Team-based learning at ten medical schools: two years later

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PURPOSE In 2003, we described initial use of team-based learning (TBL) at 10 medical schools. The purpose of the present study was to review progress and understand factors affecting the use of TBL at these schools during the subsequent 2 years.

METHODS Representatives from 10 schools evaluated in 2003 were again evaluated in 2005. They were interviewed by members of the Team Based Learning Collaborative using a semistructured interview process. Data were analysed by 2 researchers using the constant comparative method and were triangulated through sharing results with other interviewers at regular intervals to verify conclusions and form consensus.

RESULTS TBL continued to be used in all but 1 school. At the 9 remaining schools, TBL was added to 18 courses, continued to be used in 19 and was discontinued in 13 courses. At some schools, it was discontinued in single courses in lieu of new, longitudinal integration courses in which TBL was a main instructional strategy. Faculty, student, course and institutional factors were associated with changes in TBL use.

CONCLUSIONS Faculty, administration/curriculum, students and characteristics of specific courses influence ongoing utilisation of TBL. Those who desire to implement TBL would do well to take these factors into account as they plan implementation efforts at their schools.

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INTRODUCTION

Team-based learning (TBL) is a well-defined instructional strategy that is being employed increasingly in medical education.[1–7] Developed originally for business schools and other higher learning settings,[8,9] TBL allows a single instructor to manage multiple small groups simultaneously in 1 classroom. TBL has garnered interest within the medical education community because of its potential to promote active learning without requiring large numbers of faculty facilitators. A number of studies have appeared in the medical literature providing empirical evidence of potential benefits from TBL. Such benefits include increased student engagement,[5] higher-quality communication processes[4] and increased National Board of Medical Examiners shelf examination scores.[6]

In 2003, we described the use of TBL at 10 schools throughout the country.[10] At that time, 32 courses included components of TBL that ranged in scope from single-session applications to entire courses. Initial outcomes indicated positive student and faculty responses and improved student engagement. Each school planned to continue using TBL and expand into new areas of their curricula.

With support from the Fund for Improvement of Post Secondary Education (FIPSE), we organised the Team Based Learning Collaborative in 2003 to

Overview

What is already known on this subject

- Team-based learning (TBL) is an instructional strategy used increasingly in medical education.
- Several studies indicate favourable learning outcomes.
- Little research exists regarding 'optimal' factors associated with TBL use.

What this study adds

- Understanding of the evolution and application of a teaching application, TBL, over 2 years at 10 initial schools.
- Identification of inhibitors or enablers that influence implementation of TBL.
- Identification of the factors to consider for educators exploring the use or implementation of TBL at their school.

Suggestions for future research

- In the future, factors related to the process of diffusion of this educational innovation into courses, schools and the larger medical community should be explored.

Description of TBL

TBL consists of 3 repeating phases. During the first phase, learners read and study material independently outside class. During the second phase, learners complete an individual readiness assurance test (IRAT) to assess their basic understanding of facts and concepts included in the phase 1 study material. After the IRAT, pre-assigned teams of 5–7 learners re-take the same test, forming a consensus about each answer (group readiness assurance test – GRAT). These consensus answers are scored for immediate feedback. Once the instructor feels that students have mastered the core concepts through phases 1 and 2, the class moves into phase 3 application activities. During phase 3, students work in their teams on assignments that provide the opportunity to apply phase 1 and phase 2 knowledge in real-world complex problems. All teams in the class work on the same problem at the same time. Teams share their answers to the application problems simultaneously for immediate comparison with other teams' solutions. Because the problems reflect real-world complexity and ambiguity teams often arrive at different solutions, which promote total class discussion. As part of the process, learners also assess the contribution of peers within their group (peer evaluation). While a 'pure' application of TBL would include all 3 phases, the method allows flexibility for instructors to use selectively 1 or more of the phases, depending on the contextual demands of the course or session. This flexibility has been especially important in medical education, due to the unique constraints inherent in many medical contexts.[10]

In addition to content delivery and in-class activities, TBL also fosters active participation by providing incentives for pre-class preparation and in-class group discussion. Class time is shifted away from learning facts and towards application and integration of information. Unlike some forms of active learning, such as problem-based learning, a TBL instructor retains control of content and acts as both facilitator and content expert.[9]

METHODS

Participants

Eleven faculty members who had been a part of the TBL collaboration and had co-ordinated and monitored the use of TBL at the 10 original schools served as the study group. The 10 schools included: University of Arizona College of Medicine, Baylor

harness the growing enthusiasm and experience of early adopters.[11] The Collaborative is an informal scholarly community made up of individuals from schools throughout the country, and its members are committed to pursuing a shared understanding of the outcomes and challenges associated with the use of TBL across the continuum of undergraduate, graduate and continuing medical education and health sciences education.

Having established a 'baseline' with the 10 schools in 2003, the purpose of our study was to examine the status at these same 10 schools 2 years later in order to understand those factors influencing the use of TBL. Two questions guided our inquiry: (1) has the use of TBL at these schools increased, decreased or remained the same; and (2) what common characteristics, if any, appear to explain any direction of change? Before describing the details and results of our study, we provide a brief overview of the essential elements of TBL.

College of Medicine, University of North Carolina Chapel Hill School of Medicine, University of Oklahoma Health Sciences Center, University of Rochester School of Medicine and Dentistry, University of Texas Medical Branch at Galveston, University of Texas Health Sciences Center at Houston, University of Texas Southwestern Medical School, Texas Tech University Health Sciences Center and Wright State University Boonshoft School of Medicine. Two members from the University of Texas Medical Branch at Galveston were included to represent TBL use in the Medical School and the School of Allied Health. This group of faculty partnered with Baylor College of Medicine from 2000 to 2003 to pilot TBL in medical education. As a pilot project, the successful use of TBL in all settings was not an expected outcome. Partnering did not require faculty to participate in this research; those who did so volunteered and were encouraged to describe both positive and negative experiences of TBL use.

Data collection

We collected data using a multiple case study approach.[12] Six members of the Team Based Learning Collaborative (VFS, PH, REL, KKM, CP, BFR) conducted open-ended, semi-structured interviews in

2005. The interviewers used a guide that contained 7 standardised, open-ended interview questions[13] which asked about general impressions of the dissemination of TBL at the school, degree of TBL use in specific courses, scholarship on TBL and future plans. A series of prompts were included to ensure that each question was explored in similar detail between interviewers. A copy of the interview guide is provided in Table 1. All interviews were conducted over the telephone. Three of the interviewers (KKM, REL, VFS) also served as interviewees for their respective schools; in these cases, another member conducted the interview. The interviews took place over a 2-week period. Interviewers took field notes and transcribed them immediately after each interview. These notes were approximately equal in depth, completeness and length over the interviews, and provided 33 pages of textual data for analysis. This study was conducted with oversight from the Institutional Review Board at Baylor College of Medicine.

Data analysis

We used the constant comparative method to analyse interview data.[12] First, an evaluation specialist not involved previously in TBL (BMT) and 1 interviewer (VFS) reviewed all field notes. These 2 analysts

Table 1 *Interview guide*

Questions	*Prompts*
Restate purpose of interview	Potential use in publication
	Obtain useful data for sessions proposed at upcoming conferences
	Help plan consensus conferences
'Before we get specific, let me get your general impression about the overall dissemination of team learning at your institution'	
'Now let's go through items [courses] included in 2003 paper[10]. For each course, has team-based learning increased, decreased, or stayed the same?'	Why? (explore specific enablers and inhibitors)
	What elements of team learning are used?
	What impressions have students and faculty had about use of the team learning in each specific course? What 'evidence' are these impressions based on?
	What unexpected outcomes/consequences have occurred?
'Were the past two years consistent with the ''future plans'' in the 2003 table?'	Why? Why not? (explore specific enablers and inhibitors)
'Has team learning been introduced into new courses?'	Why? (explore specific enablers and inhibitors)
	When and how did this happen? (Be as specific as possible)
	What elements of team learning are used?
	What impressions have students and faculty had about use of the team learning in each specific course? What 'evidence' are these impressions based on?
	What unexpected outcomes/consequences have occurred?
''What scholarship has resulted from use and evaluation of team learning (papers, presentations, and invitations to do talks)?	
''What are current or future plans for team learning at your institution?	
''As we update the 2003 paper, do you have any suggestions about things we should say in our conclusions about the merit or worth of team learning?	

repeated 8 iterations of review and discussion to examine emergent characteristics. To triangulate the results, the evaluation specialist and interviewer shared their results with other authors at regular intervals to verify conclusions and form consensus on issues of disagreement.[12,13] Finally, we presented the results and conclusions back to interviewers as a member check to verify the plausibility of our conclusions.[12] Four authors (BMT, VFS, PH, BFR), then performed a final review of the feedback from member checks to further refine the results. All data are presented without identifiers.

RESULTS

Changes in TBL use

Our first research question addressed changes, if any, in the use of TBL at the original 10 schools. We found that TBL continued to be used in at least 1 course at 9 of the original 10 schools. Of the 32 original courses, TBL use continued in 19 courses and was discontinued in 13 others. TBL use was discontinued completely at 1 school due to the departure of a key faculty partner. Multiple factors were associated with the discontinuation of TBL; however, 9 of the 13 discontinued TBL courses occurred at 2 schools. At those schools, use of TBL as one of several instructional methods was discontinued in individual courses in favour of its use as the primary teaching method within integrated courses. TBL was introduced into 18 courses at 8 of the institutions. Changes in TBL use at individual schools are shown in Table 2. TBL was utilised in other instructional venues as well, including new student orientation and continuing medical education. A variety of factors contributed to changes in TBL use, and the factors are discussed in the next section.

Enablers and inhibitors

Our second research question involved identifying the enablers and inhibitors associated with the change in use of TBL at the original schools. The themes associated with the changes of TBL described by the participants are recorded in Table 3 and are organised by faculty, administration/curriculum, student and course.

Faculty

For faculty who were early adopters of the method, ongoing training, faculty attitude and perceived outcomes of the method were essential to TBL success. While initial exposure to the method often garnered a high degree of enthusiasm among faculty, ongoing exposure was critical to help faculty understand and apply the method effectively. [Italicised texts are taken directly from interviewers' field notes.]

> Faculty were surprised at how they misunderstood how to use the method initially… So 1 outcome was that they relearned the method… They have discovered that the better you understand and closer you adhere to Michaelsen's principles, the better the process works. (Interviewee 2)

Faculty needed time to become comfortable with the method. Many interviewees indicated that the initial use of TBL was of limited success: 'the first year of TBL was not perceived as good because faculty were uncomfortable with the method. Delivery of content was good with TBL in the 2nd attempt to use it'. Repeated use of TBL was cited by many as essential.

To be successful, not only was quality training important, so was the level of faculty 'buy-in' or attitude toward the method. One participant indicated that TBL was successful because faculty were 'big believers' in the method. Because TBL represented a leap from both typical (e.g. lectures) and more recent (e.g. problem-based learning) forms of teaching, faculty willingness or position to accept risk was a common trait among early adopters.

> Co-operation from interested faculty [is the key] − they will spend time with educators to learn the skills they need… That is what gets it going. They have to be

Table 2 Use of TBL at individual schools

School	Discontinued	Added	Learners (year)*
School 1	2	2	MS1, MS2
School 2	0	0	
School 3	0	2	MS3-4
School 4	7	2	MS1, MS2, PA1, MS3
School 5	0	2	MS1
School 6	1	3	MS1, NS1, NS3
School 7	2	5	PA1, MS1-2, MS3, PGY
School 8	0	1	PA1
School 9	0	1	MS2
School 10	1	0	MS1

*Type of learner and year of learner involved in discontinued or added course(s); MS = medical student; PA = physician assistant student; NS = nursing student; PGY = resident.

Table 3 Enablers and inhibitors associated with the changes in use of TBL

		Enablers*	Inhibitors*
Faculty			
	Attitude	Positive belief in the method	Initial limited understanding of the method
		Strong personal motivation	
		Willingness to accept risk	
		Willingness to dedicate time to implement TBL	
	Exposure	Quality of initial training	
		Quality of ongoing support	
		Repeated utilisation of TBL	
	Outcome	Engagement and satisfaction for faculty	
		Student preparation and/or attendance	
		Increased quality/quantity of student discussion	
		Improved student academic performance	
		Increased faculty collaboration	
Administration/curriculum			
	Support	Champion of the method	
		Expectation for use of active learning methods in the curriculum	
		Support of faculty time	
	Coordination	Central coordination between courses	
Student			
	Attitudes	Positive regard for working in teams	Perceived lack of efficiency in overall use of time compared to lecture
		Early exposure to TBL	Resistance to peer evaluation as part of grading
		Repeated exposure to TBL	
Course			
	Density		TBL sessions added to already full course with no decrease in lecture time
	Structure		Active learning methods already in use and adequate faculty to facilitate (e.g. PBL)
			No textbook or formal reading materials
			Established and/or popular course
	Class size	Larger class divided into smaller units	Large class

*Where cells are empty, no enablers or inhibitors were discussed for the given area.

confident in their positions as faculty. They can't be intimidated by students... The faculty who are less certain of their roles as instructors, who see learning as the transmission of information rather than realising that for students to remember things, they have to be engaged in rich contexts. (Interviewee 3)

Many faculty at the 10 schools had been initially interested or intrigued by the method, but they wanted to see someone else try it first and/or others at the school to establish experience with the method before they tried it themselves.

The main issues were those of faculty critical mass and student response. [There was] only [one] real champion of the method. Other course faculty were 'encouraging, but neutral' – interested in the method as a novelty, but not really interested enough to spend the time to learn the method or use it. (Interviewee 6)

Faculty were positively influenced to use TBL due to improvements in students' preparation and attendance, quality of in-class discussions and academic

performance, as well as increased collaboration among faculty members. Interestingly, many indicated that TBL had improved student attendance. '*Students don't like to... come to class. [An] unexpected outcome – [we] don't require them to come, but they come anyway.*' Adopters also felt that TBL improved in-class discussion and helped students to think more critically.

I think [TBL] is very worthy. It helps students to work in teams and also helps students with critical thinking skills. One of the problems with MD students is that they just want the 'right' answer, they have problems with ambiguity. Team learning helps them in a structured and safe environment. (Interviewee 3)

Students

Not only were the faculty essential to TBL success, so were the students. In general, students displayed a large range of attitudes toward the method. Student attitudes also tended to influence faculty attitudes

and shape decisions about whether or not to continue using TBL. Initially, students viewed TBL as a less efficient instructional strategy compared to lecture. One interviewee described the concerns of students as: '*Some of the initial concerns were that this wasn't an efficient way to learn, and students are very time sensitive*'. Interviewees suggested that if students were exposed early to TBL and had repeated experiences with the method, both within and between courses, their attitudes improved. As students gained more experience with the TBL process, they seemed to '*be more comfortable with the process… They feel more involved in their learning and with the group*'.

However, many students were resistant to peer evaluation as part of TBL grading. At 1 college, '*peer evaluation generated so much hostility they stopped it during the first year.* [Students] *didn't like evaluating each other [and] gamed it. Very few viewed it as a professional development experience*'. Students did not view peer evaluation as an integral part of the TBL experience, opting to 'game' it by giving every group member the same grade.

Administration and curriculum

TBL was more likely to be used when support was provided at the administrative level. In some courses, TBL was implemented in response to a mandate by administration to use more active learning methods. For others, the expansion of TBL was associated with a champion of the method, either at administrative, curricular or course levels. As 1 interviewee noted, TBL was incorporated into a clerkship after '*a department chair who was a skeptic of the method* [saw] *the effect of low performing student test scores* [and became] *a "believer" in the method. This allowed the clerkship director to try the method*'. In addition to the mandate or 'buy-in' from administration, the support of faculty time to revamp existing course materials was also essential.

On a curricular level, co-ordination of activities with other courses that used TBL simultaneously was essential. Where such co-ordination did not occur, participants reported that students felt overburdened with reading assignments and tests, sometimes leading to decreased or discontinued use of TBL.

> We had been '*gung-ho*' on the use of team learning. [We] *had 1–2 sessions in every course in the 1st and 2nd year and at the same time* [a course director] *had developed another integrated medical problem solving* [course] *that was designed around team learning… There were so many team learning courses that they* [the students] *complained about the reading and testing*. (Interviewee 11)

Not only was co-ordination of TBL sessions between courses important, course directors also realised the importance of co-ordinating TBL sessions with other major curricular occurrences, such as examinations, to avoid overwhelming students.

Course

On a course level, issues of structure, content density and class size impacted the continued use of TBL. Courses that already included active learning methods, such as problem-based learning courses with sufficient faculty facilitators and courses with established and highly regarded lectures, were not likely to adopt TBL. '*In that* [lecture-based] *course, the lectures are very popular and it was felt that replacement of them would be very unpopular and a radical departure in a very highly rated component of the course*'. TBL was also difficult to adopt or implement into courses that '[did] *not have a textbook or single formal reading material*' or courses in which '*team learning sessions were viewed as something being added to an already packed curriculum*'. It was evident that the structure and density of the course itself were enables or inhibitors of TBL. Interviewees also suggested that splitting very large classes led to easier logistics in terms of administering the readiness assurance test and the application phase of TBL.

CONCLUSIONS

In 2003, we embarked on a study of TBL at 10 schools to determine whether this instructional strategy had value for use in medical education. We concluded that the initial experiences at the 10 schools were favourable.[10] Since that time, several studies have provided empirical evidence of favourable learning outcomes associated with TBL.[2–7,14,15] Given the steadily increasing interest and evidence base supporting TBL, the purpose of our study was to understand the issues surrounding the use of TBL at the 10 schools in our original study, not as a measure of the value of this method but rather in an effort to understand factors associated with changes in the use of the method. We understood at the outset of this study that we would observe both increases and decreases in the use of the method, and that both situations would provide valuable data to inform the choices of educators who are beginning to adopt and implement TBL.

We found that TBL had been adopted and implemented into 18 courses, some of which were clinical/residency programmes, suggesting that this instructional method has applicability beyond pre-clinical, basic science courses. In 9 courses, TBL was discontinued in exchange for new co-ordinated, integrated, longitudinal courses in which TBL was a central pedagogical method.

Our study suggested that faculty and the educational environment were vital to TBL use. Faculty enablers included experience with the method, confidence through repeated use, exposure through quality professional development opportunities and perceived positive outcomes. The attitude of the students and the structure, density and size of the course were also factors that were either an enabler or inhibitor. Finally, support and co-ordination at the administrative or curricular level, including champions of the method, also affected TBL adoption. These findings are reflective of a larger body of research regarding Diffusion of Innovations,[11,16] suggesting that programme users (faculty), programme adopters (administration), linkage agents (champions of the method at the curricular and/or administrative level) and the environment (course, administration or curriculum, students) are vital to successful use of new innovations such as TBL.

Limitations and implications for research

While these results provide valuable insight into TBL use at 10 schools, they may have limited generalisability. Specifically, these 10 schools were early adopters of TBL. In addition, because we chose to use a multiple case study approach and utilised some participants as interviewers, these participants could have been influenced by their experiences or the experiences of other interviewers. However, we also assert that this approach also provided a rich data set, informed by multiple interviewers and interviewees. Adhering to data integrity, triangulation was accomplished though multiple interviewers, reviewers and member checks of the results. As other schools adopt TBL, it would be valuable to determine the factors related specifically to the process of diffusion of this innovation into courses, schools and the broader medical education community.[11,16]

Implications for practice

In conclusion, we revisited the 10 schools in our original 2003 study[10] to gain insight into the utilisation of TBL in medical education. At some schools the use of TBL increased, while at others it declined. A number of factors at the faculty, student, course and administrative/curricular levels were associated with those changes. Those who desire to implement TBL would do well to take these characteristics into account as they plan implementation efforts at their schools.

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