

Effect of Training on Phase II Students in Scenario Based MCQs on their Problem Solving Ability in Pathology

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Abstract

Background: Recall-based MCQs primarily assess memory and are inadequate for evaluating higher-order cognitive skills required for solving complex clinical problems. Scenario-based MCQs, aligned with the CBME 2019 curriculum, assess higher domains of Bloom's taxonomy such as application, analysis, and synthesis.

Objectives: To evaluate the effect of training on Phase II MBBS students in solving scenario-based MCQs in pathology and to assess perceptions of students and faculty regarding this training.

Methods: A prospective interventional study was conducted over 4 months among 150 Phase II MBBS students, of whom 97 participated. Students underwent pretest and posttest assessments using validated scenario-based MCQs from urinary system, cardiovascular system, and hematology. Structured training sessions were conducted between tests. Perceptions were collected using a Likert scale questionnaire. Data were analyzed using the Wilcoxon signed-rank test and percentages.

Results: The mean posttest score (9.8) was significantly higher than the pretest score (6.6) ($p < 0.001$). About 80% of students found the training effective, and 85% reported improved confidence. Faculty perceived the method as beneficial but time-consuming.

Conclusion: Training in scenario-based MCQs significantly improves problem-solving ability and confidence among students. This approach can enhance competency in managing complex clinical scenarios and aid in preparation for postgraduate examinations. Further studies are needed to assess long-term outcomes.

Introduction

It is generally accepted that assessment drives learning. Assessment helps the student to focus on learning. The assessment of knowledge involves various methods such as essay questions, short answer questions, multiple-choice questions (MCQs), oral viva, and many more. One of the most common methods used these days is MCQs. (1) Recall based MCQs just assess the memory of students. They are not useful in solving complex cases. While Scenario based MCQs assess higher level of Bloom's cognitive domain such as interpretation, synthesis and application of knowledge ie analytical and problem solving capabilities.

Problem solving scenarios are real life or hypothetical situations that require students to think critically and come up with solutions. These scenarios provide a practical and engaging way for students to apply their critical thinking skills.

There has been emphasis to evolve from single-line recall-based MCQs to scenario-based analytical MCQs that will have a positive educational impact. In the new competency-based undergraduate medical curriculum in India, MCQs have been incorporated up to 20%.⁽²⁾

There are difficulties in solving scenario based MCQs. It include interpreting complex situations , identifying relevant details, distinguishing subtle differences between answer choices, managing time pressure, potential ambiguity in the scenario and the need for critical thinking to apply knowledge to a specific context.

Training helps in break down the problem into smaller parts , identify relevant information and resources, generate multiple possible solutions and evaluate the effectiveness of each solution.

Aims and objectives

1. To study the effect of training in phase II students to solve scenario based MCQs in pathology.
2. To observe the effect of training from student's perspective.
3. To study the effect of training from teacher's perspective

Material and methods

It is a prospective interventional study. The study was done in department of pathology on Phase II students for 4 months from August 2024 to November 2024. Institute ethics committee approval was taken. Six Departmental faculties were trained for framing scenario based MCQs and also for conducting the sessions. Written informed consent was taken from the students , who attended the session. Out of a batch of 150 students , 97 students participated in the study.

Three topics were selected (Hematology, Cardiovascular system and Urinary system). Scenario based MCQS were prepared and validated by faculties . Students were informed about the topics and told them to prepare them well in advance. Students were divided into 3 batches (A,B,C) according to their roll numbers. Batch A ,B, C was given the topics Hematology, Cardiovascular system and Urinary system respectively.

Students were explained about the sessions. Pre-test was given on 5 scenario based MCQs (2 marks each) in Google form. There was no negative scoring. After that specific training was given by different faculties to different groups on those MCQS using discussion method. It was followed by post-test on the same scenario based MCQs using randomization of question sequence and answers also .

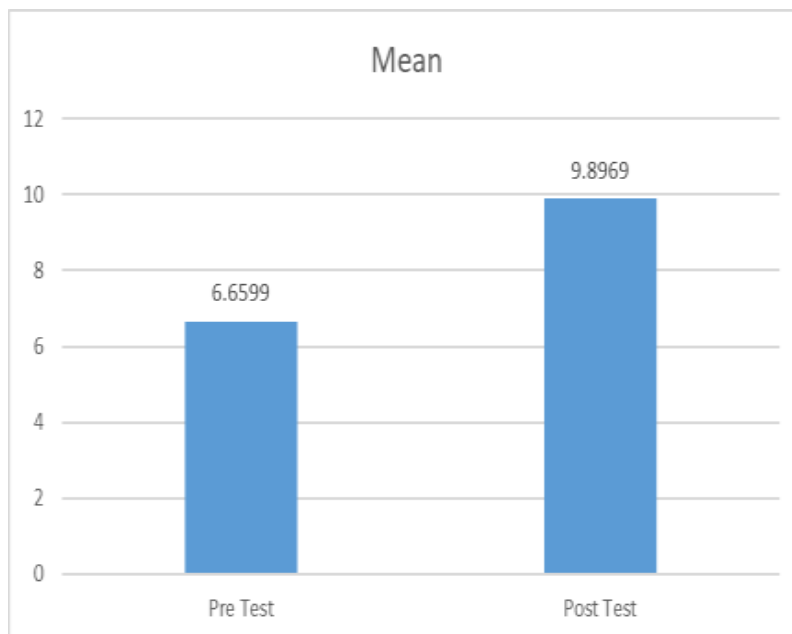
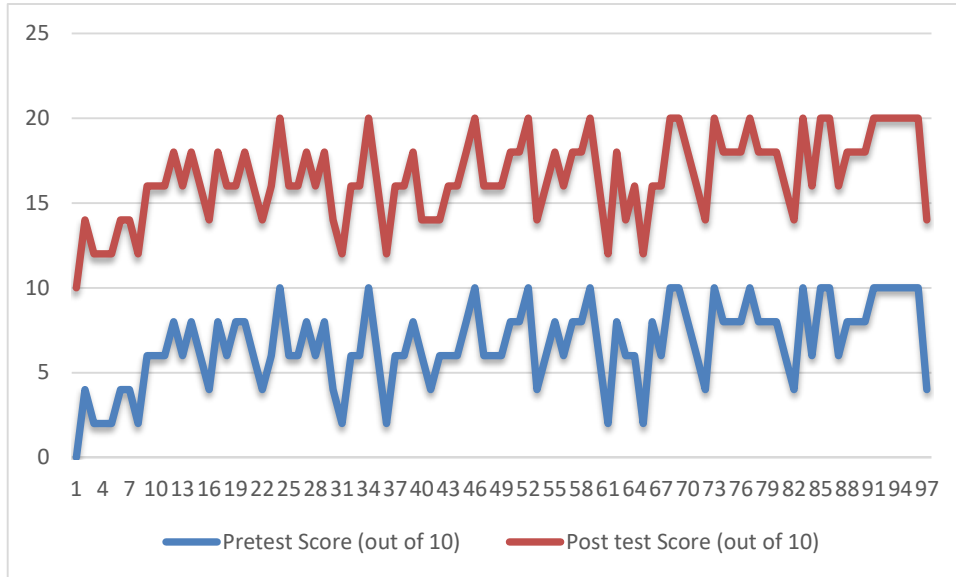
The Perception of students and faculty about the effectiveness and need of scenario based MCQs training was assessed by pre validated questionnaire on feedback form using 5 point Likert scale. Students were given questionnaire on quality of training and its effectiveness.

Comparison of Pre and post test scores was done using 'Wilcoxon signed rank test'. Students and faculty responses on perception about Scenario based MCQS were analyzed using percentages.

Result

Out of batch of 150 Phase II MBBS students , 97 students participated in the study.. Post test score (mean 9.8) was found to be higher, (stastically significant) compared to pretest score (mean 6.6). Improvement in student's score, post training was significant (p value < 0.001).

Comparison of pre and post test score of 97 students:-



| | N | Mean | Stdev | Median | Wilcoxon Signed rank Test | P-Value | Sig. at 5% level |
|-----------|----|--------|--------|--------|---------------------------|---------|------------------|
| Pre Test | 97 | 6.6599 | 2.4104 | 6.00 | 7.725** | P<0.001 | Yes |
| Post Test | 97 | 9.8969 | 0.4445 | 10.00 | | | |

** Statistically highly Significant at 0.1% level i.e. P<0.001

In feedback form on Likert scale, 80% students reported that training was effective in solving scenario based MCQS and 85% students felt that they are confident in solving scenario based MCQs after training

The image below displays the responses of the students, on the likert scale.-

| Qs | 1 (EXCELLENT) | 2 (GOOD) | 3 (AVERAGE) | 4 (POOR) |
|--|---------------|------------|-------------|----------|
| How would you rate the overall quality of the training session? | 57(60.6%) | 23 (24.5%) | 7(7.4%) | 7(7.4%) |
| How confident do you feel in solving scenario-based MCQs after the training? | 46 (48.9%) | 34(36.2%) | 7(7.4%) | 7(7.4%) |
| How effective was the training in improving your ability to analyse clinical scenarios? | 53(56.4%) | 29(30.9%) | 8(8.5%) | 4(4.3%) |
| How effective was the training in improving your ability to identify relevant information in a scenario? | 56 (59.6%) | 29 (30.9%) | 3 (3.2%) | 6(6.4%) |
| How engaging were the training methods used (group discussions)? | 51 (54.3%) | 31(33%) | 7(7.4%) | 5(5.3%) |
| Were the training materials (slides) helpful? | 50 (53.2%) | 24 (26.5%) | 15 (16%) | 5(5.3%) |

Faculties felt that this exercise is a good approach towards helping students in solving complex cases and preparing them for further Neet-PG exams. However they also felt that constructing scenario based MCQs is a time consuming and a challenging task.

Discussion

The present study investigated the effect of structured training on students’ ability to solve scenario-based multiple-choice questions (MCQs). The findings demonstrate a substantial improvement in performance following the intervention. The mean score increased from 6.6 in the pre-test to 9.8 in the post-test among 97 participants, reflecting a mean gain of 3.2 points.

To determine the statistical significance of this improvement, a paired-samples *t*-test was conducted. The results revealed that the difference between pre-test and post-test scores was highly significant ($t(96) = 7.725, p < 0.001$). This indicates that the observed improvement is unlikely to have occurred by chance and can be attributed to the training intervention.

The findings of the present study are consistent with recent research emphasizing the effectiveness of scenario-based and simulation-based training in enhancing students’ learning outcomes. Studies have shown that scenario-based instructional methods significantly improve knowledge, skills, and critical thinking abilities compared to traditional approaches (3, 4). Furthermore, simulation-based and scenario-driven learning environments promote active engagement and better retention of knowledge,

with some studies reporting large effect sizes and statistically significant improvements ($p < 0.001$) (5,6).

A recent systematic review further supports these findings, demonstrating that scenario-based and simulation-based learning can improve knowledge levels by up to 60% while also increasing student confidence and engagement (7). These findings reinforce the results of the present study, where a significant improvement in post-test scores was observed following training.

The significant improvement in scores suggests that structured training enhances higher-order cognitive skills such as analysis, application, and critical thinking. Scenario-based MCQs are designed to assess these advanced cognitive processes rather than simple recall, as described in Bloom's revised taxonomy (8,9). The training likely enabled students to better interpret contextual information and apply conceptual knowledge effectively.

Furthermore, the findings support the concept of constructive alignment, where teaching methods and assessment strategies are aligned to achieve desired learning outcomes (10,11). The training sessions, which likely included guided practice and feedback, helped students develop systematic approaches such as identifying key information, eliminating distractors, and applying logical reasoning.

Moreover, evidence suggests that structured practice using MCQs enhances both performance and learning efficiency, especially when aligned with training interventions (12).

The results are also consistent with the theory of test-enhanced learning, which suggests that repeated testing and practice improve both retention and the transfer of knowledge (13,14). Exposure to scenario-based MCQs during training may have strengthened students' ability to apply knowledge in novel contexts, thereby improving post-test performance.

Additionally, well-constructed MCQs play a crucial role in assessing learning outcomes effectively. Research on MCQ design emphasizes the importance of scenario-based questions in evaluating applied knowledge and reasoning skills (15,16). The improvement observed in this study may therefore also reflect increased familiarity with the structure and expectations of such questions.

Recent literature highlights the importance of well-constructed scenario-based MCQs in assessing higher-order cognitive skills such as application and clinical reasoning (17,18). These types of questions are particularly effective in evaluating students' ability to apply knowledge in real-world contexts rather than relying on rote memorization.

The relatively large sample size ($n = 97$) enhances the reliability and generalizability of the findings. The consistent improvement across participants suggests that the training intervention was broadly effective. It is also plausible that the training contributed to increased student confidence and reduced anxiety when dealing with complex questions, further supporting performance outcomes.

Despite these positive findings, certain limitations should be acknowledged. The absence of a control group limits the ability to attribute improvements solely to the training intervention. Additionally, the study assessed only short-term outcomes, and the long-term retention of skills remains uncertain. Future research should incorporate control groups and longitudinal designs to evaluate sustained effects.

Conclusion

This study provides strong evidence that targeted training significantly improves students' performance in scenario-based MCQs. The statistically significant increase from a pre-test mean of 6.6 to a post-test mean of 9.8 ($t(96) = 7.725, p < 0.001$), along with a large effect size, highlights the effectiveness of such interventions in enhancing critical thinking and problem-solving abilities in educational settings.

Similar practices can be continued to improve the skills of students in solving complex cases. It will also be helpful to students in preparing for PG Neet examination.

As it was a pilot study, it needs to be carried out further to see the intermediate and long term outcomes.

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