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Implementation of team based learning for MBBS students – An innovative teaching learning method in medical education

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ABSTRACT

Background: Team-Based Learning (TBL) is an educational approach that enhances student engagement through individual assessments and collaborative group work. It is an effective and structured form of small group learning adaptable to large classroom settings. TBL ensures student accountability through various stages, including pre-class preparation, readiness assurance tests, problem-solving exercises, and immediate feedback.

Objectives: This study aims to implement and assess the efficacy of the TBL strategy among MBBS students in a large group teaching environment.

Materials and Methods: The pilot study adopted a TBL approach, involving steps such as pre-class preparation with PDF materials and a WhatsApp video guide issued a week prior, individual and team readiness assurance tests (iRAT and tRAT) conducted via Google Forms and hard copy MCQs, clarification sessions on MCQs and relevant medical topics, and collaborative learning through case scenarios related to Type 2 diabetes. Discussions and conclusions were facilitated by the faculty, followed by immediate and scheduled feedback using Google Forms. Statistical analysis was performed using an unpaired t-test to compare iRAT and tRAT scores.

Results: The study gathered 133 responses from the first batch and 140 from the second batch of first year MBBS students. The analysis revealed significant improvements in scores from iRAT to tRAT, indicating the effectiveness of TBL in enhancing student learning outcomes. Feedback from the students showed high levels of engagement and interest in the learning process, with over 98% in both batches finding the TBL approach interesting and interactive.

Conclusion: The findings suggest that TBL is a valuable and effective educational strategy that improves learning outcomes and fosters collaborative learning among students.

1. Introduction

Team-based learning (TBL) is an instructional approach that actively engages students in small group learning activities, providing opportunities to apply conceptual knowledge through a structured sequence involving individual work, teamwork, and immediate feedback.[1] TBL was originally developed by Professor Larry Michaelsen in the 1980s at a business school in the United States as a response to increasing class sizes and concerns about the effectiveness of lecturing to large groups.[2] Michaelsen created TBL as an engaging way to teach large numbers of students that incorporates immediate feedback, student decision-making, and active small group and class discussions.[2] Rather than simply transmitting content, TBL focuses on the application of knowledge through problem-solving that requires both conceptual and procedural understanding.[3] In recent years, TBL has grown increasingly popular

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in medical and healthcare education programs as a student-centered, resource-efficient teaching methodology. Healthcare educators globally have adopted TBL in various combinations across diverse settings and content areas.[2] To standardize the numerous variations in how TBL is implemented in health professions education, Haidet et al. developed a formal framework.[4]

2. What is Team-based Learning?

Team-based learning (TBL) is an innovative, student-centered approach that supports the flipped classroom method in healthcare education.[5] The in-class TBL activities provide an interactive, expert-led teaching session where a large number of students work in small teams to apply content to specific problems.[6]

The structured TBL format, illustrated in Figure 1, follows a sequenced series of steps that allows students to apply and build on conceptual knowledge. This involves preparation, readiness assurance testing, feedback, and application of knowledge through clinical problem-solving activities.[2] Through these steps, students engage in self-learning, analysis, communication, collaboration, speculation, reasoning, and problem-solving within their small teams.[2,6] TBL can be used with large classes (over 100 students) or smaller groups (under 25 students), incorporating multiple small teams of 5-7 students each in a single classroom.

It is specifically characterized by three key components:[2,6]

Individual advanced student preparation

Individual and team readiness assurance tests (tRATs)

The majority of in-class time devoted to decision-based application assignments completed in teams

3. Why do we use TBL? – Justification

The primary goal of team-based learning is to move beyond simply covering content and instead ensure students have opportunities to practice applying course concepts and solving problems.[3] Recent systematic reviews provide evidence of positive outcomes in terms of student experience and academic achievement with TBL, particularly when compared to traditional lectures. A major benefit of TBL is that it allows large numbers of students to experience small-group active learning facilitated by a smaller number of expert instructors. It also exposes both educators and students to different teaching methods and knowledge.[7]

Given these advantages, we implemented TBL as a new teaching-learning strategy in order to assess its effectiveness among first-year MBBS students at a tertiary care institute in Tamil Nadu.

The specific objectives were:

1. To implement the team-based learning strategy for large group teaching classes among MBBS students.
2. To analyze the effectiveness of individual and group learning scores achieved through the team-based learning strategy.

4. Materials and Methods

The new teaching-learning strategy adopted for this study was a team–based learning method that was implemented among the MBBS students (two different batches) of Arunai Medical College andHospital, Tiruvannamalai. The new teaching-learning strategy adopted for this study was a team–based learning method that was implemented among the MBBS students (two different batches) of Arunai Medical College and Hospital, Tiruvannamalai. It included the following steps viz, pre-classroom preparation/material, iRAT, tRAT, Clarification session, Problem-solving activity, and the discussion and conclusion by the faculty/facilitator.

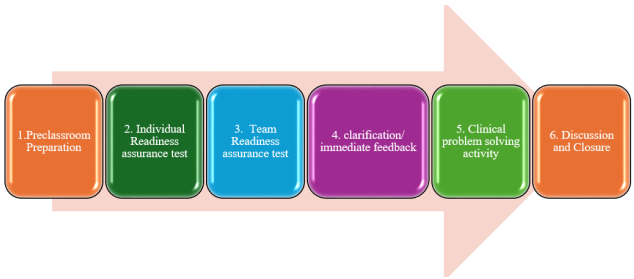

Figure 1: Steps of team based learning

1. Pre-classroom material/preparation – PDF document of a topic with a WhatsApp video guide posted in the group a week before to the first-year MBBS students. The session was on the Natural history of disease, concepts of disease causation, multifactorial causation, Iceberg phenomenon, and the levels of prevention.
2. Individual readiness assurance test (iRAT) and Team readiness assurance testing (tRAT) – iRAT was done by using Google form consisting of 10 MCQs on the topic provided for pre – classroom preparation. Each MCQ was assigned a score of 1 and there was no negative marking for wrong answers. This was followed by tRAT where a hard copy with the similar set of multiple choice questions was provided to each team. The students were divided into 17 teams with 8 members in each team for the first MBBS batch. For the other batch of first-year MBBS, the students were divided into 15 teams. A total time of 30 minutes was allotted for completion of iRAT and tRAT.
3. Clarification session – In this session the doubts and key answers on the MCQs and the topics (natural history of disease, disease causation, multifactorial and web of causation, levels of prevention) provided in the

material were discussed and clarified. The time allotted was 30 minutes for the clarification session.

4. Problem-solving activity – Now, the facilitator presented to the students a clinical case scenario that consisted of a diabetic case and a few questions related to the natural history of diabetes and the level of prevention. The same team of students was made to discuss and present the answers to the clinical case scenario. The time allotted was 40 minutes for the discussion among the team members and 20 minutes for answers presentation by the students.
5. Discussion and conclusion were done by the facilitator on the case scenario and questions related to the case. The time allotted was 20 minutes.
6. Another 10 minutes were allotted for the feedback session. Immediate feedback and scheduled Google form feedback was obtained from the students.

Figure 2: IRAT in TBL: Assessing individual readiness

Figure 3: TRAT in TBL: Assessing team readiness

4.1. Stastical analysis

1. The average individual readiness scores and average team readiness scores for each batch.
2. Then we used an unpaired t-test to determine if the difference between the individual and team average scores was statistically significant or could be due to chance variation.
3. A p–value of < 0.05 was considered to be statistically significant.

5. Results

For MBBS BATCH 1: A total of 133 individual responses were obtained for the iRAT (individual assessment) and a total of 17 team scores were obtained for the tRAT session. The individual mean score was 5.4 and the tRAT score was 8.8. The unpaired t-test analysis of individual and team scores showed that the mean score has improved a lot from 5.4 to 8.8 with a t – value of -8.94339 and a p–value < 0.00001. According to the students' feedback analysis, 98.3% of them thought that team-based learning was engaging and dynamic. (Table 1)

For MBBS BATCH 2: A total of 140 responses were obtained for the iRAT and a total of 15 team scores were obtained for the tRAT session. The iRAT mean score was 6.0 and the tRAT mean score was 8.8. Using unpaired t–test analysis the t – value obtained was -5.97727 with a p – value of < 0.00001. According to the students' feedback analysis, 98.2% of them thought that team-based learning was interesting and interactive. (Table 1) The mean scores comparison for both the two batches are shown in Table 1 and the feedback analysis is shown in table 2. In both student batches, there was a statistically significant increase in the tRAT score relative to the iRAT score, indicating that team-based learning is a successful approach for improving student learning outcomes.

6. Discussion

Our study's results demonstrate the efficacy of the TBL teaching-learning approach in improving students' learning capacity in medical education. Since most of the students found our TBL session was engaging and dynamic, the TBL technique may be used with the MBBS students in the large group teaching class as a teaching and learning method. Our research also demonstrates that students are more driven to do better when given the chance to learn as a team than when learning alone, as seen by an increase in tRAT scores over iRAT levels.

Most of the MBBS students agreed that TBL improved their ability to develop their ideas during the session and the preparatory material made them understand the topic easily. It also helped them in answering the individual readiness assurance test. They also gave an affirmation that working in a team not only enhanced their knowledge but also provided a platform to understand the importance of communication and collaborative learning. The clarification session by the facilitator has provided in-depth understanding of the topic thoroughly. It also developed their skill in answering the case – based questions and comprehensive analysis of the study topic. After the whole session, the students' perspective on working in teams as well as their feelings of comfort, satisfaction, and professional growth had significantly changed. The TBL approach encouraged self-directed learning and enhanced their capacity to apply newly

Table 1: Comparison of iRAT and tRAT scores for the first year MBBS students

First YearMBBS Batch	iRAT Mean Score	tRAT Mean Score	t Value	P Value
Batch 1	5.4	8.8	-8.94	< 0.00001
Batch 2	6	8.8	-5.97	< 0.00001

Table 2: Feedback analysis of the first year MBBS students

Feedback of TBL Session	Response percentage on strongly agree and agree	
	Batch 1Response Rate	Batch 2 Response Rate
The pre classroom study material and the video guide on concept of disease and natural history of disease was easy to understand	97.6%	92.9%
The individual readiness assurance test (MCQs) helped us in acquiring foundational knowledge from the preparatory material	97.6%	92.8%
The team readiness assurance test (same MCQs as in iRAT) provided platform for working as a team and the importance of collaborative learning	97.5%	96.4%
The clarification session provided in depth understanding of the topic thoroughly	98.4%	93.8%
The clinical case scenario on diabetes mellitus was a brainstorming activity which helped us in applying the learned concepts of the topic	100%	96.4%
Overall, the TBL session was interesting and interactive	98.3%	98.2%

acquired knowledge to clinical situations.

TBL is a very recent approach to medical education pedagogy. It is a tool for learning that allows an extensive number of students to participate in small-group instruction without a lot of faculty members. Furthermore, faculty members are drawn to TBL's integrated approach to helping students build professional qualities like leadership, while students are drawn to its dynamic and collaborative style. The majority of MBBS students concurred that TBL enhanced their capacity to formulate thoughts during the session and that the readings helped them grasp the subject matter. They were also able to answer the individual readiness assurance exam better as a result of it.

The use of TBL programmes also provides medical schools with cost-saving strategies because there are more medical students and fewer teaching staff members.

The influence of TBL has been evaluated by a number of outcomes, such as student perception, student knowledge acquisition, and faculty perception, based on the research that have been examined.[2] The students considered the usage of smaller groups, the readiness assurance exams, the quick student feedback, and time efficiency to be all excellent parts of the TBL experience. Despite requiring an educational approach and facilitator guidance, TBL remained student-centered and had a variety of beneficial results. TBL specifically produced smaller groups, quicker feedback on progress, and improved pre-class preparation. The readiness assurance testing component of the TBL teaching-learning approach holds students accountable, which encourages them to finish the pre-reading assignment. As a consequence, less material needs to be addressed in class.

Additionally, giving students time in class to practise critical thinking and problem-solving skills helps them grasp and retain more of what they have learned. TBL's interactive format helps medical students improve their teamwork and communication abilities while also offering an excellent learning experience.[8] In a study comparing TBL to PBL, We found that students were drawn to TBL because of its active and collaborative style. They identified three main benefits of TBL: small group sizes, the Readiness Assurance Testing procedure, and instant feedback. When it comes to encouraging engagement and learning, TBL has shown to be more effective than other small group work formats like PBL.[9] Students gain greatly from learning in a team-based learning setting. Students are focused on the topic at hand and actively engaging with the material being covered while they are learning in groups. Students are afforded the opportunity to explore multiple streams of reasoning and collaborate with their peers to develop a convincing argument in response to a given question.

Since peer-level learning opens up fresh research routes and complements the instructor's perspective, it can have a significant effect on student performance.[10] TBL considerably outperformed traditional lecture methods in terms of total assessment scores in a randomised crossover experiment. TBL scores were higher than lecture for items of both the application and recall types. One benefit of

TBL is that, in contrast to traditional lecture formats, which prioritise learning and remembering facts linked to complicated problems, this approach concentrates on applying knowledge to solve complex problems.[11] In the same way, a review article offers the first comprehensive assessment of the data to date about TBL's effectiveness in health professions education.

Furthermore, no study found that the TBL group's scores decreased, and the researchers concluded that TBL is reassuring to curriculum planners who are searching for active learning strategies that emphasise applying previously learned material as well as to those who lack faculty members for small group learning activities.[12] According to a systematic review, facilitators noted that learner participation and interaction was significantly higher with TBL than with traditional lectures, and students generally enjoyed the chance to work in groups and discuss the material with their peers. Similarly, TBL outperformed traditional lectures alone in terms of academic achievements. The majority of authors came to the conclusion that TBL was successful and decided to keep include this method in their courses based primarily on these two criteria.[13] The authors of a review study noted that the majority of the articles that looked at student attendance or participation did so by directly comparing it to lecture-based teaching or by having teachers recall student attendance. These comparisons consistently revealed that students participated more in TBL-based classrooms. Data pertaining to learner attitudes and perceptions indicated increased interest in TBL and improved levels of self-efficacy.[14] The sequential approach of TBL encourages students to go beyond merely mastering the fundamentals. In an application exercise that is well-designed, teams must apply their knowledge to real-world scenarios.

Students must acquire and exhibit strong teaching, listening, and negotiating abilities in order to reach an agreement. According to the study's findings, students in two successive second-year classes performed noticeably better on Problem Based Questions pertaining to the material they had studied via TBL modules, indicating that TBL enhances students' learning.[15] In a different research, the authors looked at the benefits of include team-building exercises in a third-year medical student's core clerkship. The findings indicated that team-building exercises could be a valuable complement to conventional didactic clerkship programmes in medical education.

In comparison to traditional lectures on the same material, student ratings of involvement with team learning activities were much greater. After participating in team learning exercises, students' perspectives about the benefits of teamwork became more positive. Team learning exercises were seen as being far more successful and entertaining than the traditional lectures that were still part of the curriculum, though they were still thought to be beneficial to some level.[16] According to one research, having several groups in one room and tiny, individual teams of five to six kids was a definite strength of the TBL. Relationships both inside and between groups were formed under the direction of facilitators. Through the power of interaction, students gained from this engagement in the form of friendly competition and camaraderie. Engaging participants in active learning activities can help foster a better comprehension of the material and improve retention of that information.[17] TBL promotes greater learning and the development of higher-order cognitive abilities, which is one of its main benefits. Students may apply their knowledge and mastery of fundamental science ideas through team discussions and interactions as they work to solve a series of clinically oriented problems, which increases student accountability. By fostering student interactions that are predicated on learning the various methods of instruction and communication among the members, TBL promotes students to develop interpersonal ties among the group members.

In addition, team-based learning (TBL) combined with cooperative learning can reduce the likelihood of interpersonal disputes and recognise each member's particular strengths and shortcomings.19 Apart from the numerous benefits that team learning offers students, the facilitator derives satisfaction from helping them build their knowledge within the TBL framework and engaging in collaborative learning activities.

7. Conclusion

According to the findings of our research, one learning technique that may be used to enhance learning and offer a platform for collaborative learning is team-based learning. Numerous elements of the TBL process were preferred by the students, especially the incentive to complete the prereading and the team's participation.

8. Limitations

1. The TBL method should have been compared with another teaching learning method to present the effectiveness of the TBL which would have been more authentic.
2. The disadvantages of small group discussion were evident in some of the groups, that some students were remaining aloof during the group discussions and at the same time some knowledgeable students were dominating the group discussion. This could have affected the team scores which may be high or low.
3. No individual group faculty mentor was allotted to the groups to guide the students during the discussion to facilitate the group discussion.

9. Source of Funding

None.

10. Conflict of Interest

None.

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