Adopting Team-Based Learning for In-Service Teachers: A Case Study

Zachary M. Walker  
National Institute of Education, Singapore, zachary.walker@nie.edu.sg

Toh Guo Zheng  
tohguozheng6@outlook.com

Redante Mendoza

Elise Lee

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Abstract
Team-based learning (TBL) is an instructional pedagogy that has gained recent popularity due to its effectiveness in disciplines such as medicine and business. However, TBL has not been widely adopted in teacher education based on reviews of research and practitioner based literature. The purpose of this case study was to assess the implementation and effectiveness of TBL in a Singapore teaching institute with thirty in-service teachers. Quantitative and qualitative data was collected from teachers about their experience learning through TBL. Research findings revealed that 1) teachers generally perceived TBL to be a positive experience, although several areas for improvement were suggested; 2) quality of scores through TBL was high, with team scores being significantly higher than individual scores. The findings from this study have the potential to guide the design of future TBL courses in education.

Keywords
Team-Based Learning, Pedagogy, Teamwork, Teacher Education

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Adopting Team-Based Learning for In-Service Teachers: A Case Study

Zachary M. Walker; Toh Guo Zheng, Redante Mendoza, and Elise Lee
National Institute of Education, Nanyang Technological University, Singapore
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Team-based learning (TBL) is an instructional pedagogy that has gained recent popularity due to its effectiveness in disciplines such as medicine and business. However, TBL has not been widely adopted in teacher education based on reviews of research and practitioner based literature. The purpose of this case study was to assess the implementation and effectiveness of TBL in a Singapore teaching institute with thirty in-service teachers. Quantitative and qualitative data was collected from teachers about their experience learning through TBL. Research findings revealed that 1) teachers generally perceived TBL to be a positive experience, although several areas for improvement were suggested; 2) quality of scores through TBL was high, with team scores being significantly higher than individual scores. The findings from this study have the potential to guide the design of future TBL courses in education.

INTRODUCTION

Team-Based Learning (TBL) is an instructional approach designed to combine the principles of Problem-Based Learning, Student-Centred Instruction, and Constructivism. Popularized by Larry Michaelsen in the late 1970s, TBL first gained prominence in medical education as a framework to develop intern and resident doctors (McMahon, 2010). TBL has since been adopted throughout health sciences and business curricula, and more recently, in teacher training (Samad, 2015). TBL is a team-based, peer teaching strategy that focuses on fostering positive team dynamics through intra-team communication. TBL provides students with opportunities to expose inconsistencies between their current and new understanding in order to build new knowledge (Samad, 2015; Hrynchak & Betty, 2012). One of the values of TBL is that it can be used as a complete course framework strategy but is versatile enough to be effective when delivered as part of a hybrid design (Michaelsen & Sweet, 2008).

Sequence of Team-Based Learning

A TBL sequence typically consists of three stages. The three stages can take place within a single course meeting or distributed over several sessions. These stages are student preparation, readiness assurance, and application. In the student preparation stage, students are provided learning resources to study individually before the TBL session. Students should review the materials prepared before coming to class. Upon arrival to class, the instructor proceeds with the readiness assurance tests. Students first complete the Individual Readiness Assurance Test (IRAT). The IRAT is a multiple-choice test assessing knowledge gained from the learning resources provided by the instructor. The IRAT is usually comprised of 10-15 questions and students are provided approximately 15 minutes to complete the assessment (McMahon, 2010). During the IRAT, students fill in an assessment form and, concurrently, copy their answers down on a separate document for later retrieval.

Following the IRAT, students proceed with the Team Readiness Assurance Test (TRAT) which takes places as soon as the time limit is up for the IRAT. The TRAT is comprised of the same multiple-choice questions but students complete the TRAT with teammates that have been pre-assigned. Individuals know which answers they provided for the IRAT and can discuss their responses with their teammates. The teams answer questions using a specially design scratch-off answer card. Once the teams complete the TRAT, they are provided an opportunity to appeal any questions they believe to be unfair or ambiguous.

The IRAT and the TRAT are designed to assess student readiness before advancing to the higher level problem-solving required in the application stage. The application stage requires students to apply the knowledge learned in problem-based scenarios. This stage involves intra-team discussion and larger class discussions, with the emphasis on the application of knowledge as opposed to simple rote learning. Application exercises (AE) are provided during this stage which focus on students working together to solve a common problem. For example, if the unit is focused on learning more about social media, the IRAT and TRAT may cover definitions, types of social media, and statistics about the use of social media today. The application exercises may have students come up with creative ways to use social media in a classroom, business, or specific industry.

Principles of Team-Based Learning

In McMahon’s (2010) analysis of TBL, he states four essential principles. The first principle is team formation and maintenance. Teams should be formed at the beginning of the course and members should stay together throughout the course. Instructors should be deliberate and thoughtful in team formation and ensure that members come from different knowledge base and backgrounds. The process of groups actualizing into efficient teams may be bumpy and require maintenance but this process should be worked out by the members themselves without much intervention from the instructor. This allows students to learn to work with each other instead of relying on themselves as individuals.

The second principle is that all students should be accountable for their contribution to the team. This crucial because students learn best when there is an immediate need and an appropriate incentive (McMahon, 2010). TBL holds students accountable through their individual grades and their contributions to the team score. To increase accountability, peer evaluation can also be strategically incorporated into parts of the course. A key to effective peer evaluation is facilitating a frank discussion with honest, constructive criticism given. Instructors should ensure that students understand the importance of honest peer evaluation by team members.

The third principle of TBL is the provision of real-time feedback to students. This is implemented through the use of scratch-off
answer cards during TRAT, where answers will signal to teams whether their interpretation of the concept was correct. Real- time feedback is critical to learning of knowledge and reinforces student learning by addressing small increments of the overall learning objectives. Corrections to misconceptions can be offered immediately by peers or the instructor to strengthen learned knowledge.

The fourth principle stated by McMahon (2010) is that team assignments in the application phase should promote both student learning and teamwork. For the TRAT assignment, AE should be designed to require team interaction. This covers an important aspect of TBL – peer teaching. The assignment should not be able to be broken into individual assignments with each student covering one assignment; it is the peer teaching that drives team formation.

Background for the study

The majority of the research on the effectiveness of TBL has been conducted in medical and business contexts. For example, Reing et al. (2011) examined 137 students’ attitudes and satisfaction towards a TBL course in upper division accounting. The authors found that students generally rated TBL positively and recognised its benefits to develop teamwork skills. A similar study was conducted by Chad (2012) who examined the first time use of TBL in a postgraduate marketing module in an Australia university. The author found that TBL had a positive influence on student engagement and offered opportunities for assisted learning. In a more rigorous study, Vasan et al. (2011) ran a longitudinal 5-year study comparing student performance of a TBL-based pre-clinical course and the traditional course. The authors found that student performance was not only higher in the TBL-based course but also perceived TBL to be a motivating factor for students. Importantly, these studies, along with many others, researchers have demonstrated that TBL is an effective teaching method enabling educators to offer students a more enhanced and stimulating learning experience.

Most recently, a support of a longitudinal study of medical students taught using TBL was conducted by Zghieb et al. (2016). Based on a new curriculum, 90 TBL sessions were implemented in 2 years to 102 medical students to evaluate the long-term impact of TBL. The authors found sustained and cumulative improvement in teamwork and communication skills, professional, and personal development over time. This was the first study to demonstrate the long-term active impact of TBL. Research has also branched out into evaluating ‘modified’ TBL classes, which retain core features of TBL but incorporates other aspects of pedagogy that may be more suitable for its target audience. One such study was conducted to examine the impact of modifying TBL. Research has also branched out into evaluating ‘modified’ TBL classes, which retain core features of TBL but incorporates other aspects of pedagogy that may be more suitable for its target audience. One such study was conducted to examine the impact of modifying TBL. Researchers have demonstrated that modified TBL is an effective teaching method enabling educators to offer students a more advanced and stimulating learning experience.

Grading Process

After the TRAT was completed, the instructor went through each question and gave teams the opportunity to point out any misinterpretations of the scenario. An example question was, “You have a student who has special learning needs. List and describe each of the features in a smartphone that can help in learning.” The purpose of this example was to get teams to consider all students needs and discuss on the features of a smartphone that can fulfill those needs. All necessary resources, including flipcharts and markers, were provided.

Data Collection

Both quantitative and qualitative data were collected to establish a comprehensive understanding of the effectiveness of TBL implementation in our course. Quantitative data was collected through the TBL questionnaire which comprised of a demographics section and close-ended questions asking about teachers’ experience of TBL. The demographics section consisted of six items asking teachers on their gender, area of teaching, age, ethnicity years of teaching, and number of technology courses taken. The body of the questionnaire consisted of questions asking teachers about their TBL experience. Statements were developed from a review of the literature with several being adapted from validated questionnaire surveys used in other studies (Frame et al., 2015). An example of

answer, but their score would be reduced with each unsuccessful scratch. This allows teams to receive partial credit for proximate knowledge (Michaelson & Sweet, 2008).

**Figure 1.** IRAT scratch card for the team.

The TRAT commenced immediately after IRAT. For the TRAT, teams at each table worked together to come to an agreement on each question. The TRAT focused on immediate feedback and was assessed using the immediate-feedback assessment (IF-AT), through a self-scoring answer cards (see Figure 1). These cards serve as timely feedback and allow teachers to correct misconceptions immediately. On these cards, members scratch off one of the four options covered with opaque film to search for a star that indicated the correct answer. If the team found the star on their first try, they received full credit score of four points. If not, they would continue scratching until they find the correct answer.
the statement was, “The use of TBL enhanced my learning experience in class”. The statements were presented in a 5-point Likert scale format with a response of 1 indicating very strong agreement to a statement, and a response of 5 being a very strong disagreement. The questionnaire was peer-reviewed by the TBL facilitator who had designed TBL questionnaires in previous courses.

To collect more detailed responses from teachers, a focus group interview was conducted after the completion of all TBL activities. One teacher was randomly selected from each team to take part in the interview. The interview lasted 60 minutes. Questions were designed to be an extension of the questionnaire statements asking about their TBL experience (See Figure 2). A total of seven questions including “Which part of the TBL did you learn the most” and “What did you like and not like about your experience of TBL?” were presented. The interview was facilitated by the external TBL facilitator with an assistant.

### RESULTS

#### Quantitative Analysis

The overall, four themes that emerged from teachers’ overall experience of TBL were: most interesting, most helpful, peer evaluation through ranking, and punctuality. The percentage of teachers that contributed their thoughts to each theme was included, with a higher percentage representing more teachers voicing out on that theme (see Table 3).

The most interesting aspect of TBL was the exchanging of ideas in discussions. Teachers thought that every member had a different interpretation of the questions and that they could apply this interactive pedagogy in their own classrooms. They also enjoyed the burning questions as it provided opportunities to clarify any questions with ambiguous answers.

Teachers commented that the aspects of TBL that were most helpful to their learning was application exercises and team readiness discussions. Teachers liked application exercises because the quality of answers they produced had practical value. Through the intra- and inter-team discussions, teachers were able to remember concepts as they had already discussed them. Overall, words that teachers used to describe their overall learning from TBL were: “Engaged”, “Beneficial”, and “Sustainability”.

Peer ranking of each team members’ contribution emerged as the most disliked part about TBL. Teachers felt that the ranking system could be unfair to teachers who could fail their module because of getting the lowest points and suggested to replace the peer evaluation ranking system with another form of peer evaluation.

Another aspect that teachers disliked was the requirement to be punctual for TBL sections, especially the IRAT that first takes place during classes. Teachers expressed dissatisfaction with the need to be punctual for TBL sections, especially the IRAT that first takes place during classes. Teachers had undertaken the module as part of their Masters’ curriculum and had concurrent commitments (e.g., work, teaching) that would prevent them from being punctual all the time. Teachers pointed out that schedules may clash or unforeseen circumstances may arise from their commitments and these events may cause them to be late.

### DISCUSSION

Comparison of IRAT and TRAT performance revealed that mean TRAT scores were significantly higher than mean IRAT scores by 7.05 points. This result was expected and in line with the theoretical underpinnings of TBL, which state that TBL provides the depth of understanding that can only come from solving problems in teams that are too complex for any individual effort (Michaelsen & Sweet, 2008). Furthermore, this result is in line with previous studies that have found TRAT scores to be better than IRAT scores (Vasan et al., 2011; Leong et al., 2011), further providing evidence for the use of TBL in the Asian teaching context.

The strongest positive correlation was found between teachers’ TRAT score and their FCG. There was also a positive correlation between IRAT scores and teachers’ FCG, although not as strong. This
The aspects of the course that teachers found to be the most interesting

- The discussions going on, exchanging of ideas, and discussing with group mates is what makes it interesting.
- The idea of discussions is very interesting because we can relate it back to our classrooms teaching as well so it is something very interactive.
- Application exercises and team readiness
- I really liked the application because no point learning all the theory without knowing how to apply in real life situation. So when the group shared… it was very enlightening.
- We are able to remember most of the (materials) because we already discussed it.

The aspects of the course that teachers found to be most helpful for their overall learning

- I guess we are uncomfortable with it because as educators we have heard of extrinsic motivation versus intrinsic motivation. When you come up with a ranking system, it creates an extrinsic motivation for you to contribute, in a sense. Because you’re worried that you will not be contributing enough. And I’m very uncomfortable with that.
- Sometimes we are late because of school meetings and all that, so we will not miss the IRAT and sometimes the TRAT will join halfway.
- … because we are part-time (students), we will always encounter the string part… the commitment.
- It is not our intention to be late. We did try to justify why we are not full-time students with intentions to be away, we are working adults who were forced to attend meetings.

Peer evaluation through ranking

- A remark that pertains to the difficulty of the peer evaluation system
- A remark that pertains to the difficulty of the need to be sharply on time for classes

Punctuality

- The themes, definitions, percentage of teachers who responded, and most representative statements for each theme.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
<th>Percentage of Teachers</th>
<th>Most interesting</th>
<th>Most helpful</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer evaluation through ranking</td>
<td>A remark that pertains to the difficulty of the peer evaluation system</td>
<td>83%</td>
<td>50%</td>
<td>83%</td>
</tr>
<tr>
<td>Punctuality</td>
<td>A remark that pertains to the difficulty of the need to be sharply on time for classes</td>
<td>83%</td>
<td>50%</td>
<td>83%</td>
</tr>
</tbody>
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