things, discussing them, and teaching each other. However, it also enables them to develop certain professional skills, such as problem-solving, teamwork, oral communication, and interpersonal skills. In this unit, group-based learning strategies are introduced, and PBL and PjBL are described and compared [11, 12].

Unit 4: Textbook Team-Based Learning

This unit describes TBL as is done in the textbook by the original developers of the method [3]. Discussed in depth are the three phases of the strategy, including preparation, application, and unit assessment; the four essential principles of TBL, which relate to group formation and management, student accountability, group assignments, and feedback; and a comparison of TBL to PBL and PjBL. The unit also includes several video clips, which were taken during an exemplary TBL classroom session, and which illustrate various aspects of the TBL strategy.

Unit 5: Practical recommendations for using TBL in engineering courses

TBL as described in [3] was originally developed and optimized for senior and graduate level courses in psychology and business. When it was first used by the author in the sophomore-level electric circuit sequence, it was observed that some of the textbook aspects of the strategy did not work particularly well; subsequently, four beneficial changes evolved, which have improved its

use in those sophomore-level courses. Those changes are discussed in this unit as practical recommendations. Briefly, they relate to the use of learning outcomes, including one related to learning the principles of TBL; to the use of shorter preparation assignments and more frequent readiness testing in the preparation phase; to the use of a specific problem-solving scheme during the application phase; and to the use of formative assessments in the unit assessment phases.

Evaluation

The online training course has been piloted by several faculty volunteers. In addition to completing all course requirements and passing the unit mastery quizzes as described above, they also completed an evaluative questionnaire that has provided feedback to help improve the course. The questionnaire contains multiple-choice and open-ended questions related to the following: a) length of time needed to complete each learning unit; b) ease of navigation within the course site; c) clarity of writing and ease of comprehension of the textual course content; d) quality and usefulness of the illustrative video clips; e) usefulness and difficulty of the mastery quizzes.

For improvement purposes, the evaluative questionnaire determined that Unit 4, on textbook TBL, takes approximately twice as long to complete as the other units, approximately 100 minutes versus approximately fifty minutes. It was also suggested that parts of Unit 4 in particular are unclear and/or difficult to comprehend, and that several mastery quiz questions, particularly some of those in the pool for Unit 4, are ambiguous. Limited though the evaluative data is at this point, it is clear that Unit 4 needs revision. Thus, for the next version of the course, Unit 4 is being divided into two units, the material therein is being rewritten for clarity, and the associated mastery quiz questions are being examined and rewritten as needed.

Conclusion

The purpose of this project has been to provide engineering faculty with an on-line training course that will help them obtain the knowledge and skills needed to incorporate various forms of student-centered learning, especially TBL, in their own practice. A preliminary version of the course has been piloted and evaluated by several faculty volunteers. Using that feedback, the course is being revised, and a second edition is now being developed. Eventually, the course will be made available to other engineering faculty wishing to effectively use more student-centered learning, both lecture-based and predominantly group-based, in their courses.

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Biographical Information

Robert O'Connell received the B.E. degree in electrical engineering from Manhattan College and the M.S. and Ph.D. degrees in electrical engineering from the University of Illinois. He is a Professor of Electrical and Computer Engineering at the University of Missouri-Columbia. In addition to technical interests in electric power systems, he spends time developing modern teaching and learning methods for engineering education.