
AC 2012-5163: TRAINING ENGINEERING TEACHERS ONLINE FOR PRACTICE AND APPLICATION OF TEAM-BASED LEARNING (TBL)

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Training Engineering Teachers Online for Practice and Application of Team-Based Learning (TBL)

Background

Copious research has shown that traditional lecturing is a very inefficient way to facilitate conceptual learning¹, and that student-centered active learning can result in a deeper understanding of the concepts in question⁸. Furthermore, when active learning is conducted in an extensively group-based learning environment, students develop various generic, professional functioning knowledge skills, such as problem-solving, written and oral communication, independent learning, team work, etc.

Team-Based Learning (TBL) is a form of group-based learning that is being used successfully in sophomore-level electric circuit theory courses at the affiliated institution. Because of this success, a department-wide initiative is underway to encourage other faculty to use TBL in their courses as well. It is hoped that TBL will eventually become the signature pedagogy of our department. Our experience has shown, however, that TBL as described in the literature⁵ should be modified somewhat in order to be used most effectively in engineering. In order to share this knowledge with other instructors who wish to adapt the TBL approach in their courses, the authors have teamed up to create an online training course.

Choosing TBL over PBL (Problem-Based Learning)

One of the prominent instructional practices in the STEM fields (Science, Technology, Engineering, and Mathematics) is the minimally guided approach that has been referenced by various names such as discovery learning, problem-based learning, inquiry learning, experiential learning, and constructivist learning. In problem-based learning^{2,9} teams of students confront open-ended realistic problems and are required to develop solutions by following a prescribed multi-step problem-solving scheme in which instructors function as tutors who also follow a prescribed scheme of tutorial behavior. It is important to understand that the problems to be solved are assigned without any prior instruction by the instructor so that the problems themselves dictate what declarative content knowledge has to be learned (independently and interdependently by the students) in order to solve the problem. The phrase “The problem drives the learning” is often used in descriptions of problem-based learning^{1,10}. Because the problems themselves, without any prior instruction, hint at and ultimately determine what content knowledge is to be learned (in order to solve the problems), the problems must be designed with extreme care in order to assure that the learning outcomes and content are all adequately addressed. However, even when problems are designed with such care, student teams often find ways of solving them without proper understanding of the intended content knowledge. Thus,

there is a danger, when using problem-based learning, that the desired learning content would not be learned. Avoiding these so-called knowledge gaps is one of the biggest challenges to appropriately using problem-based learning^{3,6}.

In team-based learning, on the other hand, in the Preparation phase, students are told exactly what specific content material needs to be learned in order to be successful in the subsequent Application phase. They take a readiness test and are given a subsequent brief corrective lecture over the important content before beginning the Application phase. Thus, there is much less risk of creating knowledge gaps when using team-based learning, which is the principal reason why team-based learning and not problem-based learning, was chosen for our initiative.

Online TBL Training Course for Engineering Teachers

An online delivery format is chosen due to two main reasons. First, the prospective trainees are faculty in a higher-education institution who prefer flexible schedules on any training needs. Second, effective use of media such as video clips, narrative presentation, web resources, etc. is the most practical way of delivering training that focuses on practice and application.

Part #	Topics	Activities
1	Introduction to TBL and Limitations of Traditional Learning	Quiz 1
2	Active Learning	Quiz 2
3	Group-based Active Learning	Quiz 3
4	Team-based Learning	Quiz 4
5	Practical Recommendations and Suggestions	Quiz 5 Final Project: Write a Lesson Plan

Table 1. Online TBL Training Course Framework

During the informative sessions (part 1 through 4 in Table 1), trainees will learn about TBL from instructor’s presentation recordings and video clips excerpted from an actual classroom that demonstrate best practices of TBL strategies. They will check their understanding in each part through an online quiz that they can retake as many times as needed until achieving a predetermined level of success in order to move on to the next. The trainees will also have an opportunity to design or modify their own course with TBL by working on a lesson plan as a final outcome of the training.

Instructional Design Strategies for Adult Training

Knowles’s adult learning theory⁴ was adapted as instructional design strategies for the online TBL training course. Table 2 below illustrates how the principles of adult learning theory are applied in the course design and development. It highlights six key points addressed in the adult learning theory.

	Key Points of Adult Learning Theory⁴	Application in Online TBL Training Course
1	Adults have a need to know why they should learn something.	Department-wide initiative, voluntary-based participation
2	Adults have a deep need to be self-directing.	Self-paced, mastery learning
3	Adults have a greater volume and different quality of experience than youth.	Final Project: Writing a lesson plan
4	Adults become ready to learn when they experience in their life situations a need to know or be able to do in order to perform more effectively and satisfyingly.	Success stories disseminated through showcases/seminars, recognition in the department
5	Adults enter into a learning experience with a task-centered (i.e. problem-centered, life-centered) orientation to learning.	Informative sessions along with quizzes, task-centered final project
6	Adults are motivated to learn by both extrinsic and intrinsic motivators.	Extrinsic motivator: department-wide initiative and recognition, consideration in tenure-track review Intrinsic motivator: success stories, course evaluation, enthusiasm for better teaching

Table 2. Application of Knowles’ Adult Learning Theory

Knowles emphasized adults as independent learners who are motivated by their own specific needs. The voluntary motivation by both extrinsic and intrinsic motivators is critical for adult learners to be successful in their learning. Adult learners learn better when they direct and reflect their own learning on practical matters.

The TBL training course will be available for those who are willing to apply the practice of TBL in their teaching. The participation will be voluntary but due to the department-wide initiative and publicly recognized success on TBL practice by distinguished fellow faculty, it is anticipated that enthusiastic teachers who have already shown their strong interest will immediately buy in this professional development opportunity. At the end of the training session which will be managed in their own pace, the trainees will be able to walk out with a lesson plan they can utilize in their teaching practice.

Conclusion

The design and development of the online TBL training course discussed in this paper is based on the successful experience⁷ of one of the authors who has adapted and implemented TBL for his two-course electric circuit theory sequence in electrical and computer engineering. There is no apparent reason why the lessons learned from one engineering discipline cannot be applied to any engineering courses. To assist instructors who are unfamiliar with the strategy, but interested in using it, we have conducted training seminars throughout the past three semesters. The online TBL training course is the continual endeavor to help willing instructors to learn how to employ TBL in more practical matters.

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