

EFFECT OF NEGATIVELY FRAMED MCQS IN THE MEDICAL EDUCATION

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Article Received on
09 Jan. 2019,

Revised on 30 Jan. 2019,
Accepted on 19 Feb. 2019

DOI: 10.20959/wjpr20193-14370

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ABSTRACT

The current study aimed to investigate the effect of positively and negatively framed MCQs in the medical education by estimating the difficulty index and discrimination index of the MCQ items. A total of 156 students in the second year MBBS of SMMCHRI were included in the study. A total of thirty (three sets of 10 each named as Set A, Set B and Set C) MCQs were framed from the recently covered theory topic in Pharmacology. Set A consisted of 10 positively framed MCQs i.e without any 'not', 'except' and 'false' in the stem while the Set B consists of 10 negatively framed MCQs. Set C was an replica of Set B except capitalization and underlining of the negative words ('not', 'except') to facilitate the easy noticing in the stem of the MCQ. Difficulty and discrimination index were used. The average score

obtained by the students were highest in the positively framed MCQ set (45.5%) while the lowest score was seen in the negatively framed MCQ set i.e Set B (31.9%). The average difficulty level of positively framed MCQ falls under the category 'ideal' (D_{fi} of Set A was $45.1 \pm 7.3\%$) while the negatively framed MCQ falls under the category 'Difficult' (D_{fi} of Set B was $22.2 \pm 4.6\%$). The negatively framed MCQs decrease the students' performance and lose the discrimination property. It can be minimized by underlining and capitalizing the negative words in the stem of MCQ.

KEYWORDS: Multiple choice question; Medical Education; Negatively framed; difficulty index.

1. INTRODUCTION

Multiple choice questions (MCQs) are commonly used in different levels of examinations of various fields.^[1] Though seems to be very easy to construct, the ideal MCQs are actually very difficult to frame.^[2] The thought, act and approach to pessimism always have a negative effect in human mind.^[3] Hence while constructing a MCQ, it is being said that one should avoid framing a MCQ in negative way.^[4] This is because to avoid the confusion in the examinee and to prevent wasting the extra effort and time in attempting the negatively framed MCQs.

Answering a MCQ in the field of medicine requires a great effort and attention span as responses are often constructed with overlapping facts and only a thin line exists to delineate the actual response from the distractors of the MCQs. Hence, the examinee might become less attentive in the later part of the examination and the use of negatively framed words like 'not', 'except', 'false' etc., in the stem could be easily missed. However all these facts are not properly studied and the literature search came up with only a very few evidence.

Hence the current study aimed to investigate the effect of positively and negatively framed MCQs in the medical education by estimating the difficulty index and discrimination index of the MCQ items.

2. MATERIALS AND METHODS

Approval and study subjects

The study was proposed to the Medical education unit, Srimuthukumaran medical college Hospital and research institute, Chennai and approval was obtained. A total of 156 students in the second year MBBS of SMMCHRI were included in the study.

Preparation of the MCQs

In order to avoid the memory bias, MCQs were framed from the theory topics (CNS and CVS) in pharmacology which were taught in the last two months. A total of thirty (three sets of 10 each named as Set A, Set B and Set C) MCQs were framed from the above mentioned topic. All the three sets of MCQs were validated internally before implementing to the students. Set A consisted of 10 positively framed MCQs i.e without any 'not', 'except' and 'false' in the stem while the Set B consists of 10 negatively framed MCQs. Set C was an replica of Set B except capitalization and underlining of the negative words ('not', 'except')

to facilitate the easy noticing in the stem of the MCQ. Each item in the set consists of four responses and only one response is the best option.

Implementation of the MCQs

The MCQs were implemented to the students for 10 minutes in one theory class without any prior intimation. All the sets of MCQs were distributed randomly to the students and hence each student had a choice of receiving of any one of the MCQ sets. The aim of the study was clearly explained to the students and oral consent was obtained before participation in this study. Ten minutes time was given exactly to answer the MCQs and the students were instructed to not to discuss amongst themselves. Constant invigilation was made for the ten minutes. The selection bias was avoided by implementing the MCQs to the whole batch of second year MBBS.

Assessment of the effectiveness

The following tools were used in this study to meet the aim.

- 1) The difficultness of negatively framed MCQs was assessed by calculation and comparison of
 - (a) Total number of MCQs answered correctly by the students in Set A, Set B and Set C.
 - (b) Difficulty index of each item in Set A, Set B and Set C.
 - (c) Discrimination index of each item in Set A, Set B and Set C.
- 2) The effect of highlighting the negative words was assessed by calculation and comparison of
 - (a) Total number of MCQs answered correctly by the students in Set B and Set C.
 - (b) Difficulty index of each item in Set B and Set C.
 - (c) Discrimination index of each item in Set B and Set C.

Calculation of difficulty index of the item

The marks obtained by the students were calculated and was arranged in the ascending order. From this data, based on the marks scored, the students were classified into three categories namely, high achievers ($\geq 60\%$ of the maximum score) and low achievers ($\leq 30\%$). For each item, the number of students selecting the different options amongst the high and low achievers was calculated.

The difficulty index of an item is then calculated by

$$\text{Difficulty index (Df}_i\text{)} = (H + L)/N \times 100 \text{ where}$$

H= Number of students selecting the correct option in high achievers

L = Number of students selecting the correct option in low achievers.

The particular item is categorized as 'difficult' if the difficult index value (Df_i) is $\leq 30\%$, as 'ideal' when Df_i is $30.1\% - 69.9\%$ and as 'very easy' when Df_i is $\geq 70\%$. The calculation was applied for all the items (10 CQs in all 3 sets) and the difficulty index value for each item in all the set was derived and compared.

Calculation of discrimination index of the item

The same procedure (as explained in the section 2.5) was followed and the discrimination index was calculated as follows.

$$\text{Discrimination index } (Dc_i) = (H - L) / N \times 2$$

The particular item was taken as 'with good discrimination' when Dc_i value is between 0.25 – 0.35, 'with excellent discrimination' when Dc_i value is ≥ 0.35 and 'with poor discrimination' when when Dc_i value is ≤ 0.25 .

Statistical analyses

The data are expressed as percentage or mean \pm SEM according to the nature of data. One-way ANOVA was used to compare the three different groups. $P < 0.05$ was kept as level of significance. Graph pad PRISM version 5 was used for the statistical analyses.

3. RESULTS

Baseline characteristics

The baseline characteristics of the three different groups are summarized in table 1. A total of 136 students participated in this study. Out of 136 students, 51 students (37.5%) answered in Set A, 41 students (30.1 %) in Set B and 44 students (32.4 %) attempted Set C.

The students were categorized into high and low achievers based on the marks scored by them and by the predetermined rules (as explained in methods) in all the three sets. The percentage of high achievers in Set A, Set B and Set C are 27.4%, 12% and 25% respectively while the percentage of low achievers are 25.4%, 65.8% and 47.7% respectively.

Table 1: Baseline characteristics of the students in different MCQ sets.

S.No	Characteristic	Set A	Set B	Set C
1	Number of students participated (N)	51	41	44
2	High achievers (Scored $\geq 60\%$ of the maximum score)			
	Number (n)	14	5	11

	Percentage (%)	27.4	12.1	25
3	Low achievers (Scored ($\leq 30\%$ of the maximum score))			
	Numbers (n)	13	27	21
	Percentage (%)	25.4	65.8	47.7

Foot note: Set A – positively framed MCQs; Set B – negatively framed MCQs; Set C – Negatively framed MCQs with underlining of the negative words. Total n = 136 students.

Difficultness of negatively framed MCQ

The total number of MCQs answered correctly by the students in Set A was 45.5% while in set B it was 31.9% and in Set C it was 41.4%. The difficulty indexes of the different sets of MCQs are shown in the table 2.

Table 2: Difficultness of negatively framed MCQ.

S.No	Parameter	Set A	Set B	Set C
1	Number of MCQs answered correctly (n)	232	131	170
2	Average correct score (%)	45.5	31.9	41.4
3	Number of MCQ item with level as (n=10 in each set)			
	‘Very Easy’	1	0	0
	‘Ideal’	6	5	6
	‘Difficult’	3	5	4
3	% of difficulty index - Df_i (Mean \pm SEM)	45.1 \pm 7.3	22.2 \pm 4.6*	35.1 \pm 4.2
4	Number of MCQ item with discrimination as (n=10 in each set)			
	‘Excellent’	7	0	4
	‘Good’	1	3	1
	‘Poor’	2	7	5
5	% of discrimination index - Dc_i (Mean \pm SEM)	0.43 \pm 0.05	0.19 \pm 0.03*	0.27 \pm 0.04

Foot note: Set A – positively framed MCQs; Set B – negatively framed MCQs; Set C – Negatively framed MCQs with underlining of the negative words. One-way ANOVA was used to test the difference between the groups. * indicates $p < 0.05$ when compared to ‘Set A’.

DISCUSSION

The present study aimed to investigate the effect of negatively framed MCQs in the medical education by measuring and comparing the number of correct responses in positively and negatively framed MCQs set. The difficultness of negatively framed MCQs was quantified by using two indices namely difficulty index (D_{fi}) and discrimination indices (D_{ci}).

In my study, the average score obtained by the students were highest in the positively framed MCQ set (45.5%) while the lowest score was seen in the negatively framed MCQ set i.e Set

B (31.9%). It is also important to note that the percentage of average score was better in set C than set B indicating that highlighting the 'negative words' in the stem have effect on drawing the students' attention.

Moreover, the percentage of high achievers decreased when negatively framed MCQs were implemented (27.4% in Set A Vs 12.1% in Set B) and improved when the negatively framed MCQs were highlighted (12.1% in Set B Vs 25% in Set C). Similarly, the percentage of low achievers was increased when negative words were incorporated in the stem of MCQs (25.4% in Set A Vs 65.8 in Set B) and decreased when the words were highlighted (65.8% in Set B Vs 47.7%).

This study also tried to quantify the level of difficultness in answering the different sets of MCQ. The difficultness index is the measure of difficulty level of each item.^(5, 6) In my study, the average difficulty level of positively framed MCQ falls under the category 'ideal' (D_{fi} of Set A was $45.1 \pm 7.3\%$) while the negatively framed MCQ falls under the category 'Difficult' (D_{fi} of Set B was $22.2 \pm 4.6\%$). In addition to this, highlighting the negative words improved the difficulty level from 'difficult' to 'ideal' (D_{fi} of Set B $22.2\% \pm 4.6\%$ Vs D_{fi} of Set C $35.1\% \pm 4.2\%$). The mean difference between the positively framed and negatively framed MCQs were statistically significant ($p = 0.032$).

One of the important functions and advantages of MCQs is to discriminate the 'good performing' students from the 'under-performing' students.^[1] It is assumed that the quality of discrimination decreases when negative words are included in the stem of MCQs. To prove this fact and to measure the grade of discrimination, discrimination index (D_{ci})^[7,8] was used in this study.

The D_{ci} value was decreased from 0.43 ± 0.05 in set A to 0.19 ± 0.03 in Set B ($p = 0.0063$). The average D_{ci} value of positively framed MCQ set i.e Set A falls under 'with good discrimination' property while set B falls under 'poor discrimination' category. This indicates that incorporation of negative words in the stem of MCQs made the students to 'miss' the correct option and hence the particular MCQ loses its property of discriminating the good performing student from the under-performing students.

Hence, from the above mentioned facts, it is unblemished that the incorporation of negative words like 'false', 'not', 'except', and 'not true' decreases the performance of the students and highlighting those words increases the performance.

This study has few limitations. First of all, one may argue that the results obtained in this study could be due to presence of recall bias. The study was implemented in the surprise manner and hence the recall bias (due to lack of adequate time for preparation) could play main role in the answering the MCQs by students. To decrease this bias, the MCQs were framed from the recently covered topics in pharmacology. Furthermore, the important theory and practical points taught in pharmacology were included as key learning points. Second, only ten MCQs in each set were included and it could be a small sample to test the hypothesis. However a total of 136 students were participated in this study and each student act as 'individual' unit in giving the response.

CONCLUSION

The negatively framed MCQs decrease the students' performance and lose the discrimination property. It can be minimized by underlining and capitalizing the negative words in the stem of MCQ.

REFERENCES

1. Farley JK. The multiple choice test: writing the questions. *Nurse Educator*, 1989; 14: 10-12.
2. Braddom CL. A brief guide to writing better test questions. *Am J Phys Med Rehabil*, 1997; 76: 514-6.
3. Beck AT, Weissman A, Lester D, Trexler L. The measurement of pessimism: the hopelessness scale. *J Consult Clin Psychol*, 1974; 42: 861-5.
4. Srinivasa DK, Adkoll BV. Multiple choice questions: how to construct and how to evaluate? *Indian J Pediatr*, 1989; 56: 69-74.
5. Gronlund NE. *Assessment of student achievement*. Boston, MA: Allyn and Bacon, 1998.
6. Haladyna TM, Downing, SM, Rodriguez MC. A review of multiple-choice item-writing guidelines. *Applied Meas Educ*, 2002; 15: 309-33.
7. Vydareny KH, Blane CE, Calhoun JG. Guidelines for writing multiple-choice questions in radiology courses. *Invest Radiol*, 1986; 21: 871-6.
8. Schuwirth LWT, van der Vleuten CPM. Different written assessment methods: what can be said about their strengths and weaknesses? *Medical Education*, 2004; 38: 974-9.