

Team-based Learning (TBL) “Toolkit”

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This is intended as a brief introduction to the method. Several useful books are available, to which the reader is referred for in-depth information.

What is Team-based Learning?

TBL is an active learning method suitable for large or small groups. It has been utilized in lecture halls of up to 200+ students and in much smaller clerkship and residency settings. In pre-clinical courses, it has been used to supplement lectures with active learning, or used to completely eliminate lectures. In the latter situation, the onus for basic information mastery is placed on the students with pre-session readings. Class time utilizes 5-7-person teams of students working together to apply and consolidate their knowledge.

TBL is a several-step process:

- 1) Preparation – Reading assignments are to be completed before class.
- 2) Readiness assurance tests (RATs) are given at the beginning of each section or class. These are taken first by each individual, and then by each team working as a group. The answers are then reviewed by the teacher to ensure that basic concepts are understood before starting the exercises.
- 3) Group exercises (e.g. cases) with multiple-choice questions are discussed and answered by teams working as a group. Then these are reviewed and discussed by the teacher and entire class.
- 4) Lectures can be used to either present material (instead of relying entirely on assigned readings) or for review, or entirely omitted.
- 5) Peer assessment by team members
- 6) Grades can be derived from any or all of the following components:
 - Individual RATs
 - Team RATs
 - Answers on group exercises
 - Peer assessment

This is not PBL (Problem-based learning)

There are major distinctions from problem-based learning (PBL). PBL is applied only in a small-group setting, optimally 10 or fewer students with one faculty member; TBL can be used for small or large groups with one or a few faculty members in nearly any setting, including a lecture hall. In PBL, faculty expertise in the topic is not mandatory, although it is useful; in TBL, faculty expertise is assumed. In PBL, attention is supposed to be placed on inter-personal interactions among team members; while in TBL the focus is on the output of the teams in terms of the RAT scores and answers/reasoning reported for the group exercises. Perhaps most importantly, in PBL basic information mastery depends on students identifying knowledge gaps and resources during class sessions, while in TBL students are expected to come to class with basic information mastery.

Advice from experts on identifying exercises and objectives

First, decide what you want students to be able to DO after your course (e.g. generate a diagnostic strategy for prototypical clinical scenarios). Then, decide what they need to KNOW in order to do this. This latter question gives you the content objectives to be acquired through readings or lectures. The application objectives can be constructed as group exercises.

What are the practical issues?

How are teams constructed?

How should the teams be arranged and in what rooms?

What sort of preparation should be assigned?

How are the RATs created and administered?

How are application exercises created?

What does the teacher do during the case exercise classes?

Should there be large-group lectures and/or review sessions?

How should peer assessment take place?

How is an individual student's final grade created?

Team construction

The experts agree that teams should NOT be self-selected, should contain 5-7 students, and should remain together for the duration of the course. Some schools assign students randomly to teams, others have a process for team assignment done the first day which aims to evenly distribute learners with expertise on the subject among the teams. You should first decide what sort of expertise would be most useful in solving the application exercises – e.g. third year residents vs. earlier stage learners, or students with vs. without prior clinical employment such as nurses. Learners with those characteristics line up first, followed by the rest of the learners, and then the learners count off by the number of teams to be constructed. We strongly suggest avoiding all-female or all-male teams.

Team location/geography

All types of locations, including large lecture halls, have been used successfully. Team members must be seated close together in a way in which they can see and hear each other during discussions taking place among team members. It is helpful if there can be some separation between different teams. Students also must be able to see a screen on which the cases/questions will be projected, to see and hear the instructor, and to hear other students in class not on their own teams. Wireless mikes are very useful for this in larger rooms.

Preparatory readings or lectures for core content

The difficulty of determining these will vary depending on whether there is a resource on which the course faculty can agree. Learners should be given lists of topics and objectives (with the relative importance of various topics) to help guide their reading. As mentioned, many courses continue to have some lectures to deliver at least some of the core content. For more advanced learners, e.g. residents, basic expertise may be assumed (or not).

Creating the readiness assessment tests (RATs)

These should be fairly short, basic, non-ambiguous questions based on the reading assignments/lecture/underlying clinical content. The intent is to assure at least a basic understanding of the topic(s) and generate conversation that will enhance learning.

Administering the RATs

First, all the individual students complete the RAT on their own, usually at the beginning of class. Then, each team discusses and answers the same RAT that they just took as individuals. These can be done either on paper, specialized instant-feedback scratch-off forms, or via an audience response system (ARS). This allows the instructor to immediately see if the class is having major difficulty with one or more basic concepts and focus review on those topics. The main disadvantage of the RATs is that even short 3-4-question ones are time-consuming at 10 minutes minimum. The main advantage is that they promote pre-class preparation and enable the instructor to determine quickly which basic concepts are most challenging.

Creating the case exercises

This can be the most time-consuming part of the process. Cases should obviously be based on the prototypical tasks you want learners to be able to handle. The experts agree that there should be realistic uncertainty in the cases in order to generate interest and discussion, but that the answers should be fairly basic – e.g. what diagnostic test would be most useful?, which diagnosis can be eliminated by what we know now? One can create cases on PowerPoint which evolve over time and have several embedded questions, mostly in multiple-choice format. Typically, one would start with a clinical vignette, ask a question about differential diagnosis or diagnostic testing, present further data, then ask another question about diagnosis, test sensitivity, management, etc. There is a team learning collaborative (tcollaborative.org). Membership comes with access to shared cases. Experts say the application exercises should satisfy the “4-S principle”: significant problem (important clinical question, not a “factoid”); same problem with simultaneous reporting of a specific – often MCQ - answer for all teams to stimulate inter-team debate.

Administering the case exercises

One can go through several case exercises per session. The optimal time per session is 1-2.5 hours, especially if a RAT starts the session. One or two faculty are adequate for even large numbers of learners; at least one should be a content expert. Teams should simultaneously answer the same questions, after time for intra-team discussion. This can be accomplished by showing cards imprinted with large letters, via the ARS, or writing on boards. An advantage of the ARS is speed (you know when most teams have decided on an answer) and independence (if a team is waffling between A and B, they will decide on A because they see another team confidently holding up A). After teams vote for their answers, the faculty member should guide a discussion of the pros and cons of the various answers, ending up with a summary statement a) there really was one clearly right answer of X for this particular reason, or b) one or more answers, e.g. diagnoses, could be supported by the information presented thus far. The entire class discussion

after posting of the team answers is needed to flesh out different aspects of the case and to reinforce the “right” answers.

What is the role of lectures?

Courses are all over the map on this. Some courses eliminated lectures entirely and rely on readings for all basic information accrual. Others have just one review lecture before the final section test. Others use TBL instead of small groups for their case discussion sessions but have retained all of their lectures.

What about peer assessments?

This is part of standard TBL and is meant to foster accountability. Several different methods of peer assessment have been described; examples are available on the TBL collaborative website.

How is a final grade generated?

There are multiple potential contributors of TBL to an individual’s grade:

- Individual RAT scores (individual gets 0 if absent)
- Team RAT scores (individual gets this even if absent, in most systems)
- Team performance on case exercises (ditto)
- Peer assessment as a separate contribution, or modifier to team scores

Different schools and courses have decided to include/weight these very differently.

What is the evidence about TBL?

Three major outcomes have been commonly reported: student activity/engagement; student performance on examinations; and student satisfaction. There are consistent reports showing much higher student engagement during TBL than during lecture, and similar student engagement to small group learning. Student exam performance, mostly measured pre- and post- course change, has been either similar or improved vs. comparator education modalities. Student satisfaction has usually been reported as similar or improved vs. comparators, however some data suggest that students prefer really small groups of 10 or fewer learners.

Variations on the “flipped classroom” theme, e.g. Just-in-time Teaching

Most TBL experts state that, to get the benefits of TBL, one must use all of the components, and have all of them contribute to the learners’ grades. It is unclear that there is evidence to support this. There is a variation called Just-in-time Teaching, described first for undergraduate physics classes, which does not utilize semi-permanent teams at all. The individual RAT can be given electronically before class, allowing the faculty member to concentrate class time on concepts not well understood prior to class, while just briefly reviewing concepts already mastered by most of the students. The in-class exercise questions are answered first by all individuals using any method – ARS, show of hands, boards, etc. If more than 70% answer correctly, the professor quickly reviews the reasoning behind the correct answer. If fewer than 30% answer correctly, the professor must spend time reviewing the topic before re-asking the question. If an intermediate number answer correctly, the professor asks students to get together in

groups of 2-3, with people who answered differently from them, to discuss the question and then re-vote after discussion. In this variation, the teams are quite transient, potentially changing from question to question.

Recommended article:

Parmelee D, Michaelsen LK, Cook S, Hudes PD. Team-based learning: A practical guide: AMEE Guide No. 65. *Medical Teacher* 2012;34:e275-e287.