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Comparative Study Between Conventional Didactic Lectures and MCQ-Based Reinforcement in Enhancing Learning and Retention Among Undergraduate Medical Students

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ABSTRACT

Background: Conventional didactic lectures remain widely used in undergraduate medical education; however, passive learning may limit student engagement and long-term retention. Multiple-choice question (MCQ)-based reinforcement may facilitate active recall, formative assessment, and sustained learning. This study compared conventional didactic lectures with MCQ-integrated teaching for improving learning outcomes and knowledge retention among undergraduate medical students.

Methods: A prospective quasi-experimental comparative educational intervention study was conducted among Phase III Part 1 MBBS students at a tertiary care teaching institution in Bengaluru, India. Of 248 eligible students, 216 participated (87.1%) and were allocated into two teaching groups of 108 students each. The control group received conventional didactic lectures, whereas the intervention group received didactic lectures supplemented with 25 validated MCQs addressing factual knowledge, interpretation, and clinical application, followed by immediate feedback and explanations. Learning outcomes were assessed using pre-test, immediate post-test, and four-week retention test scores. Student perceptions of MCQ-based reinforcement were assessed using a structured five-point Likert-scale questionnaire. Between-group comparisons were performed using independent t-tests, with paired t-tests used for within-group comparisons.

Results: The baseline characteristics and pre-test scores were comparable between groups. The MCQ reinforcement group demonstrated significantly higher post-test scores than the didactic lecture group (79.2 ± 8.1% vs. 67.3 ± 7.8%; $p<0.001$). The mean improvement from pre-test to post-test was 24.6% in the intervention group compared with 12.2% in the conventional lecture group. Four-week retention scores remained significantly higher in the MCQ reinforcement group (74.8 ± 7.7% vs. 62.4 ± 7.5%; $p<0.001$). Most students reported that MCQ-based reinforcement improved examination confidence (91%), understanding of concepts (89%), lecture interactivity (88%), long-term retention (87%), attention during lectures (84%), and self-directed learning (81%).

Conclusion: Integrating structured MCQ-based reinforcement with conventional didactic lectures significantly improved immediate learning and four-week knowledge retention among undergraduate medical students. MCQ-based reinforcement represents a feasible adjunctive teaching strategy for enhancing learner engagement and retention in competency-based medical education.

Keywords: Multiple-choice questions, retrieval practice, medical education, conventional didactic lectures, MCQ-based reinforcement, undergraduate medical students, educational measurement.

INTRODUCTION

Assessment is an integral component of undergraduate medical education because it not only evaluates student achievement but also influences the way students learn and retain knowledge. Multiple-choice questions (MCQs) are widely used assessment tools because of their objectivity, reliability, and ability to assess different cognitive domains. In recent years, MCQs have also gained importance as learning tools that promote active recall and long-term retention of knowledge. [1-3]

Ophthalmology and orthopaedics are clinically intensive subjects requiring integration of theoretical knowledge with clinical reasoning. Conventional didactic lectures remain the most common teaching method in undergraduate medical education; however, passive learning during lectures may reduce student engagement and retention of concepts. Incorporation of MCQs during and after lectures may improve concentration, examination preparedness, and conceptual understanding. [4-6]

Previous studies have shown that formative assessment and retrieval-based learning strategies improve academic performance and long-term retention among medical students. [7-9] However, limited Indian studies have comparatively evaluated conventional didactic lectures and MCQ-integrated teaching in undergraduate ophthalmology and orthopaedics education.

Therefore, the present study was undertaken to compare the effectiveness of conventional didactic lectures alone versus lectures integrated with MCQ-based reinforcement in improving learning outcomes and long-term retention among undergraduate medical students in ophthalmology and orthopaedics.

MATERIALS & METHODS

Study Design

A prospective quasi-experimental comparative educational intervention study was conducted.

Study Setting

The study was conducted in the Departments of Ophthalmology and Orthopaedics at Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, Karnataka, India.

Study Duration

The study was conducted over a period of three months.

Study Population

The study population included Phase III Part 1 MBBS students attending undergraduate teaching sessions in ophthalmology and orthopaedics.

Sample Size

Out of 248 eligible undergraduate medical students, 216 students participated in the study, yielding a response rate of 87.1%. As all eligible students during the study period were included, formal sample size calculation was not performed.

Inclusion Criteria

- Students attending regular ophthalmology and orthopaedics lectures.

- Students willing to participate in the study.

Exclusion Criteria

- Students absent during more than 25% of lecture sessions.
- Students unwilling to participate in the study.

Ethical Clearance

Institutional Ethics Committee approval was obtained prior to commencement of the study [SIMS & RC/EC-18/Fac-01/2024-25].

Study Procedure

Students were allocated into two teaching groups using batch-wise allocation to minimize contamination between teaching sessions.

- Group A attended conventional didactic lectures alone.
- Group B attended didactic lectures integrated with structured MCQ-based reinforcement sessions.

A total of 25 validated MCQs were administered following lecture sessions in the intervention group. The MCQs included single best-answer questions assessing factual knowledge, interpretation, and clinical application. MCQs were independently peer-reviewed by faculty members from the Departments of Ophthalmology and Orthopaedics to ensure content validity and relevance to competency-based learning objectives.

The design and validation of the MCQ format were based on established principles of assessment quality and clinical competence evaluation described in the medical education literature (Newble et al., 1979; Jørgensen et al., 2019). [13-14]

Immediate feedback and explanations were provided following MCQ sessions.

Three assessments were conducted:

1. Pre-test assessment before the intervention
2. Post-test assessment immediately after lecture sessions
3. Retention test conducted four weeks after the intervention

Feedback Questionnaire

A structured and validated 5-point Likert scale questionnaire was administered after completion of the intervention to assess student perceptions regarding understanding of concepts, retention, examination preparedness, interactivity, and self-directed learning.

The questionnaire was reviewed by faculty members for content validity.

Statistical Analysis

Data were analyzed using SPSS software version 25. Quantitative variables were expressed as mean ± standard deviation. Paired t-test and independent t-test were used for statistical analysis and comparison of scores between groups. A p-value of <0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

Out of 248 eligible undergraduate medical students, 216 students participated in the study, yielding a response rate of 87.1%. The study population included 122 females and 94 males with a mean age of 21.4 ± 1.1 years. Students were equally distributed between the Departments of Ophthalmology and Orthopaedics and between the didactic lecture group and the MCQ reinforcement group.

Table 1. Baseline Demographic Characteristics of Study Participants

Variable	Didactic Lecture Group (n=108)	MCQ Reinforcement Group (n=108)	p-value
Mean age (years)	21.3 ± 1.2	21.5 ± 1.1	0.41
Male students	46	48	0.78
Female students	62	60	0.81
Ophthalmology postings	54	54	—
Orthopaedics postings	54	54	—

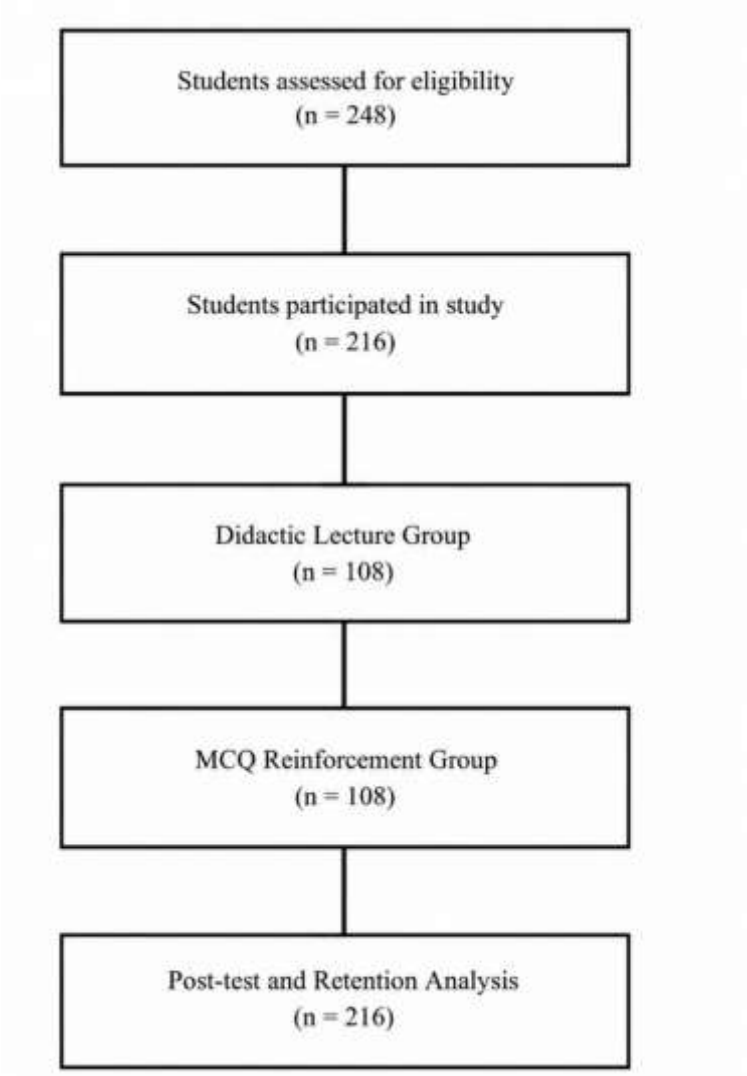

Figure 1. Participant flowchart showing recruitment and participation of undergraduate medical students.

Comparison of Learning and Retention Scores

Both groups showed improvement in post-test scores compared with baseline assessments. However, students in the MCQ reinforcement group demonstrated significantly greater improvement in immediate post-test and delayed retention scores compared with the didactic lecture group.

The mean improvement in post-test scores in the MCQ reinforcement group was 24.6% compared with 12.2% in the didactic lecture group. Retention scores after four weeks remained significantly higher in the MCQ reinforcement group.

Table 2. Comparison of Pre-test, Post-test, and Retention Scores Between Study Groups

Assessment	Didactic Lecture Group Mean Score (%)	MCQ Reinforcement Group Mean Score (%)	p-value
Pre-test	55.1 ± 8.9	54.6 ± 9.2	0.72
Post-test	67.3 ± 7.8	79.2 ± 8.1	<0.001
Retention test	62.4 ± 7.5	74.8 ± 7.7	<0.001

Table 3. Comparison of Learning Gain Between Study Groups

Parameter	Didactic Lecture Group	MCQ Reinforcement Group
Mean improvement from pre-test to post-test	12.2%	24.6%
Mean retention after 4 weeks	62.4%	74.8%
Percentage decline from post-test to retention test	4.9%	4.4%

Student Feedback Analysis

Most students perceived MCQ-based reinforcement as useful for improving understanding, concentration during lectures, long-term retention, examination preparedness, and self-directed learning in both ophthalmology and orthopaedics.

Table 4. Student Perception Regarding MCQ-Based Reinforcement

Feedback Parameter	Agree/Strongly Agree (%)
Improved understanding of ophthalmology and orthopaedics topics	89%
Increased attention during lectures	84%
Enhanced long-term retention	87%
Improved confidence for examinations	91%
Encouraged self-directed learning	81%
Made lectures more interactive	88%

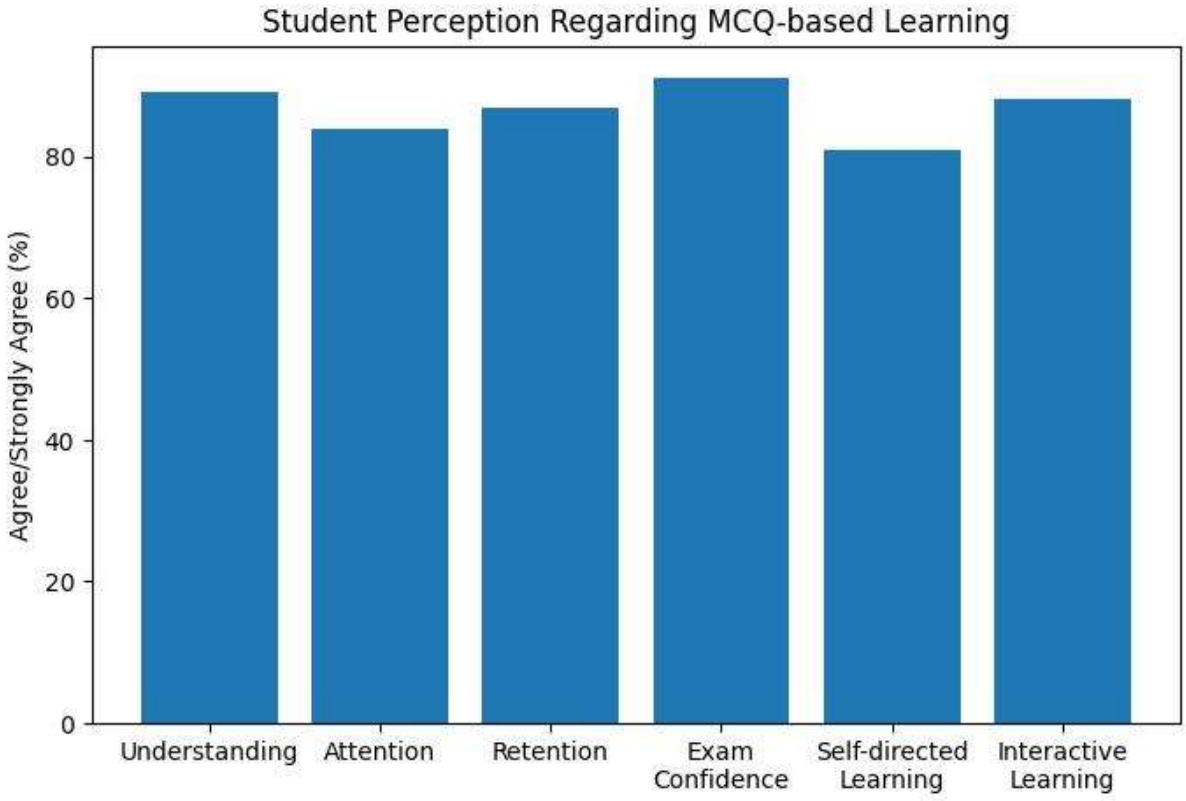

Figure 2. Student perception regarding usefulness of MCQ-based learning.

DISCUSSION

In the present study, students who received MCQ-integrated teaching performed better in both immediate and delayed assessments than those exposed to conventional lectures alone.

The improved post-test and retention scores observed in the MCQ reinforcement group suggest that active learner engagement and repeated recall contributed to better retention of concepts. Immediate feedback provided after MCQ sessions may also have reinforced understanding and corrected misconceptions. Similar findings have been reported in previous studies evaluating

formative assessment and retrieval-based learning strategies in medical education. [1-3] Conventional didactic lectures are effective for delivering core concepts to large groups of students; however, passive learning during lectures may reduce concentration and long-term retention. Incorporation of structured MCQ sessions into routine teaching may improve learner participation, conceptual understanding, and examination preparedness. In the present study, most students reported improved concentration, better understanding of concepts, and increased motivation for self-directed learning following MCQ-integrated teaching sessions. Similar observations have been reported in previous medical education studies evaluating formative assessment methods and test-enhanced learning strategies. [6-11, 15] Evidence from medical education assessment research also highlights the importance of question quality, reliability, discrimination, and acceptability when structured assessment formats are used. [12]

The strengths of the present study include its comparative design, inclusion of students from two clinical departments, and assessment of both immediate learning outcomes and delayed retention. Use of validated MCQs and a structured feedback questionnaire further strengthened the study methodology. The study was conducted in a real-world classroom setting, thereby improving the practical applicability of the findings within competency-based undergraduate medical education.

However, certain limitations should be acknowledged. The study was conducted at a single institution, which may limit generalizability of the findings. The follow-up duration was relatively short, and long-term academic performance was not evaluated. Student feedback was subjective and may have been influenced by response bias.

Further multicentric studies involving larger sample sizes and longer follow-up durations are recommended to evaluate the long-term educational impact of MCQ-based reinforcement strategies across different medical specialties. Integration of structured MCQ-based learning within undergraduate curricula may serve as a practical and cost-effective educational intervention for improving student engagement and long-term retention.

CONCLUSION

The present study demonstrated that integration of multiple-choice question-based reinforcement with conventional didactic lectures significantly improved learning outcomes and long-term retention among undergraduate medical students in ophthalmology and orthopaedics. Students exposed to MCQ-integrated teaching showed better post-test performance, improved retention scores, and higher levels of engagement compared with students attending conventional lectures alone.

The findings support the role of retrieval-based learning and formative assessment in competency-based medical education. The strengths of the study include its comparative design, inclusion of two clinical departments, and assessment of delayed retention. However, the study was limited by its single-center setting and relatively short follow-up duration.

The findings suggest that incorporating structured MCQ-based reinforcement into routine undergraduate teaching may provide a practical and feasible approach to improving student engagement and long-term retention.

Declaration by Authors

Ethical Approval: Approved [SIMS & RC/EC-18/Fac-01/2024-25].

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Conflict of Interest: The authors declare no conflict of interest.

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