

TEACHING TOPICS

TEAM-BASED LEARNING

MOVING FROM KNOWLEDGE TRANSFER TO KNOWLEDGE APPLICATION

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This Teaching Topic is about Team-based Learning (TBL). Team-based Learning is an instructional strategy, that focuses on preparation and collaborative learning and teaching. Teachers can use this strategy to encourage students to discuss the content in-depth and learn from their mistakes. It is suitable for both small and large groups of students.

WHAT IS TEAM-BASED LEARNING?

TBL is an active and collaborative instructional strategy that is learner-centred and instructor-directed¹. Students are responsible for their own preparation before class and their involvement during class, and they are required to apply their knowledge in solving authentic problems¹. This strategy was developed in a business school² in the 1990s by a professor who wanted to take the advantages of small group learning to large groups of students. In TBL, students prepare for the tutorial individually by studying the required materials. As a result, the precious time during contact hours can be used for deep learning. In class, students individually accomplish a multiple-choice test (Figure 1). Immediately after, they retake the test in a group of 5 to 7 students² using discussion as a means to reach agreement on the correct answer. Next, the students work on group assignments with

an emphasis on applying the core concepts of the theory³. Rather than passively listening to a teacher, TBL offers an opportunity to discuss and apply knowledge. Student groups develop into self-managed learning teams³. Grading, peer evaluation and feedback are used to promote both individual and group learning¹.

WHY USE TBL?

Team-based Learning has many advantages, for instance¹:

- Proven effectiveness in small and large student groups
- Only one instructor is needed (to guide the process)
- Students learn to work together in a team
- Versatile instructional strategy
- The multiple-choice tests quickly provide the teacher with information about obstacles to student learning, so he or she knows which subjects to emphasize
- Interactivity encourages peer learning among students
- Students learn to apply their knowledge

A 2011 review⁴ of multiple studies confirms that students are more engaged and satisfied in TBL classes. These studies also indicate that students do better on exams. Parmelee and Michaelsen³ concluded that teams outscore their own very best member 99.9+ percent of the time. This conclusion is based on 30 years of data covering 6,161 students. Together, these students formed 1,115 teams, of which 1,114 teams outscored their very best member.

Nevertheless, researchers feel that more high-quality studies are needed to confirm the positive effects TBL has on learning outcomes.

TEAM-BASED LEARNING

(Repeated 5-7 times per course)

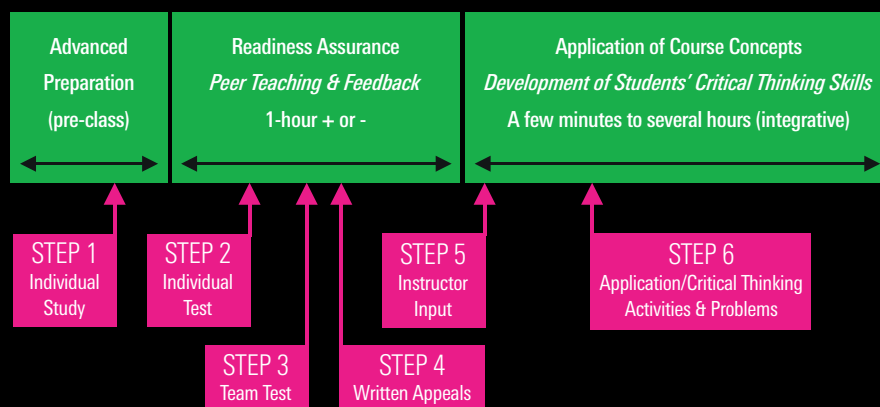


Figure 1. Instructional activity sequence for TBL content unit.

Adapted from Parmelee & Michaelsen (2010)³.

HOW DOES TBL WORK?

TBL has a specific sequence of activities. Parmelee et al.¹ describe these steps from both students' and instructors' perspectives.

ESSENTIAL STEPS FOR STUDENTS

- 1 Advance assignment**
Students prepare for the TBL meeting by individually studying materials or completing assignments (outside the classroom).
- 2 Individual readiness assurance test (iRAT)**
Students individually take a multiple-choice test (consisting of 10 to 20 questions).
- 3 Team readiness assurance test (tRAT)**
Students retake the test, but now as a team. They use discussion as a means to reach agreement on the correct answer. Immediate feedback is important, so 'scratch cards' are often used. The students can then see if their team is correct. If not, they can discuss further, scratch a second answer and so on.
- 4 Instructor clarification review**
The instructor uses the results of the tRAT to clarify the most difficult concepts.
- 5 Team application (tAPP)**
This is the most important step. Student teams apply their knowledge to a real-life and realistic problem. All teams work on the same problem at the same time, resulting in clear, easily presentable solutions.
- 6 Appeal**
In the event of an incorrect answer, students are offered the opportunity to defend their answer in writing, potentially resulting in a review of the initial assessment.

ESSENTIAL STEPS FOR INSTRUCTORS

Instructors using TBL are advised to employ Backward Design, starting with identifying learning goals to make sure the tutorials are related to these goals (Figure 2).

- 1 Situational factors and learning goals**
Identify important situational factors and define learning goals.
- 2 tAPP**
Create or find an authentic and believable problem for which students can't simply look up the answer.
- 3 iRAT/tRAT**
Create multiple-choice questions.
- 4 Advance assignment**
Make students aware in advance of the knowledge they are expected to acquire.
- 5 Instructor clarification review**
Use tRAT results to identify and explain difficult concepts.
- 6 Appeal**
Potential review of initial assessment for teams that successfully defend their answer.

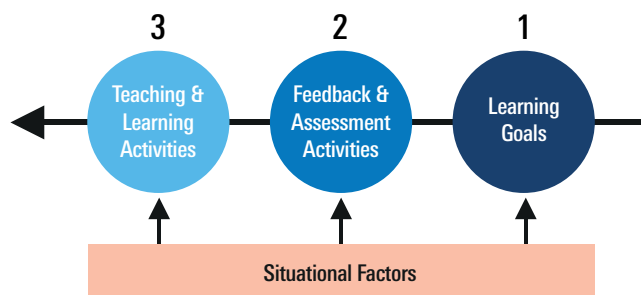


Figure 2. Backward design process. Adapted from Parmelee, Michaelsen, Cook & Hudes (2012)¹.





WHERE AND WHY DID YOU IMPLEMENT TBL?

"I introduced TBL sessions in the Circuits & Electronics course, which is part of the Smart Technology module in the Creative Technology programme. I was inspired to implement TBL based on talks with people from CELT and fellow teachers who had already conducted a TBL pilot. As a teacher I'm always looking for the best way to 'ignite' and encourage the learning process of students. TBL has many ingredients that can facilitate this process. I implemented TBL in 4 out of the 10 sessions in the course. These TBL sessions were optional, and students could earn extra credit to bump up their final grade."

WHAT'S THE ADDED VALUE OF TBL FOR YOU?

"In my experience TBL's added value is multifaceted. The most important aspects are:

ATTENTION SHIFT

The attention of students is shifted to the day's topic; this induces a more active role (preparation) rather than the passive role (consumption) that I sometimes observe during lectures. TBL brings focus.

LEARNING FROM MISTAKES

Tests now serve more than one purpose rather than just resulting in a final grade at the end of a course. TBL tests can serve as stepping stones to learn from mistakes, which is very effective. And by creating a safe atmosphere, students learn not just from their own mistakes, but also from other's. Learning from each other is a hallmark of TBL. In my experience, students are better prepared for the final test when they have seen and discussed the topic previously during TBL sessions. I am convinced that TBL leads to more profound knowledge acquisition.

GAMIFICATION

The group test can be a very stimulating and motivating experience for students. It encourages collaboration (within a group) and sometimes even competition (between groups). The group tests make use of scratch cards, which can be construed as the 'gamification of education'. Students receive instantaneous feedback on their answers. Learning becomes fun."

IMMEDIATE FEEDBACK

TBL also provides the teacher with instantaneous feedback, because the test results show exactly which topics students are having difficulties with. Directly afterwards, you have the opportunity to give an on-the-spot micro lecture about those topics.

REFLECTING

It can be refreshing for you as a teacher to try a different format. TBL places teachers in a different role as compared to a 'traditional' lecturer. And, somewhat surprisingly, TBL helped me learn to value lectures. Using TBL and experiencing a different teaching format gives rise to self-reflection. I think the same goes for students too. In conclusion, I have noticed that some topics are better dealt with in a traditional lecture setting than in a TBL format. TBL certainly has many advantages, but it would be too much of a good thing to simply use it everywhere.

WHAT DO STUDENTS THINK OF TBL?

"On average, 70 – 80% of the students participated in each of the sessions. Overall, students are very enthusiastic. I make screencasts of my lecture slides with a voice over. They appreciate the taped lectures, because they can then go over the material at their own pace and as often as they wish. The atmosphere during the group test is positive, and the students value learning from each other."

WHAT CHALLENGES ARE ASSOCIATED WITH TBL? DO YOU HAVE TIPS FOR OTHER TEACHERS?

"One of the challenges I still face has to do with the time for the individual and group test. Since there are big differences in the time needed by students to finish the tests, you have to adapt to their needs on the spot. I'm currently trying a solution that involves handing out a piece of paper with practice material. Students can work on this as soon as they have finished the individual test, and spend their time usefully while waiting for the group test to start. The most important tip I can give other teachers is to give yourself preparation time! There are two things that cost me a lot of time: creating the screencasts (writing a script, setting up slides, taping the screencasts) and formulating the tests (on a more conceptual basis than 'regular tests'). A final word of advice: you can encourage discussion during the group tests even more by using a 'wrong question' (e.g. one with multiple correct answers) on your TBL test now and then. This fosters critical thinking among students and keeps the discussion lively."

DO YOU WANT TO USE TBL?

The Centre of Expertise in Learning and Teaching (CELT) is available for advice and support in using Team-based Learning. CELT can also provide official TBL scratch cards for the tRAT.



More information about the scratch cards and TBL advice and support: tinyurl.com/CELT-TBL

CHALLENGES IN TBL

If you want to use Team-based Learning, you'll have to keep a few challenges in mind:

- TBL will be a new experience for many students. It is essential to explain to them what you will be doing, and why. You can show them the learning objectives, tell them how TBL contributes to achieving these objectives and remind them of the benefits they will experience³.
- Good multiple-choice questions are essential for a successful TBL experience. However, creating plausible alternative answers can be difficult. You can ask your faculty's educational adviser for help.
- Make sure that TBL is integrated into your course, module or curriculum¹. If you use TBL isolated from the rest of the course, the benefits might not be optimal.
- You will have to create teams for the tRAT and tAPP. Strive for teams with a diverse composition (distributing the knowledge resources fairly), and make sure the process is transparent¹.

Parmelee & Michaelsen (2010) give more tips for doing effective Team-based Learning.

UT TEACHERS' & STUDENTS' EXPERIENCES WITH TBL

We have created a short movie about 'Team-based Learning in action'. You can watch this movie, including interviews with Wieteke de Kogel and some of her students, here:

 vimeo.com/238081123



ROBIN DE GRAAF FACULTY OF ENGINEERING TECHNOLOGY (ET) ON TEAM-BASED LEARNING

"I decided to use TBL in my course in Collaborative Design & Engineering (CIT), because I noticed that students came to the lectures unprepared and experienced difficulties understanding the theoretical concepts discussed. Worse, several students started the project in the second part of the course without fully understanding the basic theory. As

my course is aimed at teaching teamwork, TBL seemed an ideal way to address these issues.

My experience with TBL has been very positive. The iRAT indeed ensured that students came better prepared to the lectures, and the tRAT triggered a lot of discussion among students. In particular, working with the TBL scratch

cards was experienced as fun and effective. Students mentioned they learned a lot thanks to the immediate feedback from the scratch cards, and because their peers could explain the answer if something was unclear. Moreover, project teamwork later on in the course improved.

I will definitely use TBL again next year."

UT CASE RESULTS

In 2016, Professor Wieteke de Kogel-Polak of Engineering Technology implemented TBL in two of the nine sessions in Module 1 (Design and Manufacturing - Manufacturing Systems). Student observations, a SIMS motivation questionnaire on the entire course and an exam result analysis were conducted to measure the effect of the TBL sessions.

Students were actively involved in the TBL sessions. During the iRAT and tRAT students worked seriously

and with dedication. The final individual and team results, however, were not decidedly high. During the tAPP, the groups discussed the different possible answers, while having their books on the table.

There was no real change in motivation measured between the start and end of the sessions, nor did the exam results increase compared to the year before. The TBL students did not achieve better results compared to students who did not work with TBL. However, implementing and

fine-tuning TBL is expected to result in more positive outcomes in the future. Moreover, the teacher was very happy with the current design of this part of the module, and she is investigating further improvements.

Even though significantly better test and motivation results have not yet been measured, students are enthusiastic. Furthermore, TBL offers teachers a basis for emphasizing more profound knowledge acquisition and skills building.

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