SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Dhali *et al*., 2025
doi: 10.21276/SSR-IIJLS.2025.11.4.54

Original Article

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Introduction of Team-Based Learning in Anatomy among Phase 1 Students in Medical College, Kolkata, West Bengal

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Received: 18 Feb 2025/ Revised: 29 Apr 2025/ Accepted: 24 Jun 2025

ABSTRACT

Background: Team-based learning (TBL) is a highly structured, effective approach in conjunction with traditional classroom learning technology. It is built around a sequence of learning modules, followed by a series of classroom-based activities that train the student's brain to acquire knowledge and apply it, leading to better outcomes in the course curriculum.

Methods: A prospective interventional study was conducted in the Anatomy Department of Medical College, Kolkata. From the Phase 1 MBBS students in the current academic year, 100 were included in the study population. A team-based learning module was prepared, and the perceptions of students and faculty members or facilitators were recorded through quizzes, tests, and feedback questionnaires. Data analysis was done by comparing percentages using bar graphs, pie charts, and histograms.

Results: It was documented that 80% of students and 83.4% of the facilitators rated the TBL approach as excellent. Student feedback showed that TBL was an interesting and innovative learning technology, with a satisfaction index of 80.3%. The faculty found this approach interesting in terms of student interest, participation, and comprehension, with 100% positive responses. Improvements were seen in the scores of the formative and summative assessments.

Conclusion: The team-based learning approach has the dynamics and framework that stimulate deeper learning of curricular concepts. The faculty found this co-active approach to be better than didactic teaching to achieve the learning outcomes

Key-words: Team-Based Learning, innovative TLM, Feedback, Learning Module, Anatomy

INTRODUCTION

Team-based learning (TBL) is defined as "an active learning and small group instructional strategy that provides students with opportunities to apply conceptual knowledge through a sequence of activities that includes individual work, teamwork, and immediate feedback" [1]. TBL was initially designed by Professor Larry Michaelsen in the 1980s in the United States of America for use in business schools. Michaelsen developed TBL in response to increasing class sizes and his concern about the effectiveness of lecture-based instruction for large groups [2]. TBL provides the opportunity to continue teaching engagingly, cater to large numbers of students, provide immediate feedback, involve students in decision-making, and promote active small-group and class discussions [2]. TBL goes beyond the simple transfer

How to cite this article
Dhali RS, Saha S, Chakrabarty S, Badyal DK, Samuel CJ. Introduction of Team-Based Learning in Anatomy among Phase 1 Students in Medical College, Kolkata, West Bengal. SSR Inst Int J Life Sci., 2025; 11(4): 8165-8171

Access this article online
https://iijls.com/

doi: 10.21276/SSR-IIJLS.2025.11.4.54

of content to the application of knowledge through conceptual and procedural problem solving [3]. In recent years, TBL has gained popularity in medical and healthcare education as a resource-efficient, student-centred teaching pedagogy, sometimes introduced as an alternative to Problem-based learning (PBL). Globally, an increasing number of healthcare faculties have adopted TBL in various combinations across diverse settings and content areas [2]. As there are many variations in how TBL is delivered within health professional education, in our project, we followed the guidelines laid down by Haidet and colleagues in 2012 [4].

Team-based learning trains the student's brain in acquiring skills rather than putting strain on it by incorporating too many facts and data. This is a practical approach to learning, in conjunction with traditional classroom/lecture-based instruction, that engages in collaborative activities to improve acquired knowledge, skills, and problem-solving [5-8]. One of the major roles of the Indian Medical Graduate (IMG) is to be a member of a healthcare team. While the MBBS program is structured to build this competence throughout the course, an introduction to working in a team is essential at the beginning. Good time management is critical for a medical student to become a Professional. Many college deadlines occur at the same time, and unless the student plans, he/she will find it difficult to manage them.

Team-based learning (TBL) is used in the medical field to implement interactive learning in small groups [6]. Learning anatomy and its subsequent application requires students to recall a great deal of factual content. It satisfied their innumerable queries. It gives students opportunities to solve problems by applying the knowledge acquired through group study, discussions, and activities such as quizzes and seminars, thereby enhancing their understanding and perception of the subject. Students perceived TBL as a motivator to be a responsible team member and to contribute to the team's collective learning. It reinforced self-directed learning and fostered an appreciation for peer respect [9]. Application exercises on solving problems in applied Anatomy, after working as a team, are a helpful learning strategy. Accountability for high-quality team performance must be assessed through frequent assessments, including formative, continuous internal assessment, and summative assessment.

MATERIALS AND METHODS

Study design and Setting- A prospective interventional study was conducted at the Anatomy Department of Medical College, Kolkata. The study sample was recruited from the current academic year. They were explained the procedure of team-based learning in detail, along with its benefits in terms of outcomes. A prospective study was conducted from May 2021 to April 2022. Achieving participation from the study sample at a given time was possible only during the first few months of this academic year. Later, due to pandemic restrictions, the number of students faltered, and the subjects available for the project work also varied at times.

Study participants and sampling- This study began with the participation of 250 Phase I MBBS undergraduate students, after obtaining ethical clearance from the institutional ethics committee and before approval by the scientific review committee. Both faculty and students were sensitised to the team-based learning method. A structured feedback questionnaire was used to assess students' and faculty's perceptions. Modules for TBL were prepared for interactive discussion while applying innovation.

TBL consisted of structured modules that were taught gradually in three steps: -

STEP 1-Pre-class Preparation and Individual pre-class work- At first, only lecture-based classroom teaching was done in a large group at the lecture theatre. Students were given sources of reading material on the assigned topics, such as textbooks, reference books, and journal articles, before class.

STEP 2 - Assessment in class

In-class individual readiness assurance test (IRAT) done in the form of quizzes/MCQ tests- At the beginning of each new learning session, the students were assessed as individuals and then as a group with immediate feedback on their answers. This assessment approach is known as the "readiness assurance process".

Team readiness assurance tests (TRAT)- Team readiness assurance tests (TRAT) were held after studying pre-reading materials. Students were divided into four teams of 25 each, and then each team was allotted a teacher cum facilitator under whose guidance team-based learning happened. Then they were assessed by teachers

doi: 10.21276/SSR-IIJLS.2025.11.4.54

using questionnaires with MCQs, and the results were recorded.

Selection of topics- The following topics in Anatomy are selected for study purposes: Anatomy of the Diaphragm, Liver, Uterus, Stomach, development of the heart, development of the kidneys, and development of the gonads. In between learning and team activities, a weekly doubt-clearing session was also held through group discussion among the teams.

STEP 3- Application-focused exercises were given to the teams to solve the problems discussed already

The instructor faculty planned the sessions meticulously, prepared the study material, and evaluated the sessions regularly. The instructor also presented a PowerPoint on each topic to clear any doubts that arose during the discussion. Once the instructor felt that the students had mastered the main concepts of the RAT, the class would proceed to an application exercise. The students were then assessed using MCQ papers, which the teachers then evaluated. Quizzes were also conducted, taking all 4 teams together periodically to assess their perception of the topic and team performance was also recorded.

Evaluation of the student performance

Outcome measurement was done in 3 ways: -

i) Formative assessment

ii) Self-assessment through feedback questionnaires

iii) Peer assessment

Evaluation of the faculty performance

Faculty self-assessment was conducted through feedback questionnaires. Peer assessment served as a powerful tool for assessing and encouraging the development of professional behaviour, particularly the interpersonal dimensions. Students in this technique receive training to provide specific, constructive feedback. All data collected from the pre-TBL and post-TBL assessments are then compared, and significance is calculated if any. The Satisfaction Index for each item was calculated using the following formula:

Total number of positive responses × 100

Total number of responses, expressed as a percentage. So here we took the help of the following formula, as was done in the referred work [10].

$$\frac{[(n1 * 1) + (n2 * 2) + (n3 * 3) + (n4 * 4) + (n5 * 5)] *}{(n1 + n2 + n3 + n4 + n5)}$$

Where n is the total number of students gaining the score mentioned in the subscript for that particular item

n1=number of participants who had opted for Strongly Disagree

n2=number of participants who had opted for Disagree

n 3= number of participants who had opted for Neutral

n4=number of participants who had opted for Agree

n5= number of participants who had opted for Strongly Agree

RESULTS

It was found that as high as 80% of students and 83.4 % of the faculty had rated the TBL learning approach as excellent, 10.8% found it to be a perfect method, whereas 8.8% had found it to be a good method, as shown in Fig. 1. This overall rating was done at an early period of the study, immediately after the sensitisation sessions were successfully conducted among the faculty and the student participants. Hence, the entire batch was available for the overall rating. Feedback revealed that the students were satisfied with the TBL approach, and their knowledge, comprehension, and interest in the topic increased after they used TBL as an innovative teaching-learning method, with a satisfaction index of 80.3%. The students realised that self-study, discussion, and teamwork helped improve their understanding of the topics, with a satisfaction index of 84.2. The students felt better equipped to answer questions in Anatomy rationally, with a satisfaction index of 80.6 (Fig. 2).

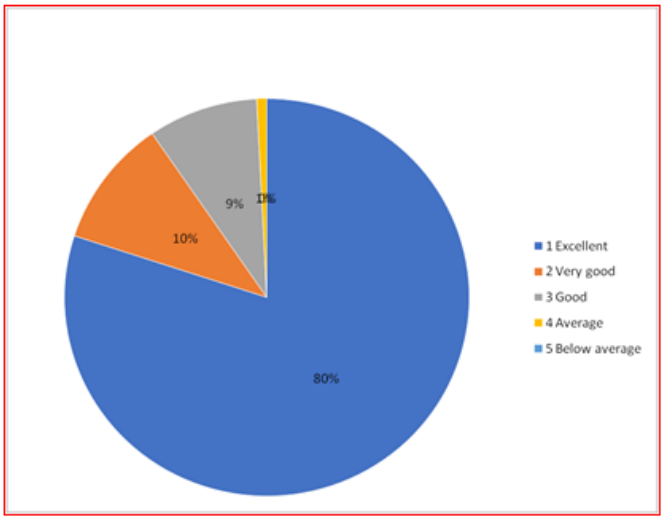

Fig. 1: Overall Rating for Team-based learning approach by the Students and Faculties

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The faculty also agreed that this approach was worthwhile for teaching Gross Anatomy and Embryology, based on student interest, participation, and comprehension, with 100% positive responses. However, they felt that TBL as TLM is time-consuming and requires extra effort beyond curricular needs.

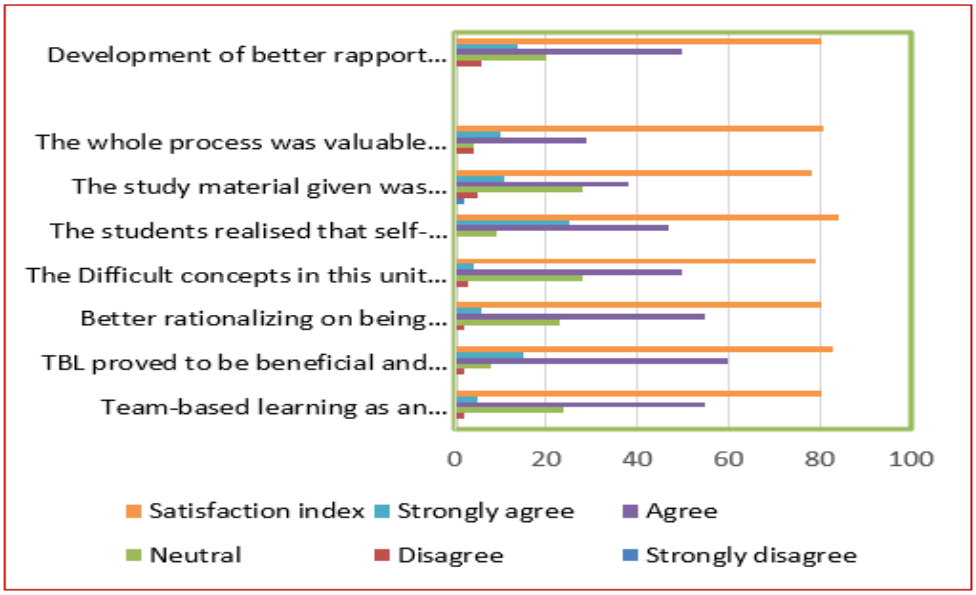

Fig. 2: Feedback responses of the Phase 1 Students and Satisfaction Indices regarding TBL based on the Likert Scale

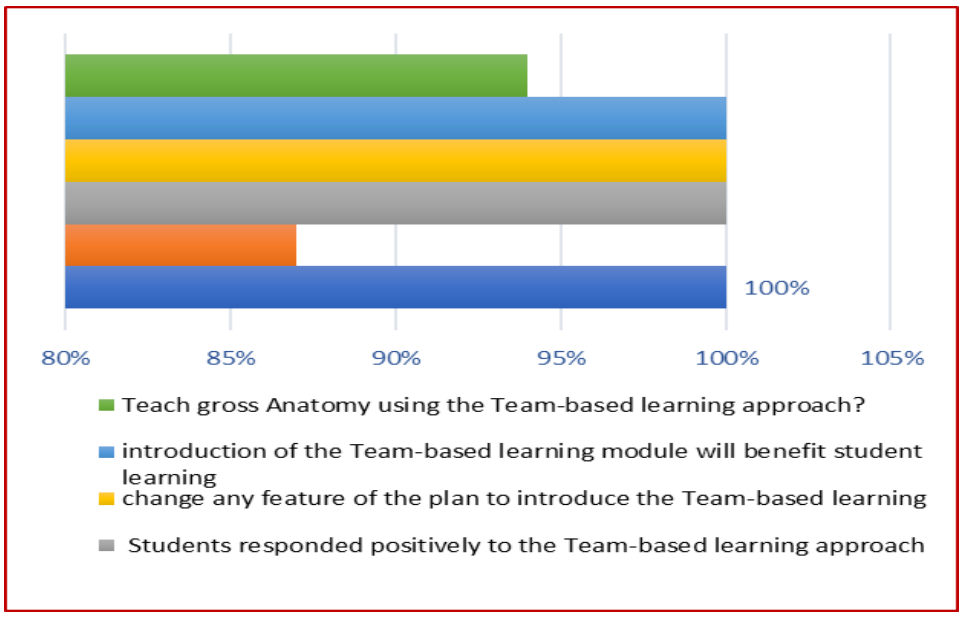

Fig. 3: Responses expressed in percentage from the Anatomy Faculty interview on the Team-based learning approach

The faculty felt 100% confident in introducing the TBL module, which would, in turn, benefit students' learning, and were ready to change any feature of the plan to introduce TBL as a teaching-learning method, as evident in Figure 3. They also stated during the interview that they had never heard about the team-based learning approach for teaching undergraduate students. Faculty members gradually implemented TBL for teaching gross anatomy at a response rate of more than 90% as revealed in the structured interview. It was also found that more than 85% of the faculty members had a positive approach to team-based learning. Feedback from the departmental Faculty was recorded on a Likert Scale (Table 1).

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Table 1: Feedback from Anatomy faculty on the TBL class approach based on the Likert scale

Content	Response					Mean Rating
	1	2	3	4	5	
TBL class is more engaging than the traditional Anatomy class	10(83.4%)	2 (16.6%)	0 (0%)	0 (0%)	0 (0%)	1.12
TBL class is more interesting than the traditional Anatomy class	9 (75%)	3 (25%)	0 (0%)	0 (0%)	0 (0%)	1.19
TBL class is more beneficial than the traditional class for teaching Anatomy	10(83.4%)	2 (16.6%)	0 (0%)	0 (0%)	0 (0%)	1.12
TBL class was suitable for both slow and fast learners	6 (50%)	3 (25%)	3 (25%)	0 (0%)	0 (0%)	2.25
I would recommend the TBL class for all topics of Anatomy	11(91.7%)	1 (8.3%)	0 (0%)	0 (0%)	0 (0%)	1.06

Values are presented as several responses to each statement (%), and the total number of Anatomy Department faculty respondents = 12

DISCUSSION

Team-based learning cultivates a cognitively enriching environment by directing students toward the development of practical and analytical skills rather than overwhelming them with excessive information. This pedagogical approach shifts the emphasis from passive reception of content to active intellectual engagement, thereby facilitating deeper processing and long-term retention. When implemented alongside traditional classroom or lecture-based methods, it creates a complementary instructional framework that enhances comprehension through structured peer interaction. The collaborative nature of team-based learning promotes collective reasoning, reflective discussion, and shared responsibility for academic outcomes, all of which contribute meaningfully to improved knowledge acquisition, refinement of skills, and strengthened problem-solving abilities. Through this integrative model, learners are encouraged to think critically, articulate their understanding, and apply concepts more effectively within both academic and clinical contexts [7,8]. The primary intent of TBL, which is denoted as a version of the modified flipped classroom, is to go beyond the simple coverage of content and to focus on ensuring that the students practice using course concepts to solve problems. In other words, TBL can be defined as a learner-centred instructional strategy that is based on techniques for developing high-performance learning teams and that can enhance the quality of student/trainee learning in almost any course [9-11]. Team performance was consistently observed to be positively impacted as well as improved due to the better performance of teams as compared to individuals on course exams and through improved communication and awareness within teams [12]. The findings of this exploratory study reveal a clear improvement in students' academic performance, as evidenced by significantly higher post-test scores following the Team-Based Learning intervention. Students reported heightened comprehension of difficult biochemical concepts, greater engagement, and increased confidence, reflected in consistently high satisfaction indices across multiple feedback items. The study also demonstrates that TBL fostered analytical thinking, communication skills, and collaborative learning, with learners expressing that self-study and teamwork markedly enhanced topic mastery. Moreover, comparison between batches showed that students exposed to TBL performed better than those taught exclusively through lectures, indicating its pedagogical value in the Indian medical education context [11,12].

Due to these circumstances, offline teaching for the concerned batch could be conducted only for the initial few months. Consequently, there was frequent rescheduling of assessments and practical classes while theoretical instruction continued, leaving limited opportunities for conducting additional group activities essential for TBL sessions. Similar implementation challenges, such as reduced group interaction time and faculty availability, have also been reported in previous TBL literature [13,14]. These constraints also meant that

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not all faculty members or residents were able to attend every session consistently. Furthermore, the restricted time available for each session did not allow clarification of all participants' doubts.

LIMITATIONS

Study limitations were that although the study had begun with 250 students of the MBBS batch of 2021-22, all of them could not be assessed through feedback forms because of time constraints owing to the restrictions imposed on movement and normal life by the COVID-19 pandemic, which was the biggest limitation.

CONCLUSIONS

TBL promotes active learning within a group of students, and group work enhances the ability to apply course content & improves communication skills. Learners felt motivated to solve complex problems, triggering active participation and learning through group dynamics. TBL promotes the development of self-managed learning groups. The entire procedure was highly engaging for the participants and facilitators. Assignments also motivated SDL practice, as they provided pre-reading materials alongside class lectures, and improved students' team spirit, attitude, communication skills, and interaction with the team. TBL is an application-oriented teaching method that aims to combine small- and large-group learning by incorporating multiple small groups into a large-group setting and applying innovation. It has positive educational outcomes in terms of knowledge acquisition, participation, engagement, and team performance. TBL is superior to didactic lectures, according to previous research. This teaching-learning method can be improved by frequent faculty meetings and focused group discussions during module design and before the actual implementation of TBL, with meticulous and thoughtful selection of pre-class reading material/resources before taking the tests.

CONTRIBUTION OF AUTHORS

Research concept- Ranjita Santra Dhali
Research design- Ranjita Santra Dhali, Soma Saha
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Materials- Sourav Chakrabarty
Data collection- Soma Saha
Data analysis and interpretation- Soma Saha, Ranjita Santra Dhali
Literature search- Sourav Chakrabarty
Writing of the article- Ranjita Santra Dhali
Critical review- Dinesh Kumar Badyal
Article editing- Clarence James Samuel
Final approval- Clarence James Samuel

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