An Online Training Course for Instructors Wishing to Implement Team-Based Learning (TBL)

Robert M. O'Connell
Department of Electrical and Computer Engineering
University of Missouri
Columbia, MO, USA
oconnellr@missouri.edu

Pil Won On
College of Engineering
University of Missouri
Columbia, MO, USA
onp@missouri.edu

***Abstract*— Due to success at adapting and implementing team-based learning (TBL) for use in sophomore-level electric circuit theory courses, an initiative is underway to encourage other faculty to use TBL in their courses, and instruct them in how to do so. The purpose of this work-in-progress paper is to describe an online training course that is being developed to assist engineering instructors in learning to use TBL as well as other forms of group-based student-centered active learning in the classroom. Currently, the course consists of five units, each of which culminates in a quiz that must be taken successfully before moving on to the next section. The content sections consist of Powerpoint slides plus detailed instructor commentary for further explanation. Also included are selected illustrative video clips taken during an exemplary classroom session.**

Keywords—team-based learning; online faculty training; student-centered active learning.

I. INTRODUCTION

Research has shown that traditional lecturing is an 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, teamwork, etc. [1]. Team-Based Learning [3] (TBL) is a form of group-based learning that has been used successfully in many academic settings both outside [3] and within engineering [4-8].

Author R. O. has been successfully implementing and adapting TBL for use in sophomore-level electric circuit theory courses [7, 8] for three years. Because of this success, an initiative is now underway to encourage other engineering faculty to use TBL in their courses also. Experience has shown, however, that TBL as described in the literature [3] needs 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 this process we have developed an online training course that shares our knowledge of and experience teaching with TBL [9]. An online delivery format was chosen over a live, face-to-face format to provide prospective trainees greater scheduling flexibility and to permit inclusion of illustrative video clips and detailed instructional explanatory text. This work-in-progress paper describes the course delivery format, course content, unit mastery quizzes, and the results of an evaluative survey taken of volunteers who agreed to pilot the course. Information from that survey is being used to make improvements to the course.

II. 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.

Currently, 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 to generate a quiz. Thus, a trainee will see a slightly different quiz each time he 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.

III. COURSE CONTENT

In order to facilitate learning of the principles of TBL, it has been helpful to first place TBL in the context of other group-based learning methods, such as problem-based and project-based learning [10], and to place group-based learning methods in the context of student-centered active learning generally [11]. Thus, the course consists of five learning units, which are described briefly in this section.

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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 differences among 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 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 traditional 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 highly efficient learning styles, such as doing things, discussing them, and teaching each other. It also enables students to develop certain professional skills, such as problem-solving, teamwork, oral communication, and interpersonal skills. While we consider TBL to be the group-based method of choice for basic engineering courses, in order to fully appreciate its virtues as well as its limitations, it is important to know how it compares with the other popular group-based methods, i.e., PBL and PjBL, which are the subject of this unit.

Unit 4: Textbook Team-Based Learning (TBL)

This unit essentially describes TBL as is done in the textbook by the original developers of the method [3]. Discussed in depth are the three phases of TBL (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 six video clips, taken during an exemplary TBL classroom session, that 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 author R.O. in the sophomore-level electric circuit sequence, it was observed that some of the textbook aspects of the strategy did not work well in those classes; subsequently, four beneficial changes have evolved, which have improved its use in the electric circuit sequence. 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.

IV. Evaluation

The online training course is currently being piloted by several faculty volunteers. In addition to completing all course requirements as described above, pilot volunteers also complete an evaluative questionnaire that is helping to 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.

To date two volunteers have piloted the course and completed the evaluative questionnaire, the results of which suggest that Unit 4 is disproportionately long, 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 quiz for Unit 4, are ambiguous. Limited though the evaluative data is at this point, it is clear that Unit 4 needs work. Thus, for the next version of the course, Unit 4 is being divided into two units, the material therein is being rewritten, and the associated mastery quiz questions are being examined and rewritten as needed.

V. 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 "first edition" of the course is being piloted and evaluated by several faculty volunteers. Using feedback from them, 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 improve student engagement and learning in their courses.

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