International Journal of Clinical & Biomedical Research
Vol 11, Issue 1, 2026.

Sumathi Publications
Original Article

# Impact of an integrated quiz-based learning approach on academic performance and student perception in first-year MBBS students

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## Abstract

Teacher - centered approach in medical education are now a day's being replaced by integrated, learner centered ones. Using quiz based learning, especially across curriculum areas, facilitates deeper understanding, acquisition and application of the new knowledge. However, the effectiveness of integrated quiz based learning approach for the first professional MBBS course is still insufficient. The present study therefore evaluated the effectiveness of an integrated quiz based learning and learners perception regarding its efficacy. This was an educational interventional study on 150 phase one MBBS students. However, final participation across all rounds along with completed feedback, was obtained from 141 students only, and their responses were included in statistical analysis. Participants were randomly assigned to five teams with 30 in each team. An integrated quiz on preclinical disciplinary was conducted in four rounds: MCQ, visual, case-based and rapid fire. Descriptive statistics were used to analyze baseline data, performance scores, perceived difficulty, and student's feedback. The rapid fire round was perceived as most difficult format by 49% students, followed by case based (26%) and visual rounds (16%). The physiology topic was found to be the hardest by 39% of participants. Student perception were highly in favor, as 96% agreed that the quiz is the support for easy learning, 96% reported for better revision and 98% endorsed a fostered positive learning environment. All the students (100%) were expressed their willing to participate in integrated quizzes in future classes. The maximum team score among the teams was 49/60 and minimum of 38/60 - showing variability in group performance. Quiz based teaching effectively enhanced engagement, motivated students, deeper understanding, and created positive learning environment in the undergraduate medical curriculum. Positive learner feedback supports the incorporation of this active learning method within a first professional MBBS programme.s.

**KEYWORDS:** Integrated quiz; MBBS students; Active learning; Medical education; Student perception.

## Introduction

Competency-Based Medical Education (CBME) has revolutionized the medical training in the recent years by emphasizing on outcome-based Learning and endorsement of novel teaching–learning strategies [1]. Despite the transition, most of the medical colleges in India continue to rely predominantly on traditional didactic lectures to teach larger groups of undergraduates [2]. Such lectures, typically ranging from 40 to 60 min in duration, are suboptimal for sustaining learner engagement, as attention span has been shown to decline markedly after about 20 min [2].

Consequently, learners often remain passive recipients of information rather than active participants in the learning process, which adversely affects meaningful understanding and long term knowledge retention [3].

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**eISSN: 2395-0471**
**pISSN: 2521-0394**

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Educational research underscores that learning is inherently active and interactive teaching – learning approaches are more effective than passive didactic teaching [4].

Interactive teaching–learning methods facilitate a two way communication between the teacher and the student during interactive class room. It leads to enhance learner attention and decrease in unidirectional monologues [1]. Methods such as structured questioning, quizzes, audience response system (ARS), role play, clinical case scenario and audiovisual integration are well accepted in literature for fostering learner engagement and enhancing conceptual clarity [2]. These active learning strategies are in line with goals of medical education, as they promote critical thinking abilities, analyzing skills, and information synthesis skills that clinical practice demands [5,6].

The first year of MBBS students experience difficulties in transition from school to impounding professional curriculum and the rapid absorption of the basic knowledge [7]. To mitigate these problems there has been a growing acceptance of interactive learning techniques, including quiz based learning. This sort of quizzing in "a lecture" engages learners in retrieval practice, immediate feedback, performance time duration and motivation reinforcement which leads to more deliberate practice. When used within an integrated, cross disciplinary preclinical approach to learning, they aid in increasing conceptual connection and application of principles; as well as understanding.

There is limited published literature on the effectiveness of integrated quiz-based learning to improve academic performance and satisfaction across undergraduate first-year MBBS students, notwithstanding that there is increasing interest in interactive educational methods. Thus, the present study was conducted to assess the effect of an integrated quiz based integrative intervention on academic performance and student's perception about its usefulness, perceived difficulty and overall learning experience among first-year MBBS students.

## Materials and Methods

**Study Design**: The study used a hybrid evaluative design involving both performance assessment and perception analysis of learner. The intervention was conducted as quiz using a structured format, while perception data were collected from all students through standard questionnaire.

**Ethical Considerations**: The research was conducted in accordance with ethical standards for educational research involving human subjects. The study was approved by the Institutional Ethical Committee ref no ELMC&H/EC/2025/256. Written informed consent was obtained from all participants. Participant confidentiality was strictly maintained.

**Place of Stud**y: This study was carried out in the preclinical departments, i.e., Anatomy, Physiology and Biochemistry of a medical college with MBBS course. All the quiz rounds and skill stations were held in main lecture theatre environment with audio visual teaching aids, to ensure equitable question delivery and learning content between specialties. This study was carried under the aegis of Medical Education Unit for academic control.

**Study Population and Sampling Method**: A total of 150 Phase I MBBS students included in this study. A convenience sampling method was used and then they were randomly assigned into five groups, with 30 students in each group. However, final participation across all rounds along with completed feedback, was obtained from 141 students only; 9 students were dropped due various reasons, and the responses of these 141 were included in the statistical analysis.

**Intervention and Follow-up**: The intervention consisted of an integrated quiz that covered core concept from preclinical departments. The quiz structured into four rounds: an MCQ round, visual interpretation round, case-Based and rapid-fire rounds. All teams participated in each round, and scoring was carried out on-site subject experts using a standardized scoring system. Team-specific performance results were recorded and compared across rounds. Following the intervention, student's perceptions were assessed using a validated 10 point perception questionnaire. Students' perceptions evaluated perceived effectiveness, utility during revision, and overall satisfaction with the integrated citation quiz format.

**Outcome Measures**: Primary outcome measures were performances of the teams across four rounds of quiz, and students' perceptions difficulty across various rounds on subject domains (Anatomy, Physiology and Biochemistry). Additional outcomes included student's feedback regarding acquired new knowledge, the educational value of the integrated quiz as learning tool; willing to participate in similar activities in future and perception of the learning environment. Secondary outcomes involved identification of most challenging quiz rounds, and subject areas are interpreting these results in relation to team performance.

**Statistical Analysis**: Descriptive statistics were applied for data analysis. Continuous variables including age and screening test scores are presented as mean ± standard deviation.

Categorical variables such as gender distribution, educational background, perceived difficulty levels and feedback responses were presented as percentage. Team performance between quiz rounds was compared using descriptive statistics overall and by round total and round reports of the scores. All results were represented in tabular form to enhance clarity, interpretation and readability.

## Results

**Table1. Baseline Characteristics of Study Participants (n = 141)**

| Variable | Mean ± SD / n (%) |
|---|---|
| Age (years) | 18.7 ± 0.9 |
| Gender (Male/Female) | 57 (40) / 84 (60) |
| Schooling Background (CBSE/ ICSE/State Board) | 65 (47) / 29 (20) / 47 (33) |
| Medium of Instruction (English/ Regional) | 113 (80) / 28 (20) |

The demographic and baseline academic details of the 141 first year MBBS students, who participated in the study are shown in Table 1. The mean age of the subjects was 18.7 ± 0.9 years, reflecting the relatively homogenous age distribution. As for gender distribution, 57 students (40%) were male and 84 students (60%) were female. Regarding educational background, 65 students (47 %) had completed schooling from CBSE, 29 students (20 %) from ICSE and 47 students (33 %) from the State Boards, representing diverse pre-university educational exposure. The majority of students (n = 113, 80%) were educated in English medium and 28 (20%) were educated the regional-medium education.

**Table 2. Distribution of Difficulty Ratings for Quiz Rounds (n = 141)**

| Quiz Round | Rated "Most Difficult" n (%) | Mean Difficulty Score (1–5) |
|---|---|---|
| Rapid Fire | 69 (49) | 4.6 |
| Case-Based | 36 (26) | 3.9 |
| Visual Round | 22 (16) | 3.2 |
| MCQ Round | 14 (10) | 2.7 |

Table 2 presents students perceived difficulty across the four quiz rounds based on input from 141 students. The rapid-Fire round was perceived as the most challenging by 69 (49%) and showed highest mean difficulty score of 4.6, reflecting the requirements for immediate recall under strict time constraints. This was followed by the case-based round, which 36 (26%) rated as most difficult, with a mean difficulty score of 3.9, possibly due to the need for analytical reasoning and synthesis of knowledge. The visual round was considered difficult by 22 (16%) participants, with corresponding mean difficulty score of 3.2. The least difficult part was the MCQ round with only 14 respondents (10%) perceived; and lowest mean difficulty score of 2.7. Over all, these findings indicate that time pressured and cognitively demanding formats particularly the rapid fire round posed the greatest challenge to students.

**Table 2: Subject-Wise Difficulty Perception (n = 141)**

| Subject | Rated "Most Difficult" n (%) | Correct Response Rate (%) |
|---|---|---|
| Physiology | 55 (39) | 61 |
| Biochemistry | 47 (33) | 68 |
| Anatomy | 39 (28) | 72 |

Student perception of subject specific difficulty across the three pre-clinical subjects are presented in Table 3. Among the 141 participants, Physiology was identified as the most difficult subject by 55 students (39%) and was associated lowest percentage of correct response rate 61%, suggesting that the level of difficulty corresponded to higher conceptual, cognitive demands. Biochemistry was rank most difficult by 47 (33%), with a correct response rate of 68%, suggesting challenges in metabolic pathways and biochemical mechanisms.

Anatomy, although perceived as most challenging but smaller proportion of students 39 (28%) likely relatively structured and fact-based content. According to these responses, there is a discipline specific difference in perceived difficulty and performance, reflecting variation in cognitive load and level of expertise.

**Table 4. Student Perception of Integrated Quiz as Learning Tool (n = 141)**

| Statement | Agree n(%) | Neutral n(%) | Disagree n(%) |
|---|---|---|---|
| Integrated quiz helps easy learning | 135 (96) | 5 (4) | 1 (1) |
| Quiz improves revision of difficult topics | 135 (96) | 4 (3) | 2 (1) |
| Quiz improves learning environment | 138 (98) | 3 (2) | 0 |
| Quiz should be continued in future | 141 (100) | 0 | 0 |

In table 4 shows extremely positive student perceptions of the integrated quiz learning approach among the 141students. In all, 135 (96%) of students agreed that they found learning easier with the integrated quiz, five (4%)

were neutral and one (1%) disagreed. Similarly, 135 students (96%) also agreed that the method supported effective revision of challenging topics, while 4 were neutral about this (3%), and 2 disagreed (1%).

Perception of learning environment was positive and highly favorable among 138 students (98%), that the quiz-based learning fostered a positive leaning atmosphere; neutral in 3 (2%) and 0 as disagreement. Notably, 100% of students (141) concurred that integrated quizzes should be a part of future academic years. Collectively, these results indicate the effectiveness and strong accessibility of the integrated quiz-based education method.

**Table 5. Comparison of Team Performance Across Rounds (n = 5 teams)**

| Team | MCQ Score (15) | Visual Score (15) | Case-Based Score (15) | Rapid Fire Score (15) | Total Score (60) |
|---|---|---|---|---|---|
| Team 1 | 12 | 10 | 11 | 9 | 42 |
| Team 2 | 11 | 12 | 10 | 11 | 44 |
| Team 3 | 13 | 11 | 12 | 10 | 46 |
| Team 4 | 10 | 9 | 11 | 8 | 38 |
| Team 5 | 12 | 13 | 12 | 12 | 49 |

Table 5 compares the performance of five teams in the four-quiz round. Team 1 scored 12 in MCQ, 10 in visual round, 11 in Case-Based and 9 in rapid-fire with cumulative score of 42. Team 2 achieved score of 11, 12.10 and 11 across the respective rounds, with a total of 44. Team 3 was consistent performance, scoring 13 (MCQ), 11 (Visual), 12 (Case-Based) and 10 (rapid-fire) for a total of 46. Team 4's score was lowest overall performance, with score of 10, 9, 11 and 8 for a total of 38. In contrast Team 5 was the highest performance score with 12, 13, 12 and 12 for a total of highest score of 49. The observed variations in team performance likely reflect differences in team dynamics, knowledge of subjects and diverse quiz format.

## Discussion

The finding of the present study is consistent with a growing body of literatures showing benefits of interactive, learner-centered pedagogy approach in medical education. The demographic features of participants, a relatively young, high at their academic best, is comparable to chorts examined in earlier study by Chilwant [1] and Roopa et al. [2], who also evaluated interactive learning strategies for similar undergraduate classes. This similarity strengthens the validity of comparison between the present findings and those previously reported.

In the current study, the rapid-fire round perceived as most challenging quiz format, this findigns aligns with Rao and DiCarlo's [5] in context of-peer instruction. These authors claimed that immediate-response questioning imposes a high cognitive load and demands rapid, fluent memory access, which although challenging, can facilitate deeper leaning. Students struggle in the Case-Based round further corroborating findings reported by Pettit et al. [8] and Gupta et al. [9] who found that high-order analytical questions particularly in gamified or case-based settings promote reasoning but can be perceived as challenging. On the other hand, MCQ and Visual rounds were associated with lower difficulty ratings, consistent with findings by Roopa et al. [2], in which structured formats were rated as less stressful for early learners.

Subject specific trends in perceived difficulty observed in our study are also consistent with previous studies. The greater perceived difficulty experienced in Physiology is consistent with the results of Rao and DiCarlo [5], who attributed challenges in this subject to its abstract g abstract and integrative. The moderate difficulty associated with Biochemistry in our research is in agreement with a previous study by Kaur and co-workers [10], who highlighted the conceptual density and conceptual of biochemical pathways. Anatomy, which had the highest correct response rate despite being perceived as difficult by some students, this finding supports observations by Roopa et al. [2], who suggested that structured, facts-based content is relatively easier for novices learns.

Student perceptions in present study were overwhelmingly favorable toward the integrated quiz approach, with nearlyt all respondents' improvement in understanding, revision and motivation to engage in learning. These findings are well supported in the literature. Roopa et al. [2] reported that most dental students preferred small group interactive session over formal lectures, while Kaur et al. [10] and Gupta et al. [9] similarly observed strong student preference for interactive teaching methods identifying quizzes as the most favored interactive tool among pharmacology students. Begum et al. [11] reported higher levels of student satisfaction with interactive methods in community medicine. The widespread acceptance of an active learning approaches by both teacher and students, particularly the use of quizzes as retrieval-based feedback when compared to a passive format including evidence from Freeman et al [15]. The general willingness among students in current study towards quiz-based learning, further acceptability of interactive teaching modalities.

Trends in team performance observed in this study provide additional support for the existing literature. Students consistently scored higher

in MCQ and Visual rounds while scored lower in rapid-fire round. Similar patterns have been reported by Chilwant [1] and Pettit et al. [8], who demonstrate that structured question formats tend to yield higher accuracy, whereas time-constrained or analytical formats test more effectively assess the depth of knowledge and oftern result in lower scores. Moreover, the enhanced participation, interaction and peer learning evident during the quizzes sessions in the presnt study align with findings by Kaur et al. [10] and Chilwant [1], who reported similar results in a computer-interactive classroom environment.

Collectively, present study findings contribute to a significant body of evidence indicating that interactive and quiz-based teaching approaches improve learner attention, motivation, participation, and better conceptual understanding. Consistent with work of Roediger's observations [13], and Karpicke, J.D. [14] provided substantial evidence that concept retention can be improved with more frequent quizzes. Freeman, S., et al [15] in his meta-analysis performed in 2014 observed that quizzes as an active-learning strategy the present study also reinforce the same.

Although there is more planning and facilitation, the move away from traditional didactic teaching method to more interactive methods, this will enhance student engagement and learning outcome achievement. Importantly, the findings of the present study further endorse the assertion that quizzing is not just an engaging classroom activity but a durable pedagogical approach capable of strengthening knowledge retention, improving recall and fostering interconnected understanding in early medical education.

## Conclusion

This study suggests that quiz-based learning is an effective, and interesting teaching tool for MBBS students. The intervention enhanced the engagement of students and paved way for improved comprehension and recall of key concepts. A majority of students cited significant benefits of the integrated quiz format, including facilitating learning, support for revision of challenging topics, and creating a positive learning atmosphere. Overall, integrated quiz based learning model may be recommended as a supportive student-centred educational tools that enhance learner involvement and promote deeper learning to strengthen concept understanding in the early phase of medical education.

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