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TBL is a collection of practices that support one another for powerful instructional effect. This chapter describes the building blocks of team-based learning and the steps necessary to put them into place.

The Essential Elements of Team-Based Learning

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Team-based learning (TBL) possibly relies on small group interaction more heavily than any other commonly used instructional strategy in postsecondary education (for comparative discussion of different approaches, see Fink, 2004; Johnson, Johnson, and Smith, 2007; Millis and Cottell, 1998). This conclusion is based on three facts. First, with TBL, group work is central to exposing students to and improving their ability to apply course content. Second, with TBL, the vast majority of class time is used for group work. Third, courses taught with TBL typically involve multiple group assignments that are designed to improve learning and promote the development of self-managed learning teams.

This chapter begins with a brief overview of TBL. Next, we discuss the four essential elements of TBL and then walk through the steps required to implement them. Finally, we examine some of the benefits that students, administrators, and faculty can expect from a successful implementation of TBL.

A Broad Overview of TBL

The primary learning objective in TBL is to go beyond simply covering content and focus on ensuring that students have the opportunity to practice using course concepts to solve problems. Thus, TBL is designed to provide students with both conceptual and procedural knowledge. Although some time in the TBL classroom is spent ensuring that students master the course

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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 in the future. Figure 1.1 outlines generally how time in one unit of a TBL course is organized.

In a TBL course, students are strategically organized into permanent groups for the term, and the course content is organized into major units—typically five to seven. Before any in-class content work, students must study assigned materials because each unit begins with the readiness assurance process (RAP). The RAP consists of a short test on the key ideas from the readings that students complete as individuals; then they take the same test again as a team, coming to consensus on team answers. Students receive immediate feedback on the team test and then have the opportunity to write evidence-based appeals if they feel they can make valid arguments for their answer to questions that they got wrong. The final step in the RAP is a lecture (usually very short and always very specific) to enable the instructor to clarify any misperceptions that become apparent during the team test and the appeals.

Once the RAP is completed, the remainder (and the majority) of the learning unit is spent on in-class activities and assignments that require students to practice using the course content.

The Four Essential Elements of Team-Based Learning

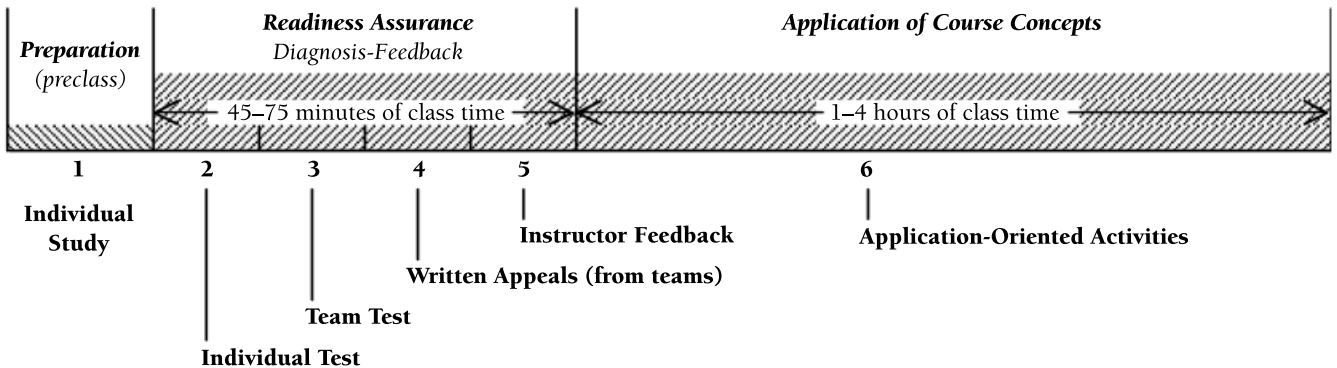
Shifting from simply familiarizing students with course concepts to requiring that students use those concepts to solve problems is no small task. Making this shift requires changes in the roles of both instructor and students. The instructor's primary role shifts from dispensing information to designing and managing the overall instructional process, and the students' role shifts from being passive recipients of information to one of accepting 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 and may even seem to be a dream rather than an achievable reality. They are, however, achievable when the four essential elements of TBL are successfully implemented:

- Groups. Groups must be properly formed and managed.
- Accountability. Students must be accountable for the quality of their individual and group work.
- Feedback. Students must receive frequent and timely feedback.
- Assignment design. Group assignments must promote both learning and team development.

When these four elements are implemented in a course, the stage is set for student groups to evolve into cohesive learning teams.

Figure 1.1. Team-Based Instructional Activity Sequence



Note: This sequence is repeated for each major instructional unit—typically five to seven per course.

Element 1: Properly Formed and Managed Groups. TBL requires that the instructor oversee the formation of the groups so that he or she can manage three important variables: ensuring that the groups have adequate resources to draw from in completing their assignments and approximately the same level of those resources across groups, avoiding membership coalitions that are likely to interfere with the development of group cohesiveness, and ensuring that groups have the opportunity to develop into learning teams.

Distributing Member Resources. In order for groups to function as effectively as possible, they should be as diverse as possible. Each group should contain a mix of student characteristics that might make the course easier or more difficult for a student to do well in the course (for example, previous course work or course-related practical experience) as well as demographic characteristics like gender and ethnicity. The goal here is to equip groups to succeed by populating them with members who will bring different perspectives to the task.

Findings in both group dynamics research (Brobeck and others, 2002) and educational research (Chan, Burtis, and Bereiter, 1997) illuminate the positive impact of diverse input in problem-solving discussions on both learning and performance. When group members bring many different perspectives to a task, their process of collaborative knowledge building in pursuit of consensus is powerful to watch. In addition, although member diversity initially inhibits both group processes and performance, it is likely to become an asset when members have worked together over time and under conditions that promote group cohesiveness (Watson, Kumar, and Michaelsen, 1993).

Minimizing Barriers to Group Cohesiveness: Avoiding Coalitions. Coalitions within a group are likely to threaten its overall development. In newly formed groups, either a previously established relationship between a subset of members in the group (such as a boyfriend and girlfriend or fraternity brothers) or the potential for a cohesive subgroup based on background factors such as nationality, culture, or native language is likely to burden a group with insider-outsider tension that can plague the group throughout the term. Because it is human nature to seek out similar others, allowing students free rein in forming their own groups practically ensures the existence of potentially disruptive subgroups (Fiechtner and Davis, 1985; Michaelsen and Black, 1994).

Time. Any group dynamics textbook will tell you that groups need time to develop into high-performing teams, regardless of whether you favor sequential or life cycle models (Tuckman, 1965; Tuckman and Jensen, 1977), cyclical models (Worchel, Wood, and Simpson, 1992), or adaptive or nonsequential models (McGrath, 1991). For this reason, 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.

Element 2: Student Accountability for Individual and Group Work. In lecture classes, there is no need for students to be accountable to anyone other than the instructor. By contrast, TBL requires students to be accountable to both the instructor and their teammates for the quality and quantity of their individual work. Furthermore, teams must accountable for the quality and quantity of their work as a unit. (For a review of the effects of accountability on an array of social judgments and choices, see Lerner and Tetlock, 1999.)

Accountability for Individual Preclass Preparation. Lack of preparation places clear limits on both 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 that the task was designed to stimulate. No amount of discussion can overcome absolute ignorance. Furthermore, lack of preparation also hinders the development of cohesiveness 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 that individual students be made accountable for class preparation.

Accountability for Contributing to The 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 activities such as individual preparation for teamwork, reliable class attendance, attendance at team meetings that may have occurred outside class, positive contributions to team discussions, and valuing and encouraging contributions from fellow team members. Peer assessment is essential because team members are typically the only ones who have enough information to evaluate one another's contributions accurately.

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, and the other is using procedures to ensure that such comparisons occur frequently and in a timely manner.

Element 3: Frequent Immediate Student Feedback. Immediate feedback is the primary instructional lever 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 (Bruning, Schraw, and Ronning, 1994; Kulik and Kulik, 1988; Hattie and Timperley, 2007). Second, immediate feedback has tremendous impact on group development (for a review, see Birmingham and McCord, 2004).

Element 4: Assignments That Promote Both Learning and Team Development. The most fundamental aspect of designing team assignments that promote both learning and team development is ensuring that they truly require group interaction. In most cases, team assignments generate a high level of interaction if they require teams to use course concepts to make decisions that involve a complex set of issues and enable teams to report their decisions in a simple form. When assignments emphasize making decisions, most students choose to complete the task by engaging each other in a give-and-take content-related discussion. By contrast, assignments that involve producing complex output such as a lengthy document often limit both learning and team development because they typically inhibit intrateam discussions in two ways. First, discussions are likely to be much shorter because students are likely to feel an urgency to create the product that is to be graded. Second, instead of focusing on content-related issues, they are likely to center on how to divide up the work. Thus, complex product outputs such as a lengthy document seldom contribute to team development because they are likely to have been created by individual members working alone on their part of the overall project.

Summary. By adhering to the four essential elements of TBL—careful design of groups, accountability, feedback, and assignments—teachers create a context that promotes the quantity and quality of interaction required to transform groups into highly 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 preparation and attendance motivates team members to behave in prosocial ways that build cohesiveness and foster trust. Using RAPs and other assignments to provide ongoing and timely feedback on both individual and team performance enables teams to develop confidence in their ability to capture the intellectual resources of all their members. Assignments that promote both learning and team development motivate members to challenge others' ideas for the good of the team. Also, over time, students' confidence in their teams grows to the point that they are willing and able to tackle difficult assignments with little or no external help.

Implementing Team-Based Learning

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 process involves making decisions about and designing activities at four different times: before class begins, the first day of class, each major unit of instruction, and near the end of the course. In this section, we discuss the practical steps a TBL instructor takes at each of these points, but for a treatment that is even detailed and practical, we direct readers to Michaelsen, Knight, and Fink (2004).

Before Class Begins. Traditional education, particularly in undergraduate programs, has tended to separate knowledge acquisition from knowledge application both between and within courses. In a typical biology course, for example, students listen to lectures through which they are expected to absorb a great deal of knowledge that they will then later be asked to put to use in a biology lab. In fact, even within higher-level courses, students often spend much of the term absorbing knowledge that they do not put to use until a project that is due just prior to the final exam.

TBL uses a fundamentally different knowledge acquisition and knowledge application model. With TBL, students repeat the knowledge acquisition and knowledge application cycle several times within each individual course. They individually study the course content, discuss it with their peers and the instructor, and immediately apply it in making choices that require them to use their knowledge. Thus, students in TBL courses develop a much better sense of the relevance of the material because they seldom have to make unreasonably large inferences about when and how the content might become useful in the real world. Rather than being filled with libraries of "inert knowledge" (Whitehead, 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 first identifying and clustering instructional objectives and then designing a grading system around them.

Identifying Instructional Objectives. Designing a TBL course requires instructors to "think backward." What is meant by "think backward"? In most forms of higher education, teachers 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 contrast, designing a TBL course requires instructors to "think backward"—backward because they are planned around what they want students to be able to do when they have finished the course; only then do instructors think about what students need to know. Wiggins and McTighe (1998) used the term *backward design* to describe this method of course design, which enables the instructor to build a course that provides students both declarative and procedural knowledge (in other words, conceptual knowledge and the ability to use that knowledge in decision making). This is a useful distinction, but if you have taught only with conceptual familiarization as your goal, it can be surprisingly difficult to identify what exactly you want students to be able to do on completion of a course. The following question is a good a good place to start.

What are the students who really understand the material doing that shows you they get it? Imagine you are working shoulder-to-shoulder with a former student who is now a junior colleague. In a wonderful moment,

you see that colleague do something that makes you think, "Hey! She really got from my class what I wanted her to get. There's the evidence right there!" When you are designing a course backward, the question you ask yourself is: "What specifically is that evidence? What could a former student be doing in a moment like that to make it obvious she really internalized what you were trying to teach her and is putting it to use in a meaningful way?"

For every course, there are several answers to this question, and these different answers correspond to the 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 she really learned what you wanted her to. For now, do not think about the classroom; just imagine she is doing something in an actual organizational context. Also, do not 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 she is doing, what decisions she 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 units. Second, the scenarios will enable you to use 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 on which you can base students' grades.

Once you have brainstormed the scenarios and the details that accompany them, you have identified your instructional objectives, which often involve making decisions that are based on insightful applications of the concepts from your course. Now you are ready to ask three more questions:

- *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, experiential exercises, and are likely to prompt you to provide supplementary materials of your own creation or simple reading guides to help students focus on what you consider most important in the readings or lab findings. In addition, the answers will be key in developing questions for the readiness assurance process.
- *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 organizational settings in which your scenarios occurred into the classroom, although computer simulations, video (including full-length feature films), and requiring students to learn by doing (see Miller, 1991, and Michaelsen and McCord, 2006) are coming much closer to approaching the real world. But you can provide enough relevant information about those settings to design

activities that require students to face the same kinds of problems and make the same kinds of decisions they will make in clinical and laboratory settings.
- *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 you are determining an instructional objective, it is crucial to know how 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. With TBL the view is that you should teach to the test as long as the test represents (as closely as possible) the real use to which students will ultimately apply the course material: what they are going to do with it, not just what they should know about it.

Designing a Grading System. The other 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 provide incentives for individual contributions and effective work by the teams, as well as 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 able or less motivated peers. Instructors worry that they will have to choose between grading rigorously and grading fairly.

Fortunately, many of these concerns are alleviated by a grading system in which a significant proportion of the grade is based on individual performance, team performance, and each member's contributions to the success of the 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.

The First Day of Class. Activities that occur during the first few hours of class are critical to the success of TBL. During that time, the teacher must accomplish four objectives: ensure that students understand why you (the instructor) have decided to use TBL and what that means about the way the class will be conducted, form the groups, alleviate students' concerns about the grading system, and set up mechanisms to encourage the development of positive group norms.

Introducing Students to TBL. Because the roles of instructor and students are so fundamentally different from traditional instructional practice, it is critical that students understand both the rationale for using TBL and

what that means about the way the class will be conducted. Educating students about TBL requires at a minimum providing them 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, and demonstrated by one or more activities.

In order to foster students' understanding of TBL, we recommend two activities. The first is to explain the basic features of TBL using overhead transparencies (or a PowerPoint presentation) and clearly spelling out how the learning objectives for the course will be accomplished through the use of TBL, compared to how the same objectives would be achieved using a lecture-discussion course format. The second activity is a demonstration of a readiness assurance process using the course syllabus, a short reading on TBL, or some potentially useful ideas, such as what helps and hinders team development or strategies for giving helpful feedback (see Michaelsen and Schultheiss, 1988) as the content material to be covered. (In a class period of less than an hour, this activity might occur on day 2.)

Forming the Groups. When forming groups, you must consider the course-relevant characteristics of the students and 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 the class. For a particular course, characteristics that could make it easier for a student to succeed might include previous relevant course work or practical experience or access to perspectives from other cultures. Most commonly, characteristics making it more difficult for students to succeed are the absence of those that would make it easier, but might include such things as a lack of language fluency.

We recommend forming the groups in class in the presence of the students to eliminate student concerns about ulterior motives the instructor may have had in forming groups. (For a depiction of how to form groups quickly and effectively, see Michaelsen and Sweet, 2008, and for a more detailed explanation and video demonstration, go to www.teambasedlearning.org.)

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 with divided-up group assignments 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, class attendance, and devoting time and energy to group assignments: counting individual scores on the readiness assurance tests 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 entire group at risk.

Many instructors choose to alleviate student concerns about grades by directly involving students in customizing the grading system to the class. Students become involved by participating in setting grade weights (Michaelsen, Cragin, and Watson, 1981; Michaelsen, Knight, and Fink, 2004). Within limits set by the instructor, representatives of the newly formed teams negotiate with one another to reach a consensus (all of the representatives must agree) on a mutually acceptable set of weights for each of the grade components: individual performance, team performance, and each member's contributions to the success of the team. 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.

Each Major Unit of Instruction. Each unit of a TBL course begins with a readiness assurance process (RAP), which occurs at least five to seven times each term. The RAP provides the foundation for individual and team accountability and has five major components: (1) assigned readings, (2) individual tests, (3) team tests, (4) an appeals process, and (5) instructor feedback.

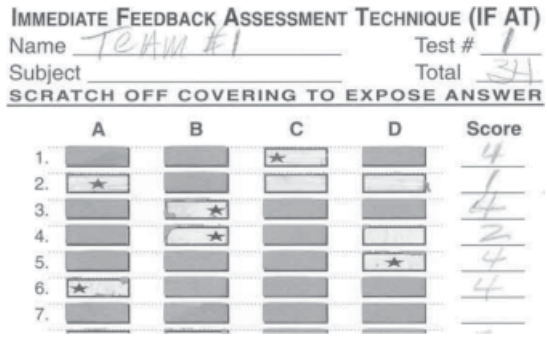
Assigned Readings. Prior to the beginning of each major instructional unit, students are given reading and other assignments that should contain information on the concepts and ideas that must be understood to be able to solve the problem set out for this unit. Students complete the assignments and come to the next class period prepared to take a test on the assigned materials.

Individual Test. The first in-class activity in each instructional unit is an individual readiness assurance test (iRAT) over the material contained in the preclass assignments. The tests typically consist of multiple-choice questions that enable the instructor to assess whether students have a sound understanding of the key concepts from the readings. As a result, the questions should focus on foundational concepts, not picky details, and be difficult enough to stimulate team discussion.

Team Test. When students have finished the iRAT, they turn in their answers (which are often scored during the team test) and immediately proceed to the third phase of the readiness assurance process, the tRAT. During this third phase, students retake the same test, but this time as a team, and the teams must reach agreement on the answers to each test question. They then immediately check the correctness of their decision using the intermediate feedback assessment technique (IF-AT), a self-scoring answer sheet (see Figure 1.2) that provides feedback on each team decision. With the IF-AT answer sheets, students scratch off the covering of one of four (or five) boxes in search of a mark indicating 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 find the mark, but their score is reduced with each unsuccessful scratch. This allows teams to receive partial credit for proximate knowledge.

The answer sheets are an effective way to provide timely feedback on the team RATs (not the iRATs—otherwise members would know the answers before the team test and discussion would be pointless). Furthermore, using

Figure 1.2. Immediate Feedback Assessment Technique



the answer sheets makes it possible to provide real-time content feedback to multiple teams without requiring them to maintain the same work pace.

Getting real-time feedback from the IF-AT provides two key benefits to the teams. First, it enables members to correct their misconceptions of the subject matter. Finding a star immediately after scratching the choice confirms the validity of it, and finding a blank box lets them know they have more work to do. Second, it promotes both the ability and the motivation for teams, with no input from the instructor, to learn how to work together effectively. In fact, those who have used the IF-ATs for their tRATs have learned that doing so virtually eliminates any possibility that one or two members might dominate team discussions. "Pushy" members are only one scratch away from embarrassing themselves, 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 impact of the IF-AT on team development is immediate, powerful, and extremely positive. In our judgment, using the IF-ATs with the tRATs is the most effective tool available for promoting both concept understanding and cohesiveness in learning teams. Anyone who does not use them will miss a sure-fire way to implement TBL successfully.

Appeals Process. At this point in the readiness assurance process, students proceed to the fourth phase, which gives them the opportunity to refer to their assigned reading material and appeal any questions missed on the group test. That is, students are allowed to do a focused restudy of the assigned readings (this phase is "open book") to challenge the teacher about their responses on specific items on the team 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. 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 readiness assurance process, this appeals exercise provides yet another review of the readings.

Instructor Feedback. The fifth and final part of the readiness assurance process is 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 Readiness Assurance Process in Summary. This process allows instructors to minimize class time that often is used instead to cover material that students can learn on their own. Time is saved because the instructor's input occurs after students have individually studied the material, taken an individual test focused on key concepts from the reading assignment, retaken the same test as a member of a learning team, and completed a focused restudy of the most difficult concepts. A cursory review of team test results illuminates for instructors which concepts need additional attention so that they 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 others report being able to cover more with the readiness assurance process than they can through lectures (Knight, 2004). Leveraging the motivational power and instructional efficiency of the readiness assurance process leaves the class a great deal of class time to develop students' higher-level learning skills as they tackle multiple and challenging application-oriented assignments.

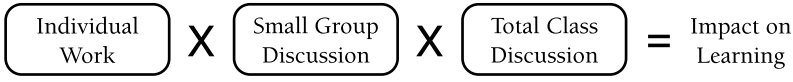
Beyond its instructional power, the readiness assurance process is the backbone of TBL because it promotes team development in four specific ways. First, starting early in the course (usually the first few class hours), students are exposed to immediate and unambiguous feedback on both individual and 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, students have a strong vested interest in the outcome of the group and are motivated to engage in a high level of interaction. Finally, cohesiveness continues to build during the final stage of the process when the instructor is presenting information. This is because unlike lectures, the content of the instructor's comments is determined by students' choices and actions during the readiness tests. Thus, the instructor's comments provide either positive reinforcement (they celebrate together) or corrective instruction (which, particularly in the presence of other groups, can be experienced as embarrassing and, in this way, provide an "external threat" that builds cohesiveness within a group). Although the impact of the readiness assurance process on student learning is limited primarily to ensuring that they have a solid exposure to the content, it also increases students' ability to

solve difficult problems for two reasons. First, by encouraging preclass preparation and a lively discussion, the process builds the intellectual competence of team members. Second, because they have immediate performance feedback, the experience of working together during the group and in preparing appeals heightens their ability and willingness to provide high-quality content feedback to one another. As a result, the readiness assurance process 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 having groups use the concepts to solve a problem. These application assignments must foster both accountability and give-and-take discussion first within and then between groups. Designing these assignments is probably the most challenging aspect of implementing TBL.

The key to creating and implementing effective group assignments is following what TBL users fondly refer to as the 4 S's: (1) assignments should always be designed around a problem that is *significant to students,* (2) all of the students in the class should be working on the *same* problem, (3) students should be required to make a *specific* choice, and (4) groups should *simultaneously* report their choices (Figure 1.3). Furthermore, these procedures apply to all three stages in which students interface with course concepts—individual work prior to group discussions, discussions within groups, and whole-class discussion between groups. The 4 S's are explained in the following paragraphs.

Figure 1.3. Keys to Creating Effective Group Assignments



To obtain the maximum impact on learning, assignments at each stage should be characterized by 4 S's:

- **Significant –** Individuals and groups should work on a problem, case, or question demonstrating concept's usefulness.
- **Same problem –** Individuals and groups should work on the same problem, case, or question.
- **Specific choice –** Individuals and groups should be required to use course concepts to make a specific choice.
- **Simultaneously report –** If possible, individuals and groups should report their choices simultaneously.

- *Significant problem.* Effective assignments must capture students' interest. Unless assignments are built around what they see as a relevant issue, most students will view what they are being asked to do as busywork and will put forth the minimum effort required to get a satisfactory grade. The key to identifying what will be significant to students is using backward design. If you identify something you want students to be able to do and give them the chance to try, it is likely that your enthusiasm will carry over to your students in a way that rarely happens when you organize your teaching around what you think students should know.
- *Same problem.* Group assignments are effective only to the extent that they promote discussion both within and between groups. Assigning students to work on different problems practically eliminates meaningful discussions because students have little energy to engage in a comparison of apples and oranges, and students will not be exposed to feedback on the quality of their thinking as either individuals or teams. In order to facilitate a conceptually rich and energetic exchange, students must have a common frame of reference that is possible only when they are working on the same problem, that is, the same assignment or learning activity.
- *Specific choice.* Cognitive research shows that learning is greatly enhanced when students are required to engage in higher-level thinking (Mayer, 2002; Pintrich, 2002; Scandura, 1983). In order to challenge students to process information at higher levels of cognitive complexity, an educational adage (sometimes attributed to William Sparke) is that teaching consists of causing people to go into situations from which they cannot escape except by thinking.

In general, the best activity to accomplish this goal is to require students to make a specific choice. Think of the task of a courtroom jury: members are given complex information and asked to produce a simple decision: guilty or not guilty. As a result, nearly one hundred percent of their time and effort is spent digging into the details of their content. In the classroom, the best way to promote content-related discussion is to use assignments that require groups to use course concepts to make decisions on questions such as these:

- Which line on this tax form would pose the greatest financial risk due to an IRS audit? Why?
- Given a set of real data, which of the following advertising claims is least (or most) supportable? Why?
- What is the most dangerous aspect of this bridge design? Why?
- Given four short paragraphs, which is the best (or worst) example of an enthymeme? Why?

For a much more thorough discussion of assignments and a rationale as to why they work so well in promoting both student learning and team development, see Michaelsen, Knight, and Fink, 2004).

- *Simultaneous reports.* Once groups have made their choices, they can share the result of their thinking with the rest of the class sequentially or simultaneously. The problem with sequential reporting is that the initial response often has a powerful impact on the subsequent discussion because later-reporting teams tend to change their answer in response to what seems to be an emerging majority view—even if that majority is wrong.

This phenomenon, which we call answer drift, limits both learning and team development for a variety of reasons. One is that it is most likely to occur when the problems being discussed have the greatest potential for producing a meaningful discussion. That is because the more difficult or ambiguous the problem is, the greater the likelihood is that the initial response would be incomplete or even incorrect, and subsequent groups would be unsure about the correctness of their answer. Another is that answer drift discourages give-and-take discussions because later responders deliberately downplay differences between their initial answer and the one that is being discussed. Finally, sequential reporting limits accountability because the only group that is truly accountable is the one that opens the discussion.

Requiring groups to simultaneously reveal their answers virtually eliminates the main problems that result from sequential reporting. Consider the question in a tax accounting course on an assignment requiring teams to choose a specific line on a tax form that would pose the greatest financial risk due to an IRS audit. One option would be for the instructor to signal the teams to simultaneously hold up a card with the line number corresponding to their choice (others simultaneous report options are discussed in Sweet, Wright, and Michaelsen, 2008). Requiring a simultaneous public commitment to a specific choice increases both learning and team development because each team is accountable for its choice and motivated to defend its position. Moreover, the more difficult the problem, the greater the potential is for disagreements that are likely to prompt give-and-take discussion, and the teams become more cohesive as they pull together in an attempt to defend their position.

Near the End of the Course. Although TBL provides students with multiple opportunities for learning along the way, instructors can solidify and extend student understanding of both course content and group process issues by reminding students to reflect on what the TBL experience has taught them about course concepts, the value of teams, the kinds of interaction that promote effective teamwork, themselves, and how certain aspects of the course have encouraged positive group norms.

Reinforcing Content Learning. One of the greatest benefits of using TBL is also a potential danger. 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. In part, this seems to result from the fact that with TBL, the volume of their lecture notes is far less than in typical courses. As a result, some students are a bit uneasy—even if they are aware that the

scores from TBL sections on common midterm exams were significantly higher than scores from non-TBL sections. As a result, on an ongoing basis—and especially near the end of the course—instructors should make explicit connections between 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 (1) giving students an extensive list of the key concepts from the course, (2) asking them to individually identify any concepts that they do not recognize, (3) compare their conclusions in the teams, and (4) review any concepts that teams identify as needing additional attention.

Learning About the Value of Teams. 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 both individual and team tests, students generally have the impression that the teams are outperforming their own best member, but 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 cumulative scores from the tests 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 Michaelsen, Knight, and Fink, 2004). Most students are stunned when they see the pattern of scores for the entire class. In the past twenty years, over 99.9 percent of the nearly sixteen hundred teams in our classes have outperformed their own best member by an average of nearly 11 percent. 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 (Michaelsen, Watson, and Black, 1989).

Recognizing Effective Team Interaction. Over time, teams get increasingly better at ferreting out and using members' intellectual resources in making decisions (Watson, Michaelsen, and Sharp, 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 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 assignment that requires students to individually reflect on how the interactions among team members have changed over time and formulate a list of members' actions that made a difference, share their lists with team members, and create a written analysis that summarizes the barriers to their team's effectiveness and what was done to overcome them. The

other, and more effective, approach is the same assignment, but students prepare along the way by keeping an ongoing log of observations about how their team has functioned (see Hernandez, 2002).

Learning About Themselves: The Critical Role of Peer Evaluations. 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, members 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. In addition, in the vast majority of teams, members develop such strong interpersonal relationships that they feel morally obligated to provide honest feedback to each other to an extent that rarely occurs in other group-based instructional approaches (see Chapter Two, this volume, for examples).

Encouraging the Development of Positive Team Norms. Learning teams will be successful only to the extent that individual members prepare for and attend class. We have learned, however, that when we provide students with ongoing feedback on attendance and individual test scores, the link between preclass preparation and class attendance team performance is so obvious that we can count on norms promoting preclass preparation and attendance pretty much developing on their own. One simple yet effective way to provide such feedback to students is 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 tests and other assignments (Michaelsen, Knight, and Fink, 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. Furthermore, promoting public awareness of the team scores fosters norms favoring individual preparation and regular attendance because doing so invariably focuses attention on the fact that there is always a positive relationship between individual preparation and attendance and team performance.

Benefits of Team-Based Learning. In part because of its versatility in dealing with the problems associated with the multiple teaching venues in higher education, TBL produces a wide variety of benefits for students, educational administrators, and 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. When TBL is well implemented, students can progress considerably beyond simply acquiring factual knowledge and achieve a depth of understanding that can come only through solving a series of problems that are too complex for

even the best students to complete through their individual effort. In addition, virtually every student develops a deep and abiding appreciation of the value of teams for solving difficult and complex problems. They can gain profound insights into their strengths and weaknesses as learners and as team members.

Compared to a traditional curriculum, faculty members in a wide variety of contexts have observed that introducing TBL enables at-risk students to successfully complete and stay on track in their course work, probably because of the increased social support or peer tutoring.

Benefits from an Administrative Perspective. Many of the benefits for administrators are related to the social impact of the fact that the vast majority of groups develop into effective learning teams. When team-based learning is well implemented:

- Almost without exception, groups develop into effective self-managed learning teams. As a result, faculty and other professional staff time used for training facilitators and involved in team facilitation is minimal.
- TBL is cost-effective since it can be successfully employed in large classes and across academic programs.
- The kinds of assignments characteristic of TBL reduce the potential for interpersonal hostilities within teams to develop to a point where administrators must deal with the personal, political, and possibly even legal aftermath.

Benefits for Faculty. There is tremendous benefit to faculty who use TBL. Because of the student apathy that seems to be an increasingly common response to 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 places of excitement that are rewarding for both them and the instructor. When team-based learning is well implemented:

- Instructors seldom have to worry about students not being in class or failing to prepare for the work that he or she has planned.
- When students are truly prepared for class, interacting with them is much more like working with colleagues than with the empty vessels who tend to show up in lecture–based courses.
- Because instructors spend much more time listening and observing than making formal presentations, they develop many more personally rewarding relationships with their students.

When the instructor adopts the view that the education process is about learning, not about teaching, instructors and students tend to become true partners in the education process.

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Effective Task Design for the TBL Classroom

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Group and team tasks are the culminating outputs of student learning in team and collaborative learning environments. How they are conceived and designed, therefore, can directly determine the success of the pedagogical strategy. A key design issue for creating effective tasks is how best to focus student knowledge, observation, and analysis toward a concrete action that makes thinking visible. Actions in the shape of clear decisions applied to complex scenarios, within a restricted framework of options, are most likely to channel student thinking toward higher-level goals. The authors provide principles and examples for designing group tasks in any discipline.

Introduction

Effective task design and management are at the heart of team-based learning (TBL). Whether or not the Readiness Assurance Process (the TBL process of testing students on their attempt to cover a unit of content on their own) is successful in preparing students to apply what they know, it is the collective decision making required by team tasks that truly focuses student learning, provides traction in the learning process, induces team cohesion, and stimulates general student enthusiasm. If the tasks are not carefully conceived and challenging in the right way, student focus drifts, classroom energy falls off, and teams fail to cohere. For this reason, task design should be a first concern for an instructor transitioning from more traditional teaching to TBL. Effective design and implementation of tasks can offset many problems, and can even carry to partial success an otherwise flawed TBL implementation. The purpose of this article is to

frame the challenge of task design conceptually, extract some principles based on that conceptualization, and offer examples showing how the principles can be put into practice in a range of disciplines.

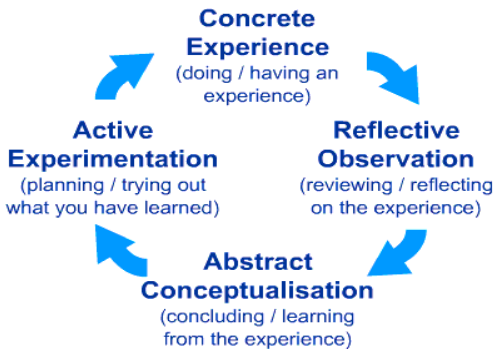
Tasks Make Learning Visible

A central tenet of TBL is that student learning is driven through frequent and, whenever possible, immediate feedback. In order for this to happen, student learning and consequent use of that learning in their thinking have to be made visible—to students themselves as well as to the instructor. Students, therefore, need to be required to *act* frequently in ways that generate consequences that provoke reflection and demonstrate visibly their thinking. The more focused and concrete the action, the more visible will be the thinking and the learning—and the more immediately useful will be the feedback.

Recent findings in neuroscience, cognitive science and psychology can help us visualize this key role of action in the learning process. Bransford (2000), for example, emphasizes the essential difference between understanding and memorization, citing numerous studies showing that simple rote learning does not lead to transfer of knowledge. Cognitive psychologist Willingham (2009) argues that "Memory is the residue of thought" (p. 54), meaning that thoughts are made manifest by actions, and only acting on information can transfer it from working memory to long-term memory. The work of neuroscientist Zull (2002 and 2011) reinforces these findings, showing that learning that has not been put into the service of action tends to remain dormant and through disuse becomes less retrievable from storage in the brain's neuronal networks.

Much of this work builds on earlier studies in psychology, namely Kolb's theory of experiential learning, depicted in Figure 1. This idea of the learning cycle is a useful guide in thinking about the process we are trying to foster in our students' cognitive functioning. The conception of learning as a cycle helps us to envision how our knowledge of the brain can be translated into successful classroom practice. In Kolb's description, the experience of an action leads to observing and reflecting on its consequences. This reflection is the first step in abstracting from the experience a conceptual understanding of what happened and what it might have meant. As abstract theorizing develops, opportunities for experimentation with the use of that knowledge should follow so that students can put their abstract understanding to the test. It is this ongoing interplay between abstract conceptualization and active, concrete experience that creates the possibility of storing learning and applying it to new situations.

Figure 1
The Kolb Experiential Learning Cycle
(from McLeod, 2010)



In the college classroom, one of the instructor's most important jobs is to design and *stage* opportunities for students to undergo this cyclical action-reflection-conceptualization-action process so that relevant information and ideas become fully networked in the brain. A comparable level of fully networked understanding is extremely difficult to build through less-active means—by sitting through a lecture, for example, or watching a video or reading a text. Our students need to construct their own conceptual understanding within the framework of active individual experience. Each action we ask them to take leads to reflection and greater awareness, which, in turn, leads to receptiveness to new information, integration of that information, and planning for new, more informed actions. In essence, we are helping our students work toward becoming more intentional and more expert in their thinking and actions, particularly with respect to our discipline. The assigned tasks that induce these actions drive learning. They, therefore, need to be integrally connected to the larger, overarching strategy of the course and directly tied to course learning goals.

Course Design, Task Design, and Disciplinary Thinking

More traditional, instructor-centric teaching practices tend to shape courses and curricula around disciplinary content. Syllabi are routinely

structured as sequences of topics that will be covered from week to week, and often track to textbooks with similar patterns. This approach to content can sometimes be a barrier to deep learning, as it does not capture the full scope of what it means to work and think within a discipline. The signature of a discipline, whether in the humanities, sciences, social sciences, or professional fields, is less its content (which might be shared among several disciplines) than its actions. Historians are historians not just because they deal with historical texts and artifacts, but because they use historical resources to inform actions that are typical of historians, such as reconstruction of a past event, evaluation of the influence of a particular person, and the like. Sociologists might (and often do) use those very same historical resources to inform a different set of actions, such as in the analysis of a contemporary sociological condition or the determination of how a social injustice came to exist. An economist might use the same resources yet again to inform her construction of a predictive model of behavior in a given set of market conditions.

A bit further afield, but no less relevant, an epidemiologist, trying to track the evolution of a virus over time, might have reason to explore these same historical resources because they contain evidence of behavior and circumstances related to the emergence of a pandemic. Specific information ("content") does not suffice to define a discipline. Disciplines are more clearly defined by how those working within the discipline collect, organize, assess, and use information.

The real difference, therefore, between novice and expert thinkers in our disciplines is not determined by the amount of information they have covered or even mastered, but rather by their relative ability to interact with that information. Course and task design need to be pointing students not toward simply knowing more, but ultimately toward more refined, more expert ways of responding to and using information. If we want our students to become more expert in our disciplines, we need to structure their encounters with content in ways that change what they can *do* with knowledge.

Implications for Task Design

The most clarifying action a student can take is to make a decision. Requiring collective decision-making provides an opportunity for students to practice the kind of thinking we want to promote in our courses and disciplines and is the starting point for effective overall TBL course design. A well-constructed decision-based task integrates components of higher-order thinking: analysis of the particular situation to deter-

mine competing priorities and values; various lines of reasoning; use of relevant concepts, principles, laws, or other abstractions at play in the situation; reflective, critical thinking *(Are we sure of these facts? Are we sure we understand?);* and, ultimately, a judgment that is expressed in a visible, concrete action/outcome that can be evaluated. Effective team tasks point students consistently toward making decisions that reveal reasoning and understanding in service of a judgment. The judgment students make ideally will replicate as much as possible the kinds of judgments made by disciplinary thinkers.

In order to put students on this track, we first need to identify and characterize the kinds of actions and decisions that thinkers in our disciplines execute frequently. Then we can reverse engineer situations where students practice doing these very things. In this way, we ensure that students also practice using the targeted disciplinary content of the course. Here are some key questions that can help us begin the process:

- What do people in your discipline do with the information they collect and/or use? What kinds of problems do they try to solve?
- What is characteristic about the way practitioners of your discipline think—that is, how do they approach and enter problem-solving? How do they reason?
- What kinds of judgments do experts in your discipline have to make?
- What assumptions consistently inform their decisions and other actions?
- What are the discipline-specific actions and types of decisions that a successful student will be ready to carry out as a result of your course?

Jotting down several items for each of these questions will help instructors characterize and eventually locate or invent the types of tasks that will be relevant to the learning targets of their course. What follows are a few basic examples of decision-making in various disciplines.

- *Economics*: Decide which patterns of buyer behavior can be determined from a given set of consumer data.
- *Sociology*: Decide what might be the implications of a new data set for understanding a specific social phenomenon.

- *Philosophy*: Decide whether a given action is just or rational, according to specific criteria or values.
- *Business*: Decide which marketing strategy to use, given background data and consumer circumstances.
- *Literature*: Decide what patterns an author has constructed to influence reader perceptions.
- *Writing and Rhetoric*: Decide which evidence would work best to support a given thesis.
- *History*: Decide which account of an historical event is most convincing, given competing perspectives and evidence.
- *Biology*: Decide (predict) which environmental conditions will most alter an organism's DNA.
- *Chemistry*: Decide (predict) how a given molecular structure will be changed by contact with other specific types of molecules.
- *Math*: Decide which variables are significant or which calculation strategy will produce the most valid or accurate result.

From this macro perspective, in which we identify globally what students need to be doing daily in order to practice disciplinary thinking, we are ready to move to the micro-level and look at more specific elements of task design. The most successful TBL courses are those in which the instructor maintains the macro-micro perspectival exchange throughout the course. Keeping an eye trained on the macro while working on the micro will also facilitate the selection of material and formats for team tasks and other assignments. The daily, specific team tasks need to inform and align with the bigger actions (such as major graded assignments)—and vice versa.

Situating Team Tasks in a Learning Sequence

For tasks to be perceived as authentic and valuable learning opportunities, students need a clear sense that they are serving the stated learning goals and disciplinary thinking goals considered above. This is particularly true when we want to challenge students at a high level, such as by asking them to make decisions that they perceive to be above their current level

of expertise. If they do not value the kind of thinking we are asking them to practice, they may be resistant to the challenge. In this context, tasks serve various tactical purposes at different times.

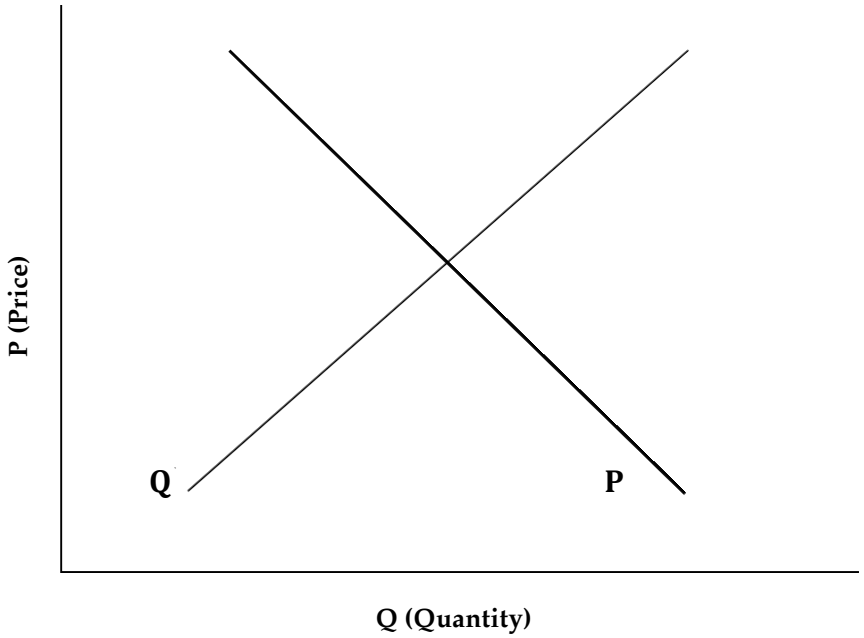
Before the RAP: Use Naïve Tasks to Launch a Learning Sequence

A common source of pushback early in a TBL course is students' mistaken belief (sometimes unintentionally reinforced by a "helpful" instructor) that they cannot do the reading on their own. In the face of resistance, many instructors will instinctually move toward one of two problematic practices: (1) giving students a highly detailed reading guide or set of questions to answer or (2) lecturing before the I-RAT. Either of these will undermine the goals of TBL. One way to avert this situation is the use of *naïve* tasks.

Naïve tasks occur at the very beginning of a learning sequence—even before the reading assignment—and are designed to induce an attitude of inquiry. When designed and managed appropriately, they serve to challenge students to test their preconceptions and practice their reasoning before being exposed to the targeted unit of content. In this way, naïve tasks serve to surface pre-existing errors in student thinking. More important, though, making and defending a decision before having access to key information promotes the perception that the information, when it is eventually provided, will be a valuable tool or resource. Consequently, students will be more likely to undertake the reading assignment with greater enthusiasm because the readings are no longer a mere requirement. They are, instead, perceived by students as being useful for the purpose of assessing and improving their own thinking.

Naïve tasks provoke curiosity and function as a kind of reading guide without becoming a crutch that reinforces students' learned helplessness the way more direct instruction can do. Reading with a specific, self-corrective purpose also replicates the way actual experts (and our brains in general) approach and respond to new information. The naïve task strategy therefore supports the long-term goal for students to begin honing their intuitions about thinking in the discipline. The example below is a naïve task from a course in economics. It can be used to introduce the fundamental concept of "elasticity" or as practice to develop deeper understanding after a general conceptual introduction. This task can be set up using a graph and a brief explanation of how the axes and curves show schematically the supply and demand relation to price within any given market. For example, Figure 2 illustrates elasticity as a concept used for measuring how likely change in a given market factor (for instance, quantity/supply) might influence another factor (for instance, demand/price).

Figure 2
Elasticity



Students are then asked to choose an answer to the following:

> Which of the following will NOT cause a shift in the demand curve for ice cream?
>
> A. The government gives every family $500 tax rebates.
>
> B. The price of frozen yogurt doubles.
>
> C. There is report that milk products used to produce ice cream have special health benefits.
>
> D. The price increases by $1.
>
> E. None of the above—these all cause shifts in demand.
>
> (*example supplied by Shawn Bushway, Criminal Justice, University at Albany*)

After students have proposed and debated possible answers to this question with their teams in class, they are ready to tackle the reading, which is a more systematic presentation of market forces. Because the naïve task has already driven students to grapple with the concepts presented in the reading, they will now read actively, with an eye toward the kinds of judgments and decisions they will be able to make, once they have understood the new information.

Here are some sample naïve tasks from other disciplines:

- *History*: Read this paragraph (from an unknown source). In which decade do you think it was written? Why?
- *Anatomy*: Look at this photo of a liver. What does it suggest about the health condition of the person it belongs to? Why?
- *Literature*: Read this paragraph. Predict the actions and fate of the character you see described, based on the limited information provided (and be ready to say why.)
- *Engineering*: Look at this design of a bridge. In an earthquake, which element is most at risk of failure? Why?
- *Computer Science*: Look at this sequence of code. Which series of actions is it designed to execute in the robot? Why?
- Various disciplines: Read this specific claim/statement. Which of the following theories does it appear to represent/support?

While naïve team tasks can be used at the very beginning of the RAP before students have read, they can also be used during the "informed" application task phase of a sequence. In the latter case, naïve tasks prepare students for new concepts that build on those already encountered in the core readings (discussed below).

Finding the appropriate level of difficulty for naive tasks is essential to their success: The tasks need to require a real judgment and a concrete decision based on that judgment rather than merely ask students to supply or apply basic knowledge. By asking students to act in the face of "insufficient information," naïve tasks validate the role of information when it finally lands. In order to create room for information, a naïve task needs to be difficult enough that most teams will struggle and likely arrive at the wrong answer at first.

Beyond the level of difficulty of the task, cultivating an atmosphere of playfulness is essential to encourage teams to persist in the face of this difficulty. Students have to feel an intrinsic reward for "playing along" and even getting the wrong answer. Handling wrong answers is also a crucial moment for instructors—we need to acknowledge their errors in thinking while demonstrating that with more information, the challenge we have presented is surmountable. Finally, a publicly reported team decision is essential so that students are held accountable for their current thinking (like experts and professionals) and have an opportunity to re-examine their position in light of other students' responses to the same challenge.

Because naive tasks are intended to induce reflection and surface common student misconceptions rather than evaluate students' final level of learning, and because students need encouragement to take risks in their thinking, the stakes for naïve tasks should remain low. This means that they will most likely be ungraded, or at most be good for bonus points, in order to minimize the perceived cost of error. The psychological support of the team is also a fundamental component of naïve tasks. The team structure allows students to be less self-conscious about errors than when they feel they are individually accountable.

After the RAP: "Informed" Tasks That Put Knowledge to Use

An essential difference between a traditional course and one designed for TBL is the role of content. In a TBL course, acquisition of course content/knowledge is not the primary learning goal, but it is the vehicle for students to practice specific ways of thinking and acting. "Informed" tasks, as opposed to naïve ones, ask students to convert their reading, understanding, and reasoning into judgments and clear decisions that make the learning and thought process visible.

There are multiple levels of informed tasks, and one of the first challenges facing new TBL adopters is creating lower-level tasks that require real judgments and authentic decisions rather than simple plug-in responses. It is important to keep in mind that the Readiness Assurance Process has confirmed basic understanding, and this does not need to be repeated. Tasks that aim too low and ask only for basic recall/recognition/rote memorization create little opportunity for meaningful struggle. These tasks will often lead the most diligent students on the team to dominate the conversations because they can simply rely on their memory or superior reading skills, and less diligent students will learn that they can freeload. This will not only undercut intellectual development, but will also compromise team cohesion.

Assessing basic understanding is typically best suited for individuals (in a homework task, for example). However, if the instructor does decide to review basic understanding of concepts using team tasks, these should minimally ask students to *interpret* or *translate* ideas and information so as to demonstrate understanding rather than recall. Lower-level application tasks, which ask students to *transfer* conceptual knowledge to concrete situations and specific examples, also can be used to review and/or confirm basic understanding.

Bloom's Taxonomy (1956) is the best-known model for classifying learning objectives by level of intellectual challenge. The simplified version in Figure 3 is a useful distillation of the taxonomy into three basic cognitive levels and suggests some types of tasks that will lead to actions corresponding to each category.

What follows are some elaborated suggestions for framing tasks that address skills at the various levels.

Knowledge/Comprehension (framed as interpretation, transfer, and simple application):

- Rank the following statements from most to least effective in summarizing the author's argument about X. (interpretation)
- Assign the following new statement to one of the three categories identified by the author. (transfer, simple application)
- According to the chapter, which of the following (new statements) would be an acceptable definition of X? (interpretation)
- According to the reading, which of the following (new items) would be the best example of concept X? (transfer, simple application)
- *Physics*: According to the reading, which kind of stress is most likely to be at work when force is applied at point A in the following (new) diagram? (transfer, simple application)
- *History*: Now that you know the definition of "dynasty" from the readings, which of the following (new) examples from history is most representative of the concept? (transfer, simple application)

Figure 3
Bloom's Taxonomy (Simplified)

Synthesis/Evaluation	• Predict consequences • Predict patterns • Make judgments
Application/Analysis	• Find causes • Find patterns •Conduct comparisons
Knowledge/Comprehension	• Recall information • Restate accurately • Translate into new language

- *Social Work*: Which theory covered in the reading provides the best explanation of what occurred in this (new) case of child abuse? (transfer, simple application)

Analysis (framed as comparison, contrast, analytical differentiation):

- Which factor in the given list below would you weigh most heavily in a diagnosis of X (a new case)?
- Which of the following theories (that you just read about) would be most useful in predicting the outcomes of this (new) process?
- Which of the following (new) statements is consistent/not consistent with the writer's perspective?
- Which of the following claims about X phenomenon could be explained/defended/refuted by an application of Y theory?

The highest-level tasks require more complex processing and use of knowledge. They target broader judgments that reference multiple factors and thereby call for expert-like decision-making:

Advanced Analysis, Synthesis, and Evaluation (framed as expert-like judgments that integrate understanding for complex decisions):

- Rank the following strategies/recommendations / explanations in terms of which would be the most effective, in light of the theories we just read about.
- Given the facts of this scenario, and the competing priorities, decide upon which of the following recommendations you would make first.
- Analyze this new data set: Based on the theories covered in the reading, and given what you now know about X, which of the following explanatory hypotheses has the most credibility?
- Based on the facts as you now interpret them, evaluate the relative truth of the following claims by ranking them.

As most of these latter examples show, one reliable technique for writing higher-level tasks is to think in terms of situations, scenarios and cases that are typically encountered in the discipline. Brookfield (2011) provides an effective overview, with examples, of "Scenario Analysis" techniques, in *Teaching for Critical Thinking*. Scenarios allow you to embed many variables that can be used to introduce multiple concepts, theories and perspectives into students' discussion, as well as to complicate the task, if desired, through a mix of relevant factors and red herrings.

Promoting Critical Thinking Through Task Design

Critical thinking is a productive consequence of intellectual frustration. It begins to occur at that moment where knowledge, insight, reasoning, and other assets prove to be inadequate for addressing with complete confidence the problem at hand: Students are forced to make a decision that stretches them. This is the moment where they will finally adopt a critical thinking attitude and ask themselves, "What are we really sure of? Are we making the right assumptions? Are we overlooking something because we are biased? Have we exhausted all possibilities? Do we have access to any additional information? What does our best judgment tell us? What are the potential consequences of any of our possible actions? Which of those consequences are we most willing to accept?"

The emergence of critical thinking in the TBL classroom is closely interwoven with the building of team coherence. Team coherence and critical thinking both develop when students are forced to consider, respect, evaluate, and respond to the positions and ideas of other team members. This rarely occurs when the task is open-ended, such as in a brainstorm

or other "generate solutions" assignments. As long is as it is possible to believe that "one idea is just as good as another—we don't need to evaluate and prioritize," many students (and most humans!) will shy away from the hard work of real thinking.

The function of the collective decision task, therefore, is to place a restrictive frame around the team's action. This restriction forces the team to evaluate, integrate and, if needed, respectfully discount a team member's inputs *en route* to a judgment and a focused decision. A sound idea, a persuasive line of reasoning or a convincing argument will eventually emerge when it withstands the critique of all team members. As the team's coherence develops, so do the comfort, freedom and willingness of individual members of the team to speak frankly about the value of any other team member's idea.

A secondary but nevertheless important dimension of this centripetal pressure on teams is time limitation. As long as students have the impression that a decision can be deferred or deflected ("we don't have enough time, so we give up"; "we need more information, so we won't respond") critical thinking will not readily occur. Time limits on tasks and the expectation that reporting will happen, finished or not, are therefore essential.

Finally, a crucial element of the critical-thinking process is making mistakes: if students are to develop an attitude of persistence in the face of difficulty, they must become experienced in confronting and reflecting candidly on the errors in their thinking. This means that it is essential for teachers to balance the pressures created by forced decisions and time limits with a healthy respect for honest, thoughtful mistakes. In fact, instructors must force students to make errors that will create opportunities for careful consideration of where their prior knowledge and ways of thinking are insufficient. Creating this atmosphere requires a mix of graded and ungraded team tasks, careful attention to team-building, and strategic debriefing of tasks to induce productive reflection. The 4-S principles of task design are essential to fostering this environment.

Principles of Task Design: Elaboration on Michaelsen's 4 S's

We begin this section by referencing the original framework for TBL task design, conceived first by Michaelsen, Knight, and Fink (2004) as the 3-S's, then later revised by Michaelsen and Sweet (2008) to become the 4-S's:

- Significant problem
- Specific choice

- Same problem
- Simultaneous report

The longer we have worked with these principles, the more relevant and empowering they have proven to be. Each of the S's captures a necessary dimension of task design and management. "Significant problem" and "specific choice" establish how the task will be drawn from content and structured for student action. "Same problem" and "simultaneous report" address how the task will be administered and managed. In the following paragraphs, we seek to build out from these principles, by elaborating on their original rationale and by supplying some examples of how they can be operationalized.

1. Significant Problem: Selecting Content for a Task

What is truly problematic in your field and in the content you are teaching? What is difficult to understand fully and to resolve? In order for students to engage with your content at a high level, they have to believe that what they are struggling to do really matters. Tasks, therefore, need to address questions that are compelling in your discipline. The best tasks ask students to make judgments and decisions that parallel those of experts exposed to similar (or, at least, parallel, analogous) circumstances, conditions and information. A truly *significant problem* is, ideally, one where the teams' responses may not fully resolve the issue; they serve mainly as the pretext and entry point for inquiry and reflection. In fact, the very best problems (which may or may not be within the scope of your particular course) point toward disagreements among experts in the field—problems where different paths can lead to credible and defensible solutions.

When the problem is significant, real learning occurs during the debriefing of the task. If the debriefing discussion ends shortly after students show their answers, the challenge may not have been sufficiently problematic or, therefore, truly significant. In the best of cases, there will be substantial disagreement among the teams, but even when all teams have chosen the "correct" or "best" answer, a truly significant problem can still lead to a lively discussion in the debrief, as students will still need to explain and justify their thought processes, which may vary across teams.

Tasks that can be accomplished by applying simple knowledge in a single-step reasoning process to arrive at an answer are unlikely to challenge students meaningfully. Similarly, tasks that simply elicit an opinion, impression, or personal perspective will fall short of the mark. Tasks that allow students to stumble upon a correct answer without having engaged

in a rigorous thought process are destined to be trivial. *To be effective and authentically significant a task has to lead students to a decision point that invites—and may even demand—the question "Why?"* "Why?" is the doorway to course content and disciplinary thinking—and to meaningful inter-team conversations.

2. Specific Choice: Delimiting Student Action

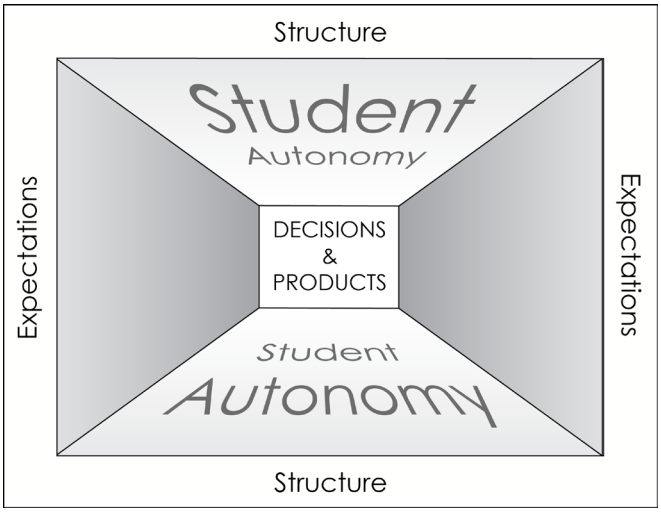
Our instincts sometimes tell us that the best way to lead students toward a full exploration of multiple perspectives is to start discussions with a wide-ranging question or set of questions that will open several possible avenues of inquiry. Whenever we tell students to "discuss," we envision that they will use the collective wisdom of their group to converge toward meaningful possibilities. The problem with this approach among relative novices is that they often take the conversation in directions that may not be highly productive. Contrary to our instincts, we need to shape and stage student conversations around tasks that more carefully direct them toward a productive outcome, a *specific choice*. Figure 4 uses the image of a tunnel to communicate the dynamic of an effective discussion. At the outset of the process is the frame that establishes the field of action. The format of the question structures the discussion and sets expectations for how it will be reported. At the other end of the process is the moment of public accountability, in the form of the proposed solution (product or decision) that emerges from the team discussion. Between these two moments, the teams experience a sense of relative autonomy. They are free to exploit any means at their disposal to find and evaluate all relevant possibilities in the process of reaching the conclusion supported by all team members.

Tasks that direct students toward a specific choice do not stifle student thinking but concentrate it so that feedback on the task can be directed at specific, anticipated discoveries and realizations. Restricted decision making allows the instructor to ensure the terms of the whole class debrief. The forced compare-and-select approach means that students will be engaged in very specific points of analysis during the team decision-making process. A broader-ranging discussion can follow during the task debrief, after students have begun to sort through the possibilities that the instructor has provided.

What follows is an example of how a typical discussion prompt becomes a TBL question. Consider a typical group discussion prompt (from a course in sociology):

> Discuss the factors that Karlsen, writing in *The Devil in the Shape of the Woman*, argues are relevant in an accusation of witchcraft. What seems to be important?"

Figure 4
The Shape of the Learning Process in a TBL Course



A TBL decision task prompt could read as follows:

> Based on your reading in Carol Karlsen's *The Devil in the Shape of the Woman*, which of the following would she consider the most relevant factor in an accusation of witchcraft?
>
> A. Accuser's concern with maleficium
>
> B. Accuser's gender
>
> C. Accuser's relationship with clergy
>
> D. Accused's relationship with clergy
>
> E. Accused's age

Here we have pointed the teams' conversations to a limited set of possibilities, and in doing so we have ensured that students will weigh exactly the factors we want them to weigh. If there are other issues that are important, we will have the opportunity to bring those out in the debrief of the team answers.

The example above demonstrates one obvious strategy for creating specific choice tasks: multiple-choice questions. Below are several other

formats that can also lead to simultaneously reportable, focused choices.

Ranking: Rank the following solutions in order of their plausibility (Debrief: Report highest or lowest).

Sorting: In the envelope on your table are strips of paper, each listing a statement about X phenomenon. Sort them according to the 4 theories we have been studying (Debrief: Report whole solutions on poster; or, ask students to announce by show of cards how they categorized an individual item).

Scoring: Read the following excerpt. On a scale of 1-4, assign a score that indicates how successfully this writer has applied X principle.

Sequencing (chronological; procedural; logical; narrative): Place the following events from American history in chronological order; or place the following steps in the order that represents the most effective procedure for solving X problem.

True/False: Evaluate the following statements and decide as a team whether they are true or false. Be prepared to explain and defend your team's answers:

- Humans are more highly evolved than ants.
- Over time, species evolve into better or more highly evolved species.

(*example supplied by Kristina Spaulding, Psychology, University at Albany*)

What does not belong? Look at this slide (not shown) that lists nine consumer behaviors. With your team, select the five (or three, etc.) behaviors that research has shown to be most greatly affected by an economic downturn.

Matching: Figure 5 provides an example of a task based on matching.

3. Same Problem: Strategic Task Administration

Same problem can be one of the least intuitive elements of 4-S design, because it runs counter to many traditional beliefs about teaching. As information in the disciplines continues to expand, we feel increasing pressure to "cover" as much content as we possibly can in any given class period. Well-meaning instructors may believe that one way to achieve this coverage—and to remove ourselves from the center of our classrooms—is to create situations where students "teach" each other. To achieve this,

Figure 5
Matching

Match the claims in list 1 with the correct causal mechanisms in list 2.

List 1: Claim	*List 2: Causal Mechanism*
A. Farm subsidies increase production.	1. Slaughterhouses have become fewer and larger.
B. Market concentration in food production and distribution leads to increased subsidies.	2. The policy lowers the cost per unit, which leads to an increase in demand for the good.
C. High corn yields cause negative externalities, such as pollution runoff.	3. HFCS lowers the cost of soda, which increases consumption.
D. E coli infections have increased dramatically.	4. Fertilizers and pesticides increase production per acre.
E. Corn subsidies increase child obesity.	5. Many former executives served in the USDA and FDA.

(*Example supplied by David Rousseau, Rockefeller College of Public Affairs & Policy, University at Albany*)

we divvy up tasks, asking each group to be responsible for one element of the content and then to share their findings with the rest of the class. But when it comes time to report and "teach" the others, there is little intrinsic motivation for students to care or listen. Rather than inspiring curiosity about what the other groups have to say, the divide-and-conquer approach actually quells it. Students are forced to sit through reports and discussions that have no immediate relevance to them.

Students *are* interested in what their peers have to say when they themselves have a stake in the conversation. If all teams are at work on the same task, the learning moment will be the debriefing of team responses, which begins with comparison of those responses across teams. When a team can see that "We were sure we were right, but our answer is different from everyone else's!" they are ready to listen to their peers and participate in a learning conversation. Their egos and emotions are engaged. They have an authentic desire to know: "How did you arrive at that answer? What about X? Why didn't you consider Y?"

4. Simultaneous Report

Now that all teams are working on the same task, the logic of a dramatic, *simultaneous report* becomes evident. It is useful for the instructor to adopt a visualization method that works well consistently: cards, posters, personal response systems (clickers), whiteboard "reveal," or other mechanism. Experience has convinced us that cards or other visual tools work better than clickers for this purpose. While clickers can be used to simultaneously report team decisions, they fail to provide the crucial sense of immediacy and dramatic ownership that comes when students hold up cards or sheets showing how they decided, *vis à vis* the other teams.

Aside from the theatrical flourish that brings energy to the classroom, simultaneous report has a more fundamental function in the learning process: public, highly visible accountability that levels the playing field for all students in the room. Students need to see how their thinking compares to that of others in order to reflect candidly and self-assess. If teams are asked to report their responses sequentially, rather than simultaneously, students can fall into the trap of self-deception: their ideas can conveniently and comfortably morph to those that belong to whichever group's report seems most convincing or most admired by the instructor. In this case, the opportunity for real self-assessment is lost. Sequential reporting also introduces the risk that students will begin off-task side conversations and fail to pay attention to or participate in the whole class discussion.

Consistently creating tasks that allow for simultaneous report is a chal-

lenge for instructors new to TBL. In some cases (for example, multiple choice questions), report-out strategies are relatively simple to devise. With more complex tasks, a little more creativity is sometimes required. For example, if students are asked to create a ranked list, a simultaneous report can begin by asking teams to show (on a card, for example) their top one or two—or bottom one or two—choices.

Beyond the 4-S's: Other Principles of Task Design

4S+1: Focus Tasks on Concrete Actions

Too often, we initiate discussions with students by directly referencing abstractions they have read about, such as definitions, systems, principles, taxonomies. A prevailing assumption is that once students master the language of a definition or schema, they will then be able to use those tools in their thinking and decision making. When we begin with abstractions, however, we frequently find that students can mimic understanding by identifying or even reciting formal definitions but may not really grasp the implications of what they are able to recognize—and even repeat accurately.

Students' passive familiarity with abstract concepts will be converted to active understanding only when it is applied and tested at the level of concrete, specific scenarios that evoke the abstractions without necessarily citing them. The economics example above of teaching "elasticity" by means of a question about the price of ice cream is a case in point. The earlier in the process students can be confronted with specific situations, the more quickly they will gain traction with the abstractions.

To illustrate further, let us consider a classic approach in which an instructor asks students to check their understanding using a multiple choice format and bases the task on statements written in language close to that of the textbook.

Original question:

> By what mechanism does dopamine cause behavior to increase or strengthen?
>
> A. Dopamine causes pleasure.
>
> B. Dopamine motivates willingness to work for reinforcement.
>
> C. Dopamine predicts the arrival of a reinforcer.
>
> D. None of the above

A student responding to this question is likely to recognize a correct answer that echoes the language of the reading ("reinforce"), but familiarity with the language does not indicate that students can apply the concept. To do so, the task would need to be more concretely situated:

Revised question:

> Sara finds that she cannot stop eating chocolate. Which of the following explanations is the most credible?
>
> A. It causes Sarah to feel pleasure.
>
> B. It increases Sarah's motivation to seek out and eat chocolate.
>
> C. It creates a sense of anticipation for something good (chocolate).
>
> D. None of the above
>
> (*example supplied by Kristina Spaulding, Psychology, University at Albany*)

Students who can answer this question accurately are likely to have demonstrated an understanding of how dopamine works, because they cannot slide by with simply parroting textbook language.

What we know about the nature of learning is that students gain deeper traction, faster, with course content if their first encounters with it include concrete experiences framed by and informed by the abstractions. As we move through a learning sequence or cycle, tasks may eventually become more abstract, but students need to start with decisions that make real and visible the significance and implications of targeted concepts.

4S+2: Worksheets Are for Individuals; Decisions Are for Teams

In the interests of efficiency, we may be tempted to present a sequence of small tasks all at once. Designing tasks that lead students through a complete thought process is an essential strategy, but giving teams several tasks at the same time on a single handout or a worksheet will lead to behaviors that TBL is specifically designed to prevent (for example, a dominant student taking over or a "divide and conquer" approach).

Teams are effective when their tasks drive them to converge collectively on a single decision. If we really want teams to work through a suite of tasks, we will need to isolate each one as a separate decision, with

simultaneous report at each step of the way. In this case, they should be scaffolded, one upon the other, each leading to decisions with greater complexity and integration of learning.

If the suite of ideas cannot be represented as a sequence of discrete team decisions, consider assigning the earlier parts of the sequence to individuals to work on separately before assigning teams a decision-making task. This approach works well in courses that require students to practice quantitative calculations. Students work through the necessary calculations individually, then convene as a group to make a broader, more conceptual judgment that is based on the collective understanding gained from individual work.

4S+3: Plan the Debrief When You Plan the Task

The design of a task is ultimately only as good as its execution and management. If you have not anticipated what students' responses to the task will be, you may not be ready to debrief their decisions effectively. What if everybody agrees or gets it right? What if everyone gets it wrong? A task that adheres to 4-S design and works well on paper can be completely derailed in the classroom by the unexpected. Having some strategies in mind can help to avoid this problem.

Have a concrete plan for simultaneous report—and make sure not to follow a simultaneous report with a sequential report of each team explaining its answer. Cluster answers during the debrief: "I see that several of you said 'A.' Team 2, what was your reasoning for 'A'? Ok, did any teams have a different reason for answer 'A'? Team 4, you said 'B'; why?" While it is important to bring to the surface the different reasons for why teams arrived at their answers, polling each team in sequence undermines the purpose of simultaneous report. If every team gets the correct or best answer, the debrief of team answers will proceed very differently than a situation where there is a wide variation in answers. An instructor must assess where a deeper analysis of multiple team answers is required and where it is superfluous or repetitive.

Defer the reveal of a correct or best answer, if there is one, until you have debriefed the teams' responses—"as if" all responses are possible. In some cases, you may even want to leave the problem unresolved, so you can send students back into their teams (or back to the texts) to reconsider their thinking via a new question. Once the instructor has stepped in and offered the "correct" answer, meaningful discussion has ended because the expert has spoken. There is an essential difference between asking student teams how they arrived at an answer that might be right, and asking them how they arrived at their answer if they already know it is wrong.

Know where students are likely to struggle with a task, but be flexible when your prediction isn't on target. Out of respect for students, you may have to let them go a ways down the wrong path before you redirect them to more productive territory. As instructors, we are often made uncomfortable by student errors, and we feel responsible for immediately correcting them. However, intervening too early can diminish a team's sense of ownership of their own responses.

4S+4: Logistics and Management Matter

The problems of typical "group-work" are much more likely to arise if students are unclear about what is expected of them. We have found that some basic logistical strategies are useful in keeping teams focused and engaged.

Give clear directions for each task in writing (ideally projected on the classroom screen). If there is to be a series of tasks, show directions for each separate step/sub-task on a separate slide. Keep directions visible while students are working. This serves several purposes: First, writing out each step of the directions in advance forces you to think through the process in which you want students to engage; second, you don't have to remember all the steps in class because they are right in front of you; third, teams are now able to work autonomously (and you don't have to repeat the directions individually to each of them). Students will quickly learn that they, not the instructor, are responsible for keeping their teams on task.

Use time limits—and make them visible. If students feel that a conversation can continue *ad infinitum*, especially with a complex question, they will defer making a decision (and spend a lot of time trying to convince you that they *can't* reach a decision). Requiring teams to produce an answer—publicly—within a given time helps them maintain focus and also sends the message that "we can't" isn't an option. To create an even greater sense of urgency, always allow less time than you think they really need to answer a given question. The energy that is created by a good task can quickly be depleted by lag time when teams finish before time is up. Finally, this is also a strategy for encouraging teams' autonomy and accountability. Rather than depending on you to remind them of how much time remains to complete a task, students learn that they need to track their team's progress and arrive at answers in the given amount of time.

Practice team tasks from day one. There are several good reasons to have students engaging with challenging team tasks from the first day of class, but one of them is to get them accustomed to the level of autonomy and accountability they will be facing in a TBL classroom. For many

students, this is an adjustment, and there will be some growing pains associated with the process. Starting right away with content-driven, meaningful tasks (even before you discuss the syllabus!) will help to demonstrate not only *why* you have structured your course in the ways you have but also *how* students are expected to handle the process. Naïve tasks work especially well on Day One.

4S+5: Use Non-4 S Tasks Sparingly, but Strategically

A key function of 4 S design is building team cohesion. After teams have begun to perform effectively (often around or after the midpoint of a semester), you may find it possible to mix in tasks that ask for a more complex product. You should continue using 4 S tasks frequently to continue team building, but pushing teams to engage in more synthesis/creation tasks may require more flexibility with task design. For this purpose, we propose a few practices that, when teams are already functioning at a high level, can work with some consistency. Note that many of these examples still allow for and suggest using simultaneous report; keep this in mind any time you diverge from a strict 4 S structure. Having the opportunity to compare products across teams remains powerful, even when those products are complex.

Limited Word Task: Teams are asked to distill a complex idea or set of ideas into a single word or limited number of words (1, 2 or 3)

> *Example:* Given the situation described in the case study you just read, use 3 words to summarize the first actions a therapist would need to address in responding to this patient. When prompted, send a team member to the board to write your 3 words.

Single Claim Task: Similar to the single word task, teams are asked to summarize an argument in a single clause sentence/thesis.

> *Example:* Read the paragraph on the handout and, as a team, summarize its primary argument in a single sentence. When prompted, send a team member to the board to write your sentence.

Construct a Thesis: Teams are given a context and asked to take a stance on an issue and construct a thesis statement that they would use to make a written argument.

> *Example:* Using the example of *one* character in the novel, write a thesis statement to defend or refute the following claim: "In James Baldwin's novel *Go Tell it on the Mountain*, the Church is ultimately a positive force in the characters' lives because it provides an empowering community and a place where individuals can express themselves." When prompted, send a team member to the board to write your thesis.

Framing an Argument: Adapted from Bean's (2001) frame paragraph exercise, this is an expansion of the "construct a thesis" exercise where in addition to creating their thesis, teams are asked to identify the sub-arguments they would use to flesh out their argument.

> *Example:* After you have created your thesis statement, list four arguments (in the form of a topic sentence) in support of your thesis statement with at least one specific piece of evidence from the text, with page number, which you would use to support each.

Diagram or Image Task: Teams are asked to distill and represent a complex set of relationships into a single image, diagram, or flow chart, which is drawn on a large sheet of poster paper. Using a pre-established cue, all the posters go up at the same moment for simultaneous report. Debriefing can be traditional (instructor asks teams to explain their representation), or can be adapted to practices where students comment on each other's works (e.g., gallery walk) using stickers or other tools.

> *Example:* Design a flow chart predicting the sequence of physical and mental actions of children solving the following problem. . . .

Reports and Debriefs for Non-4-S Tasks

Tasks with more elaborated products may require some invention when it comes to having teams report and compare their answers. Rather than have students report sequentially, there are other strategies available for reporting that retain the energy and focus of simultaneous reporting. One of these is the technique known as the "Gallery Walk," in which teams write their products on large sheets of paper and attach them to the wall in the manner of an art gallery. Students (either in teams or as individuals) then pass around the room and record their evaluation or comments for each product. Numbers or other mechanisms can be used to rank products

according to various criteria. In this way, the assessments of the products can be reported simultaneously, for example:

- Hold up a card/number for the poster that represents _____ most clearly.
- Hold up a card for the poster that is most/least _____.

Another approach is for students to attach colored stickers to posters according to given criteria. The reporting then follows from identifying the posters with the most stickers of a given color. Other excellent techniques for reporting and assessing complex team tasks, such as "Stacked Transparencies," "Hot Seat," "Best Solution Tournament," can be found in Appendix 2 of Sibley and Ostafichuk's *Teamwork That Works: Guide to Implementing Team-Based Learning* (2013).

Conclusions

Effective task design can be daunting and time-consuming because it requires a new perspective on both student activity and the content of your course. For this reason, it is important to enter TBL with an attitude of exploration and reflection: Tasks that "don't work" are often very valuable as they give you the opportunity to re-consider your goals and your approach. Just as we advocate for creating a classroom atmosphere where students come to recognize the role of errors in the learning process, we believe that instructors must enter their own TBL courses with the expectation that there is room to learn and grow.

Thinking analytically about what you expect a task to accomplish, the kinds of thinking it is seeking to promote, how it is constructed to induce student action, and the responses you expect from students—these are not only crucial to success in the classroom, but are also key to becoming more facile with the process of task design. After you have experimented with different task structures, based on the principles and strategies discussed in this chapter, you will discover what works for your classroom, your students, and your content. Experience will also help you hone your instincts about where modifications will make tasks more successful. Having just a few of these formats under your belt will ultimately make task design more navigable with each successive implementation.

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