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A comparison of multiple-choice questions versus descriptive questions for assessment of cognitive domain in final year medical undergraduates

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Abstract
Background and Objectives: Assessment is an essential component of student education. MCQs offer many unique advantages over descriptive questions like time factor, ease of validation, easiness of scoring. The study compared the effectiveness of the MCQ mode of assessment to the descriptive type of question format in assessing the cognitive domain of medical students.
Methodology: An observational, comparative study was conducted among 78 medical undergraduates from a private medical college in south Kerala, India, from June 2016 to August 2016. Each student was assessed separately by four sessions of both descriptive questions and MCQs, irrespective of the complexity of the subject. Statistical analysis was done using SPSS 20.
Results and Conclusion: A statistically significant correlation was noted between the marks of MCQ and descriptive questions in all four sessions of examinations. Compared to the descriptive type of questions, MCQs were equally effective for assessing the cognitive domain of medical students. It can be included for the internal assessment examinations and recommended for university examinations.

Keywords: medical undergraduates, cognitive domain, multiple choice questions, descriptive questions

Introduction

Assessment is a vital component of any educational curriculum and has a powerful influence on the learning process. An evaluation system rather than the educational objectives or instructional techniques determines what the students ultimately learn [1]. Assessment of learning is considered one of the most challenging and time-consuming aspects of education. It is mandated to assess students to evaluate whether pre-determined educational objectives are atta [2, 3]. Learning progress of a medical student assessed using theory, practical, clinical, and viva voce examination. Assessment methods aid in the timely evaluation of student progress, and appropriate assessment methods will facilitate and motivate student approach to better learning [4]. A student should be assessed for his knowledge, skills, and attitude. Inappropriate design of assessment formats may lead to unwanted outcomes and may affect their performance during assessments [5]. Reliability and validity are the main aspects of an assessment tool. The cognitive domain of knowledge is judged by theory and viva-voce examinations. The theory question papers are framed using subjective or descriptive questions. The descriptive questions include long essay questions, modified essay questions, structured essay questions, and short answer-type questions (SAQ). The subjective type of assessment includes multiple-choice questions (MCQ) [6]. MCQs offer many unique advantages that include time factor, ease of validation, and ease of scoring.[7]MCQs are commonly preferred for assessment because they provide a large variety of examination components that encompass many content areas. Further, it can be administered in a relatively short period and graded using the computer [8].

Despite offering various advantages, MCQs are criticized for giving way to only the lower order cognition with mere guessing or recognizing the answer from the choices provided. This criticism is attributed to flaws in the construction of MCQs. The MCQs "guessing factor" which allows a chance probability of choosing the right answer is considered a disadvantage. [9] MCQ may create situations in which an examinee can answer a question by recognizing the correct item, but could not have answered in the absence of items. It might hinder assessing the reasoning abilities. The effect called cueing is especially problematic when diagnostic reasoning is judged [10].

Currently, MCQs are not employed effectively for assessing the cognitive domain of medical students in Kerala, the southernmost state of India. The medical university of Kerala has excluded and does not consider MCQs for final summative assessments of medical graduates. Likewise, internal assessments conducted by most of the medical institutions in Kerala and across many other universities lack MCQs. Hence the study compared the

effectiveness of multiple-choice questions to descriptive questions for assessment of cognitive domain in final year medical undergraduates.

Methodology

After getting the approval from institutional ethics committee, the study was conducted for a period of two months from June 2016 to August 2016. Seventy-eight final-year medical graduates from a private medical college in south Kerala, India, participated in the study. The students were assessed by four sessions of examination held at twice weekly intervals. Study topics for the exam selected from the syllabus based on the priority of relevance and clinical application. Each session evaluated five chapters in Medicine. Each question paper had two parts; Part I contained 30 MCQs and Part II contained one structured Essay Question (SEQ) and five short answer questions (SAQ). Part I duration was 30 minutes and Part II duration was one hour

Setting Question papers

Questions were framed in such a way that it contained an ideal mixture of questions to assess the various aspects of cognitive domain including recall, data interpretation and problem solving skills. The essay format was structured and short answer questions more specific. MCQs were selected based on the discrimination and difficulty indices. MCQs were designed to focus relevant areas of the topic. Questions were reviewed for their precision by peers in the department.

Pattern of Mark distribution

Part I: MCQs - 1 mark for each correct response, with the maximum score of twenty five.
Part II: One structured essay question for ten marks and five short answer questions three marks each, with the maximum score of twenty five.

Valuation of Answer sheets

Part I and Part II were valued by different assessors. The second assessor was blinded from the marks obtained by the students for other part. Based on their total scores, students were categorized into three groups-those with 60% and above marks, 40-60 %, and less than 40%.

Statistical Analysis

Scores of exams were analyzed using descriptive analysis and presented as mean, SD, median, and range. Statistical analysis was done using SPSS version 2.0. The Spearman's rank correlation coefficient was calculated between MCQ and short answer questions /structured essay questions. Wilcoxon Signed-Rank test was employed to find the statistical significance of the difference between MCQ and short answer questions /structured essay questions SAQ / SEQ, in each group. A scatter diagram of MCQ vs SAQ /SEQ was plotted.

Results and Discussion

Table 1 depicts the descriptive statistics of four sets of examinations. Figure 1 portrays the student categorization based on their scores. Statistically significant correlation was observed between MCQs and SAQs for each of the four sessions and marks combined as depicted in table 2. Figure 2 depicts the scatter diagram showing the correlation between MCQs versus SAQs.

Table 1: Descriptive statistics of four sets of examination

Session	Mean	SD	Median	Minimum-Maximum
First session				
MCQ (maximum marks 25)	12.81	3.13	13.0	6-20
SAQ/ Essay (maximum marks 25)	12.59	3.23	12.5	2-20
Second session				
MCQ (maximum marks 25)	13.24	3.18	13.0	2-20
SAQ/Essay (maximum marks 25)	14.85	3.31	15.0	3.75-22.5
Third session				
MCQ (maximum marks 25)	14.56	3.50	15.0	2-23
SAQ / Essay (maximum marks 25)	14.05	3.13	14.0	3.75-20
Fourth session				
MCQ (maximum marks 25)	13.42	3.18	14.0	2-19
SAQ / Essay (maximum marks 25)	12.94	3..03	13.0	2.5-19
Total				
MCQ (maximum marks 100)	54.04	9.50	54.0	13.81
SAQ / Essay (maximum marks 100)	54.03	10.46	54.0	12-75.25

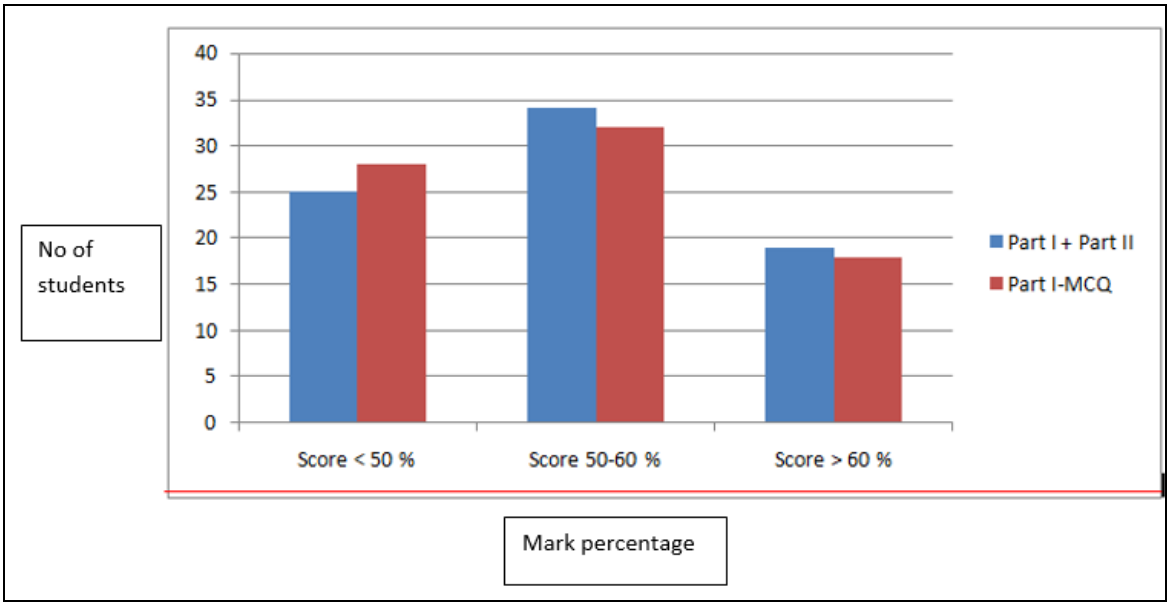

Fig 1: Categorization of students based on the score

Table 2: Spearman's Rank Correlation coefficient comparing MCQs and SAQs

MCQ vs SAQ/ Essay	Spearman's Rank Correlation	p value
First session	0.49	<0.0001
Second session	0.514	<0.0001
Third session	0.579	<0.0001
Fourth session	0.403	<0.0001
Combined	0.782	<0.0001

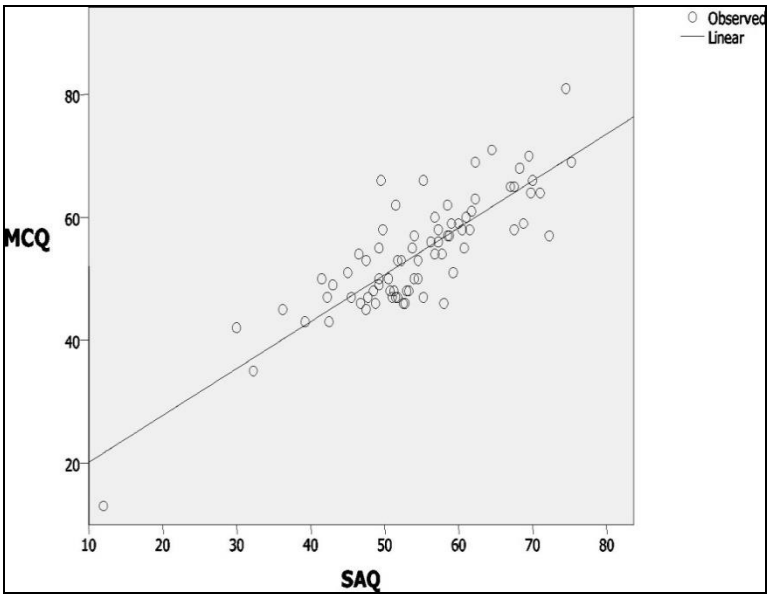

Fig 2: Scatter diagram of MCQ score vs SAQ/Essay scores of all students

The Modified Essay Question (MEQ) was developed by Hodgkin and Knox for the examination of the Royal College of General practitioners. It has since been used to assess General Practitioner trainees to various posts in their training. [11] It is a reliable assessment tool and successfully adopted to evaluate the communication skills and the five levels of cognitive processing specified by Bloom. SAQ involves writing short answers to short questions sampled from a large part of the curriculum. [12] MCQs have become an integral part of written examination and are perhaps the only assessment method for students appearing in competitive examinations like entrance examinations. MCQ is a time-tested assessment method for undergraduate and postgraduate medical education. [13, 14] MCQs usually test the recall of information. [15]

The results of the study showed that MCQs are equally good as descriptive assessments in evaluating the cognitive domain of students. Similar findings were observed for all the different examination sessions conducted. MCQs carry a lot of advantages like reliability, validity, ability to cover large areas of the subject, and ease of valuation. It also helps in the interpretation, synthesis, and application of knowledge than just testing

the recall of isolated facts. The study findings were similar to the observations of other studies that compared MCQs with open-ended questions and found the scores in both the type of assessment comparable. [8, 15]
The study result echoed the findings of few studies that found that student scores in the MCQs and the descriptive questions are closely related. [15, 17-19] Thus support that both methods essentially measured similar ability. However, this was contrary to the findings of few other studies that found that MCQs and descriptive questions may be closely related, but not identical. [20]
MCQs are assessment tools to test the data interpretation and problem-solving skills of the candidate. However, designing such structured MCQs is a complex and time-consuming process. [21] A good MCQ test paper should have a blend of questions capable of assessing an individual's capability with problem-solving skills than mere guesswork. The standard of quality of the MCQs needs to be tested to assess if the test questions reflect students' performance in the course.

Conclusion
Appropriately constructed MCQs assess higher-order cognitive processing of Blooms' taxonomy - interpretation, synthesis, and application of knowledge instead of just testing recall of isolated facts. MCQs are comparable with the descriptive-type questions for assessing cognitive skills. MCQs have the definite advantage of covering large areas of the curriculum and the easiness to value without inter-examiner variability. MCQs should be included for formative assessments and university examinations. Including MCQs in the final summative assessment may particularly make the evaluation a less tedious task. As periodic formative assessments help improve students' performance. MCQ assessments can also be conducted more frequently.

Implications
As MCQs are comparable with the descriptive type questions for assessing cognitive skills, they should form a part of question papers. MCQs have the definite advantage of covering large areas of the subject and the easiness to value without inter-examiner variability. Moreover, MCQs also can be used for frequent short formative assessments of students.

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