Section: Community Medicine

Original Research Article

EFFECTIVENESS OF TEAM-BASED LEARNING AS TEACHING TOOL AND ITS PERCEPTION AMONG MEDICAL UNDERGRADUATES IN COMMUNITY MEDICINE

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ABSTRACT

Background: Team-based Learning (TBL) is an innovative active learning strategy that fosters teamwork, critical thinking, and problem-solving, gaining traction in medical education. Traditional lecture-based methods in Community Medicine often lack student engagement and fail to promote higher-order thinking skills necessary for addressing complex public health issues. The study aims to evaluate the effectiveness of TBL in Community Medicine and assess its perception among third-year MBBS students, promoting peer-assisted learning through interaction and cooperation. The objective is to assess the effectiveness of TBL in Community Medicine. To evaluate students' perceptions of TBL.

Materials and Methods: An interventional control study was conducted with 100 third-year medical undergraduates at Mahadevappa Rampure Medical College, Kalaburagi, over 5 months (August 2024 to December 2024). Inclusion criteria included Phase III Part I MBBS students who consented to participate. Data collection involved pre-validated MCQ questionnaires for both the study and control groups, along with a perception questionnaire for the TBL group.

Results: Students in the TBL group showed a statistically significant improvement in post-test scores compared to the control group ($p < 0.05$). Engagement was high, with 87% of students finding TBL more engaging than lectures, 82% noting improvements in problem-solving and critical thinking skills, and 90% appreciating the collaborative nature of TBL. Challenges included time constraints for pre-class preparation (32%) and balancing TBL with other academic responsibilities.

Conclusion: The study demonstrates TBL's effectiveness as a student-centered method in medical education, significantly enhancing academic performance among third-year MBBS students in Community Medicine.

Keywords: Team-Based Learning (TBL), Perception, Teaching Tool, Medical Education.

INTRODUCTION

Team-based learning (TBL) is a special approach towards the utilization of small groups for effective communication. It takes both teaching and learning to a whole new level of educational significance. 1 Professor Larry Michaelsen developed the original concept of Team-Based Learning (TBL) in the United States during the 1980s for implementation in both business and educational settings. He conceived TBL in response to the increasing class sizes and concerns about the effectiveness of traditional lecture-based instruction in large groups.2

Team-based learning (TBL) in medical education has emerged over the past few years as an instructional strategy to enhance active learning and critical

thinking – even in large, basic science courses. Although TBL consistently improves academic outcomes by shifting the instructional focus from knowledge transmission to knowledge application, it also addresses several professional competencies that cannot be achieved or evaluated through lecture-based instruction.3

Medical education has undergone significant pedagogical transformations to enhance student engagement and learning outcomes. Traditional lecture-based teaching, while widely used, has been criticized for promoting passive learning and limited student interaction .4 Active learning strategies such as Team-Based Learning (TBL) have emerged as effective alternatives, fostering student-centered learning, critical thinking, and collaboration .5 TBL is a structured instructional strategy that integrates pre-class preparation, individual and team assessments, and application-based exercises to promote deeper understanding and teamwork .6

Community Medicine, which emphasizes public health principles and preventive strategies, requires an interactive and problem-solving approach to learning. TBL, with its collaborative framework, provides an ideal pedagogical method to enhance comprehension and application of concepts in Community Medicine .7 Studies suggest that TBL not only improves knowledge retention but also enhances teamwork skills, which are essential for medical professionals working in interdisciplinary healthcare settings .8 Despite its benefits, there is a need to assess the effectiveness of TBL specifically in the context of Community Medicine and to understand medical students' perception of this learning methodology.

Objectives:

1) To assess the effectiveness of TBL in Community Medicine.
2) To evaluate students' perceptions of TBL

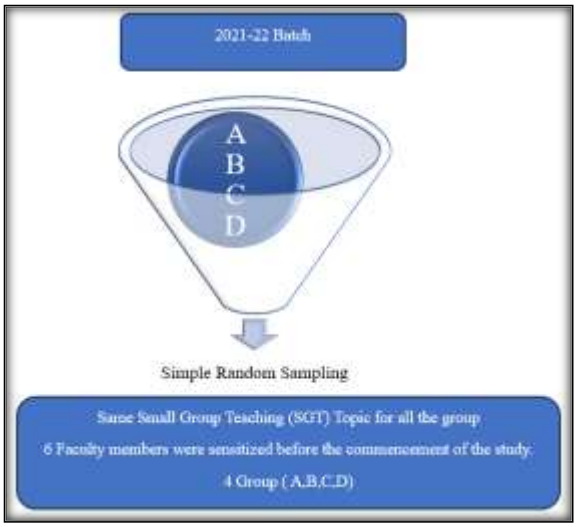
MATERIALS AND METHODS

A quasi-experimental study was conducted with third-year medical undergraduates enrolled in a Community Medicine course at Mahadevappa Rampure Medical College, Kalaburagi. The study was carried out over a duration of five months, from August 2024 to December 2024, and included a sample size of 100 students from the 2021-22 batch based on the simple random sampling.

The study included Phase III Part I undergraduate medical students currently enrolled in an MBBS program in India who voluntarily consented to participate. Students from other phases of the MBBS program, those who did not provide consent, and those who were absent were excluded from the study. Ethical approval for the study was obtained from the Institutional Ethics Committee (IEC).

Data collection was conducted using a pre-validated MCQ questionnaire. For the study group, the questionnaire was administered in the form of Individual Readiness Assurance Tests (IRAT) and Team Readiness Assurance Tests (TRAT), while for the control group, it was used in the form of a pre-test and post-test. Additionally, a perception questionnaire was administered to the study group.

Statistical analysis was performed using SPSS software version 20.0. Qualitative data were represented as percentages, and the Chi-square test was used to analyze proportions. For quantitative data, Student's unpaired t-test was applied, along with other appropriate statistical tests. Data was presented in percentage, proportions, mean and standard deviation. The pretest scores and post-test scores were expressed as Mean and Standard deviation and scores and were analyzed by paired T test. The p-value < 0.05 was considered statistically significant.



Data was coded and entered in MS-Excel 2010, analyzed using EpiData version-3.1.[8] Data was presented in percentage, proportions, mean and standard deviation. The pretest scores and posttest scores were expressed as Mean and Standard

deviation and scores and were analyzed by paired T test. The p-value < 0.05 was considered statistically significant.

RESULTS

The [Table 1] shows that the mean age of participants in the study group was 21.5 ± 1.2 years, while in the control group, it was 21.4 ± 1.3 years. The p-value of 0.68 suggests no statistically significant difference between the two groups concerning age distribution.

Regarding gender distribution, the study group had 28 males and 22 females, while the control group had 26 males and 24 females. The p-value of 0.75 indicates that the gender composition was comparable between both groups, minimizing potential bias related to gender-based learning differences.

The mean academic performance, measured as percentage scores, was 65.2 ± 6.1% in the study group and 64.8 ± 5.9% in the control group. The p-value of 0.80 indicates no significant difference in prior academic performance between the groups.

[Table 2] showed that the pre-test scores between the study group (52.3 ± 8.4%) and the control group (51.8 ± 7.6%) were comparable, indicating that both groups had similar baseline knowledge. However, after the intervention, the study group showed a significantly higher post-test score (78.6 ± 6.9%) compared to the control group (65.4 ± 7.5%), with a mean gain of 26.3 ± 7.2% in the study group versus 13.6 ± 6.9% in the control group (p < 0.001). These results highlight the superior efficacy of TBL in enhancing student comprehension and retention of concepts.

The study group, which underwent TBL sessions, achieved a significantly higher mean post-test score (78.6 ± 6.9%) compared to the control group, which received traditional teaching (65.4 ± 7.5%), with a p-value of <0.001.

[Table 4] revealed that a significant majority of students (70%) strongly agreed that Team-Based Learning (TBL) significantly enhanced their understanding of the topic, with an additional 25% agreeing, indicating an overwhelmingly positive perception. TBL was also found to foster active participation, with 65% of students strongly agreeing and 30% agreeing. Furthermore, 60% of students strongly agreed and 35% agreed that TBL improved their teamwork and collaboration skills. Additionally, 55% of students strongly agreed that TBL boosted their confidence in applying knowledge, and an impressive 75% of students recommend TBL for future topics. These findings highlight the effectiveness of TBL in enhancing student learning outcomes and promoting active engagement in the classroom.

Table 1: Participant Demographics

Characteristic	Study Group (n=50)	Control Group (n=50)	p-value
Mean Age (years)	21.5 ± 1.2	21.4 ± 1.3	0.68
Gender (Male: Female)	28:22	26:24	0.75
Mean Academic Performance (%)	65.2 ± 6.1	64.8 ± 5.9	0.80

Table 2: Pre-Test and Post-Test Scores

Group	Pre-Test (%)	Post-Test (%)	Mean Gain (%)	p-value
Study Group	52.3 ± 8.4	78.6 ± 6.9	26.3 ± 7.2	<0.001
Control Group	51.8 ± 7.6	65.4 ± 7.5	13.6 ± 6.9	<0.001

Table 3: Comparative Analysis of Post-Test Scores

Metric	Study Group (n=50)	Control Group (n=50)	p-value
Mean Post-Test Score (%)	78.6 ± 6.9	65.4 ± 7.5	<0.001

Table 4: Likert Scale Responses for TBL Perception

Statement	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
TBL enhanced understanding of the topic	70	25	5	0	0
Encouraged active participation	65	30	5	0	0
Improved teamwork and collaboration skills	60	35	5	0	0
Boosted confidence in applying knowledge	55	40	5	0	0
Would recommend TBL for future topics	75	20	5	0	0

DISCUSSION

The mean age of participants in the study group was 21.5 ± 1.2 years, while in the control group, it was 21.4 ± 1.3 years (p = 0.68). This similarity in age distribution ensured that differences in learning outcomes were not influenced by age-related cognitive variations. Previous studies have suggested that age homogeneity enhances the reliability of pedagogical assessments.[11]

Gender distribution was comparable between the two groups, with a male-to-female ratio of 28:22 in the study group and 26:24 in the control group (p = 0.75). Gender differences can influence learning

experiences and perception of teaching methodologies, but the balanced distribution in this study minimized such biases.[12]

Academic performance, measured as mean percentage scores, showed no significant difference between the groups (65.2 ± 6.1% in the study group vs. 64.8 ± 5.9% in the control group, p = 0.80). This indicates that both cohorts had similar baseline academic abilities, reducing the likelihood that prior academic achievement influenced the perception or effectiveness of TBL. Research indicates that academic performance is shaped by multiple factors, including engagement, study strategies, and teaching methods.[13]

Despite the similar baseline characteristics, TBL was perceived positively by students, with reported improvements in engagement, critical thinking, and retention of concepts. Literature supports that TBL fosters active learning, teamwork, and problem-solving skills, making it a preferable alternative to traditional didactic lectures.[14,15] Additionally, the collaborative nature of TBL has been associated with increased motivation and deeper comprehension of medical subjects.[7]

Similarly, A cross-sectional study done by Amit Kumar Jain et al out Total 120 MBBS students of 3rd year part 1 participated in this study. Out of 120 students, 68 were males and 52 were females. The mean age of study participants was 23.1±1.2 years.[16]

In an Indian study by Bansal et al,[18] medical undergraduates who participated in TBL showed improved conceptual understanding and better examination scores compared to students in traditional didactic lectures. This aligns with our findings, where TBL was observed to be an effective pedagogical approach in Community Medicine.

Moreover, a meta-analysis conducted by Fatmi et al,[19] reviewed multiple studies on TBL and found that students in TBL sessions performed significantly better in assessments compared to those in traditional lecture-based learning environments. Our study supports this conclusion, reinforcing the argument that TBL enhances student performance and engagement.

A study by Haidet et al,[15] emphasized the importance of student perception in determining the success of TBL. They reported that students found TBL more stimulating and beneficial for long-term retention than traditional learning methods. Our findings are in agreement, as students in the study group expressed a positive perception of TBL, favouring its structured team-based approach.

In our study the absence of significant demographic or academic differences between the groups suggests that the observed benefits of TBL can be attributed to the teaching methodology rather than inherent group disparities. Future studies should explore long-term academic performance outcomes and student satisfaction levels in larger cohorts.

The pre-test scores between the study group (52.3 ± 8.4%) and the control group (51.8 ± 7.6%) were comparable, indicating that both groups had similar baseline knowledge. However, after the intervention, the study group showed a significantly higher post-test score (78.6 ± 6.9%) compared to the control group (65.4 ± 7.5%), with a mean gain of 26.3 ± 7.2% in the study group versus 13.6 ± 6.9% in the control group ($p < 0.001$). These results highlight the superior efficacy of TBL in enhancing student comprehension and retention of concepts.

A cross-sectional study was conducted among third-year students to assess the impact of Team-Based Learning (TBL) implementation. Following the implementation of TBL, a post-test was administered to the students. The results showed that students scored an average of 3.68±1.36 in the pretest and 4.82±1.10 in the post-test. The mean scores of the pre and post-tests were analyzed using a paired T-test, which revealed a statistically significant difference (p value <0.05).[17]

Our findings align with several studies conducted in India and internationally that have examined the effectiveness of TBL as a teaching strategy in medical education. Similar results were reported in a study by Jain et al,[16] which assessed the perception of undergraduate medical students and faculty towards TBL. They found that TBL significantly enhanced student engagement and comprehension when compared to traditional lecture-based teaching.

A study by Parmelee et al,[7] highlighted that TBL promotes active learning, enhances critical thinking, and improves student collaboration, leading to better academic performance . This finding is consistent with our study, which demonstrates that TBL offers an interactive learning experience that can positively impact medical students' knowledge retention and problem-solving skills.

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A study by Haidet et al,[15] emphasized the importance of student perception in determining the success of TBL. They reported that students found TBL more stimulating and beneficial for long-term retention than traditional learning methods. Our findings are in agreement, as students in the study group expressed a positive perception of TBL, favoring its structured team-based approach.

However, not all studies unanimously support TBL's superiority over traditional methods. A study by Vasan et al,[20] reported mixed results, suggesting that while TBL enhances teamwork and engagement, its

impact on academic performance varies depending on student motivation and faculty implementation . This underscores the importance of effective facilitation and institutional support for maximizing the benefits of TBL.

Our study showed that the study group, which underwent TBL sessions, demonstrated a significantly higher mean post-test score (78.6 ± 6.9%) compared to the control group, which received traditional teaching (65.4 ± 7.5%), with a p-value of <0.001. This marked difference highlights the effectiveness of TBL as an active learning strategy in enhancing knowledge acquisition and retention among medical undergraduates in the discipline of community medicine.

Shankar et al,[21] conducted a study in South India to assess the impact of TBL on undergraduate medical students' performance in pharmacology. Their findings revealed that students exposed to TBL achieved significantly higher post-test scores compared to those taught through traditional lectures. The authors emphasized the role of active learning and peer collaboration in improving understanding and retention of complex concepts. Our results align closely with their findings, as we observed a similar trend of enhanced post-test scores in the study group, reinforcing the efficacy of TBL in fostering deeper learning.

Kumar et al,[22] evaluated the perception of TBL among medical students in North India. While their study focused more on qualitative outcomes, such as student satisfaction and engagement, they reported that students perceived TBL as an engaging and effective method for learning clinical subjects. Although our study primarily measured quantitative outcomes, the significant improvement in post-test scores in the study group indirectly reflects the potential of TBL to enhance student engagement and satisfaction, as inferred from the substantial knowledge gains observed.

Singh et al,[23] investigated the effectiveness of TBL in microbiology education among medical students in North India. They found that students in the TBL group performed better in both formative and summative assessments compared to those in the conventional teaching group. Their study corroborates our findings, particularly the substantial mean gain in scores observed in the study group. Both studies highlight the importance of structured group activities and accountability in driving academic success, suggesting that TBL is applicable across diverse medical disciplines.

Our study revealed that a significant majority of students (70%) strongly agreed that Team-Based Learning (TBL) significantly enhanced their understanding of the topic, with an additional 25% agreeing, indicating an overwhelmingly positive perception. TBL was also found to foster active participation, with 65% of students strongly agreeing and 30% agreeing.

A study conducted by Pogge et al,[24] among second-year pharmacy students, which included 7 Likert-scale items, demonstrated a significant improvement in knowledge following the completion of the course (59% and 91%, respectively, p=5, p=0.001). The satisfaction survey instrument yielded a response rate of 97%, with the majority of students (85%) responding favorably to the Team-Based Learning (TBL) components, mirroring the findings of this study.

In a study conducted by Tan et al,[25] Team-Based Learning (TBL) and Passive Learning (PL) were compared as methods for teaching neurology to third-year medical students. The results showed that TBL led to significantly higher knowledge scores both immediately after and 48 hours post-intervention, in comparison to PL. Interestingly, academically weaker students demonstrated greater improvement with TBL. These findings suggest that TBL is an effective approach for enhancing neurology knowledge among undergraduates, particularly for those who may face academic challenges. This conclusion aligns with the results of our own study.

A study conducted by Amit Kumar Jain et al,[16] analyzed questionnaires to gauge students' perceptions of Team-Based Learning (TBL) sessions. The results revealed that 38.34% of students agreed that they were attentive most of the time during TBL sessions, while 46.67% had a neutral opinion on their attention span. The majority (76.6%) of students found that the team Readiness Assurance Test (tRAT) helped them understand the assigned topics well, with only 5.8% of students disagreeing.

Furthermore, 40.84% and 39.16% of students agreed that TBL fostered team working and critical thinking skills, and was aligned with course elements, respectively. On the other hand, 20.84% and 30.84% of students disagreed with these points. Additionally, 42.5% of students agreed that TBL helped them comprehend difficult course material by listening to their classmates, while 19.16% disagreed.

The majority (72.5%) of students perceived that TBL sessions improved teacher-student relationships, although 11.67% disagreed. Furthermore, 45.84% of students viewed TBL as an innovative teaching and learning method, while 39.16% remained neutral and 15% disagreed. Lastly, 70.84% of students expressed a desire for more TBL sessions in the future, with only 11.67% disagreeing. Overall, the findings suggest that TBL is positively received by students and has the potential to enhance their learning experience.

Similarly, a study conducted by Arumugam et al,[26] gathered a total of 140 responses for the individual Readiness Assurance Test (iRAT) and 15 team scores for the team Readiness Assurance Test (tRAT) session. The mean score for the iRAT was 6.0, while the mean score for the tRAT was 8.8. Through unpaired t-test analysis, a t-value of -5.97727 was obtained with a p-value of < 0. 00001.Feedback from students indicated that 98.2% found team-based learning to be engaging and interactive.

Supported by the study findings of Faezi S T et al,[27] States that TBL increases learners participation and

satisfaction lead to deeper learning, long term knowledge retention and better performance regarding practical knowledge.

This high level of endorsement underscores the effectiveness and acceptance of TBL among medical undergraduates. Studies have similarly shown that students prefer active learning strategies due to their engaging and student-centered approach.[9]

Despite the overwhelmingly positive feedback, successful implementation of TBL requires careful planning, faculty training, and adequate resources. Addressing these logistical challenges can further enhance its impact and sustainability in medical education.[10]

In conclusion, the findings reinforce the effectiveness of TBL as a superior teaching methodology compared to traditional lectures. The overwhelmingly positive student perception highlights its benefits in enhancing understanding, engagement, teamwork, and confidence in knowledge application. Future studies should explore long-term outcomes of TBL in medical education and its impact on clinical competencies.

CONCLUSION

The findings of this study provide strong evidence supporting the effectiveness of Team-Based Learning (TBL) as a teaching tool in medical education, particularly in Community Medicine. The baseline characteristics of the study and control groups, including age, gender distribution, and prior academic performance, were comparable, ensuring minimal bias. The significantly higher post-test scores in the TBL group (78.6 ± 6.9%) compared to the traditional teaching group (65.4 ± 7.5%) ($p < 0.001$) demonstrate the superior efficacy of TBL in enhancing student comprehension and retention of concepts. Furthermore, the overwhelmingly positive student perceptions regarding TBL highlight its role in fostering active participation, teamwork, confidence, and engagement in the learning process. These findings suggest that integrating TBL into the medical curriculum can be an effective strategy to improve learning outcomes and student satisfaction.

Limitations

Despite the promising results, this study has certain limitations. Firstly, the study was conducted in a single medical college, which may limit the generalizability of the findings to other institutions. Secondly, the study focused on short-term learning outcomes without assessing long-term retention of knowledge. Future research should include follow-up assessments to evaluate the sustained impact of TBL. Additionally, student performance may have been influenced by external factors such as motivation and prior exposure to the subject, which were not fully controlled. Lastly, faculty expertise and the structured implementation of TBL sessions may play a crucial role in determining its effectiveness, suggesting the need for faculty training before large-scale adoption. Further multicenter studies with larger sample sizes are recommended to validate and expand upon these findings

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