



Research Article

Evaluation of Multiple Choice Questions by Item Analysis in a Medical College- A Pilot Study

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Abstract

Introduction: Assessment is an integral part of any learning and training. Multiple choice questions (MCQs) are a widely used tool in assessment protocols. To increase the validity of MCQs standard prevalidation and post validation protocols are recommended. Item Analysis is a post validation procedure.

Aims and Objectives: Difficulty index, Discrimination index and Distracter effectiveness are the parameters used to evaluate the standard of MCQs

Materials and Methods: This study was conducted in the Department of Pathology at a Medical College. This is a retrospective study. The Term end examination MCQ paper after the 1st semester was assessed. Based on the answers marked by the students the Difficulty index, Discrimination index and Distracter effectiveness were calculated.

Results: In the present study, according to the Difficulty index criteria 50% of the MCQs were acceptable, of which 15% were ideal. On the basis of Discrimination index, 60% were good discriminator and 35% of the MCQs were excellent with a DI greater than 0.35%. In 45% MCQs the distracters were effective. Only 7 out of 20 MCQs satisfied all the criteria for an ideal MCQ.

Conclusion: This exercise was an eye opener revealing the quality of the MCQs and it will also help while formulating MCQs for future exams.

Keywords: MCQ, item analysis.

Introduction

Assessment is an integral part of any learning and training. There are various methods of evaluation and assessment for medical students. Multiple choice questions (MCQs) are a widely used tool in assessment protocols. MCQs have the advantage of having a high degree of objectivity and

reliability and can assess a large area of content in a small time span. To increase the validity of MCQs standard prevalidation and post validation protocols are recommended. Item Analysis is a post validation procedure. It is a process of collecting, summarizing and using information from students responses to assess the quality of

MCQs. Difficulty index, Discrimination index and Distracter effectiveness are the parameters used to evaluate the standard of MCQs.^{1, 2}

Aims and Objectives

- The main purpose of this study was to determine whether
- The items were too difficult or too easy (using difficulty index)
- The items could discriminate between high and low achievers (using discrimination index)
- To assess the distracter effectiveness

Materials and Methods

This study was conducted in the Department of Pathology at a Medical College. This is a retrospective study. The Term end examination MCQ paper after the 1st semester was assessed. 103 students appeared for the exams. 20 MCQs were given. Each MCQ had four options – A, B, C and D. Each MCQ was of 0.5 mark. There was no negative marking and the time allotted was 20 min. Prevalidation of the paper was done by the Head of the Department and the Department Curriculum Committee.

The papers of the 103 students were arranged according to the decreasing order of marks. The 1st 34 students i.e the high achievers and the last 34 students i.e the low achievers were included in this study, while the rest of the students (35 students) were excluded.

Based on the answers marked by the students the Difficulty index, Discrimination index and Distracter effectiveness were calculated.

The calculations were done using the following formula:

$$\text{Difficulty index (P)} = \frac{H + L}{T} \times 100$$

H: number of students answering correctly in high achieving group

L: number of students answering correctly in low achieving group

T: total number of students in two groups including non-responders

$$\text{Discrimination index (d)} = \frac{H - L}{T} \times 2$$

Distracter effectiveness: Any of the distracter, which did not attract even 5% (3 response) of the total response was said to be a non- functional distracter.

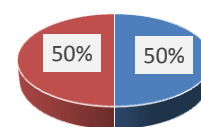
Observation and Results

Difficulty Index (P)

It is the percentage of students who select the correct answer for an item. It ranges from 0-100%. Higher the value of Difficulty Index easier is the question. It is calculated as the percentage of students who correctly answered the item.

Parameter	Difficulty index
Very Difficult	Difficulty index less than 30%
Acceptable	Difficulty index 30% to 70%
Very Easy	Difficulty index above 70%

Fig.1: Classification of MCQ as per Difficulty index



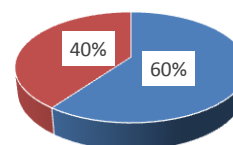
■ Acceptable ■ Very Easy

Discrimination Index (DI)

It is the ability of an item to differentiate between the high and low achievers. It ranges from 0 to 1. If DI is higher, the item is more able to discriminate between high and low achievers.

Parameter	Discrimination Index
Good Discriminator	Discrimination Index more than or equal to 0.2
Poor Discriminator	Discrimination Index less than 0.2

Fig.2: Classification of MCQs as per Discrimination Index



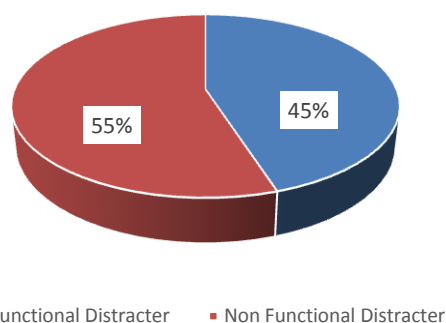
■ Good Discriminator ■ Poor Discriminator

Distractor efficiency (DE)

It shows the effectiveness of the incorrect options (distractors) given in the item. It shows whether distractors are functioning as distractors or not functioning. Non Functioning distractor (NFD) is an option other than correct answer which is selected by less than 5% of total students in high and low group, while the distractors which are selected by 5% or more than 5% of the students are considered as functional distractors.

Distractor efficiency was determined for each item on the basis of the number of NFDs in it and ranged from 0 to 100%. DE was 100%, 66.6%, 33.3% and 0% based on presence of zero, one, two or three NFDs in an item respectively.

Fig.3: Classification of Distractors as per distractor effectiveness



Discussion

An ideal MCQ should have average level of difficulty (>30-60%) with higher discrimination index (> or equal to 0.25) and 100% distractor efficiency (meaning all three incorrect responses should function)

In the present study, according to the Difficulty index criteria 50% of the MCQs were acceptable, of which 15% were ideal. On the basis of Discrimination index, 60% were good discriminator and 35% of the MCQs were excellent with a DI greater than 0.35. In 45% MCQs the distractors were effective. Only 7 out of 20 MCQs satisfied all the criteria for an ideal MCQ. This brings out the fact that it is difficult to construct an ideal MCQ. Adequate time and a thorough knowledge of the subject are very essential.

Parameter Difficulty Index	Present Study	Patil et al ¹	RamakrishnanM et al ²	Rao C et al ³
Very difficult	0%	36.7%	35%	10%
Acceptable	50%	46.6%	50%	85%
Very easy	50%	16.7%	15%	5%

In the present study, though 50% of the MCQs were acceptable and similar to the studies by Patil et al and Ramakrishnan et al, 50% of the MCQs were found to be very easy and there was no very difficult MCQ.

Parameter Discrimination index	Present Study	Patil et al ¹	RamakrishnanM et al ²	Rao C et al ³
Good Discriminator	60%	70%	33%	75%
Poor Discriminator	40%	30%	67%	25%

The results of Discrimination index of the present study is similar to the findings by Patil et al and Rao C et al

Parameter Distractor effectiveness	Present Study	Patil et al ¹	Ramakrishnan M et al ²	Rao C et al ³
Functional Distractor	45%	82.2%	63%	95%
Non functional Distractor	55%	17.8%	37%	5%

In the study done by Rao C et al 95% of the distractors were functional, while in the present study only 45% of the distractors were functional. Therefore, designing of plausible distractors and reducing the NFDs is an important aspect for framing quality MCQs. More number of non-functional distractors in an item increases the Difficulty index (makes item easy) and reduces Distractor effectiveness. Conversely, Item with more functioning distractors decreases the Difficulty index (makes item difficult) and increases Distractor effectiveness.¹

Conclusion

With the above item analysis data, it would be useful to hold a meeting of the test developers and changes that are needed can be done. Some items need to be corrected while some items need to be dropped. These items can then be added to the question bank. This exercise was an eye opener revealing the quality of the MCQs and it will also help while formulating MCQs for future exams. MCQs are the most widely applicable and useful type of Objective test items. They are used to measure the most important educational

outcomes-Knowledge, understanding, judgement and problem solving and therefore need to be constructed appropriately.⁴

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References

1. Patil R et al. Evaluation of multiple choice questions by item analysis in a medical college at Pondicherry, India Int J Community Med Public Health. 2016 Jun; 3(6):1612-1616
2. Ramakrishnan M et al. Item analysis: A tool to increase MCQ validity Indian Journal of Basic and Applied Medical Research; June 2017: Vol.-6, Issue- 3, P. 184-189.
3. Rao C, Kishan Prasad H L, Sajitha K, Permi H, Shetty J. Item analysis of multiple choice questions: Assessing an assessment tool in medical students. Int J EducPsychol Res 2016; 2:201-4
4. Mohammed O Al-Rukban. Guidelines for the construction of multiple choice question tests. J Family Community Med2006 Sep-Dec; 13(3): 125–133.