

Team-Based Learning (TBL) in Histology: Lessons Learned Through 7 Years of Experience

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ABSTRACT

In 2006, we began the transition from a traditional lecture-based histology course to a TBL course, gradually adding more TBL exercises each year until the course was virtually lecture-free. Our laboratory sessions using microscopes and glass slides remained unchanged. We have previously reported that TBL produces learning outcomes comparable to those of lectures (Clin. Anat. 23: 474, 2010). Based on our trail-and-error experiences of the last 7 years, we now offer 4 key suggestions for successfully implementing TBL in histology: (1) Schedule the laboratory session before the corresponding TBL exercise. This permits the use of histologic images that students already have some familiarity with. (2) Limit Internet access during the TBL exercise, especially for clinically-oriented problems. Students can quickly find the "right" answer via search engines without understanding why it is correct. (3) When discussing the TBL exercise in class, call out the names of individual students to respond using a checklist of the team rosters. This sends a clear message that all team members must fully participate in the process and be prepared to explain and defend the team's answers. (4) At the conclusion of the TBL exercise, provide a "take-home message" about what the students are expected to understand about the topic. Students often fail to connect what they see in lab or read in the text with the problems presented in the exercise.

BACKGROUND

Medical histology courses around the country are under pressure to reduce lecture hours and engage the students in more active forms of learning.

This trend is coupled with ongoing curricular reforms at many of the nation's medical schools, including our own, aimed at "integrating" the basic and clinical sciences. The assumption is that students will better understand and retain the basic science material if it is presented in a clinically-relevant context.

Team-Based Learning (TBL) is a unique pedagogy in which traditional lectures are replaced with in-class group activities. Students are expected to master the basic facts and concepts of the subject matter prior to coming to class.

We offer here our key recommendations for successful implementation of TBL, and share our survey data about students' attitudes towards TBL.

METHODS

Beginning in 2006, we systematically replaced nearly all of our traditional lectures with TBL sessions. Each two-hour TBL session embodied the material previously covered in 2 or 3 hours of lecture.

Four TBL sessions were given 2006, 7 were given in 2007, 8 were given in 2008, and 9 were given in 2009-2012.

Each TBL session consisted of an iRAT, gRAT, and Application Exercise, described in the next text box. No lectures were given for these topics.

At the start of the course, students were randomly assigned to teams of 5-7 members. These teams remained in place for the course duration.

At the end of the course, students answered 5 Likert-scale survey items about the usefulness of TBL (TABLE 1).

THE TBL SEQUENCE

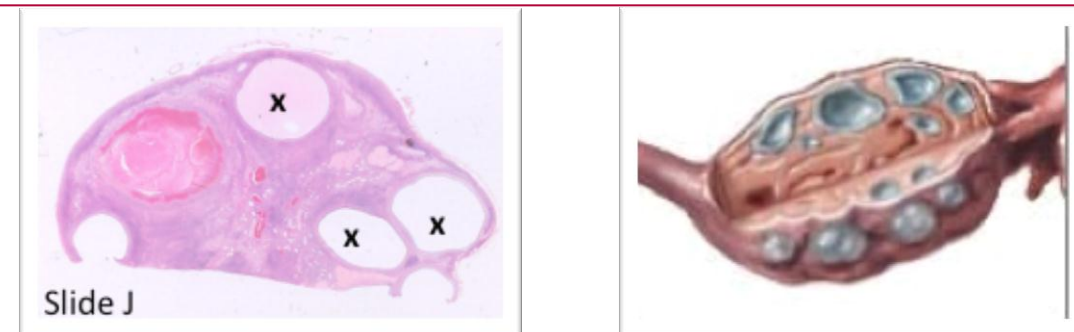
At the beginning of each TBL session, all students take a 10-question **individual Readiness Assurance Test** or **iRAT** (10 min). The purpose of the iRAT is to assess each student's knowledge of the basic material and preparation for group activity.

Each team then answers the same 10 questions again, but this time working as a group (10 min). This is called the **group RAT** or **gRAT**. The team discusses the questions until a consensus is reached about the correct answers, which are marked on "scratch-off" IF-AT cards (Epstein Educational Enterprises, Cincinnati, OH).

After completing the RATs, each team works through an **Application Exercise** consisting of 5-8 challenging questions that require synthesis of information and higher-order reasoning (60 min). Many of the questions are clinically-oriented and are not answerable unless the team accesses external sources of information. Teams are allowed to use class notes and textbook, a medical dictionary, and The Merck Manual.

After the teams' answer sheets have been collected, the instructor sequentially reviews each of the questions on the Application Exercise and asks the teams to "simultaneously report" their answers (30 min). This is done by holding up a colored card that denotes the team's answer to a given question. In this way, all of the teams can see each other's answer at the same time. Teams with different "correct" answers are asked to explain/defend their choices.

EXAMPLE OF MICROSCOPE-BASED EXERCISE



Slide J is stained with H&E.

- How does your dictionary define (**fully**) the term cyst? N.B. **not** the prefixes cyst-, cysto-, cyste-, but the word cyst.
- (1) Define (using the dictionary) the prefix "*poly-*." (2) Is it Greek or Latin?
- Examine slide J with your microscope and identify the organ.
- Explain your identification of the organ (Slide J) by listing two characteristics visible in the slide that either individually or in combination allowed you to identify the organ. These characteristics can include cells, tissue, structure, relations, relative size, shape, etc.
- What are the structures marked "x"?
- What syndrome /disease might be represented in this organ?
- What are two symptoms of this syndrome/disease?
- What is thought to be the anatomical (structural) basis of *infertility* in individuals with this syndrome / disease?
- (1) Is this organ from a younger or older woman? (2) **Briefly** explain your answer. [**HINT**: What structures diminish in number with age in this organ?]

KEY RECOMMENDATIONS

The following recommendations are distilled from our direct experiences of what has worked (and not worked) during our 7 years using the TBL format, as well as suggestions provided by our students.

Recommendation 1: Schedule the microscopy lab sessions—or however histologic images are taught in your course—before the corresponding TBL sessions. Although seemingly counterintuitive, this was a frequent suggestion by students. Having prior exposure to relevant histologic images appears to enhance the students' familiarity and comfort with material when it is presented again in the context of TBL application exercises

Recommendation 2: Do not allow Internet access during application exercises. The power of search engines is such that students can enter a few terms and quickly find the "right" answer to an application exercise, but they can't explain why it is correct.

Recommendation 3: Assure that all team members participate in the class discussions and are prepared to explain and defend their team's answers on application exercises. Relying of volunteers to answer questions limits class participation to a few bold individuals. However, systematically calling out names from team rosters requires everyone to participate.

Recommendation 4: At the conclusion of the application exercise, provide a brief summary or "take home message" of what the students are expected to understand about the topic. Students often need help seeing the relevance of the basic science material to the clinical problems presented in the application exercises.

OTHER SUGGESTIONS

If possible, utilize computer-based delivery of the application exercises so that each team views the questions as a group. In this way, the questions are delivered sequentially, forcing the entire team to engage in answering each question before going on to the next question, as opposed to team members dividing up and answering individual questions without having to pay attention to all of the questions, which we found was prevalent when using paper handouts.

Use a variety of application exercise formats:

- Multiple-choice, single right answer
- Short answer with partial credit possible
- Microscope or image based
- Clinical vignettes or experimental problems

Incorporate TBL scores into the final course grade, otherwise the students fail to take the TBL sessions seriously. Calibrate the apportionment of points awarded the iRAT, gRAT, and Application Exercise to optimally reward both individual initiative and group effort. This may take some experimentation. We finally arrived at a point system whereby iRATs = 10 points, gRATs = 5 points, and Application Exercises = 15 points.

STUDENT OPINION

TABLE 1. PERCENTAGE OF STUDENTS WHO AGREED OR STRONGLY AGREED WITH SURVEY STATEMENTS

Statement	2006	2007	2008	2009	2010	2011	2012	Cumulative
A	54.8	28.6	39.1	31.0	25.0	53.3	65.4	41.7
B	64.5	60.0	87.0	65.5	59.4	73.3	76.9	68.4
C	64.5	45.7	60.9	48.3	62.5	46.7	84.6	58.3
D	48.4	31.4	39.1	24.1	25.0	40.0	65.4	38.3
E	--	--	26.1	51.7	53.1	60.0	61.5	51.4

- I prefer TBL sessions rather than traditional lectures.
- I was able to identify the important elements of the material without a traditional lecture.
- The Application Exercises enhanced my understanding of the material.
- The TBL sessions assisted my learning of the material better than a traditional lecture.
- Overall, I feel the TBL sessions helped my course grade (added to survey in 2008).

Cumulative Response Rate for A-D: 206 out of 211 students responding (97.6%)
Cumulate Response Rate for E: 140 out of 143 students responding (97.9%)

SUMMARY AND CONCLUSIONS

After 7 years of using TBL, and experimenting with different aspects of the format, we believe we have moved closer to optimal delivery, though more refinement is necessary to fully realize TBL's potential in histology.

The cumulative survey data suggest no strong consensus in favor of TBL, but the majority of students appeared to believe that they could learn adequately without traditional lectures, that the Application Exercises were useful, and that TBL sessions improved their grade.

REFERENCES

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