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# Comparing the Student Learning Outcomes and Teaching Satisfaction of Conventional Lecture and Team-Based Learning Methods

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## ABSTRACT

Students hesitate to pursue subjects like biochemistry and manifest a lack of participation and motivation during conventional lectures. However, team-based learning facilitates interactive learning through discussion and improves learning outcomes. **Objective:** To compare the student learning outcomes and teaching satisfaction from team-based learning and conventional learning among medical students. **Methods:** A prospective study was conducted in Rahbar Medical College from December 2023 to May 2024. A total of 100 undergraduate students aged from 19 to 22 years studying biochemistry course were selected for the study. A total of 16 classes were conducted for teaching biochemistry among which 8 were taught by conventional lecture method and the rest 8 were taught by team-based learning. Students were instructed to fill out a student satisfaction scale questionnaire consisting of 20 questions at the end of the last TBL session. **Results:** The mean score of conventional lectures was 11.85 ± 1.54 with a maximum score of 15.5 and minimum score of 10 out of 20. The highest score was obtained by group assessment readiness test i.e. 16.25 ± 1.05. The mean score of conventional and TBL methods was 14.10 ± 1.12, with a minimum score of 12.20, and a maximum score of 15.95 out of 20 (P=0.016). Overall satisfaction scores in females were higher than in males (p<0.001). The mean student satisfaction score was 81.27 ± 9.18. **Conclusions:** Team-based learning yields better learning outcomes and teaching satisfaction in medical students as compared to conventional lecture methods. These results were also improved in female students than in males.

## INTRODUCTION

Cooperative learning is a type of learning which involves working with student groups to solve a common problem together [1]. This technique allows the learners to sharpen their communication skills, enhance social interaction, and foster group thinking. Team-based learning is a structured extension of cooperative learning that has been practiced effectively for decades and its incorporation in the medical field is increasing [2]. The goal of team-based learning is to improve cognitive learning by collaborating with the masses using personal expertise. Team-based learning involves three steps. Firstly, the students are encouraged to study and prepare to discuss their viewpoints. Secondly, students' cognitive ability regarding subjects studied earlier is calculated through individual and group readiness assessment tests by dividing students into groups for discussion among peers and instructors. Lastly, students are asked to present and discuss higher-level subjects with team members [3]. TBL facilitates interactive learning

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through discussion regarding principles and assessments. Laboratory medicine is often taught by conventional lectures where teachers deliver their knowledge regarding basic and professional topics. However, in this type of learning, the student outcomes depend upon the expertise of the instructor and limited information can be a hindrance to learning and satisfaction of pupils. In addition, this method does not encourage student participation and communication but it is inexpensive and faster than TBL. Critical thinking and behavioral skills are not polished through lectures which are important characteristics for a medical student. Some studies have been conducted to compare the student outcomes by team-based learning and other methods which reported increased student participation and engagement in TBL [4, 5]. In conventional learning, teachers use different teaching techniques to deliver limited information, leading to obstruction of quality education and student satisfaction [6]. However, most of these studies are conducted for subjects like pharmacology and neurology. But students hesitate to pursue subjects like biochemistry and manifest a lack of participation and motivation during conventional lectures. It was hypothesized that this lack of motivation and satisfaction is due to the teaching methods to deliver these subjects. Our study includes students studying biochemistry and the learning outcomes and satisfaction scores were compared between both genders which is a finding rarely reported in many studies comparing learning methods.

This study compared the student learning outcomes and teaching satisfaction from team-based learning and conventional learning among medical students.

## METHODS

A prospective study was conducted in Rahbar Medical College from December 2023 to May 2024. A total of 100 undergraduate students aged from 19 to 22 years studying biochemistry course were selected for the study by consecutive sampling. The sample size was calculated by Daniel's formula keeping a 95% confidence interval, 50% population proportion, and 7% precision. Students inconsistent with attendance were excluded. All the student provided their consent to become a part of the study. The ethical committee of the medical college approved the study EC/IRB Ref.No.31. A total of 16 classes were conducted for teaching clinical biochemistry among which 8 were taught by conventional lecture method and the rest 8 were taught by team-based learning. The topics were divided into each method equally by keeping in view the volume of content and difficulty. The following topics were taught in lectures; gene transcription and translation, replication of DNA and post-transcriptional modifications. The topics covered in TBL were vitamins, enzymes and protein biosynthesis. The conventional lectures were delivered keeping in view the following: topics were divided according to students' convenience and time available in each lecture, an introductory summary of the topic was provided, maintenance of listeners' attention by good presentation and comprehension, and a conclusory summary at the end of each lecture. The content of the eight lectures was tested by a multiple-choice exam on the 9th lecture with questions of varied difficulty. For team-based learning, students were allocated to groups with 6-7 members, a manager, and a designated name. TBL was conducted in the following manner: individual readiness assessment tests were conducted with multiple choice questions from easy to increasing difficulty, group readiness assessment test was conducted in closed book exam, GRAT was checked and an appeal form for every mistake for each group was filled and lastly students were asked to fill a peer evaluation form. Students rated each group member with respect to their participation, preparation of the designated topic, cooperation, and inclusivity. For this purpose, the students assigned a score out of 100 to the team as a whole, mentioning the score of each member. The topic of the next lecture was summarized at the end of each lecture and students were recommended materials for self-study. To compare the student satisfaction between the two teaching methods, students were instructed to fill out a student satisfaction scale questionnaire consisting of 20 questions which could be answered by selecting from scoring options from 5 to 1 according to Likert scoring, with 5 being totally agree and 1 being totally disagree. This questionnaire was filled out at the end of the last team-based learning lecture. The validity of the scale was tested by asking teachers to rate the questions according to necessity/no necessity in the SSS and modifications required before presenting it to the students. A CVI score of 93% was achieved, which proved the validity of the scale [7]. The Cronbach's alpha coefficient was 0.957 for the calculation of external consistency and 0.918 for internal consistency with the split-half model. The student satisfaction score in each team-based learning session was calculated by the following formula [8]: A+C=D, ·:A= IRAT score, ·:C= P% x B, ·:B= adjusted peer evaluation score, ·:P= mean peer evaluation score, D= Total score. The average score of 8 TBL lectures was a total score. The final score of the biochemistry course was the mean score of both learning methods. All the data was analyzed by SPSS version 24. The normalcy of data was tested by the Kolmogorov-Smirnov test. Independent samples t-test was used to calculate the difference between two means and one-way analysis of variance was used to calculate the difference between more than two means. Pearson correlation test was used to evaluate the association between variates. The validity of the student satisfaction scale was tested by achieving internal and external consistency by calculating the intra-class correlation coefficient and Cronbach's alpha

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coefficient (with the Split-half model for internal consistency). A p-value less than 0.05 was considered significant.

## RESULTS

The mean score of conventional lectures was 11.85 ± 1.54 with a maximum score of 15.5 and a minimum score of 10 out of 20. The highest score was obtained by GART i.e. 16.25 ± 1.05. The mean score of conventional and TBL methods was 14.10 ± 1.12, with a minimum score of 12.20 and a maximum score of 15.95 out of 20 (P=0.016). The scores of female students were significantly higher than male students (p<0.001). Overall satisfaction scores in females were higher than in males (p<0.001) (Table 1).

**Table 1:** Comparison of Mean Score of Each Method According to Student Gender (n=70)

| Method | Mean Score (Mean ± SD) | Male (Mean ± SD) | Female (Mean ± SD) | p-Value |
|---|---|---|---|---|
| Lecturel | 11.85 ± 1.54 | 11.44 ± 1.33 | 12.22 ± 1.35 | 0.071 |
| ART | 14.72 ± 1.55 | 13.42 ± 0.90 | 15.19 ± 1.83 | 0.001 |
| GART | 16.25 ± 1.05 | 14.88 ± 0.52 | 16.66 ± 1.28 | 0.001 |
| Final | 14.10 ± 1.12 | 13.09 ± 0.69 | 14.51 ± 0.89 | 0.001 |

Table 2 showed the subsequent student satisfaction scores in all eight sessions of team-based learning based on the results of individual and group readiness assessments. The results show that the scores increased with an increase in teaching sessions and the difference between the mean scores of both assessments was significant (p<0.001).

**Table 2:** Individual and Group Readiness Assessment Test Scores in 8 Sessions of TBL

| Session | Individual Readiness Assessment Test Score | Group Readiness Assessment Test Score |
|---|---|---|
| 1st | 8.51 | 11.73 |
| 2nd | 10.67 | 13.85 |
| 3rd | 17.75 | 18.66 |
| 4th | 13.12 | 15.71 |
| 5th | 15.26 | 18.38 |
| 6th | 17.82 | 16.14 |
| 7th | 17.23 | 18.32 |
| 8th | 18.07 | 18.72 |

*T-test was performed to compare scores

The mean student satisfaction score was 81.27 ± 9.18. This score was obtained by results from the SSS questionnaire at the end of the last TBL session (Table 3). Students answered questions on a Likert scale with 20 representing totally disagree (option 1) and 100 representing totally agree (option 5). Students obtained a score of 16.91 ± 1.22 (Max: 18.77, Min: 14.83) out of 20 in the last academic semester and this score was not associated with the mean TBL score (p= 0.385, r= -0.111) or extent of satisfaction (p=0.933, r= 0.015). However, the final lecture score and student average scores were significantly associated (p=0.001, r= 0.427).

**Table 3:** Student Satisfaction Score within 14 Days of Completion

| Student Satisfaction | Mean ± SD | Min | Max | Range |
|---|---|---|---|---|
| TBL | 81.27 | 9.18 | 65 | 33 |
| Conventional Lectures | 81.05 | 8.82 | 70 | 29 |

## DISCUSSION

The current study was conducted to compare the student satisfaction scores in conventional lecture sessions and team-based learning. An increase in scores was seen from lectured learning to team-based learning. This growth can be due to effective self-study course preparation and collaborative working in team-based learning. Another study comparing student satisfaction in second-year neurology students taught using TBL with scores from the last academic year reported similar results [9]. The students showed improved learning outcomes after TBL and GART scores were higher than IRAT and traditional lecture scores. The present study also used the SSS scale to confirm the reliability and validity of the results of both methods. The questionnaire revealed 80% satisfaction with the TBL method than conventional teaching. The results comply with the study by Jafri that employed the SSS scale and reported considerably high satisfaction in the TBL sessions [8]. Although most of the previous studies assessed student outcomes by employing TBL in clinical courses, the results were similar to the present study [10-12]. Zaman A *et al.*, revealed significantly higher scores using TBL as an active learning method in biochemistry students than the passive learning method and the difference between both scores was significant in below-average students [13]. However, in the current study, no correlation between students' last year scores and TBL scores and satisfaction was noted. Therefore, the academic history of the student did not affect study scores or satisfaction. However, this correlation was prominent in conventional learning, implying that TBL improves learning outcomes irrespective of student caliber and a higher score in conventional learning can only be achieved if the student has a good academic background [14, 15]. The current study administered the two methods in the full semester to compare results effectively and maintain a balance between content covered and time management. Studies previously conducted usually record results for a limited time and teaching hours and mostly only observed results for TBL, but all of them agree on higher learning outcomes and satisfaction in active learning by TBL than traditional lectures [16-18]. With respect to gender, female students performed considerably better than male students in IRAT and GRAT evaluations of team-based learning, this difference was significant in results of conventional lectures. Along with improved outcomes, teaching satisfaction was also higher in females. Although there was limited literature available comparing learning outcomes by TBL in both genders, Das S *et al.*, and Aguillon

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SM *et al.*, studied first-year medical students taught by TBL which revealed greater student satisfaction in females but test results showed better performance in males as they achieved higher exam scores [19, 20]. This difference in results from these studies and the present study may be due to differences in study duration and course, however, more studies were needed to report consistent results. In the current study, an SSS scale consisted of 20 questions that could be answered on a Likert scale to express satisfaction with TBL and conventional teaching. A CVI of 93% was achieved after consulting teachers. A score of 80% proves the validity of the resource for assessment. The reliability of the questionnaire was tested by internal and external consistency which were both high in this study indicating reliable and consistent data. Results revealed improved knowledge of the course and confidence that led to highly reproducible results as the assessments could be completed twice within 14 days. Although the course content and difficulty of data were divided equally between the teaching methods, the difference in topics taught between the first and second half of the semester may be a limitation of this research. In addition, the small sample size of student included and bias through self-reported questionnaire may have influenced the results.

## CONCLUSIONS

Team-based learning yields better learning outcomes and teaching satisfaction in medical students as compared to conventional lecture methods. These results were also improved in female students than in males.

## Authors Contribution

Conceptualization: HAS
Methodology: ZHQ
Formal analysis: FNT, SIC
Writing, review and editing: MS, BTF, BF

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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