EDITORIAL

Team-Based Learning

Mohamed Elhassan Abdalla

Correspondace: College of Medicine- University of Sharjah, UAE
melsayed@sharjah.ac.ae

Introduction:

Team-Based learning (TBL) is a teaching and learning strategy first implemented in business schools by Larry Michelson, a professor of management at university of Central Missouri(Thompson, Schneider et al. 2007) then applied in other higher education disciplines. Medical schools started to use TBL since 1999 (Thompson, Schneider et al. 2007; Tan, Kandiah et al. 2011; Haidet, Levine et al. 2012).

TBL is a teacher-directed method that involves active collaborative learning, which promotes the application of knowledge through small group discussions in a single venue with a limited number of faculties present. (Thompson, Schneider et al. 2007; Parmelee, DeStephen et al. 2009; Tan, Kandiah et al. 2011; Khogali 2013).Currently, medical schools around the world implement TBL in different ways, ranging from a single session in a course to a full course (Thompson, Schneider et al. 2007; Parmelee, Michaelsen et al. 2012; Parmelee and Hudes 2012). TBL is considered a milestone with regard to changes in medical education given its greater integration of knowledge and active learning (Zgheib, Simaan et al. 2010) and its uniqueness that it requires students to work in teams to solve problems (Borges, Kirkham et al. 2012).Since its implementation in medical education, many individuals published their experiences, either to describe the way they do it orther results of their experience.

The aim of this review article is to reflect on different experiences in terms of TBL's process, evidence of success, challenges and opportunities. Another objective is to raise questions for further research that may improve the effectiveness of this strategy.

Methods:

A search in the MEDLINE was performed using the terms "Team-Based Learning", and "Team-Based Learning and Medical Education". A total of 80 titles were found.As the aim is to review the published experiences and reports about TBL, 46 titles have been eliminated. Out of the remaining 34, four titles were not full articles (letter to editor, etc.) and five could be reached as full articles. Accordingly 25 full articles were reviewed and included in this review article.

Results:

The TBL Process

The Process of TBL is completed in three phases. The first phase is a self-study phase in which students are engaged and study materials related to the theme or topic of the TBL. The teacher carefully defines and prepares the learning materials and provides them to the students. The first phase is usually conducted outside the class and its length depends on the material presented by teachers.

The second phase involves the ready assurance tests (RATs), which have both an individual ready assurance test (IRAT), where students are assessed in the knowledge they gained in the first phase through a set of questions (usually in form of multiple choice questions), and then the team or group ready assurance test (GRAT) using the same set of questions used in the IRAT.

The RATs are important for keeping students accountable to their learning through TBL as the IRAT will be counted in their grades and the GRAT keeps them accountable to their group productivity. The RATs

EDITORIAL

also provides the opportunity for structured peer teaching and discussion among the groups. The second phase may take 2-3 hours.

The third phase is the application phase in which teams are engaged in discussions of a case or problem that requires the direct application of the concepts they reviewed in the first two phases(Thompson, Schneider et al. 2007; Thompson, Schneider et al. 2007; Parmelee, DeStephen et al. 2009; Masters 2012; Parmelee and Hudes 2012).

Typically, peer evaluations are conducted for each member's contribution during the preparation phase and in the team discussions, which contributes each member's accountability. (Nieder, Parmelee et al. 2005; Thompson, Schneider et al. 2007; Parmelee, DeStephen et al. 2009; Parmelee and Michaelsen 2010; Tan, Kandiah et al. 2011; Masters 2012; Parmelee, Michaelsen et al. 2012).

A team or group generally consists of 5-7 members, and it is advisable to have a transparent team formation process that ensures diversity and gender balances within the teams (Chung, Rhee et al. 2009; Parmelee, DeStephen et al. 2009; Haidet, Levine et al. 2012; Parmelee, Michaelsen et al. 2012).

Five articles reported amendments to the original TBL process. Abdelkhalek and colleagues reported the use of TBL as a facilitating step for Problem-based learning (PBL) at Sharjah University in the United Arab Emirates. They maintained the three phase process but they have it between the first and reporting-back sessions of the problem-based learning system they follow. In addition they do not use the IRAT and GRAT for evaluation; instead, they evaluate the students'presentations and the discussion with teachers (Abdelkhalek, Hussein et al. 2010). Despite this change in the process, the authors reported an increased level of enjoyment by the students especially about working in teams. In Lebanon, Zgheib and colleagues used TBL for teaching pharmacology for the second year medical students; they reported a modified TBL process also.They conducted phase one (the pre-class Preparation) of the TBL with two didactic sessions presented by faculty members, instead of having this phase occuring through self-learning; they referred this change to the congested nature of their curriculum.They also combined the second and the third phases with each other, allowed students to freely form their teams, did not grade the RATs and did not conduct the peer evaluations (Zgheib, Simaan et al. 2010). Despite the great change made in the TBL process, the authors believed in the applicability of such change to their local context.

At Queens University in Canada, an amendment to the TBL process was implemented during musculoskeletal course through the development of an online resource for use in all phases of the TBL process, (Davidson 2011). The use of online resources could add more enjoyment to the learning process considering the wide use of technology in education.

Regarding the team-formation process two authors from a medical school in Oman (Sultan Qaboos University- College of Medicine) have reported –

separately- that they have seperate teams for males and females, this is mainly for cultural issues related to the community of the Oman where males and females prefer to work separately(Masters 2012)(Inuwa 2012).

Advantages

In eighteen articles, the authors reported some advantages from the application of TBL.The primary advantage of TBLis that it supports the practice of active learning without requiring a large number of facilitators, typically, faculty members simultaneously act as content experts and facilitators. The TBL process has been associated with higher quality communication processes and improved teamwork skills (Hunt, Haidet et al. 2003; Nieder, Parmelee et al. 2005; Thompson, Schneider et al. 2007; Chung, Rhee et al. 2009; Abdelkhalek, Hussein et al. 2010; Haidet, Levine et al. 2012).

EDITORIAL

Additional advantages include the reinforcement of concepts, frequent feedback provided to students, increased self-efficacy of students and the promotion of selfdirected learning (Vasan, DeFouw et al. 2009; Tan, Kandiah et al. 2011).

Through the RATs and discussion, TBL allows for early detection of individuals' weaknesses, which supports faculty and team members' abilities to provide help before final exams (Parmelee, Michaelsen et al. 2012).

TBL is found to increase interaction within the team, between teams and between teams and facilitators beside increase engagement of the student when comparing it to the conventional teaching methods such as lectures. (Searle, Haidet et al. 2003; Nieder, Parmelee et al. 2005;Kelly, Haidet et al. 2005; Zgheib, Simaan et al. 2010; Tan, Kandiah et al. 2011; Inuwa 2012).The increase in students' interaction and engagement are important stimuli for learners' behaviours(Kelly, Haidet et al. 2005).Preparing students for their future roles as members of a health team (i.e., doctors) is another possible advantage of TBL (Masters 2012), yet this is not fully supported by research findings.

Authors reported that TBL increases students' engagement in learning, and improves class attendance rates, in-class discussions and academic performances (Thompson, Schneider et al. 2007; Vasan, DeFouw et al. 2009; Wiener, Plass et al. 2009; Abdelkhalek, Hussein et al. 2010; Zgheib, Simaan et al. 2010; Willett, Rosevear et al. 2011).

TBL has some advantage to the faulty members; some authors reported that TBL will increase the level of collaboration among faculty members at the same institution, e.g.: through working with each other in the material preparation (Thompson, Schneider et al. 2007).

In general the following advantages of TBL -over the conventional didactic teaching were it is flexible to use, as it can be used during a single session of a course or throughout the whole curriculum; self-learning is evident during out-ofclass preparation; it provides immediate feedback; and it can be used with real health problems (Parmelee and Hudes 2012).TBL can enhance interdisciplinary courses in a curriculum given its facilitation of the mastery of content, teamwork and problem-solving for clinical applications (Vasan, DeFouw et al. 2009).

Evidence of Success

Tan et al. compared the test scores of two groups of students (n=49) exposed to the same study materials in neurology: one group experienced TBL and the other group experienced passive learning (PL); the exact method of passive learning was not mentioned explicitly in the article, but it could be understood that it was a lecture . The TBL group's scores were significantly higher than those of the PL group, both before and after adjusting for gender and examination scores. The test scores increased for the TBL group both immediately after the TBL process and after a period of 48 hours, despite no teaching provided on the topic during the 48hours period. In this study, the improvement in scores was evident for both the weak and strong students in the TBL group when compared to the students in PL group (Tan, Kandiah et al. 2011). One limitation of this study is the small sample size (Tan, Kandiah et al. 2011).

Two other articles showed improvement in student's academic performance, they compared the examination results of the students in the academic years before the use TBL and in the academic years after the use of TBL, In their analyses of students' exam results, it is evident that TBL benefits weaker students more the good students (Chung, Rhee et al. 2009; Koles, Stolfi et al. 2010). As this observation has been mentioned in two studies out of reviewed ones, it could be an area of future research to support the use of TBL in health profession education institutes.

Four articles examined students' performances on the IRATs and GRATs and found that group performances are better than individual performance when comparing the scores of the IRAT and the

GRAT(Chung, Rhee et al. 2009; Wiener, Plass et al. 2009; Zgheib, Simaan et al. 2010; Masters 2012). Group discussion and interaction could be one of the causes for this improvement in performance.

Thomas and Bowen reported a control trial examining TBL with regard to ambulatory medicine clerkship. They used an unblended crossover design to compare the influences of TBL versus small group lectures on the knowledge objectives of the clerkship. They found that performances were better for the students experiencing TBL than those taught with small group lectures (Thomas and Bowen 2011).

Some of the articles reported on the students' perceptions of the TBL. One study concluded that students give TBL a high rate because it helps them assess their present knowledge and gain higher levels of knowledge (Wiener, Plass et al. 2009).

Another study conducted at Queen's University in Canada examined students while they were experiencing blended TBL. Three cohorts of students were studied (2005-2007), and a great preference for TBL compared to lectures was found for the 2007 cohort (Davidson 2011). This finding may reflect the accumulation of interest in teamwork over time. The results from this study can give an indicator that medical school leaders should wait for a while before deciding to quit the TBL depending on the student's opinion.

The above conclusion can be supported by a study done by Parmelee and colleagues to determine students' attitudes toward the TBL process. They focused on two cohorts of medical students; each cohort was surveyed twice, during its first and second years of medical school. The results revealed a general students' satisfaction with team experiences and peer evaluations. A greater degree of satisfaction with peer evaluation and professional development was evident for the first year students, whereas the second year students were more satisfied with the team experiences (Parmelee, DeStephen et al. 2009).

Factors Influencing Implementation

The use of TBL requires making changes in courses (unless the course is a newly developed), and these changes need to be supported by a number of factors.. The most influential factors were generated from a questionnaire completed by 703 participants. The participants were contacted from lists of individuals who had attended workshops or presentations on TBL (Thompson, Schneider et al. 2007). The factors generated include the beliefs, interest and enthusiasm of faculty members regarding the use of TBL, as well as the openness, receptiveness, and cooperation of the students.

Other factors identified include the expertise of the faculty regarding TBL preparation and implementation, as well as the availability of monitoring for them. The availability of resources for conduction of TBL including the cases and RATs banks and the presence of properly configured class rooms.

Another factor mentioned by participants was time, especially when beginning to use TBL, given that the preparation of well-constructed cases that generate discussion is time consuming.

Course characteristics are also mentioned as a factor that influences the use of TBL, including the size and content of the course.

Leadership support and the presence of a faculty development programme are needed to support TBL implementation, as discussed in the AMEE Guide for TBL (Parmelee, Michaelsen et al. 2012).

Another factor that influences TBL implementation is the success of the first trial, which encourages other staff members to try TBL and may aid in students preferring it (Abdelkhalek, Hussein et al. 2010; Zgheib, Simaan et al. 2010).

At Vienna University, students were dissatisfied with the first TBL implementation, as some thought that TBL was not compatible with their learning styles (Wiener, Plass et al. 2009). This may have a negative

influence on future implementation of TBL; despite students have highly positive results in the course which TBL.

The size of the teams may affect TBL implementation. Students typically prefer TBL when the group/class size is 20 students or more (Willett, Rosevear et al. 2011) as this will lead to formation of more teams with reasonable number of team members which will lead to increase inter-teams discussion with large number of students.

The quality of the cases and the questions presented during TBL has an influence whether students prefer it or not; this factor has been mentioned in two of the studies (Zgheib, Simaan et al. 2010; Willett, Rosevear et al. 2011).

Challenges

Thompson et al. have addressed these challenges in a discussion of the enabling and inhibiting factors associated with the TBL use.The challenges can be in the faculty side (i.e., attitudes, exposure and outcomes), administrative support, students' attitudes, course content, course structure and class size or lectures preference(Thompson, Schneider et al. 2007).

Given that TBL is a relatively new strategy of teaching and learning – when compared to other methods such as PBL, its main challenges are the exposure of both faculty and student, perception and training of faculty members and the need to see evidence of its success in the same or another institution (Thompson, Schneider et al. 2007).

Khogali discussed three challanges for the implementation of TBL, which are the lack of sufficient viable research supporting the use of TBL, the lack of familiarity of staff with TBL implementation and the investment of some medical schools in PBL (i.e. building and preparing small rooms for PBL tutorials)(Khogali 2013). **Recommendations for Improvement**

Recommendations for improving TBL practices – as suggested in the articles reviewed- include offering quality training for faculty, increase faculty member's buy-in for the method, and early repeated exposure of the students to TBL to increase their acceptance and commitment.

More research to show the effectiveness of TBL is highly recommended (Thompson, Schneider et al. 2007). Future studies should examine the long-term impact of TBL on students achievements (Chung, Rhee et al. 2009; Inuwa 2012), and improvements in peer evaluation (Parmelee, DeStephen et al. 2009).

Conclusion:

In conclusion, TBL is a potentially useful strategy of instruction and very relevant to health profession education.Despite the advantages and evidence of success, this review showed that more research is needed to determine TBL's effectiveness, factors influence its implementation and long-term effects on learning.

References:

1. Abdelkhalek, N., A. Hussein, et al. (2010). "Using team-based learning to prepare medical students for future problem-based learning." Medical Teacher**32**(2): 123-129.
2. Borges, N. J., K. Kirkham, et al. (2012). "Development of emotional intelligence in a team-based learning internal medicine clerkship." Medical Teacher**34**(10): 802-806.
3. Chung, E.-K., J.-A. Rhee, et al. (2009). "The effect of team-based learning in medical ethics education." Medical Teacher**31**(11): 1013-1017.
4. Davidson, L. K. (2011). "A 3-year experience implementing blended TBL: active instructional methods can shift student attitudes to learning." Medical Teacher**33**(9): 750-753.

EDITORIAL

5. Haidet, P., R. E. Levine, et al. (2012). "Perspective: Guidelines for reporting teambased learning activities in the medical and health sciences education literature." Academic medicine : journal of the Association of American Medical Colleges**87**(3): 292-299.
6. Hunt, D. P., P. Haidet, et al. (2003). "The Effect of Using Team Learning in an Evidence- Based Medicine Course for Medical Students " Teaching and Learning in Medicine**15**(2): 131-139.
7. Inuwa, I. M. (2012). "Perception and Attitude of Girst-Yaer Medical Students on a Modified Team-Based Learning (TBL) Strategy in Anatomy." Sultan Qaboos University medical journal**12**(August): 336-343.
8. Kelly, P. A., P. Haidet, et al. (2005). " A Comparison of In-Class Learner Engagement Across Lecture , Problem-Based Learning , and Team Learning Using the STROBE Classroom Observation Tool " Teaching and learning in Medicine: An Internernational Journal**17**(2): 112-118.
9. Khogali, S. E. (2013). "Team-based learning: a practical guide: Guide Supplement 65.1--viewpoint 1." Medical Teacher**35**(2): 163-165.
10. Koles, P. G., A. Stolfi, et al. (2010). "The impact of team-based learning on medical students' academic performance." Academic medicine : journal of the Association of American Medical Colleges**85**(11): 1739-1745.
11. Masters, K. (2012). "Student response to team-based learning and mixed gender teams in an undergraduate medical informatics course." Sultan Qaboos University medical journal**12**(3): 344-351.
12. Nieder, G. L., D. X. Parmelee, et al. (2005). "Team-based learning in a medical gross anatomy and embryology course." Clinical anatomy (New York, N.Y.)**18**(1): 56-63.
13. Parmelee, D., L. K. Michaelsen, et al. (2012). "Team-based learning: a practical guide: AMEE guide no. 65." Medical Teacher**34**(5): e275-287.
14. Parmelee, D. X., D. DeStephen, et al. (2009). "Medical students' attitudes about teambased learning in a pre-clinical curriculum." Medical Education Online**14**: 1-1.
15. Parmelee, D. X. and P. Hudes (2012). "Team-based learning: a relevant strategy in health professionals' education." Medical Teacher**34**(5): 411-413.
16. Parmelee, D. X. and L. K. Michaelsen (2010). "Twelve tips for doing effective TeamBased Learning (TBL)." Medical Teacher**32**(2): 118-122.
17. Searle, N. S., P. Haidet, et al. (2003). "Team learning in medical education: initial experiences at ten institutions." Academic medicine : journal of the Association of American Medical Colleges**78**(10 Suppl): S55-58.
18. Tan, N. C. K., N. Kandiah, et al. (2011). "A controlled study of team-based learning for undergraduate clinical neurology education." BMC Medical Education**11**(1): 9191.
19. Thomas, P. a. and C. W. Bowen (2011). "A controlled trial of team-based learning in an ambulatory medicine clerkship for medical students." Teaching and learning in medicine**23**(1): 31-36.
20. Thompson, B. M., V. F. Schneider, et al. (2007). "Team-based learning at ten medical schools: two years later." Medical Education**41**(3): 250-257.
21. Thompson, B. M., V. F. Schneider, et al. (2007). "Factors influencing implementation of team-based learning in health sciences education." Academic medicine : journal of the Association of American Medical Colleges**82**(10 Suppl): S53-56.
22. Vasan, N. S., D. O. DeFouw, et al. (2009). "A survey of student perceptions of teambased learning in anatomy curriculum: favorable views unrelated to grades." Anatomical sciences education**2**(4): 150-155.
23. Wiener, H., H. Plass, et al. (2009). "Team-based Learning in Intensive Course Format for First-year Medical Students." Croatian Medical Journal**50**(1): 69-76.
24. Willett, L. R., G. C. Rosevear, et al. (2011). "A trial of team-based versus smallgroup learning for second-year medical students: does the size of the small group make a difference?" Teaching and learning in medicine**23**(1): 28-30.
25. Zgheib, N. K., J. a. Simaan, et al. (2010). "Using team-based learning to teach pharmacology to second year medical students improves student performance." Medical Teacher**32**(2): 130-135.