

Creating High Cognitive Level MCQS will Drive Students to Clinical Reasoning? A Case Study

Clinical Reasoning And Problem-Solving Skills

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ABSTRACT

Objective: To develop clinical reasoning and problem-solving skills, medical students must be assessed at a high level of cognition according to Bloom's taxonomy. MCQs are the most employed assessment tools in medical education.

Study Design: Quantitative cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Pharmacology, Bacha Khan Medical College Mardan from 2016 to 2019.

Materials and Methods: A quantitative cross-sectional study has been performed using 250 MCQs in the final assessment exam of Bacha Khan Medical College Mardan. Each MCQ was analysed separately by five independent assessors to score it according to modified Bloom's Taxonomy. Three students also analysed each MCQ for the level of cognition. Inter-rater reliability was determined both for students and faculty. Item Analysis for MCQs was also performed.

Results: The findings showed that for high-level MCQs, inter-rater reliability between faculty was in a good range of 0.78 while between faculty and students were low as 0.27. It was also found that most high-level MCQs were in the poor discriminative index.

Conclusion: Low inter-rater reliability between students and faculty shows that faculty may create an MCQ at a high level, but the students' approach towards it may be lower order. Along with improving the assessment standards, it is also necessary to explore other factors, especially the teaching strategies to foster high-level critical thinking and clinical reasoning in medical students.

Key Words: Clinical reasoning, MCQs, Item analysis

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INTRODUCTION

Medical students must attain learning at a high level of cognition to develop clinical reasoning, critical thinking, and problem-solving skills. These competencies are essential for clinical practice¹. It is now greatly emphasized that these competencies should develop in preclinical years. The development of these competencies requires proper instructional strategies and an assessment system. Bloom's taxonomy is the most important framework from which the educators have taken help in designing instructional strategies and assessment at a high level of cognition².

The modified Blooms taxonomy having three tiers is most commonly applied for this purpose due to more

inter-rater reliability, especially in designing assessments³.

In medical education, the most commonly used tool for assessment is the MCQs. With proper training, it is possible to construct MCQs that assess a high level of cognition⁴. MCQs at a high level can also be generated through software⁵. The validity of MCQs to test the higher level of cognition has been established through various studies⁴. A significant correlation has also been found between MCQs at a high level and other assessment tools as for as student assessment score is concern⁶. MCQs created at a high level of cognition have a strong test effect⁷. It has been found that students who pass through the assessment system have a more significant percentage of MCQs of high cognition prefer deep learning. Due to a more significant percentage of low-level MCQs in examinations, it has been assumed that medical students have resorted to superficial level learning⁸. However, in most pre-clerkship medical exams, a meager percentage of high-level MCQs have been found⁹. Even in most clinical subject exams, the MCQs are of recall level with significantly less percentage in a higher level of cognition¹⁰.

It can be inferred from these findings that if MCQs are created by faculty to be categorized as high level, the

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student will also approach them in the same order. However, some of the recent studies are in contrast with this concept. Some studies have found statistical differences in the perspective of faculty and students and among the students for low and high-level MCQs¹¹. Low performers with less confidence may put an MCQ in higher-order, categorized as low order by faculty. Similarly, higher performers may assign a higher-order MCQ to lower-order due to cueing and pattern recognition¹². It has been suggested that one of the main factors for students to approach an MCQ for a level of cognition is the instructional strategy. Students taught a particular course content at a higher level will approach the relevant MCQ in that particular order and vice versa¹³. However, one of the previous studies showed no significant difference in scores of two cohorts, undergone conceptualized and route learning¹⁴. So, the most important aspect related to the MCQs level of cognition is whether the perspective of faculty (MCQs creators) and students (examinees) is the same for a higher level. Do the students approach the MCQs designated by faculty at a higher level in the same order? What is the validity of higher-order MCQs based on item analysis if the students are taught through instructional strategies that foster only low-level cognition?

This study has been performed to find the interrater reliability of high cognitive level MCQs between faculty and students. High-level MCQs are also evaluated for their validity in terms of difficulty Index and discrimination index. Their difficulty has also been compared with low-level MCQs.

MATERIALS AND METHODS

A quantitative, cross-sectional descriptive design was used to conduct the study. All the MCQs from the final exams of Bacha Khan Medical College Mardan from 2016 to 2019 in Pharmacology were included in the study. The total number of MCQs was 250. According to Modified Blooms Taxonomy, each MCQ was analyzed separately by five independent assessors (Faculty members) against preformed criteria to score it as level I, level II or level III of the cognitive domain. Three students also analyzed each MCQ at level II and Level III for the level of cognition. The students who were selected were high performers. Inter-rater reliability was determined both for students and faculty. Item Analysis was also performed to determine the discriminative Index and Item difficulty index. Table 1 shows the Proforma of MCQs evaluation for scoring the level of cognition according to Bloom's Taxonomy¹⁵.

RESULTS

The findings showed that most MCQs were at the C1 level with no MCQs in C3 level. MCQs in C2 level in 2016, 17, 18, 19 were 8%, 20%, 10% and 6% respectively. For high-level MCQs, inter-rater reliability between

faculty was in the good range of 0.78, while between faculty and students were low as 0.27.

Table No.1: Proforma of MCQs evaluation for scoring the level of cognition according to Blooms Taxonomy

Question No.	Blooms Taxonomy
	Level I Knowledge (recall of information including direct questions asking to check the factual recall, containing words like enumerate list.)
	Level II Application (ability to interpret data; questions including lab data or containing words like analyse)
	Level III Problem-solving (Use knowledge and understanding in new circumstances, including scenario-based questions containing case description and lab data asking students to initially make a diagnosis and then suggest the subsequent appropriate investigation; management modalities and counselling.)

The mean difficulty level for C1 level MCQ was 0.37 ± 0.04 while that for C2 was 0.23 ± 0.01 . C2 level MCQs were significantly more complex than C1 level. Evaluating the quality of C2, it was found that most MCQs were in poor discriminative index with a mean value of 0.31 ± 0.02 .

DISCUSSION

In this study, inter-rater reliability for high-level MCQs among the faculty was high, while low between students and faculty. This is in accordance with the previous study¹¹. In one of the studies, it was found that students approach the level of cognition for particular MCQs depending on their competency. Those students who are well performers approach the MCQs directly by recognising various patterns, while low performers approach it as high level by analytic thinking and problem solving¹². In another study, it was found that the faculty may assign an MCQ as high order may be approached by the students as low order while an MCQ assigned by faculty as low order may be approached as high order by the students due to various factors of pattern recognition, cueing and most importantly their learning methods¹³.

The result of this study showed that high-level MCQs were more challenging in comparison to low-level MCQs. Previous studies in various fields have shown the same findings^{16,17,2}. It can be concluded from this finding that as high-level MCQs involve high-level critical thinking, so they require more effort in solving, as evident from their high difficulty index.

The most exciting finding of this study shows that the mean Discriminative Index of the MCQs in the C2 level

is in the poor range. This means that high cognition level MCQs are not performing well. A previous mega study conducted in non-medical subjects showed similar results. That study showed C1 level MCQs having a better discriminative index¹⁷. In contrast, another study found higher level MCQs to have better discriminative indices than low-level MCQs¹⁶. So, the high cognitive level as designated by the faculty cannot be alone taken as the sole factor for the validity of MCQs.

In conclusion, it can be stated that faculty may create an MCQ at a high level, but the student's approach towards it may be in the lower order. This factor affects the validity of high-level MCQs, as evident by the poor Discrimination index. Along with improving the assessment standards, it is also necessary to explore other factors, especially the teaching strategies to foster high-level critical thinking and clinical reasoning in medical students.

CONCLUSION

Low inter-rater reliability between students and faculty shows that faculty may create an MCQ at a high level, but the students' approach towards it may be lower order. Along with improving the assessment standards, it is also necessary to explore other factors, especially the teaching strategies to foster high-level critical thinking and clinical reasoning in medical students.

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