

Chapter 5

Team-Based Learning

Kathryn K. McMahon

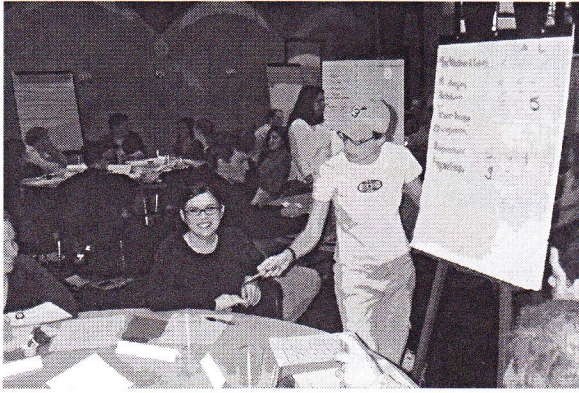
Team-Based Learning (TBL) is a large group, peer teaching strategy, that can alternately be described as an expert-led, interactive and analytical teaching strategy. TBL keeps the class together (large group) with one or more expert(s) while the students apply the content to specific problems (analytical) in small groups (interactive) at intervals during the learning session. The students are expected to prepare prior to the session. Content is *used* throughout the session rather than simply introduced. This approach allows students to practice with the content under the watchful eye of the expert.

Larry Michaelsen originated TBL in the late 1970s at the University of Oklahoma business school. It came to the attention of medical education in the late 1990s when Boyd Richards and colleagues began piloting it at Baylor School of Medicine. Through funds from the US Department of Education this group introduced TBL to the medical education world by hosting a series of annual conferences and by presenting TBL at untold numbers of schools and professional meetings. There is now an annual conference focused on TBL that is held by the TBL Collaborative, a non-profit professional organization that evolved out of those early conferences. More information about that group and its conferences can be found at the TBL Collaborative webpage (<http://tblcollaborative.org>). Another very useful webpage about TBL is the Team-Based Learning webpage (<http://teambasedlearning.apsc.ubc.ca>). The TBL Collaborative provides consultants to help with early implementation of TBL. Information about these consultants can be found at both of the web pages given above.

A thorough discussion of TBL is given in a recent text by Michaelsen et al. (2008a). Details of TBL philosophy, along with implementation instructions, are provided in the book. The book also features several short chapters on experiences of medical faculty that might be of assistance to a first time implementer of TBL.

K.K. McMahon (✉)

Department of Medical Education, Paul L. Foster School of Medicine,
Texas Tech University Health Sciences Center, El Paso, TX, USA



TBL Fundamentals

TBL is best used as a course strategy rather than a rarely used deviation from didactic lecture. That said, it can be used very effectively at any “dosage.” Thus, TBL can be successful when used as the sole teaching method, as part of a hybrid of teaching methods or even only once in a course. The more students and faculty use it the more comfortable they are with it. With increased comfort, less time is spent on the process and more preparatory and session time is devoted to content and its application. As with most endeavors, the more time invested by the faculty, the higher the quality of experience for students. Likewise the better prepared the student comes to a TBL session the more they will get out of that session.

A TEAM Versus a Small Group

The difference between “small group” and “team” needs to be addressed as one considers the “dosage” of TBL that will be used. A team evolves out of a small group that works together for a period of time and over several sessions. TBL can also be a tool for teaching teamwork and professionalism when it is a frequently used, predominant learning method of the course. The assignment of individuals to teams is important for this use of TBL. Students’ competence in some aspect(s) of the content of the course should be distributed throughout the small groups. The instructor should engineer the composition of the teams with this in mind rather than allowing students to simply self-assign themselves to groups.

It is frequently asked how long a group of students need to work together to develop into a team. As a general rule, it takes about six to eight separate sessions. Thus, from this perspective it is recommended that the groups should stay together for at least 15–20 sessions to allow students to profit from the team. Therefore, instructors commonly require that teams stay intact for one semester or an entire year.

TBL Stages

There are three stages or phases to TBL. These can all take place in and around a single session or be staggered over two or more sessions. The stages are:

- a. Student Preparation.
- b. Readiness Assurance.
- c. Application.

Student Preparation

In the preparation stage, the student completes an assignment such as a reading, attending a lecture/session, viewing a video or performing an interview. Preparation should be guided by clear instructions/learning objectives from the instructor as to the content and depth of student understanding. The student should be given a realistic time period for this preparation. A flaw that instructors should avoid is to give an exhaustive or extensive literature/reading assignment that takes several days to read, much less understand and learn. Similarly instructors should avoid using objectives that are superficial and/or vague. For example, to assign the entire book of a leading text of renal physiology and then to give the learning objective of “Describe the normal physiology of the kidney” has two flaws. The learning objective does not give sufficient guidance to appreciate the depth and breadth of knowledge the instructor expects the student to learn. It also is unrealistic to expect a student to “consume” an entire textbook for one or even several sessions – regardless of the teaching method/strategy to be used.

Readiness Assurance

The Readiness Assurance stage uses a relatively short set of questions (e.g., quiz, exam, or test) that test understanding of key concepts found in the preparatory materials. This stage has become known as the Readiness Assurance Test (RAT). This stage has four individual steps (iRAT, gRAT, Appeals and Feedback) that revolve around allowing the individual student, small groups, and the entire group to work on content. The students individually take the test (iRAT) followed by the small groups (teams) taking the same test as groups (gRAT). To allow for student concerns that a question on the test was either ambiguous or in some other way flawed, groups are then encouraged to submit written Appeals. Finally the instructor leads a brief discussion involving all teams as a review of the test and content (Feedback). The purpose of the Readiness Assurance stage is to assure both the student and instructor that the student understands the content to the level needed for problem solving, analysis, evaluation and/or synthesis.

The RAT stage commonly takes about one hour. Recognizing that all four parts of the stage occur in that time, one can see that the nature and number of questions

significantly impacts the success of this stage of TBL. New implementers of TBL often have questions about this. Commonly a multiple choice test of 10–12 questions works well. These questions should focus on the key points from the preparation materials. The questions can be layered in complexity, i.e., some are very concrete and focused on a single concept while others integrate multiple concepts. Generally assume that about 10 minutes will be used for the iRAT, 20 min for the gRAT, 5–10 min for the Appeals, and 10–15 min for the instructor Feedback.

Please note that the instructor is “teaching” only during the last 10 or so minutes. Most of the learning occurs during the first three stages of Readiness Assurance. During the iRAT, students recognize what they do not understand. During the gRAT, peer teaching occurs easily and naturally. Finally, during the Appeals, students must learn to construct a logical argument.

Usually the iRAT can be performed on an easily graded answer sheet (e.g., Scantron™). The gRAT can be completed on this same type of sheet or an Immediate Feedback-Assessment Technique (IF-AT or “scratch-off”) self-scoring answer sheet. The IF-AT form allows immediate feedback to the students of each team. This serves as an additional tool for learning, commonly brings fun into the process and thus is highly recommended. This type of “scratch-off” form is available from a variety of educational supply companies and can be found by simple internet searches using the key word “IF-AT forms.”

Application

The real “meat” of TBL occurs in the Application stage. Here is where students, in their teams and later in the large group discussion, really learn as they use the concepts to critically think about a situation posed to them. Application assignments are commonly a clinical or basic science experiment vignette with an accompanying question. There are a few aspects of this stage that are characteristic of TBL. Generally each application assignment has two process steps. First, the same assignment is given to all teams and the teams are allowed to work on the question for a time period. Second, all teams work with the instructor in the large group to evaluate and discuss the question. This happens easily by using some simple “rules” called the Four S’s. The team assignment (vignette with question) should be:

- (1) *Significant* to the student;
- (2) The *same* for all students;
- (3) Designed to make a *specific* choice; and,
- (4) Reported *simultaneously* by the teams.

We will return to the Four S’s in a moment but let’s first talk about the time needed for a “representative” assignment in the Application stage. The Application stage can occur within the same learning session as the RAT or it can occur at one or more later sessions after the RAT is completed. The decision on which to choose is



very much dependent on the nature and design of the course, the design of the learning objectives (depth and breadth) and the individual preference of the instructor. It is common that the Readiness Assurance and Application stages occur contiguously because of ease of course scheduling and other logistical issues. Thus, for a two-hour session, the first 50 min might be used for the Readiness Assurance stage and the remaining time (60–70 min) used for the Application stage. How does the instructor divide up the time within the Application stage? The concept to keep in mind is that *most* learning takes place in the team discussion of the assignment. This is when the individual students are beginning to put together the logic of the final choice. With this in mind the instructor is encouraged to allow a significant portion of time for team discussion of the assignment and a lesser portion focused on the large group discussion of team decisions. Thus if there is a 60 min block of time for the Application stage it is suggested that there be two Application assignments. For each assignment approximately 20 min should be for the individual teams to work and approximately 10 min to be used for the large group discussion. In cases where the teams are to submit a written description of their logic and choice of options, this written material should be picked up by the instructor before the large group discussion. More comments about written descriptions of Team logic are noted below.

Use of progressive cases is a “twist” that can be used to tie aspects of two assignments together. In such cases less time may be needed to review the vignette. For example a vignette might be the description of a first clinical encounter with a patient. In that vignette, clinically relevant information might be the chief complaint and physical finding. The first application might be to choose the most likely diagnosis given the physical findings from a reasonable set of differential diagnoses. That assignment might take 20 min of discussion at the team level and 10 min of large group discussion. Alternatively, the assignment might be to choose the top test that should be ordered to help develop a differential diagnosis. The next case could specifically list the result of the first assignment (top diagnosis or test performed) and a resulting question developed from that result. For example, the first

assignment might ask students to choose the highest priority diagnosis. The second assignment might then reveal that the tests support a specific diagnosis and ask the team to choose the next step in the management of the patient. In this scenario the team discussion might be less intense and so only 10 min might be needed and 5–7 min for the large group discussion. Whether or not isolated assignments or progressive assignments are used, it is important to keep the Four S's in mind.

More About the Four S's

The need of *significance* of the assignment would seem obvious but it should be stressed that the *student* should be able to see that significance. Sometimes the most easily written assignment is not the most useful assignment for students. Developing a useful assignment is a very important part of TBL. Faculty often find this the most challenging part of early implementation of the TBL method/strategy. Working collaboratively or at least asking other faculty to critique the assignment is a good way to improve the quality of an application assignment.

The use of the *same* assignment for all Teams is essential for two reasons. There is a logistical reason of having a large group discussion rather than simply a collection of small group reports. To accomplish this all of the Teams must have worked on the same assignment. The second reason is that it is essential that everyone has had a chance to think about the assignment in order to encourage the maximum learning. If one student (or group of students) reports to the rest of the group on one topic (assignment) and others likewise report on other assignments, much less learning by any individual student occurs. What generally happens in this situation is that the reporter learns quite a bit about their assignment and much less about all other assignments. They are actively engaged in their assignment and most likely passively engaged in other assignments.

The rule of the assignment requiring a *specific* choice is very important to TBL. This aspect differs from other small group learning methods which commonly allow for open-ended questions that foster an open discussion between individual students and/or the instructor. The use of a specific choice fosters critical thinking by making participants choose from among various options thus, students must learn how to make decisions at the individual, team and collective session levels. This is particularly true if the options are all plausible alternatives at the level of the students' understanding. Thus, while the structure of the vignette/question appears to be very similar to a single-best answer multiple choice question, it really can go beyond that. More than one of the options might be correct. The logic the team used to select the option they chose is the core of the work. The team should be able to logically explain why they chose one option over the others including why they did not chose the other options. Some faculty who use TBL specifically ask the teams to write their logic and submit it for evaluation by the instructor. Others simply listen to the team's oral presentation of the logic at the large group step of the session. Either way, the real learning comes from

the individual student thinking about and discussing with their team, the various advantages and disadvantages of the options and making a *specific* choice from those options.

The “rule” of *simultaneous reporting* of the teams’ choice is also very important to TBL. Since the development of the logic of the team’s choice is important to the learning within the Application stage, it is important that all teams simultaneously report which option they picked so that no team can rely on another team for the logic. Any team might be asked to defend their choice, so they must be prepared to do that at the moment of the simultaneous reporting. Simultaneous reporting is easily accomplished by giving each team a set of numbered placards that correspond to the various choices. The instructor then announces to the entire session attendees that all teams are to raise the appropriate placard at a particular time point (e.g., “on the count of three”). The instructor then recognizes the distribution of responses among teams. Then the instructor can initiate a discussion by asking randomly one team to state one point that they considered in their decision. Rather than allowing that team to give all points in their decision, the instructor can shift to another team and ask them to respond to that point and to add one point from their team’s discussion. Thus the instructor can orchestrate the discussion, occasionally ask a team why they did not consider one of the options the team did not pick, bring up an unaddressed concept that is important, or praise the logic used by all or particular teams.

Essential TBL Principles

TBL has some essential components. These make TBL unique from other learning strategies.

Team Formation and Maintenance

Team formation is critical. Resources students bring to the class should be distributed evenly throughout the teams. For example, in a pharmacology course, those students who have previously worked in a pharmacy might have a wealth of knowledge about medications and their use. Thus, those individuals should be assigned to different teams to prevent the concentration of pharmacologic knowledge on one team. The instructor should consider what knowledge base would best be distributed throughout the Teams. Tips about methods to do this easily can be found at the Team-Based Learning webpage (<http://teambasedlearning.apsc.ubc.ca>) and in several of the texts written for using TBL (Michaelsen et al., 2004; Michaelsen et al., 2008a, b).

Team maintenance is another issue that must be considered if TBL is being used as a predominant teaching method in a course. Some Teams or individuals in a given Team can be dysfunctional and cause disruption to either the Team or the class. Instructors should understand that the Team building process goes through normal group dynamics phases (sometimes referred to as forming, storming, norming and

performing). This process may make “bumps in the road” for some Teams but normally will work themselves out without intervention by the instructor. Scheduling some time for training the class about the TBL process and peer assessment helps with normal team maintenance. Open discussions or feedback sessions about how things are going and instructors’ willingness to listen to student concerns often will help ease tensions. In extreme cases, changing the team composition might be needed but only as a last resort.

Student Accountability and Incentive

A second essential component of TBL is that all students are accountable. Students learn best when there is an immediate need and an appropriate incentive. Grading performance can be used to hold students accountable for their learning in TBL and thereby evaluation of performance is an immediate incentive. TBL is designed so that the individual student is held accountable for their acquisition of knowledge if the iRAT is graded. Also the individual’s ability to use the knowledge and cooperate with other team members are accountable if the gRAT and Application assignments are graded. As the small groups develop into teams, the individual members learn what attribute each team member brings to the group and learn to use those attributes to make the team most successful. Thus gRATs and applications are also evidence of each team member’s knowledge. Thus, each TBL session provides several opportunities for students to be held accountable. Of course, the ability to work in the team and the development of professionalism are other very important aspects of TBL for which students can be accountable.

TBL can and should include the evaluation of each team member by their team peers for helpfulness and professionalism. This aspect of the evaluation should not be done at each session but should be done only occasionally, such as at a midpoint and at the end of the course. Peer evaluation can be done by a relatively short list of specific questions to which the students respond for each of their peers. The instructor must help the students understand the importance of peer evaluation. This is best done by frank discussion with the students as to the frequency of use, and the need for honest constructive criticism. The instructor should demonstrate how to give and receive such constructive evaluation. The Team-Based Learning webpage (<http://teambasedlearning.apsc.ubc.ca>) gives useful tips about Peer Evaluation.

Real-Time Feedback

TBL also provides an opportunity to give frequent feedback in real time. This occurs in the Readiness Assurance stage by immediate scoring of the iRAT and/or the use of IF-AT answer sheets. If neither of these tools can be used, the instructor can distribute answer placards as described previously for Application assignments. Electronic audience response systems could also be used to identify team choices for the questions. By any of these routes the instructor can give feedback at the time

the students are most acutely aware of their thought processes. This is an important component of the learning and consolidation of knowledge process. Frequent feedback is most useful to reinforce student learning when it addresses small increments of the overall learning objectives.

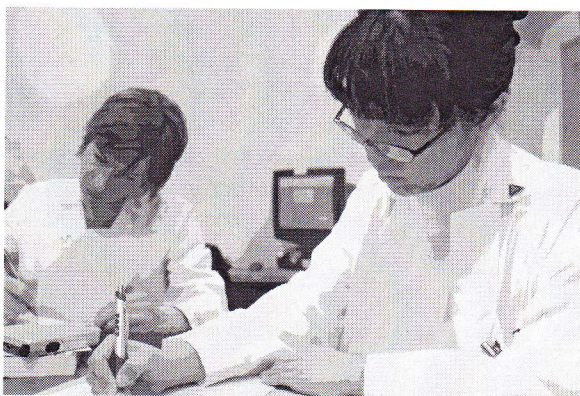
Similarly, the Application stage allows students to gain feedback from their peers and from the instructor as they develop and use their knowledge base to develop their logic of arguments. Corrections can be made as the logic is developed and as the student gains expertise in using their knowledge. This can be reinforced by the instructor's praise and encouragement.

Team Development and Peer-Teaching

Finally, team assignments in the Application stage must promote both learning and team development. These assignments must truly require use of the learning content but also require group interaction. Peer education is a significant aspect of TBL. The essence of TBL is lost if the assignment simply can be broken up into small components and the individual students cover different aspects. It is the peer education that drives team formation. Because of the development of teams, TBL can be used to teach professionalism. Good teams work well together because the members trust and respect each other, contribute consistently and can be relied upon.

Proof of Usefulness of TBL for Student Success and Student Satisfaction

There is a growing bibliography of research on TBL implementation (Levine et al., 2004; Meeuwse and Pedersen, 2006; Searle et al., 2003; Thompson et al., 2007), its usefulness in learning (McInerney, 2003) and student satisfaction (Parmelee et al., 2009). A comprehensive listing of this literature is found at the Team-Based Learning webpage (<http://teambasedlearning.apsc.ubc.ca/>) and in the list of references below.



References

- Levine RE, Haidet P, Lynn DJ, Stone JJ, Wolf DV, Paniagua FA (2004) Transforming a clinical clerkship with team learning. *Teaching and Learning in Medicine* 16(3): 270–275.
- McInerney MJ (2003) Team-based learning enhances long-term retention and critical thinking in an undergraduate microbial physiology course. *Microbiology Education Journal* 4(1): 3–12.
- Meeuwssen HJ, Pedersen R (2006) Group cohesion in team-based learning. *Mountain Rise* 3(1) (at <http://mountainrise.wcu.edu>).
- Michaelsen, LK, Knight AB, Fink LD (Eds) (2004) *Team-based learning: A transformative use of small groups in college teaching*. Stylus Publishing, Sterling, VA.
- Michaelsen LK, Parmelee DX, McMahon KK, Levine RE (Eds.) (2008a) *Team-based learning for health professions education: A guide to using small groups for improving learning*. Stylus Publishing, Sterling, VA.
- Michaelsen LK, Sweet M, Parmelee DX (2008b) Team-based learning: small group learning's next big step. *New Directions for Teaching and Learning* 2008(116): 1–128.
- Parmelee DX, DeStephen D, Borges NJ (2009) Medical students' attitudes about team-based learning in a pre-clinical curriculum. *Medical Education Online* 14(1) (at <http://www.med-ed-online.org>).
- Searle NS, Haidet P, Kelly PA, Schneider V, Seidel CL, Richards BF (2003) Team learning in medical education: initial experiences at 10 institutions. *Academic Medicine* 78(10): S55–S58.
- Thompson BM, Schneider VF, Haidet P, Levine RE, McMahon KK, Perkowski LC, Richards BF (2007) Team-based learning at ten medical schools: two years later. *Medical Education* 41(3): 250–257.

Web Pages

The Team-Based Learning Collaborative: <http://tblcollaborative.org>
Team-Based Learning: <http://teambasedlearning.apsc.ubc.ca>