Original Article

Indian Journal of Medical & Health Sciences
Volum e 6 Number 1, January - June 2019
DOI: https://dx.doi.org/10.21088/ijmhs.2347.9981.6119.1

Multiple Choice Questions: A Potent Tool for Assessment of Medical Students

Ayaz Khurram Mallick[1], Marya Ahsan[2]

Abstract

Validity, reliability and feasibility are important attributes for any method of assessment. Increasing objectivity in any method of assessment increases its reliability and validity. Multiple choice questions (MCQs) has only one possible answer hence it is highly objective. However, constructing a good MCQs not only requires good in-depth knowledge of the subject but good amount of planning. Failing to do this can result in technical flaws in MCQs in the form of testwiseness and irrelevant difficulty which reduces its reliability and validity. Effectiveness as an MCQ can be assessment by item analysis which helps to improve the quality of MCQs and identify which MCQs are either too easy, too difficult or technically flawed. Hence this review article in written which highlights the measures to be taken while constructing a MCQ and how to minimize flaws in them.

Keywords: Validity; Reliability; Objectivity; Technical flaws; Item analysis.

Introduction

Assessment has been identified as possibly the single most potent influence on student's learning. It not only allows a student to focus on what needs to be studied but also affects their approach towards learning. Therefore, it is important that method of assessment be valid, reliable, objective and feasible [1,2]. Many tools such as long essay questions, short answer questions, viva voice, practical examinations etc. are used to assess learning. However, when it comes to assessing the knowledge component of a medical graduate, multiple choice questions (MCQs) plays a very vital role [3,4]. Introduced in the 50's, MCQs have been shown to be more reliable in testing knowledge than the traditional essay questions [5]. Perhaps that is one of the reason why it is accepted as a widely used tool in the assessment of undergraduates and postgraduates not just in India but world-wide.

What are multiple choice question?

MCQs does not need any introduction. MCQ is an objective question for which only one possible answer exists. However ever since its introduction, there have been many modifications resulting in various different formats. Some of the common formats are mentioned in Table 1.

Types of MCQs [5,6,7,8]

Table 1: Common types of multiple choice questions used for assessment

Type of MCQ	Features
A-Type or the single best response type	This consists of a question or a statement followed by a list of options of which one of them is the best response.
R-Type or Extended Matching Questions	This is a reverse form of A Type MCQs. Here a series of answers are listed followed by a theme or series of question. The respondent is required to match the answer with the correct theme.
Multiple True or False	Here a question or a theme is followed by four to five statements which may either be true or false. This type of MCQs is not recommended now
Assertion and Reasoning type	In this type of MCQs, a statement is given followed by a reason for it. The students are required to answer whether the statement and the reasons are true and if they are dependent or independent of each other.

Author's Affiliation: [1]Professor, Dept of Biochemistry, [2]Associate Professor, Dept of Pharmacology, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh 243006, India.

Corresponding Author: Ayaz Khurram Mallick, Professor, Dept of Biochemistry, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh 243006, India.

E-mail: ayazmallick@yahoo.com

Received on 01.06.2019
Accepted on 24.06.2019

In this article emphasis is given on A-Type or single best response type of MCQ as they are commonly seen in the Indian examination concerning both undergraduates and postgraduates

Components of MCQs [9,10]

The question along with the all the options is called as an item. This item consists of a stem, a lead in question and multiple options. The correct or the best response answer among the options is called as the key whereas the incorrect options are called as distractors. For example:

Stem: 45 year old male patient complains of acute pain at the base of his great toe. Synovial fluid analysis showed presence of urate crystals.

Lead in: Drug of choice for his treatment is…….

Options: A. Probenacid …….....Distractor
B. Allopurinol …….....Distractor
C. Aspirin …… ....Distractor
D. Cholchicine ……..……..Key

Construction of MCQs

Before constructing MCQs it is essential to have good knowledge of the content of the topic and the learning objectives. One has to decide on the number of questions and how much weightage is to be given to the various topics. A well-constructed MCQ should be written at a level of difficulty appropriate to the level of the students. The multiple choice test should include items of varying level of difficulty which will enable the assessment the higher cognitive domain of the students.

The stem

One has to keep in mind that the question stem with the lead in statement of a well-constructed MCQs should be context rich i.e. it should test the application of medical knowledge rather than context free which tests only the recalling ability of the student. The context mentioned here can be a case scenario and the questioned to be answer is dependent on that case scenario. The focus of the question should be on the problems that one would encounter in clinical practice rather than those which assesses the knowledge of trivial facts or obscure problems which they would seldom encounter.

Guidelines while writing the stem

- The stem should present a single clearly formulated problem.
- The stem should be stated as a question or incomplete statement.
- The stem should contain as much wordings as possible.
- Unnecessary or extraneous wordings in the stems should be avoided.
- Minimize the use of negatives such as 'NOT' in the stem. If at all used it should be written in capitals. Avoid stems which ends in EXCEPT as this again is a negative stem.

The options

Writing the options is perhaps of prime importance in construction of a quality MCQs. Firstly, the answer of the key should clearly be the best response and there should be no ambiguity. Secondly and most importantly, it is the wrong option or the distractors which defines the quality of the MCQs [9]. Writing a plausible distractor is time consuming and the most difficult part while preparing MCQs. A distractor should represent a common misconception among the students about the correct answer. It should create a confusion in the mind of those students who have not prepared well.

Guidelines for writing the options

- The key answer should clearly be the best
- All distractors must be plausible
- Options should be uniform and arranged in logical order
- Options should be as short as possible
- Vary the location of the right response appropriately
- Avoid terms like 'never', 'always', 'most likely', 'could', 'can' etc. in the options
- Avoid the use of 'All of the Above' and 'None of the Above' carefully

Technical flaws in MCQs [10,11]

Flaws in MCQs are common and results due to an ill-structured items. This threatens the validity of MCQs. Role of a teacher is to make sure that these flaws and the factors leading to these flaws are kept minimal in order to have a fair and a valid

assessment. These flawed items may not only tends to benefit borderline students but may penalize high achieving students. Technical flaws in MCQs are classified into two categories: 'testwiseness' and 'irrelevant difficulty'. Test wisenessis a skill which allows a student to choose the right answer without knowing the correct answer. Students who are test wise look for mistakes or clues in the items and make a guess. Irrelevant difficulty on the other handresults due a poorly prepared MCQs. Here the flaw is either in the stem or the option which confuses the students. Common technical flaws are summarized in the table 2.

Table 2: Common technical flaws which affects the validity and reliability of the multiple choice questions

Testwiseness	Irrelevant Difficulty
Grammatical cues	Vague terms (should, may, always, never)
Logical Cues	Poor sequence in numeric data
Word repeats	Unnecessary information
Longest option is correct	Ambiguous or unclear information
Implausible distracters	More than one correct answer
Convergence	No correct answer
Absolute term (Should, always, never)	Fails the 'Cover the Hand Test"
All of the above	Negatives in the stem
None of the above	

Item Analysis [12]

The most important purpose of an assessment is to evaluate the students' performance. After an examination how do we know whether the examination was good enough to assess the students? For this very purpose item analysis is done which includes a group of statistical tests for assessing the quality of the MCQs. Item analysis is done after a test with a purpose to improve the quality of the MCQs. Item analysis can help identify those MCQs which are either too easy, too difficult or technically flawed.

Steps of item analysis

Step 1: Perform the test with a given set of MCQs

Step 2: Rank the students based on their marks

Step 3: Divide the students in two group: As High Achiever Group (HAG) and Low Achiever Group (LAG)

Step 4: Apply the appropriate tool

Step 5: Analyze the results

Tools of item analysis

Commonly used tools for item analysis are (Table 3)

1. Facility Value (FV) or Difficulty index

This measures how many students have responded to a particularly question correctly. It indicates how easy or difficult a question is. It is expressed as percentage and ranges from 0% (hardest) to 100% (easiest). It is recommended that a MCQ test starts with questions with higher FV and as the test progresses the FV of the items should decrease.

2. Discrimination Index (DI)

As the name suggests this test helps in detecting those items which can discriminate students who have prepared well from those who have not prepared well. It ranges from 0 to 1.0. A DI of 1 indicates it is an ideal question as all the high achievers have got it right and all the low achievers have got it wrong. Sometimes the DI may be negative which means either the key is marked wrong or the item is flawed. (Principle of assessment).

3. Distractor efficiency

A good distractor should be plausible and should be opted by those students who have not prepared well. Any distractor which is not picked up by 5% of the students fails to be called as a good distractor.

Table 3: Summary of various tools used for item analysis and their interpretation

Test	Formula	Interpretation
Facility value or difficulty index	$\frac{HAG + LAG}{2} \times 100$	≥ 85%: Easy 51 – 84%: Moderate ≤ 50%: Hard
	$\frac{2 \times (HAG - LAG)}{\text{Total number of students}}$	
Discrimination index		≥0.35: Good item 0.2 – 0.35: Acceptable range ≤ 0.2: Unacceptable
Distractor Efficiency		< 5%: Unacceptable option

Conclusion

Single response or A Type MCQs are a valid,

reliable, highly objective and one of the most preferred tool for assessment of knowledge in medical students. If properly construction, MCQs can test all the levels of cognitive domain starting from knowledge right up to analysis, synthesis and even evaluation. However constructing a quality MCQ is time consuming and challenging which requires early planning. A poorly framed item can make the MCQs less valid. Item analysis is performed post-test and includes tests which helps not only to determine the quality of MCQs but also to improve them.

References

1. Shaifali I, Ahsan M, Mallick A. A study on objective structured practical examination (OSPE) as a tool for assessment of medical students. Indian J Bas App Med Res. 2016;5(2):784-90.
2. Awan U, Ahsan U. Assessment; is viva acceptable. Professional Med J. 2016;23(2):213-16
3. Abdulghani HM, Ahmad F, Irshad M, Khalil MS, Al-Shaikh GK, Syed S, Aldrees AA, Alrowais N, Haque S. Faculty development programs improve the quality of Multiple Choice Questions items' writing. Scientific reports. 2015 Apr 1;5:9556.
4. Schuwirth LW, Van Der Vleuten CP. Different written assessment methods: what can be said about their strengths and weaknesses?. Medical education. 2004 Sep;38(9):974-9.
5. Al-Rukban MO. Guidelines for the construction of multiple choice questions tests. J Family Community Med. 2006;13(3):125-33.
6. Ghate J, Sinha M, Sinha R.Correlation of MCQ subtypes with grading of performance among undergraduate students in apreclinical discipline. Int J Res Med Sci. 2017;5:446-51.
7. Sim S, Rasiah RI. Relationship Between Item Difficulty and Discrimination Indices in True/ FalseType Multiple Choice Questions of a Para-Clinical Multidisciplinary Paper. Ann Acad Med Singapore. 2006;35(2):67-71.
8. Williams JB. Assertion reason multiple choice testingas a tool for deep learning: a qualitative analysis. Assessment and evaluation in higher education. 2007;31(3):287-301.
9. Kilgour JM, Tayyaba S. An investigation into the optimal number of distractors in single-best answer exams. Advances in Health Sciences Education. 2016 Aug 1;21(3):571-85.
10. Singh T, Gupta P, Singh D. Principles of medical education. 4th ed. New Delhi: Jaypee Brothers Medical Publishers; 2013.
11. Walsh K. Oxford Textbook of Medical Education. 1st ed. New Delhi: Oxford University Press; 2018.
12. Singh T. What to assess? In: Principles of Assessment in Medical Education. 1st Ed. New Delhi: Jaypee Brothers Medical Publishers; 2012.p.14–24.