

Are Difficulty Index and Discrimination Index Useful Tools For Assessing The Quality Of An MCQ? - A Cross Sectional Study.

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Abstract

Background: Good quality multiple choice questions (MCQs) can test knowledge of the students in depth which covers large syllabus in short time. MCQs if post validated accurately can give us items with known difficulty index and discrimination index. However not many teaching institutes have provided adequate importance to item analysis.

Objectives: The objectives of the study were to find out difficulty index (P) and discrimination index (d) for each item in a physiology MCQ test paper.

Materials and methods: Physiology MCQ test paper comprising of 20 items, with answer key and answer papers of 250 first Year Physiotherapy students were obtained and item analysis was performed. Choice marked for each item by each student and his scores were entered in Microsoft Excel. Students were ranked & top 1/3rd and bottom 1/3rd were chosen as high achiever and low achiever group respectively. Difficulty index and discrimination index for each item was determined.

Results: 3 multiple choice questions were very difficult with difficulty index (p) <30%. 9 questions were within acceptable range of difficulty index (p- 30 to 70). 8 questions were easy with a difficulty Index (p) above 70%. Discrimination index (DI) of 6 out of 20 questions was below 0.20 and hence unacceptable. DI of 8 questions was between 0.20 to 0.25 and so acceptable. 4 questions were found to have a good discrimination index (DI= 0.25 to 0.35). 1 question was found to have excellent discrimination (DI= 0.35 or more). One item had negative discrimination index.

Conclusion: It can be concluded that difficulty Index (p) and discrimination Index (DI) are very useful tools for the assessment of the quality of an MCQ. An item with known and acceptable difficulty level and discrimination power should be preserved for future exams.

Key Words: Difficulty Index, Discrimination Index, Item analysis.

Introduction

Multiple choice questions (MCQ) are widely used for MBBS students in colleges as classroom test and as entrance test for under graduate and post graduate courses. A typical MCQ item consists of a question (stem) and a set of options that consist of possible answers to the question with single best correct answer. A student's task is to select the one option that provides the best answer to the question asked.

A distinct advantage of using MCQ items on classroom tests is that grading tends to be quick and without subjective bias of evaluator.

Another important advantage is that a well-constructed MCQ test can yield scores at least as reliable as those produced by a constructed-response test, while also allowing for broader coverage of the topics covered in a course. [1]

While framing MCQs for an examination, it is advisable that there is a valid and reliable reference question bank with known difficulty level and discriminate index of MCQs. However adequate importance is not paid by many educational institutes to creation of such MCQ banks. Hence this study and item analysis was undertaken to find out difficulty index and discrimination index in Physiology in a Physiotherapy examination with the intention of creating of item bank.

Materials and Methods:

This cross sectional study was conducted in a private medical college in 250 first year physiotherapy students. Objectives of the study were to check the quality of MCQs on the basis of responses of students and to identify properly framed questions and questions that need modifications. Approval for the present study was obtained from local ethics committee.

Physiology MCQ paper of the I BPTH preliminary exam was analyzed. There were 20 MCQs in total with 4 options including single best option which was considered as correct response. One mark was awarded for each correct response. There was no negative marking for incorrect response. Option marked for each item by each student and his MCQ scores were entered in Microsoft Excel sheet. Students were then ranked in descending order of their scores. Top 1/3rd and bottom 1/3rd were chosen as high achiever group (H) and low achiever group (L) respectively. Difficulty index (how difficult the question was for all the takers) and discrimination index (how well the questions discriminated more knowledgeable students and less knowledgeable students) were measured. Most authors suggests that the discriminations coefficient should be at least +0.20. [2, 3, 4]

Table 1 shows formulae for calculating difficulty index and discrimination index. [5, 6]

Table 2 and Table 3 show general interpretation of difficulty index and discrimination index of MCQs with reference to standard values. [5, 6, 7]

Results:

No of multiple choice questions =20 No. of students =250

insert tables here sir all 5 tables

Table 4 and Table 5 show interpretation of difficulty index and discrimination index of MCQs in the present study.

Table No.1-Formulae for different parameters^{5,6}

Parameters	Formula
Difficulty index (P) (for correct option)	$[(H+L) \times 100 / T]$
Discrimination index (d)	$[(H-L) \times 2 / T]$

Table No.2- Difficulty index ^{5,6,7}

Difficulty index	Interpretation
30-70 %	Acceptable
More than 70 %	Very easy
Less than 30 %	Difficult

Table No.3-Discrimination index^{5,6,7}

Discrimination index	Interpretation
0.2 to 0.25	Acceptable
Between 0.25 to 0.35	Good
More than 0.35	Excellent
Less than 0.2	Poor
Negative value	Poor- defective item

Table No.4 - Difficulty index interpretation

Sr no.	Difficulty index	Total items	Interpretation
1	30-70 %	9	Acceptable
2	More than 70 %	8	Very easy
3	Less than 30 %	3	Difficult

Table No.5 – Discrimination index interpretation

Sr no.	Discrimination index	Total items	Interpretation
1	0.2 to 0.25	8	Acceptable
2	Between 0.25 to 0.35	4	Good
3	More than 0.35	1	Excellent
4	Less than 0.2	6	Poor
5	Negative value	1	Poor-defective items

DISCUSSION

Use of MCQ as testing method in medical curriculum is increasing. So it becomes very important that quality of questions be maintained too. For that one may follow the widely accepted item writing guidelines, such as putting the central idea of the question into the stem and avoiding the use of negation whenever possible.^[8,9] Another way to examine the quality of MCQ items involves analyzing the responses that examinees make, and this is the approach used in the present study.

It is clear that thoughtfully written MCQ items can serve to assess higher-level cognitive processes, although creating such items does require more skill than writing memory based items.^{10,11} One criticism is that the format of MCQ items lets students guess even when they have no subjective knowledge of the topic under consideration.^[12]

Downing (2003)⁸ points out blind guessing is quite uncommon on well-written classroom tests than informed guessing, which is based on a critical consideration of the question and the available options, provides a valid measure of student achievement.^[13]

The higher the difficulty index value, lower is the difficulty and lower the difficulty index value; greater is the difficulty of an item. For discrimination index, higher is the index, better the item can discriminate between those students with high tests scores and those with low ones.

Result as seen in the Table no 4, there were 3 questions with difficulty index (p) <30%.

9 questions were within acceptable range of Difficulty index (p). Out of those 9, 8 questions were of Difficulty Index (p) >70%, so they can be considered as easy (optimum) as far as the difficulty is concerned. The easier acceptable items can be used in a question paper in the beginning or can be interspersed throughout the paper to provide psychological boost to the low achievers. Similarly difficult questions can be retained and used to select toppers.

As seen in Table no 5, DI of 8 questions were >0.20 and so acceptable.

4 questions were categorized as having Good Discrimination (DI= 0.30 to 0.39)

1 questions was categorized as having Excellent Discrimination (DI= 0.4 or more)

Discrimination index (DI) of 6 out of 20 questions was below 0.20 and hence unacceptable. One item had a negative discrimination index.

The MCQ test paper didn't contain ambiguous questions, the answer key was right, the correct answers didn't involve more than one response and there was no typographical error. Perhaps learning objectives of the teaching learning session were not met far as MCQs with DI below 0.2 or negative DI are concerned. Students either did not understand or misunderstood what was taught.

Conclusion:

It can be concluded from the present research that Difficulty Index (p) and Discrimination Index (DI) are very useful tools for the assessment of the quality of an MCQ. An item with known and acceptable difficulty level and discrimination power should be preserved in the form of item banks for future exams.

Acknowledgements:

We sincerely thank Department of physiology, DY Patil University, School of Medicine Navi Mumbai and the local institutional ethics committee for allowing us to undertake this research study.

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