

Original research article

Evaluation of Distractor Effectiveness of Single Best Response type of Multiple Choice Questions by item Analysis

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Abstract

Background: The most reliable format of objective evaluation is multiple choice questions (MCQs) which ideally should be drawn from a question bank of valid and tested items/MCQs. Distractor effectiveness is one of the most important tool to assess the quality and validity of a MCQ. Items with known functional distractors form an important part of assessment in MCQ test paper.

Objectives: The objectives of the study were to find out distractor effectiveness for each item in a physiology MCQ test paper.

Materials and methods: Physiology MCQ test paper comprising of 40 items, with answer key and answer papers of 198 first MBBS students were obtained. 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. Distractor effectiveness for each item was determined using appropriate formula.

Results: Out of 120 distractors, 97 (80.83%) were functional distractors. 16 items had in all 23 (19.17%) non-functional distractors. 24 items had all functional distractors, 10 items had 1 non-functional distractor, 5 items had 2 non-functional distractors and 1 item had 3 non-functional distractors. All other distractors for each item were acceptable.

Conclusion: Valid items with functional distractors can be incorporated in item bank. Items with non-functional distractors should be revised.

Key words: Distractor effectiveness, Item analysis.

Introduction

Objectivizing evaluation is becoming increasingly important in the field of education. The most popular and reliable format of which is multiple choice questions (MCQs). A single MCQ in a MCQ test paper is referred as an item. 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] However, the increasing usage of MCQs by itself does not guarantee a more valid and reliable evaluation system although it may make it more objective. Ideally all departments of a teaching institute should possess an item bank of valid and tested MCQs free of constructional errors and having functional distractors.

Unfortunately, not many teaching institutes have provided sufficient importance to creation of such ideal item banks which can be done by item analysis which is analyzing the performance of a MCQ after it has appeared in a question paper. By neglecting proper item banking with the help of item analysis, students are subjected to MCQs in exams valid which are incapable of distinguishing between knowledgeable and ill-informed students as they have badly constructed distractors.

With this background, the present project was undertaken to find out items with functional distractors by performing item analysis on first MBBS internal physiology examination.

Material and Methods:

The present study was conducted in department of physiology of a government medical college after obtaining consent from the institutional ethics committee. All first MBBS students who appeared in preliminary Physiology examination conducted were included while students absent for the examination were excluded from the present study. It was observed that 2 students out of 200 did not appear for the examination

MCQ test paper comprising of 40, single best response type of items, its answer key and corrected answer papers of 198 first MBBS students were collected.

All the items in test paper were prevalidated by subject experts. The time allotted for the examination was 40 minutes. Each item had 4 options. Each correct answer was given half mark.

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 and low achiever group respectively. Thus responses of total 132 students (T) were assessed.

Frequency table for each item was prepared. For example

Options	No. selecting the option amongst high achievers (H)	No. selecting the option amongst low achievers (L)
a (Key)	53	25
b (Distractor)	1	9
c (Distractor)	5	8
d (Distractor)	7	24
No response (NR)	0	0
Total responses	66	66

Distractor effectiveness was calculated by using the following formula -

Table 1: Formula for distractor effectiveness ^[2, 3]

Parameters	Formula
Distractor effectiveness(for distractors)	$[(H+L) \times 100/T]$

Table 2: Evaluation of distractor effectiveness ^[2,3,4]

Distractor effectiveness	Interpretation
More than 5 %	Acceptable
Less than 5 %	Non-functional

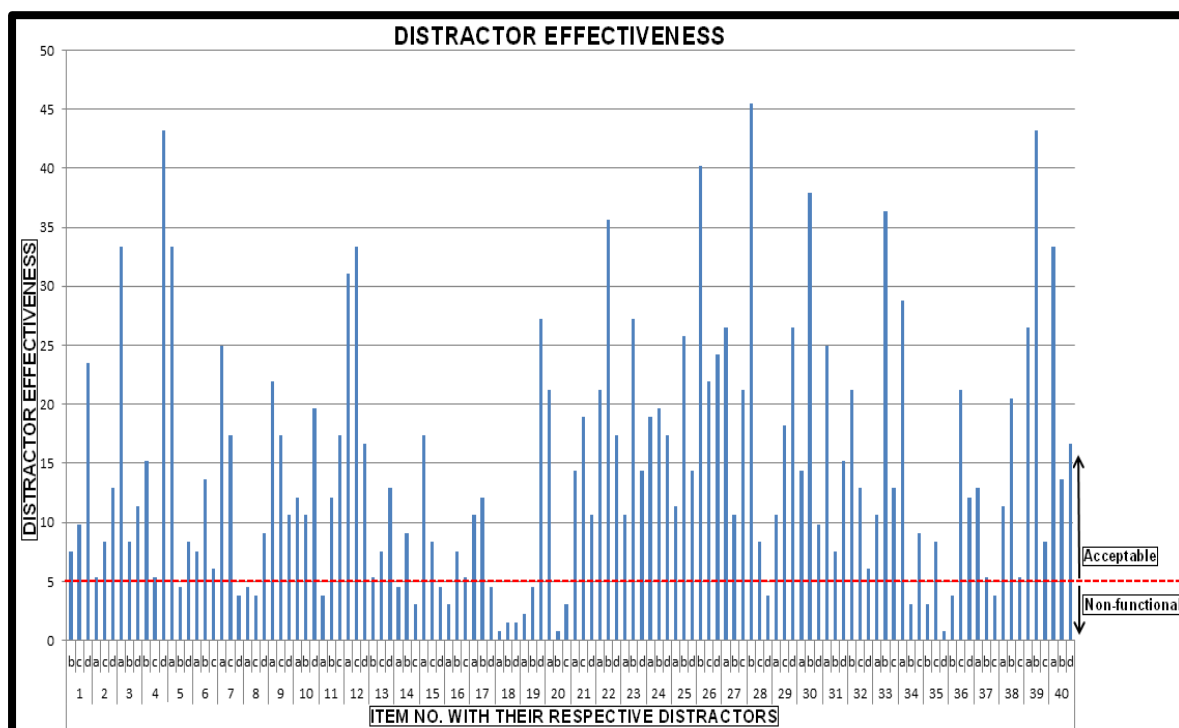
RESULTS:**Table 3: Distractor effectiveness interpretation**

Sr no	Item No	Option	Distractor effectiveness (%)	Interpretation
1	5	b	4.54	Nonfunctional
2	7	d	3.78	Nonfunctional
3	8	a	4.54	Nonfunctional
		c	3.78	Nonfunctional
4	11	a	3.78	Nonfunctional
5	14	a	4.54	Nonfunctional
		c	3.03	Nonfunctional
6	15	d	4.54	Nonfunctional
7	16	a	3.03	Nonfunctional
8	17	d	4.54	Nonfunctional
9	18	a	0.75	Nonfunctional
		b	1.51	Nonfunctional
		d	1.51	Nonfunctional
10	19	a	2.27	Nonfunctional
		b	4.54	Nonfunctional
11	20	b	0.75	Nonfunctional
		c	3.03	Nonfunctional
12	28	d	3.78	Nonfunctional
13	34	b	3.03	Nonfunctional
14	35	b	3.03	Nonfunctional
		d	0.75	Nonfunctional
15	36	b	3.78	Nonfunctional
16	37	c	3.78	Nonfunctional

* All other distractors for each item were acceptable.

Table 4: Distribution of items with non-functional distractors

Sr No	Item Characteristic	No of items	Percentage
1	Items with 0 non-functional distractor	24	60 %
2	Items with 1 non-functional distractor	10	25 %
3	Items with 2 non-functional distractors	5	12.5 %
4	Items with 3 non-functional distractors	1	2.5 %



Graph 1: Demonstrates distractor effectiveness of all items

Discussion:

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.^[5,6] One criticism is that the format of MCQ items lets students guess even when they have no subjective knowledge of the topic under consideration.^[7]

Downing^[8] points out that random guessing on well-written test questions is generally overestimated and the probability of obtaining a good test score from random guessing alone is extremely low. There is extremely low threat to test validity from guessing in reasonably long and carefully constructed objective tests.^[9]

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.^[8,10]

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.

From distractor effectiveness, it is possible to find out how many students have responded to alternatives other than the key. The purpose of the distractors is to distract a student from the correct answer. Hence, the distractor should be plausible responses. If a particular distractor is not responded to by even 5% of the total students, then it is considered as a non-functional distractor.

The present study shows that out of 120 distractors, 97 (80.83%) were functional distractors and 23 were non-functional (19.16%). [Table 3][Graph 1]

Total items with non-functional distractors were 16 (40%) out of which 10 items (25 %) had 1 non-functional distractor, 5 items (12.5 %) had 2 non-functional distractors and 1 Item (2.5 %) had 3 non-functional distractors. [Table 4]

Answer key of some items was "All of the above" which ideally should not be used. Hence even low achievers were drawn to that key as a result of which distractor effectiveness of distractors was below 5%.

Such non-functional distractors they should to be replaced or revised as they are not serving their purpose. Such items with revised distractors can be asked in subsequent examinations. After repeated use, one can identify a set of items which shows consistency with respect to acceptability of distractors (at least 5%).

Valid items having functional distractors and free of constructional errors should be noted on item card and incorporated in item bank.

Thus advantages of item analysis are detection of flaws in the questions and finding out distractor effectiveness for each item so as to develop a set of standard MCQs and also for giving feedback to teachers.

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