

Pre-test and Post-test Analysis of Online Active Learning Methods in First-Year Medical Students

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ABSTRACT

Background: There is a need to enhance teaching and learning capability in medical education. Online active learning methods are being increasingly used in all sectors of education. Multiple choice assessment tests provided before and after instruction serve as an objective way to assess the effectiveness of the teaching intervention in improving student learning outcomes.

Objective: To evaluate the effectiveness of online active learning methods using a pre-test–post-test design among first-year medical students.

Methods: 135 first year MBBS students underwent a teaching session using different online active learning methods in the subject of Biochemistry. An 18-item Multiple Choice Question (MCQ) test was before and after. The tests were conducted through online forms and students absent for the session were excluded. Point scores of the test were analysed.

Results: The mean pre-test score was 14.90 (SD = 1.50), while the mean post test score was 16.80 (SD = 1.20). The improvement was statistically significant ($p < 0.001$).

Conclusion: Online active learning methods significantly improved knowledge acquisition among first-year medical students, demonstrating the utility of MCQ-based interventions in medical education.

Keywords: Pre-test; Post-test; Extra-cellular matrix.

INTRODUCTION

Most students struggle with attention and memory during lectures (1). Traditional didactic teaching methods hardly involve the student in their own learning process. The resulting disinterest in attending lectures and the tendency to seek other learning platforms has been an emerging phenomenon ever since online learning methods have surfaced. This has driven the students out of the classroom and even affected faculty morale. For instance, Campbell et al found that the majority of the faculty had more job satisfaction with more attendance and preferred to inculcate active learning methods in large group teaching (2). A survey of 336 undergraduate medical students from India reported that only about one-fourth of students described their learning experience as “good”. Nearly 50 % of students said that teaching methods lacked problem based learning (3). Students frequently reported monotony of usual lectures as a cause for absenteeism in a survey done by Jana et al (4). Implementation of active-learning methods, thus, is a need of the hour for the students.

Assessment of knowledge has an irreplaceable role in medical education. However, assessment techniques and tests need not be limited to examinations. They can be useful devices in the teaching process itself as a part of active learning. Testing and problem solving during teaching sessions can improve critical thinking and inquisitiveness while also highlighting key mistakes that the student can improve on. Multiple-choice question (MCQ) tests serve as an excellent tool for evaluation in the classroom settings because of the

simplicity of delivery to students and the limitation of time allotted for a teaching session. They are objective and can be used to quantify and analyse results while also reducing examiner bias (5).

In this study we aim to assess the effect of online active learning methods using pre-test and post-test analysis in first year MBBS students.

MATERIALS AND METHODS

The study was conducted in the Department of Biochemistry, D. Y. Patil Medical College, Kolhapur, a recognized institution offering undergraduate medical education. The study used a pre-test post-test design in which a structured assessment of subject matter was done before and after the teaching intervention to measure the change in student performance. A total of 135 first year MBBS students were enrolled in the study. These students were all enrolled in the Biochemistry course as part of their first-year curriculum. Participation for study was voluntary, and informed consent was obtained before the pre-test. Assessment was done using structured multiple-choice questions (MCQ). The questionnaire was presented to the students as an online Google Form. Questions were developed independently by the faculty members of the Department of Biochemistry after consensus. The questions were designed to assess fundamental concepts, prescribed as 'competencies' by the national council, for the topic 'Extra-cellular matrix'. Each question had a single best answer and was rewarded 1 point, with a maximum possible score of 18. No negative points were given for wrong answers and all the questions were mandatory. The study was conducted in three phases during the same teaching period. Initially, a pre-test consisting of an 18-item MCQ questionnaire was administered to assess the baseline knowledge of the students. This was followed by a structured teaching session in which the same set of questions was used as instructional material. Immediately after the teaching session, an identical MCQ test was administered as a post-test to evaluate improvement in knowledge following the intervention. The teaching intervention incorporated active learning methods such as guided group discussion, case- & problem-based learning, explanation of correct answers and student interaction. Care was taken during assessment to prevent discussion of answers. Test results were not displayed until the end of the session. Data collected was analysed using descriptive statistics as mean and standard deviation. Normality was assessed and paired t-test was used to assess the difference between mean scores of pre-test and post-test. Statistical analysis was performed using SPSS version 25.0, and a p-value of less than 0.05 was considered statistically significant.

RESULTS

Of the total 135 students who participated in both tests, the mean pre-test score out of 18 was 6.80 and mean post-test score was 14.90 (Table 1). The results demonstrate a statistically significant improvement in post test scores compared to pre-test scores ($p < 0.001$).

DISCUSSION

Results of the study indicate that active learning methods significantly enhance knowledge acquisition during lectures among medical students. The structured use of MCQs as both teaching and assessment tools facilitated improved comprehension and retention. The improvement can be attributed to repeated exposure to the same content and interactive nature of the session which promoted deeper engagement. These results are consistent with previous literature. For example, in a study of 113 students, Rangareddy et al observed that more than three-fourth students reported improved engagement and retention with active teaching methods (6). The pre-test post-test design is widely used to study effectiveness of teaching interventions. The design ensures that the intervention addresses the tested content and the learning gain can be attributed to the intervention (7). However, the study design is vulnerable to possible practice effects due to repetition of assessment and to demand characteristics. Future studies can employ a control group to compare the intervention with other methods. Also, assessment can be done by other testing methods to describe the effect of active learning methods in detail. Studies about student perspectives in the form of qualitative surveys can further improve the implementation of active learning methods.

CONCLUSION

This study highlights the effectiveness of online active learning methods in improving learning outcomes of lectures among first-year medical students. The findings support the integration of active learning strategies as practical teaching methods into medical curricula. These strategies may help in striking a balance between the traditional lecture-based training and more novel methods to optimize teaching and learning efficiency for faculty and students.

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Ethics approvals and consent to participate: Waiver of ethical approval was obtained. Informed consent to participate was obtained from all participating students prior to giving the tests. Students were free to withdraw from the study at any stage.

Conflict of interest: The authors declare that they have no competing interests.

Authors' contributions: CK, SJ, and VS were involved in formulating the test questionnaires. RJ contributed to data analysis. SJ was a major contributor in writing the manuscript. All the authors were involved in conceptualisation of the study and review of the manuscript.

Highlights

Current knowledge:

- Both students and faculties report better learning outcomes with active learning methods.
- Novelty of study
- Analysis of effectiveness of using active learning methods while teaching using a pre-test post-test study design.

Data availability statement: Data will be available from the corresponding author upon reasonable request.

Declaration of Generative AI and AI-assisted technologies in the writing process: No Generative AI/AI-assisted tools were used for writing this manuscript.

REFERENCES

1. Catherine P, Nambi S, Vivekkumar P, Natrajan N, PSL S. Barriers to Effective Utilization of Teaching-Learning Methods: A Qualitative Study Using Focus Group Discussions among First-Year Bachelor of Medicine, Bachelor of Surgery Students in a South Indian Medical College. *Journal of Medical Education*. 2021 Jan 1;20(20):e117296. [doi:10.5812/jme.117296](https://doi.org/10.5812/jme.117296)
2. Campbell AM, Ikonne US, Whelihan KE, Lewis JH. Faculty perspectives on student attendance in undergraduate medical education. *Advances in medical education and practice*. 2019 Sep 6;759-68. [doi:10.2147/AMEP.S208960](https://doi.org/10.2147/AMEP.S208960)
3. Adlakha V, Jha T, Sahoo P, Muralidharan A, Bachani D. Students' perception of lacunae in medical education in India, and suggestions for reforms. *Natl Med J India*. 2018 Jan 1;31(1):29-31. [doi:10.4103/0970-258x.243412](https://doi.org/10.4103/0970-258x.243412)
4. Jana PK, Sarkar TK, Adhikari M, Chellaiyan VG, Ali FL, Chowdhuri S. A study on the preference of teaching methods among medical undergraduate students in a tertiary care teaching hospital, India. *Journal of Education and Health Promotion*. 2020 Jan 1;9(1):275. [doi:10.4103/jehp.jehp_176_20](https://doi.org/10.4103/jehp.jehp_176_20)
5. Haladyna TM, Downing SM, Rodriguez MC. A review of multiple-choice item-writing guidelines for classroom assessment. *Applied measurement in education*. 2002 Jul 1;15(3):309-33. [doi:10.1207/S15324818AME1503_5](https://doi.org/10.1207/S15324818AME1503_5)

6. Rangareddy H, Swamy KG, Ashakiran S, Petimani MS. Enhancing student engagement through active teaching-learning approaches among first-year medical undergraduates. *Cureus*. 2025 Jun 13;17(6):e85921. doi:10.7759/cureus.85921
7. The One-Group Pretest-Posttest Design. In: Campbell DT, Stanley JC. *Experimental and quasi-experimental designs for research*. Boston: Houghton Mifflin; 1963. pp. 7-12.

Tables: Table 1: Difference in mean pre-test and post-test scores

Test	Mean	Std. Deviation	p-value
Pre	14.90	1.50	<0.001*
Post	16.80	1.20	