Team-based learning (TBL) differs from other forms of small-group work in that it involves developing and using learning teams as an instructional strategy. As a result, implementing TBL typically requires linking each learning activity to the next and explicitly designing assignments to accomplish two purposes: deepening students' learning and promoting the development of high-performance learning teams.

We are all familiar with the look and feel of traditional, lecture-based instruction—as students, we learned that lecturing is what college teaching was mostly about—and many of us carried that model of teaching into our own early careers as professors. When coming from a chalk-'n-talk background, implementing TBL requires a fundamental change in the way you think about what happens in classrooms and laboratories. Traditionally, teachers have focused on teaching with an emphasis on facts and ideas and how best to present them. In contrast, the TBL instructor focuses on learning, and the emphasis is on what the students are doing in the classroom and how they are learning from their experience.

The goal of this chapter is to describe the key characteristics of TBL and how it can best be implemented as an instructional strategy. Throughout, we will emphasize that the tremendous power of TBL is derived from a single factor: the high level of cohesiveness and trust that can be developed within student learning groups while never stepping away from course content. In other words, the effectiveness of TBL as an instructional strategy is based on the fact that it nurtures the development of high levels of group cohesiveness and trust among students as a natural result of how content is covered in class. In TBL, the cohesiveness and trust that develops among team members derives from the sequence and structure of content-mastery activities. As the course unfolds, this cohesiveness development makes possible increasingly rich and motivated discussion among students, generating a wide variety of other positive outcomes. When one fully understands the importance of group cohesiveness and trust as the foundation for powerful learning teams, the significance of the procedures described in this chapter become clear.

The development of a small group into a learning team is best described as a transformation process (see chapter 4 in Michaelsen, Knight, & Fink, 2002, 2004).
The paragraphs that follow will outline a set of principles and practices that are critical to this transformation process. Part one of this chapter presents four essential principles for implementing TBL, part two provides a discussion of the steps involved in actually implementing TBL, and part three briefly outlines some of the primary benefits of using TBL.

**PART ONE—FOUR ESSENTIAL PRINCIPLES OF TBL**

Shifting from traditional forms of teaching to a TBL approach requires significant changes in (a) the focus of the learning objectives for a given course, (b) the nature of the classroom events intended to achieve these objectives, and (c) the role played by the instructor and students within these events.

The primary learning objective of most classes is to familiarize students with course content. By contrast, the primary learning objective in TBL (and one that is completely consistent with the demands of health professions education) is to ensure that students have the opportunity to practice using course concepts to solve problems. Thus with TBL, although some time is spent on ensuring that students master the course content, the vast majority of class time is used for team assignments that focus on using course content to solve the kinds of problems that students are likely to face as practicing professionals. This, in turn, requires that the instructor's primary role shift from dispensing information to designing and managing the overall instructional process. Furthermore, instead of being passive recipients of information, students are required to accept responsibility for the initial exposure to the course content so that they will be prepared for the in-class teamwork. Changes of this magnitude do not happen automatically. They are, however, reliable and natural outcomes when the four essential principles of TBL have been implemented.

The four essential principles of TBL are:

1. Groups must be properly formed and managed.
2. Students must be accountable for the quality of their individual and group work.
3. Students must have frequent and timely feedback.
4. Team assignments must promote both learning and team development.

When courses are designed and managed so that these principles are implemented, student groups naturally evolve into cohesive learning teams.

**Principle 1—Groups Must Be Properly Formed and Managed**

Forming effective groups requires that the instructor oversee the formation of the groups so that he or she can manage three important variables: One is ensuring that the groups have adequate and approximately the same level of resources to draw from in completing their assignments. The second is ensuring that the groups have the opportunity to develop into learning teams. The third is avoiding establishing groups
whose membership characteristics are likely to interfere with the development of group cohesiveness.

**Distributing Member Resources**

In order for groups to function as effectively as possible, they should also be as diverse as possible. That is, every group needs access to the students who have the potential for making a significant contribution to the success of their group. Thus, each group should contain a mix of student characteristics in relation to the course content (e.g., previous course work and/or course-related practical experience) as well as demographic characteristics like gender, ethnicity, and so on. Further, teams will develop faster when relevant member characteristics are evenly distributed across the groups. However, students intuitively have neither enough information nor the inclination to wisely form groups; therefore the task must always be the responsibility of the instructor. (For specific methods for grouping students see http://www.teambasedlearning.org; Michaelson et al., 2002, pp. 40-41; 2004, pp. 39-40; and chapter 6 and Appendix 2.A in this book.) Because TBL assignments involve highly challenging intellectual tasks, teams must be fairly large and diverse. Specifically, we recommend that teams should be composed of five to seven members and be as heterogeneous as possible. If teams are smaller and/or homogeneous, some are likely to face the problem of not having a sufficiently rich talent pool of individual resources needed to be successful—especially on days when one or more team members are not present in the class (see chapter 4 in Michaelson et al., 2002, 2004).

**Time—A Key Factor in Team Development**

Students should stay in the same group for the entire course. Although even a single well-designed group assignment usually produces a variety of positive outcomes, only when students work together over time can their groups become cohesive enough to evolve into self-managed and truly effective learning teams (see chapter 4 in Michaelson et al., 2002, 2004; and chapter 5 and Appendix 2.A in this book). Team development occurs through a series of interactions that enable individual members to test the extent to which they can trust their peers to take them seriously and treat them fairly. Newly formed groups tend to rely heavily on their one or two most assertive (although not always most competent) members and have not yet learned how and when to tap into the resources that reside throughout the group. Under the right conditions, however, the vast majority of groups learn how to interact much more productively. In addition, although member diversity initially inhibits group processes and performance, it eventually becomes a clear asset when members have worked together over an extended period of time (Watson, Kumar, & Michaelson, 1993).

As groups develop into teams, communication becomes more open and far more conducive to learning. In part, this occurs because trust and understanding build to the point where members are willing and able to engage in intense give-and-take
interactions without having to worry about being offensive or misunderstood. In addition (and in contrast to temporary groups), members of mature teams become more willing to challenge each other because they see their own success as being integrally tied to the success of their team. Thus, over time, members’ initial concerns about creating a bad impression by being “wrong” are outweighed by their motivation to ensure the success of their team (see chapter 4 in Michaelsen et al., 2002, 2004). When this occurs, studies have shown that 98% of teams will outperform their own best member on learning-related tasks (Michaelsen, Watson, & Black, 1989).

Minimizing Barriers to Group Cohesiveness—Avoiding Coalitions

The greatest threats to group cohesiveness development are coalitions: either a previously established relationship between a subset of members in the group (e.g., boyfriend/girlfriend, fraternity brothers, etc.) or the potential for a cohesive subgroup based on background factors such as nationality, culture, or native language. In newly formed groups, these factors are likely to become the basis for insider/outsider tension, which can plague the group for the entirety of a course. As a result, allowing students to form their own groups practically ensures the existence of potentially disruptive subgroups and must be avoided (Fiechtner & Davis, 1985; Michaelsen & Black, 1994). Thus, teachers should use a group formation process that mixes students up in a way that forces all groups to build into teams from the ground up. (For specific methods for grouping students see Michaelsen et al., 2002, pp. 40–41; 2004, pp. 39–40; http://www.teambasedlearning.org; and chapters 2 and 6 of this book).

Principle 2—Students Must Be Accountable for the Quality of Their Individual and Group Work

In traditional classes, there is no real need for students to be accountable to anyone other than the instructor. Thus, it is possible to establish a sufficient degree of accountability by simply assigning grades to students’ work. By contrast, with TBL, it is essential for individual students to be accountable to both the instructor and their team for the quality and quantity of their individual work. Further, teams must also be accountable for the quality and quantity of their work as a unit.

Establishing this accountability requires creating two conditions. One is ensuring that the quality of students’ individual and teamwork can be monitored. The other is ensuring that the quality of their work will have consequences (good and bad) that are significant enough to motivate high-quality work. The paragraphs below describe how the various practices that are part of TBL promote accountability for the behaviors that are critical to successful teamwork and individual learning.

Accountability for Individual Preclass Preparation

Lack of preparation places clear limits on individual learning and team development. If several members of a team come unprepared to contribute to a complex
group task, then the team as a whole is far less likely to succeed at that task, cheating its members of the learning the task was designed to stimulate. No amount of discussion can overcome absolute ignorance. Furthermore, lack of preparation also hinders cohesiveness development because those who do make the effort to be prepared will resent having to carry their peers. As a result, the effective use of learning groups clearly requires individual students to be made accountable for class preparation.

In TBL, the basic mechanism that ensures individual accountability for preclass preparation is the Readiness Assurance Process (RAP) that occurs at the beginning of each major unit of instruction (see below and in Michaelsen & Black, 1994). The first step in the process is an individual Readiness Assurance Test (RAT; typically 10-20 multiple-choice questions) over a set of preclass assignments, for example, readings, lab exercises, dissections, etc. Students then turn in their individual answers and are given an additional answer sheet to retake the same test as a team, coming to a consensus on their team answers. This process promotes students' accountability to the instructor and to each other. First, students are responsible to the instructor because the individual scores count as part of the course grade (discussed in detail below). Second, during the group test, each member is invariably asked to voice and defend his or her choice on every question. As a result, students are clearly and explicitly accountable to their peers for not only completing their preclass assignments, but also for being able to explain the concepts to each other.

Accountability for Contributing to Their Team

The next step is ensuring that members contribute time and effort to group work. In order to accurately assess members' contributions to the success of their teams, it is imperative that instructors involve the students themselves in a peer assessment process. That is, members should be given the opportunity to evaluate one another's contributions to the activities of the team. Contributions to the team include individual preparation for teamwork, reliable class attendance, attendance at team meetings that may occur outside of class, positive contributions to team discussions, valuing and encouraging input from fellow team members, and so on. Peer assessment is essential because team members are typically the only ones who have enough information to accurately assess one another's contributions. (See chapter 9 and part two in this book for additional information on peer evaluations.)

Accountability for High-Quality Team Performance

The third significant factor in ensuring accountability is developing an effective means to assess team performance. There are two keys to effectively assessing teams. One is using assignments that require teams to create a product that can be readily compared across teams and with expert opinions (including those of the instructor—see below). The other is using procedures to ensure that such comparisons occur frequently and in a timely manner (see below).
Principle 3—Students Must Receive Frequent and Timely Feedback

Immediate feedback is the instructional prime mover in TBL for two very different reasons. First, feedback is essential to content learning and retention—a notion that not only makes intuitive sense but is also well documented in educational research literature (e.g., Bruning, Schraw, & Ronning, 1994). The second reason immediate feedback is crucial to TBL is seldom mentioned in the education literature but is well documented in decades of group dynamics research (see chapter 4 in Michaelsen et al., 2002, 2004)—feedback is important because of its impact on team development. Further, the positive impact of feedback on learning and team development is greater when it is immediate, frequent, and discriminatory (i.e., enables learners to clearly distinguish between good and bad choices, effective and ineffective strategies, etc.).

Timely Feedback From the RATs

The RATs—mentioned above and discussed in detail later in this chapter—are where TBL provides students the feedback they need for learning and team development. Since RATs are given at the beginning of each major instructional unit, they virtually guarantee that students will have the conceptual skills required for tackling more complex application-focused assignments. In addition, feedback from the group RATs facilitates team development in two important ways. One is that because the group (not individual) scores are made public, members are highly motivated to pull together to protect their public image. The other is that immediate feedback during the group tests stimulates groups to continually improve how they communicate as a team. Because they receive the real-time feedback during the team test, students can instantly reflect on how their group failed to capitalize on the knowledge of one or more of their members—strongly motivating them to keep it from happening next time (Watson, Michaelsen, & Sharp, 1991). Thus, over time, naturally extroverted or assertive members learn to do more listening and less talking, quieter students become much more active in team discussions, and cohesiveness increases because members develop a genuine appreciation for each other’s contributions.

Timely Feedback on Application-Focused Team Assignments

Providing immediate feedback on application-focused team assignments is just as important for learning and team development, but this typically presents a much greater challenge than providing immediate feedback on the RATs. Unlike the RATs, which are designed to ensure that students understand basic concepts, most application-focused team assignments are aimed at developing higher-level thinking skills in more complex situations. As a result, these assignments can be much more difficult to design and grade, but the task is fairly straightforward once you understand the key elements in the process (see chapter 3).
In fact, many assignments you already use can likely be modified to facilitate learning and team development as TBL application-oriented activities. For example, one instructor already used a series of case write-ups to develop her medical students' diagnostic skills. She used to require student groups to write a series of one-page memos identifying a preliminary diagnosis of the patients in each case. Unfortunately, groups almost always simply divided the cases across their members, which resulted in students actively working with (and learning from) only a fraction of the cases. Furthermore, because of the large class size, she had to spend considerable time reading responses for the grading.

When she started using TBL, she modified these assignments in two ways. First, she placed the emphasis on deciding on a diagnosis rather than writing about it. Second, she involved the teams in the assessment/feedback process. Now, she prescribes the same set of cases—all students must read the cases outside class and come prepared to help develop a diagnosis for each case. In class, however, the teacher adds a vital piece of new information to the assigned case and gives teams a specified length of time to either (a) select a more likely diagnosis from a limited set of alternatives, or (b) commit to a position that one simply cannot make a definite diagnosis with the information provided. When the time for deciding has elapsed, the teams hand in a one-page form on which they report their choice and the key items of evidence supporting their conclusion (for grading purposes). Once teams have turned in their decisions, she asks the teams to simultaneously hold up a numbered card revealing their diagnostic choice and then walks through the case with the whole class by having the teams defend their choice. In this form, the outcome of each case assignment is a series of lively discussions. The discussions first occur within the teams. Then, there is always a vigorous interchange between all teams, as students challenge the rationale for each other's choices. Further, the give-and-take discussions in both phases fosters concept understanding and team cohesiveness.

**Principle Four—Team Assignments Must Promote Both Learning and Team Development**

The development of appropriate group assignments is a critical aspect of successfully implementing TBL. In fact, most of the reported problems with learning groups (free riders, member conflict, etc.) are the direct result of inappropriate group assignments. When bad assignments are used, poor results are predictable and very nearly 100% preventable. In most cases, the reason that group assignments produce problems is that they are not really group assignments at all. Instead, the structure of the assignment is such that individuals working alone rather than members working together as a group wind up doing the actual work. Further, since discussion time is so limited, these kinds of assignments inhibit learning and prevent, rather than promote, team development.

The most fundamental aspect of designing effective team assignments is ensuring that they truly require group interaction. In most cases, team assignments will generate a high level of interaction if they (a) require teams to use course concepts to make
decisions that involve a complex set of issues, and (b) enable teams to report their decisions in a simple form. When assignments emphasize making decisions, intragroup discussion is the natural and rational way to complete the task. In contrast, assignments that involve producing complex outputs, such as a lengthy document, are likely to limit discussion because the rational way to complete the task is to divide up the work and have members individually complete their part of the total task. Therefore, tasks that can be divided among team members should always be avoided. (A thorough discussion of effective team assignments follows in chapter 3).

Conclusion

By adhering to the four essential principles of TBL, teachers ensure that the vast majority of groups will develop a level of cohesiveness and trust required to transform them into effective learning teams. Appropriately forming the teams puts them on equal footing and greatly reduces the possibility of mistrust from preexisting relationships between a subset of team members. Holding students accountable for preparing for and attending class motivates team members to behave in ways that build cohesiveness and foster trust. Using RAIs and other assignments to provide ongoing and timely feedback on individual and team performance enables teams to develop confidence in their ability to capture the intellectual resources of all their members. Assignments that promote learning and team development motivate members to challenge each other's ideas for the good of the team. Also, over time students' confidence in their teams grows to the point where they are willing and able to tackle difficult assignments with little or no external help.

PART TWO—IMPLEMENTING TBL

Effectively using TBL typically requires redesigning a course from beginning to end, and the redesign process should begin well before the start of the school term. The redesign process involves making decisions about and/or designing activities at four different points in time. These are (a) before class begins, (b) the first day of class, (c) each major unit of instruction, and (d) near the end of the course.

Before Class Begins

As described in chapter 1, traditional health professions education starts with a lengthy knowledge-acquisition/knowledge-application phase that spans several academic terms or even years. During that time, students take a series of lecture-based courses in which they are asked to absorb a great deal of knowledge that they will then later (sometimes much later) be asked to put to use.

TBL, however, uses a fundamentally different knowledge-acquisition/knowledge-application model. With TBL, students repeat the knowledge-acquisition/
knowledge-application cycle several times within each individual course. With TBL, students individually study the course content, discuss it with their peers and the instructor (see the RAP below) and immediately apply it in solving problems much like those they will face in professional practice. Thus, students in TBL courses develop a much better sense of the relevance of the material because they seldom have to make inferences about when and how the content might become useful in the real world. Rather than being filled with libraries of "inert knowledge" (Wheathead, 1929) from which they then later must extract needed information with great effort, students walk away from TBL courses having already begun the practical, problem-solving process of learning to use their knowledge in context.

This benefit, however, does not occur by accident. Designing a successful TBL course involves making decisions related to (a) identifying the instructional goals and objectives, (b) partitioning the course content into macro units and identifying the key concepts for each unit, and (c) designing a grading system for the course.

Backward Design

Designing a TBL course requires instructors to think backward to deal effectively with care design decisions. What do we mean by think backward? In most forms of higher education, teachers traditionally design their courses by asking themselves what they feel students need to know, then telling the students that information, and finally testing the students on how well they absorbed what they were told. In TBL, courses are not organized initially around what you want the students to know, but instead what you want them to be able to do. Wiggins and McTighe (1998) coined the term "backwards design" to describe the process of building courses this way, and its benefits are intuitively obvious: as any experienced doctor will tell you, being able to recite all the subtle differences between one form of a disease and another is a very different kind of knowledge than being able to quickly diagnose the correct form of that disease suffered by a real, living patient.

What are students who really "get it" doing? Imagine you are working shoulder to shoulder with students from not so long ago, and in a wonderful moment you see them do something that makes you think, "Hooray! They really got from my class what I wanted them to get—there's the evidence!"

When designing a course backward, the question you ask yourself is: What, specifically, is that evidence? What could students be doing in that wonderful moment to make it obvious they really internalized what you were trying to teach them and are putting it to use in the world?

For every course there are several answers to this question, and these different answers will correspond to the macro units of the redesigned version of the course. A given real-world moment will likely demand knowledge from one part of a course but not another. So for any given course, you should brainstorm about a half dozen of these proud moments in which a former student is making it obvious that he or she really learned what you wanted the student to learn. For now, don't think about...
the classroom, just imagine the student is doing something in a real clinical or laboratory context. Also, don’t be afraid to get too detailed as you visualize these moments—in fact, come up with as many details as you can about how this former student is doing what he or she is doing, what decisions the student is making, in what sequence, under what conditions, and so on.

These detailed scenarios become useful in three ways. First, the actions taking place in the scenarios will help you organize your course into macro units. Second, the scenarios will enable you to use your class time to build students’ applied knowledge instead of inert knowledge. Third, the details of the scenario will help you design the criteria for the assessments upon which you can base your students’ grades.

Once you have brainstormed your “Aha! They got it!” scenarios and the details that accompany them, let’s step into the classroom. Those half dozen or so scenarios are what you want your students to be able to do when they have completed your class: they are your instructional objectives. Now you are ready to ask three more questions:

1. **What will students need to know in order to be able to do those things?**
   Answers to this question will guide your selection of a textbook, the contents of your course packet, laboratory exercises, and will likely prompt you to provide supplementary materials of your own creation or, simply, reading guides to help students focus on what you consider most important in the readings or lab findings. In addition, it will be key in developing questions for the RATs (see below).

2. **While solving problems, what knowledge will students need to make decisions?**
   Answers to this question will help you import the use of course knowledge from your brainstormed real-world scenarios into the classroom. You may not be able to bring the actual clinical or laboratory settings in which your scenarios occurred into the classroom (although digital video, simulation mannequins, computer animations, and so on are coming much closer to approaching “real”), but you can provide enough relevant information about those settings to design activities that require your students to face the same kinds of problems and to make the same kinds of decisions they will make in the clinical and laboratory settings.

3. **What criteria separate a well-made decision from a poorly made decision using this knowledge?**
   Answers to this question will help you begin building the measures you will use to determine how well the students have learned the material and how well they can put it to use under specific conditions.

In summary, TBL leverages the power of action-based instructional objectives to not only expose students to course content but also give them practice using it. When determining an instructional objective, it is crucial to know how you are going to assess the extent to which students have mastered that objective. Some teachers feel that designing assessments first removes something from the value of instruction—that it simply becomes “teaching to the test.” Our view is that yes, you absolutely
should teach to the test, as long as the test represents (as closely as possible) the real use students will ultimately apply the course material to: what they are going to do with it, not just what they should know about it.

Designing a Grading System

The third step in redesigning the course is to ensure that the grading system is designed to reward the right things. An effective grading system for TBL must (a) provide incentives for individual contributions and effective work by the teams, as well as (b) address the equity concerns that naturally arise when group work is part of an individual’s grade. The primary concern here is typically borne from past group work situations in which students were saddled with free-riding team members and have resented it ever since. Students worry that they will be forced to choose between getting a low grade or carrying their less-motivated peers. Instructors worry that they will have to choose between grading rigorously and grading fairly.

Fortunately, all of the above concerns are alleviated by a grading system in which a significant proportion of the grade is based on (a) individual performance, (b) team performance, and (c) each member’s contributions to the success of their teams. As long as that standard is met, the primary remaining concern is that the relative weight of the factors is acceptable to both the instructor and the students. (Assigning relative weight is addressed in the next section.)

The First Hours of Class: Getting Started on the Right Foot

Activities that occur during the first few hours of class are critical to the success of TBL. During that time, the teacher must see that four objectives are accomplished. The first objective is ensure that students understand why you (the instructor and/or course director) has decided to use TBL and what that means about the way the class will be conducted. The second objective is to actually form the groups. The third and fourth objectives include alleviating students’ concerns about the grading system and setting up mechanisms to encourage the development of positive group norms.

Introducing Students to TBL

Because TBL is so fundamentally different from traditional instructional practice, it is absolutely critical that students understand both the rationale for using TBL and what that means about the way the class will be conducted. Educating the students about TBL requires (at a minimum) providing students with an overview of the basic features of TBL, how TBL affects the role of the instructor and their role as students and why they are likely to benefit from their experience in the course. This information should be printed in the course syllabus, presented orally by the instructor, and demonstrated by one or more activities.

In order to foster students’ understanding of TBL, we typically use two activities. The first involves explaining the basic features of TBL using overhead transparencies
(or a PowerPoint presentation) including a discussion of the way in which learning objectives for this course will be accomplished through the use of TBL, as compared to a course that is taught with a more traditional approach. (see Appendix D-A1.1 and D-A1.2 in Michaelson et al., 2002, 2004). The second activity, which, with class periods of less than an hour, might occur on day two, involves using part of the first class as a demonstration of a RAT (see below) using either the course syllabus or a short reading on TBL and/or about giving helpful feedback (see Michaelson & Schultheiss, 1988) as the content material to be covered.

Forming the Groups

As discussed above, two factors must be taken into consideration when forming the groups: (a) the course-relevant characteristics of the students, and (b) the potential for the emergence of subgroups. As a result, the starting point in the group formation process is to gather information about specific student characteristics that will make it easier or more difficult for a student to succeed in this class. For a particular course, characteristics that could make it easier for a student to succeed might include such things as previous relevant course work or practical experience, access to perspectives from other cultures, and so on. Most commonly, student characteristics making it more difficult for them to succeed are the absence of those that would make it easier, but might include such things as a lack of language fluency.

The second factor that can affect student performance in a group is the presence of built-in subgroups, for example, boy/girl friends, sorority/fraternity members, ethnic groups, and so forth. Regardless of the process used to form the groups, both of these categories of individual member characteristics need to be evenly distributed across the groups (for specific methods for grouping students see Michaelson et al., 2002, pp. 40-41; 2004, pp. 39-40; http://www.teambasedlearning.org; and chapter 6 in this book).

We recommend actually forming the groups in class in the presence of the students as a means of avoiding student concerns about ulterior motives the instructor may have had in forming groups. We begin the group formation process by simply asking questions about the factors that are important to group success. For a class in pharmacology, typical questions could include, “How many of you have worked as a pharmacist?”, “How many have completed more than one class in biochemistry?” “How many of you attended high school outside of the United States?” and so forth. Students respond to each of the questions either orally or with a show of hands. Then, we create a stratified sampling frame by having students possessing a series of specific assets form a single line around the perimeter of the classroom with the rarest and/or most important category at the front of the line. After students are lined up, we have them count off down the line by the total number of groups (five to seven members) in the class. All “ones” become Group 1, all “twos” become Group 2, and so on. Following this procedure rapidly creates heterogeneous (and approximately equivalent-ability) teams (see Appendix 2.A).
Alleviating Student Concerns About Grades

The next step in getting started on the right foot with TBL is to address student concerns about the grading system. Fortunately, student anxiety based on previous experience largely evaporates as students come to understand two of the essential features of TBL. One is that two elements of the grading system create a high level of individual accountability for preclass preparation and class attendance—counting individual scores on the RATs and basing part of the grade on a peer evaluation. The other reassuring feature is that team assignments will be done in class and will be based on thinking, discussing, and deciding, so it is highly unlikely that one or two less-motivated teammates members can put the group at risk.

Years of experience have taught us that the most effective way to alleviate student concerns about grades is to directly involve students in customizing the grading system to this class. Students become involved by participating in an exercise called Setting Grade Weights (Michaelsen, Cragin, & Watson, 1981; Appendix B in Michaelsen et al., 2002, 2004). Within limits set by the instructor, representatives of the newly formed teams negotiate with one another to reach consensus (i.e., all of the representatives must agree) on a mutually acceptable set of weights for each of the grade components: individual performance, team performance, and members' contributions to the success of their teams. After an agreement has been reached regarding the grade weight for each component, the standard applies for all groups for the remainder of the course.

Using Each Major Unit of Instruction

Units of instruction in TBL (each consisting of approximately 6–10 class hours) follow the activity sequence shown in Figure 2.1. As described in part one, each in-class activity should be designed to build students’ understanding of course content and increase group cohesiveness via proper design and immediate feedback.

FIGURE 2.1
Team-Based Learning Instructional Activity Sequence
Ensuring Content Coverage

In TBL, the basic mechanism to ensure that students are exposed to course content is the Readiness Assurance Process (RAP). This process occurs five to seven times per course and constitutes the first set of in-class activities for each of the major instructional units identified through the backward design activity (see above). It also provides the foundation for individual and team accountability as one of the building blocks of TBL (see above). The RAP has five major components: (a) assigned readings, (b) individual tests, (c) group tests, (d) an appeals process, and (e) instructor feedback (see Table 2.1). Each of the individual components is discussed in the following paragraphs.

Assigned Readings

Prior to the beginning of each major instructional unit, students are given reading and other assignments that should contain information on the concepts and ideas that must be understood to be able to solve the problem the instructor identified for this unit in the backward design activity (see above). Students are to complete the assignments and come to the next class period prepared to take a test on the assigned materials.

<table>
<thead>
<tr>
<th>TABLE 2.1</th>
<th>Readiness Assurance Process</th>
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<tbody>
<tr>
<td>1. Assigned Readings. In most instances, students are initially exposed to concepts through assigned readings.</td>
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<tr>
<td>2. Individual Test. Additional exposure during the individual test helps reinforce students’ memory of what they learned during their individual study (for a discussion of the positive effects of testing on retention see Nungester &amp; Duchastel, 1982).</td>
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<td>3. Team Test. During team tests students orally elaborate the reasons for their individual answer choices. As a result, they are exposed to peer input that aids in strengthening and/or modifying their schemata related to the key course concepts. In addition, they gain from acting in a teaching role (for a discussion of the cognitive benefits of teaching see Bargh &amp; Schull, 1980; Slavin &amp; Karweit, 1981).</td>
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<td>4. Appeals. During this step, teams are given the opportunity to restore credit on both the team and individual tests (for the members of their team). As a result, they are highly motivated to engage in a focused restudy of troublesome concepts from the readings.</td>
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<tr>
<td>5. Oral Instructor Feedback. Steps 1–4 enable the instructor to learn of any specific misunderstandings in relation to the key concepts covered in the test. In step 5, he or she provides corrective feedback and instruction aimed at resolving any misunderstandings that remain after the students have done the focused review in preparing their appeals.</td>
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**Individual Test**

The first in-class activity in each instructional unit is an individual RAT (IRAT) on the preclass assignments. The IRATs typically consist of multiple-choice questions that, in combination, enable the instructor to assess whether students have a sound understanding of the key concepts from the readings. As a result, the IRAT questions should focus on foundational concepts (and avoid picky details) but be difficult enough to create discussion within the teams (see Appendix A in Michelsen et al., 2002, 2004 for information on how to create effective IRATs).

**Team Test**

When students have finished the IRAT, they turn in their answers (which should be scored during the team test) and immediately proceed to the third phase of the RAP, the group RAT (GRAT). During the third phase, students retake the same test, but this time the teams must agree on the answers to each test question and immediately check the correctness of their decision using an Immediate Feedback Assessment Technique (IF-AT) self-scoring answer sheet that provides real-time feedback for the team GRATs. With the IF-AT answer sheets, students scratch off the covering of one of four (or five) boxes in search of a mark that indicates they have found the correct answer. If they find the mark on the first try, they receive full credit. If not, they continue scratching until they do find the mark, but their score is reduced with each unsuccessful scratch. This allows teams to receive partial credit for proximate knowledge (see Figure 2.2).

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**FIGURE 2.2**
IF-AT Answer Sheet

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**Immediate Feedback Assessment Technique (IF-AT)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Test #</th>
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**Subject**

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**Scratch off covering to expose answer**

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<tr>
<th>A</th>
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In our judgment, the IF-AT answer sheets are the single best way to provide timely feedback on the group RATs (not the IRATs, otherwise, members would know the answers before the team test and discussion would be pointless).

Getting truly immediate feedback from the IF-AT provides two key benefits to the teams.

- Truly immediate feedback enables members to quickly correct their misconceptions of the subject matter. Finding a star immediately confirms the validity of their choice, but finding a blank box lets them know they have more work to do.
- Truly immediate feedback creates a situation in which, with no input from the instructor, teams quickly learn how to work together effectively. In fact, IF-ATs virtually eliminate any possibility that one or two members might dominate team discussions. Pushy members are only one scratch away from having to “eat crow,” and quiet members are one scratch away from being validated as a valuable source of information and two scratches away from being told that they need to speak up.

The positive impact of the IF-AT on team development is nothing short of astounding. In our judgment, using the IF-ATs with the GRATs is the single most powerful tool one can use to promote learning and cohesiveness in classroom learning teams. Anyone who is not using them already is missing a sure-fire way to increase their effectiveness at implementing TBL.

The IF-AT forms can be ordered from the Web site http://www.epscineducation.com. When you order a set of forms, they come with different patterns of correct answers; this prevents students from simply memorizing the patterns. The teacher receives a key to find the correct answers on any given set of forms. Further, because they are only used for the team tests and can often be used for more than one GRAT, an initial order often covers the needs of several users and/or several years of use. Thus, the cost of the forms is quite reasonable.

Appeals

At this point in the RAP, students proceed to the fourth phase. This phase gives students the opportunity to refer to their assigned reading material and appeal any questions that were missed on the group test. That is, students are allowed to do a focused restudy of the assigned readings to challenge the teacher about their responses on specific items on the group test or about confusion created by either the quality of the questions or inadequacies of the preclass readings. Discussion among group members is usually very animated while the students work together to build a case to support their appeals. The students must produce compelling evidence to convince the teacher to award credit for the answers they missed on the group test. Teachers listening to students argue the fine details of course material while writing team appeals report being convinced their students learn more from appealing answers
they got wrong than from confirming the answers they got right. As an integral part of the RAP, this appeals exercise provides yet another review of the readings.

**Instructor Feedback**

The fifth and final part of the Readiness Assurance Process involves oral feedback from the instructor. This feedback comes immediately after the appeals process and allows the instructor to clear up any confusion students may have about any of the concepts presented in the readings. As a result, input from the instructor is typically limited to a brief, focused review of only the most challenging aspects of the preclass reading assignment.

**The RAP in Summary**

The RAP allows instructors to virtually eliminate class time often wasted in covering material that students can learn on their own. Time is saved because the instructor's input occurs after students have (a) individually studied the material, (b) taken an individual test focused on key concepts from the reading assignment, (c) retaken the same test as a member of a learning team, and (d) completed a focused restudy of the most difficult concepts. A cursory review of team-test results illuminates for the instructor which concepts need additional attention so that he or she can correct students' misunderstandings. In contrast to the concerns many instructors express about losing time to group work and not being able to cover as much content, many teachers report being able to cover more with the RAP than they can in a lecture. Leveraging the motivational and instructional power of the Readiness Assurance Test leaves the class ample time for students to tackle the application-oriented assignments to develop students' higher-level learning skills.

Beyond its instructional power, the RAP is the backbone of TBL because of its effect on team development. The RAP is the single most powerful team development tool we have ever seen because it promotes team development in four specific areas. First, starting early in the course (usually the first few class hours) the students are exposed to immediate and unambiguous feedback on individual and team performance. As a result, each member is explicitly accountable for his or her preclass preparation. Second, because team members work face to face, the impact of the interaction is immediate and personal. Third, since students have a strong vested interest in doing well as a group, they are motivated to engage in a high level of interaction. Finally, cohesiveness continues to build during the final stage of the process, namely, when the instructor is presenting information. Groups become more cohesive because, unlike lectures, the content of the instructor's comments is determined by the results of the RATs and is specifically aimed at providing value-added feedback to the teams.

Even though the impact of the RAP on student learning is limited primarily to ensuring that they have a solid exposure to the content, it is still an extremely valuable teaching/learning activity because it creates a feedback-rich learning environment. By
encouraging preclass preparation and intensive give-and-take interaction, this process also increases students' ability to solve difficult problems. Preclass preparation and lively discussion build the intellectual competence of team members and enhance their ability and willingness to provide high-quality feedback to one another. This, in turn, dramatically reduces the teacher's burden of providing feedback to individual students. As a result, the RAP provides a practical way of ensuring that, even in large classes, students are exposed to a high volume of immediate feedback that, in some ways, can actually be better than having a one-on-one relationship between student and instructor.

Promoting Higher-Level Learning

The final stage in the TBL instructional activity sequence for each unit of instruction is using one or more assignments that provide students with the opportunity to deepen their understanding by using the concepts to solve some sort of a problem. As outlined above (and discussed in detail in chapter 3 of this book), good application-focused group assignments foster give-and-take discussions because they focus on decision making (not writing) and enable students to share their conclusions in a form that enables prompt cross-team comparisons and feedback.

Several examples of potential application-focused assignments that meet these criteria are shown in Table 2.2. In each case, the assignment requires teams to use course concepts to make a complex decision that can be represented in a simple form (see chapter 3). As a result, because each of these assignments could be implemented so that teams could receive prompt and detailed peer feedback on the quality of their work, the assignments would also enhance learning and team development. Learning is enhanced because students would be forced to reexamine and possibly modify their assumptions and/or interpretations of the facts, and the teams become more cohesive as they pull together in an attempt to defend their positions.

Encouraging the Development of Positive Team Norms

Learning teams will only be successful to the extent that individual members prepare for and actually attend class. Fortunately, if students have ongoing feedback

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<th>Table 2.2 Examples of Decision-Based Assignments</th>
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From a list of two to five plausible, but differentially defensible, outcomes that are related to concepts from the course, have teams choose the one that would be most (or least) affected by (plug in an example from the list below):

- A specific temperature increase (in a course in chemistry or botany).
- A drop in the blood glucose level 30 minutes after the administration of a specific drug (in a course in pharmacology or biochemistry).
- A specific cardiac blood-flow pattern (in a course in cardiology).
Fundamental Principles and Practices of Team-Based Learning

emphasizing the fact that preclass preparation and class attendance are critical to their team's success, these norms will pretty much develop on their own. One very simple, yet effective, way to provide such feedback to the students is through the use of team folders. The folders should contain an ongoing record of each member's attendance, along with the individual and team scores on the RAT's and other assignments (see Appendix D-B1.1 in Michalsen et al., 2002, 2004). The act of recording the scores and attendance data in the team folders is particularly helpful because it ensures that every team member knows how every other team member is doing. Further, promoting a public awareness of the team scores fosters norms favoring individual preparation and regular attendance because doing so naturally focuses attention on the fact that there is always a positive relationship between individual preparation and attendance and team performance.

Near the End of the Term

Although TBL provides students with multiple opportunities for learning along the way, instructors can solidify and extend student understanding of course content and group process issues by using specific kinds of activities near the end of the term. These are activities that cause students to reflect on their experience during the past semester. Their reflecting is focused on several different areas. In most cases, these end-of-the-semester activities are aimed at reminding students of what they have learned about (a) course concepts, (b) the value of teams in tackling intellectual challenges, (c) the kinds of interaction that promote effective team work, and (d) themselves.

Reinforcing Content Learning

One of the greatest benefits of using TBL is also a potential danger—particularly in health professions schools. Since so little class time is aimed at providing students with their initial exposure to course concepts, many fail to realize how much they have learned that will aid them in taking the board exams. In part, this results from the fact that, based on the reduced volume of lecture notes alone, many medical students are somewhat uneasy and some may actually feel that they have been cheated. As a result, on an ongoing basis—and especially near the end of the course—instructors should make explicit connections between board and end-of-course exams and the RAT questions and application assignments. In addition, an effective way to reassure students is devoting a class period to a concept review. In its simplest form this involves (a) giving students an extensive list of the concepts from the course—especially those that are likely to appear on the board exam, (b) asking them to individually identify any concepts that they don't recognize, (c) compare their conclusions in the teams, and (d) review any concepts that teams identify as needing additional attention.
Concerns about better students being burdened by less-motivated or less-able peers are commonplace with other group-based instructional approaches. TBL, however, enables instructors to provide students with compelling empirical evidence of the value of teams for tackling difficult intellectual challenges. For example, in taking individual and team RATs, students generally have the feeling that the teams are outperforming their own best member, but they are seldom aware of either the magnitude or the pervasiveness of the effect. Near the end of each term, we create a transparency that shows five cumulative scores from the RATs for each team—the low, average, and high member score; the team score; and the difference between the highest member score and the team score (see Appendix D, Exhibit D-A7.3 in Michaelsen et al., 2002, 2004). Most students are literally stunned when they see the pattern of scores for the entire class. In the past 20 years, over 99.95% of the teams have outperformed their own best member by an average of nearly 14%. In fact, in the majority of classes, the lowest team score in the class is higher than the single best individual score in the entire class (e.g., see Michaelsen et al., 1989).

Recognizing Effective Team Interaction

Over time, teams get better and better at ferreting out and using members’ intellectual resources in making decisions (e.g., Watson et al., 1991). However, unless instructors use an activity that prompts members to explicitly think about group process issues, they are likely to miss an important teaching opportunity. This is because most students, although pleased about the results, generally fail to recognize the changes in members’ behavior that have made the improvements possible.

We have used two different approaches for increasing students’ awareness of the relationship between group processes and group effectiveness. The aim of both approaches is to have students reflect on how and why members’ interaction patterns have changed as their team became more cohesive. One approach is an individual assignment that requires students to (a) review their previous observations about the group, (b) formulate a list of changes or events that made a difference, (c) share their lists with team members, and (d) create a written analysis that addresses barriers to team effectiveness and keys to overcoming them. The other, and more effective approach, involves the same assignment but having students prepare along the way by keeping an ongoing log of observations about how their team has functioned (see Hernandez, 2002).

Learning About Themselves

One of the most important contributions of TBL is that it creates conditions that can enable students to learn a great deal about the way they interact with others. In large measure, this occurs because of the extensive and intensive interaction within the teams. Over time, two important things happen. One is that members really get to know each other’s strengths and weaknesses. This makes them better at teaching
each other because they can make increasingly accurate assumptions about what a given teammate finds difficult and how best to explain it to that person. The other is that, in the vast majority of teams, members develop such strong interpersonal relationships that they feel morally obligated to provide honest feedback to each other.

Although students learn a great deal about themselves along the way, the instructor can have a significant positive impact on many students' understanding of themselves by using a well-designed peer evaluation process (see chapter 9 in this book). In its simplest form, this involves formally collecting data from team members on how much and in what way they have contributed to each other's learning and making the information (but not who provided it) available to individual students.

Some prefer collecting and feeding back peer evaluation data two or more times during the term (usually in conjunction with major team assignments). Others favor involving teams in developing peer evaluation criteria partway through the term but only collecting the peer evaluation data at the very end of the term. The biggest advantage of collecting and feeding back peer evaluation data along the way is that it gives students the opportunity to make changes. The disadvantage is that having students formally evaluate each other can measurably disrupt the team development process.

PART THREE—BENEFITS OF TEAM-BASED LEARNING

In part, because of its versatility in dealing with the problems associated with the multiple teaching venues in medical education (see chapter 1), TBL produces a wide variety of benefits for students, for medical education administrators, and for individual faculty members who are engaged in the instruction process.

Benefits for Students

In addition to ensuring that students master the basic course content, TBL enables a number of outcomes that are virtually impossible in a lecture-based course format and rarely achieved with any other small-group based instructional approach. With TBL:

1. Most students progress well beyond simply acquiring factual knowledge and achieve a depth of understanding that can only come through solving a series of problems that are too complex for even the best students to complete through their individual effort.
2. Virtually every student develops a deep and abiding appreciation of the value of teams for solving difficult, complex and real-world problems.
3. Many students gain profound insights into their strengths and weaknesses as learners and as team members.
Benefits From an Administrative Perspective

Many of the benefits for administrators are related to the social impact that results from the fact that the vast majority of groups develop into effective learning teams. With TBL:

1. Almost without exception, the groups develop into effective self-managed learning teams. As a result, the faculty and/or professional staff time used for training facilitators and involvement in team facilitation is minimal.
2. Since TBL can be successfully employed in even large classes, the faculty cost of mandated increases in the use of active learning approaches becomes much more of a practical reality.

Benefits for Faculty

There is tremendous benefit for the faculty who use TBL. Because of the student apathy that is a natural response to the traditional lecture-based instruction, even the most dedicated faculty tend to burn out. By contrast, TBL prompts most students to engage in the learning process with a level of energy and enthusiasm that transforms classrooms into a place of excitement that is rewarding for them and the instructor. With TBL:

1. Instructors seldom have to worry about students not being in class or failing to prepare for the work that he or she has planned.
2. When students are truly prepared for class, interacting with them is much more like working with colleagues than with the "empty vessels" that tend to show up in lecture-based courses.
3. Because instructors spend much more time listening and observing than making formal presentations, they develop many more personally rewarding relationships with their students.
4. When the instructor adopts the, "It's about learning, not about teaching" view of the education process that is a normal outcome of the backward design aspect of TBL, instructors and students naturally tend to become true partners in the education process.

REFERENCES


