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ORIGINAL ARTICLE

Item Analysis of Multiple Choice Questions of Anatomy at Aziz Fatimah Medical and Dental College, Faisalabad

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ABSTRACT

Objective: The aim of our study was to evaluate MCQs in send up exam of 2nd year MBBS. To discard or change poor items with low discriminatory index, very easy and very difficult items and items with more than one non functional distracters.
Study design: The cross-sectional study.
Place: Department of Anatomy, Aziz Fatimah Medical and Dental College. Faisalabad.
Duration of study: One month (December 2021)
Methodology: Total 45 MCQs for the subject of Anatomy were constructed for 100 students of 2nd year MBBS send up Examination 2021. The MCQs consisted of one statement with four distractor & one correct option. Data of MCQs attempted by the students was analyzed by using Microsoft Excel 2010. The difficulty index, discrimination index and distractor efficiency were the parameters used for analysis.
Results: Total 180 distractors were evaluated. The average number for difficulty index was 55.57 while that for discrimination index was 0.44. Out of 180 distractors, 41 nonfunctional distractors were seen in 26 items.
Conclusion: Most MCQs fall within an average to easy difficulty index level i.e. 30 out of 45 MCQs. Most MCQs fulfill the criteria of very good discrimination index i.e. 27 out of 45. Most MCQs have either nil, or one or two non-functional distractors. i.e. 43 out of 45.
Key Words: MCQs, Difficulty index, Nonfunctional distractors, Discrimination index, Distractor efficiency.

INTRODUCTION

Assessment is a vital part of student education, assessment tools must be effective, standardized, trustworthy and equitable. (1) There are variable evaluation tools to evaluate the knowledge of medical students. Various methods which can be used for assessment & evaluation of medical students include Multiple choice questions, Short essay questions, Viva voce Examination, Objectively structured clinical (OSCE) & Practical (OSPE) Examinations. (2) MCQs are difficult to prepare but are easy to check & assess. MCQs are usually prepared with one stem & four distractors & one right answer in medical examinations. MCQs can assess different levels of cognition of students ranging from C1 – C3 (Knowledge, Comprehension and Application) during 1st & 2nd year of MBBS. (1, 3) Post-test MCQs item analysis is a very good tool to evaluate the level of difficulty, discrimination among low & high achievers & how efficient the distractors are. (4) The most commonly used parameters to analyze MCQs include Difficulty index, Discrimination index, & Distractor efficiency. Analysis of MCQs is important to know the level of difficulty of question to distinguish between high & low achiever on the basis of question and to assess how plausible distractors are in each MCQ. (5)

The analysis of MCQs provides insight into the nature of each question so that teachers can make necessary modification in MCQs for future examinations. Similarly, some MCQs can be edited & modified while others are deleted from the pool based upon item analysis. (6)

MATERIALS AND METHODS

This is a cross-sectional study with purposive sampling. Purposive sampling is a predetermined idea. In this sampling, specific targets are examined because they possess the desired information. We selected a sample based on our knowledge about the study and population. The present study includes 45 MCQs constructed for Send up Examination of Anatomy of 2nd year MBBS class of Aziz Fatimah Medical & Dental College in Nov 2020. These MCQs encompass the whole anatomy course of 2nd year MBBS including special embryology, special histology, abdomen & pelvis, head & neck & Neuro Anatomy. Total of 100 students appeared in the test. These questions were reviewed before the examination by the subject expert. The MCQs were prepared in such a way that there were one stem & five options out of which one answer was correct while four other options were plausible distractors. Internationally recognizable standards were used to construct all MCQs. Verbal consent was obtained from the students for the conduction of study. For each correct answer one mark was allotted. The maximum marks that can be obtained were 45 while minimum score was 0. There was no negative marking.

Difficulty index:

Difficulty index corresponds to the proportion of students who correctly answered the item. (7, 8)

The difficulty index was calculated by = Students with correct responses X100

Total Students The data was interpreted according to the following table.

Range	Level of difficulty
20 & Below	Very Difficult 21 – 40 Difficult
41 - 60	Normal
60 - 80	Easy
81 & Above	Very Easy

Discrimination index

DI is the property of MCQs to discriminate the high scorers from low scorers. (8) Discrimination index was calculated by

$$DI\ (R) = \frac{h - l}{27\%\ \text{of total students}}$$

h= Number of correct responses from top 27% of students.
l= Number of correct responses from bottom 27% of students.

The data of discrimination index is interpreted by the following table.

Range	Description
0.4 & above	Very good question
0.3– 0.39	Good question
0.2 - 0.29	Average question
0.09- 0.19	Poor question

Distractor Efficiency

NFDs are those distractors which are chosen by less than 5% of test takers. (8) These distractors may not have any connection with the stem or have some hints that are not related to the correct answer. Such distractors should be omitted or replaced as they are ineffective & of no value.

Poor (4NFDs) with 0% DE Moderate (3NFDs) with 25% DE Good (2NFDs) with 50% DE Very good (1NFDs) with 75% DE
Excellent (No NFD) with 100% DE

Inclusion Criteria: All students who gave 2nd year sendup examination are included in the study.
Exclusion Criteria: First year MBBS students were excluded from the study.
Statistical analysis: Data of each MCQs was inserted in Microsoft Excel 2010 & analysis was carried out. The marks of students were organized in decreasing sequence from highest marks to lowest marks.

RESULTS

Out of hundred students who were given the test of MCQs consisting of 45 questions, the highest score was 44 out of 45 & lowest being 8 out of 45 with a mean of 24.91, median 25 & mode 32 with standard deviation of 7.84 & range is 36, which is the difference between the lowest & highest value. Difficulty index of each question was calculated & average of difficulty index was calculated with help of excel which came out to be 55.57 which falls within the category of average difficulty level (41-60). After calculation of the discrimination index of each question, we calculated its average which was 0.43 which indicates very good item according to discrimination index. We also calculated the distractor efficiency of each question.
Difficulty index: 5 Questions (11%) fall in very easy range (81 & above). 15 Questions (33%) fall in easy range (61-80).
15 Questions (33%) fall in average range (41-60).
9 Questions (20%) fall in difficult range (21-40).
1 Question (2%) falls in Very Difficult range (20 & below).

Table 1. Distribution of multiple choice questions in relation to DIF and changes done.

No. of Questions	Difficulty Index	Percentage of Questions	Changes
5	Very easy (81 & Above)	11%	Revise/Discard
15	Easy (61-80)	33%	Store
15	Average (41-60)	33%	Store
9	Difficult (21-40)	20%	Store
1	Very Difficult (20 & Below)	2%	Revise/Discard

So most of the questions fall within range of easy or average (30 Questions) 66%.

Only 10 questions fall within the category of difficult or very difficult level which is about 22%. Only 5 questions fall within very easy range which is about 11% of total questions.

Discrimination index: 27 Questions (60%) fall within the category of very good item, (0.4 & Above) 12 Questions (27%) fall within the category of good items, (0.3 to 0.39)
4 Questions (9%) fall within the category of fair items, (0.2 to 0.29).
Only 2 Questions (4%) fall within the category of poor item (0.09 to 0.19)

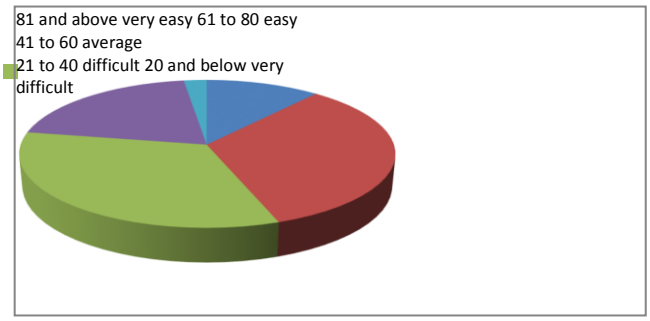


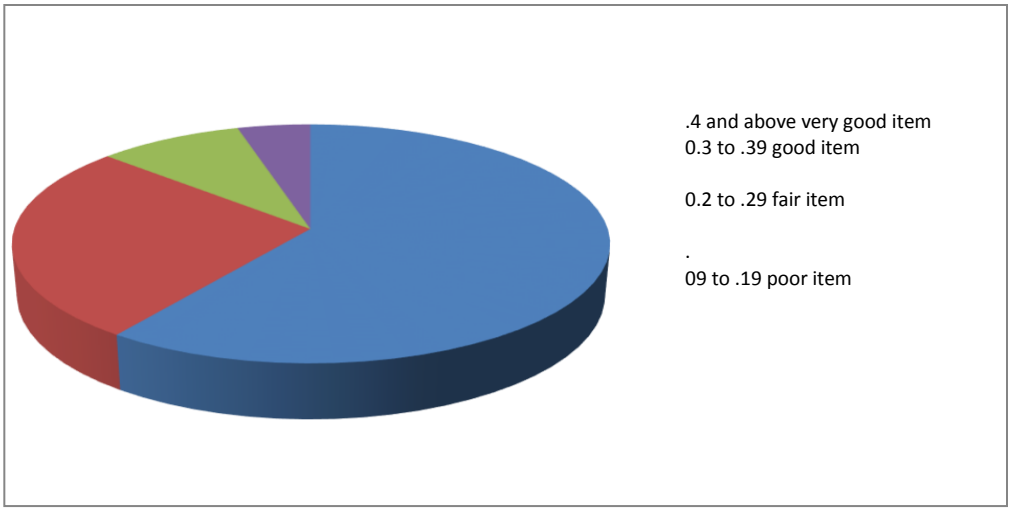
Table2. Distribution of multiple choice question in relation to DI and changes done.

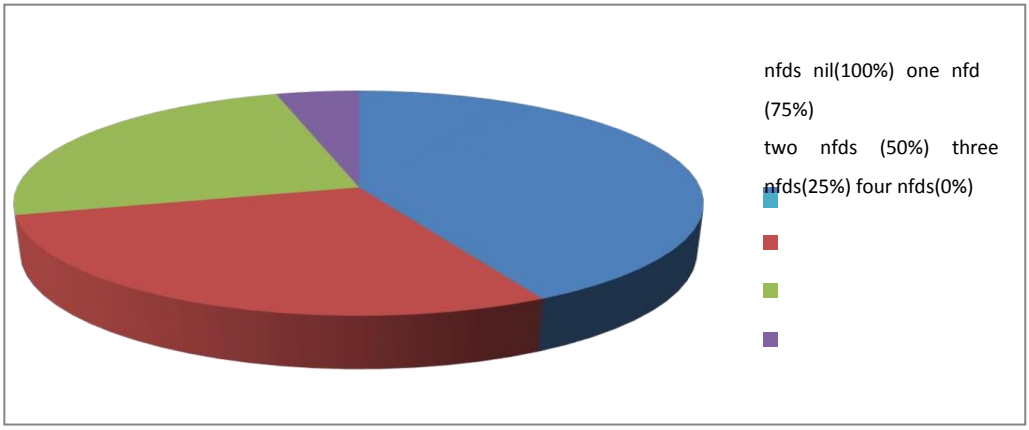
No. of Questions	Discrimination Index	Percentageof Questions	Changes
27	Very Good (0.4 & Above)	60%	Store
12	Good (0.3 To 0.39)	27%	Store
4	Fair (0.2 To 0.29)	9%	Store/Revise
2	Poor item (0.09 To 0.19)	4%	Revise/Discard

Distractor Efficiency: There were 19 questions (42%) with No NFDs and DE of 100%, 13 Questions (29%) with one NFD and 75% DE,11 Questions (24%) with two NFDs and 50% DE, 2 Questions (5%) with three NFDs and 25% DE. There was not a single question with 4NFDs & 0% DE.

Table 3. Distractor analysis and distractor efficiency

No. of Questions	No. of NFDs	Distractor Efficiency
19 (42%)	0	100%
13 (29%)	1	75%
11 (24%)	2	50%
2 (5%)	3	25%





There were total of 41 NFDs out of 225 options in 45 MCQs.

DISCUSSION

In our research, we calculated correlation between difficulty index and discrimination index. It was -0.13 which is slightly negative, it was concluded that MCQ items that demonstrate good discriminating potential tend to be moderately difficult items, and the moderately-to-very difficult items are more likely to show low discrimination. Similarly, very easy items tend to show low discriminatory index. Correlation between discrimination index and distractor efficiency was also checked which was 0.25 which is moderately positive indicating that high DI are associated with greater DE. So good and very good MCQs have more distractor efficiency.

In present study, 11% questions fall in very easy range, 33% questions fall in easy range, 33% questions fall in average range, 20% questions fall in difficult range and 2% questions fall in exceptionally difficult range as shown in table 1. Contradictory to the present study, one more study to assess MCQs of Ophthalmology exam, 80% items were found to be very easy, 13.3% MCQs were found to be of moderate difficulty and only 6.7% items were found to be very difficult.

The findings of our research is approximate to results of the study done by Dr. Sheel Thorat that 46% MCQS were covering very easy range, 36% in justifiable range and 15% MCQS were included in exceptionally difficult range of difficulty index. There was a study conducted on evaluation of multiple choice questions in Pharmacology. In this research, easy multiple choice questions were 4%, 66% were moderately difficult and high difficult questions were 30%. Reasons for high difficult items were investigated as shortcoming in item writing (41%) and C2 (knowledge) level (23%). (11)

In our study, discrimination index of MCQs was calculated. 60% fall within the category of very good item, 27% fall within the category of good items, 9% fall within the category of fair items, only 4% fall within the category of poor item as shown in table 2. It is comparable to a study in which item analysis was done to check MCQs validity in pharmacology question bank, 25% items had outstanding DI, 40% MCQs had good DI, 12.5% MCQs had sustainable DI and 22.5% had substandard DI. (12) Item analysis of MCQs in Medical Licensing Assessment was done in Mongolia using the DI, they showed that approximately 3.4% MCQ had a <0.1 DI, 8.2% MCQ had a 0.15-0.24 DI, and 88.4% MCQ had a >0.25 DI, and 11.6% of the used questions were not in a position to discriminate high scorers from low scorers. (13) The average discrimination index (DI) of the whole test was 0.48 in a study done while developing multiple choice question bank in otorhinolaryngology department by item analysis. (14) All MCQS in this study had very ideal discrimination index (DI >0.25). Sometimes DI can be negative, i.e. low scorers gave more correct responses of MCQs than high achievers. The reasons for negative DI can be wrong key, undetermined outlining of items or overall incomplete preparation of students. Items with negative DI lessen the power of the test and should be removed from the question bank.

In addition to the DIF and DI, Distractor efficiency has a great influence on the formation of MCQs. Items with NFD are important to setup DE. The number of NFDs present in a question range from 0%-100%. DE is indirectly proportional to NFD and MCQs with more functional distractors increase the DE. Items with high NFDs decrease both the DE and DI but increases the DIF; hence the MCQ is easy for the students but a bad discriminator of educational performance. DE is expressed as 0%, 25%, 50%, 75% and 100% depending on number of NFD as 4, 3, 2, 1 and 0 respectively. The selection or rejection of MCQS for question bank is best directed by DE. Items with 0% DE should be removed whereas those with 25-50% DE should be reviewed by substituting the NFDs with improved answers so that they can be kept in MCQs pool. (15)

In our study, there were 42% questions with no NFD and DE of 100%, 29% questions with one NFD and 75% DE, 24% questions with two NFDs and 50% DE, 5% questions with three NFDs and 25% DE as shown in table 3. There was not a single question with four NFDs and 0% DE.

Contrary to our research, researchers found that distractor efficiency was 23.6% in a research done on influence of distractors in item analysis of multiple choice questions (15) and in another study, mean distractor efficiency of all groups was 64.4%. (16) In another study done on item analysis of Pathology Assessment of 4th year MBBS at Rawalpindi Medical University; out of the total 200 distractors analyzed in this study, 175 (87.5 %) were functional and only 3MCQs were found to be nonfunctional. (17)

CONCLUSION AND RECOMMENDATIONS

Item analysis is a simple and valuable post examination method providing evidence on standard of MCQs by calculating DIF, DI and DE. (18) It is recommended in our research that MCQs with moderate difficulty, high value of discrimination index and with minimum 3 functional distractors are of good standard to be reserved for coming examination.

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