ORIGINAL ARTICLE

Assessment of distractor efficiency of MCQS in item analysis.

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ABSTRACT… Objective: To assess the distractor efficiency of the multiple-choice questions and find out the structural flaws in the items that negatively impact the distractor efficiency. **Study Design:** Retrospective Observational study. **Setting:** Department of Pathology, Rawal Institute of Health Sciences (RIHS) SZAMBU, Islamabad. **Period:** April 2021 to June 2021. **Material & Methods:** This study was conducted at Rawal College of Medicine, RIHS Islamabad. The data was based on the item- analysis report from a sendup exam MCQ paper (2020) of 3rd year MBBS class. Distractor efficiency of total of 140 MCQs was analyzed. Distractor efficiency was categorized as low in MCQ with 3-4 non-functional distractors, medium with 1-2 nonfunctional distractors and high if there are no non-functional distractors. These MCQs were investigated with reference to item writing guidelines proposed by Haladyna et al. The flaws identified were grouped as, within option flaws, alignment flaws between options and stem/ lead-in and other flaws. **Results:** Out of 140 MCQs, distractor efficiency was high in 58 (41%), moderate in 75 (54%) and low in 7 (5%). The item writing flaws identified in moderate to low DE items were Alignment flaws between distractors and stem/ lead-in were linguistic cues 8(10%), logic cues 10 (12%) and irrelevant distractors 5(6%). Item flaws within the distractors were non homogenous length 2 (2.4%), non-homogenous content 5(6%) and distractors with true and false statements 3(4%). Flaws that were categorized in other than distractors were low cognitive level items 13 (16%) and un-necessarily complicated stems were 8(10 %). **Conclusion:** This analysis found out distractor efficiency of multiple-choice items was moderate to high. The major flaws that negatively impact distractor efficiency include the distractors with low cognitive level, unnecessary complicated stems, logic cues, linguistic cues, irrelevant distractors and distractors with non-homogenous length and content.

Key words: Distractor Efficiency, Item Writing Flaws, Multiple Choice Questions, Non-Functional Distractors.

INTRODUCTION

Post hoc item analysis is commonly used to evaluate the quality of Multiple-choice question-based examination in medical education[1] It is useful in measuring the reliability and validity of items included in the exam.[2] It helps the educators to decide which item should be kept, discarded, or need revision for further use in another exam.[3] The commonly assessed psychometric parameters in item analysis are the difficulty index, discriminatory index (DI), and distractor efficiency (DE).[4,5] Distractor efficiency is the most important indicator that helps in improving the quality of MCQs.[7] "Distractor efficiency is an ability of the incorrect options to distract the students"[8] A MCQ is composed of a stem or lead in and multiple options. The correct option is called the key and the incorrect options are called as the distractors.[9] An item with a good distractor helps to discriminate between the informed and uninformed student. The distractor efficiency helps the educators to assess the credibility of the incorrect answers (distractors).[10] There are two types of distractors: Functional distractors (FD) or efficient distractor and non-functional distractors (NFD). The functional distractors (FD) are those that are chosen by more than 5% of examinees whereas distractors chosen by less than 5% are called as nonfunctional distractors (NFD).[11] A weak nonfunctional distractor or a non – discriminatory distractor needs to be re-evaluated.[11] The distractor efficiency would be highest if all the distractors in an MCQ are functional or efficient. The criteria for effective distractors are that all the

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options should be plausible and if possible, none should be incorrect.[6] DE of an item is evaluated on the presence of non-functional distractors. If there are none then the DE would be highest, 1-2 NFDs indicate moderate DE and 3-4 NFDs indicate low DE.[7] The items with low and moderate DE should be analyzed for the item flaws that have negative impact on the distractor efficiency.[7]

A well-constructed MCQ is an assessment tool that has a potential to assess students for sufficient knowledge of the taught content. However, it is a time consuming and difficult process to prepare an ideal MCQ with minimum item writing flaws.[12] Item writing flaws with complex long options may mislead the examinees to choose the incorrect options and some flaws provide clues that allow the unprepared or "test wise" students to guess the right answer.[13] Other item writing flaws that effect the distractor efficiency are grammar cues, logic cues, "none of the above" or "all of the above" and responses of series of true and false statements etc.[14] MCQs with such flaws are not a reliable assessment tool and does not accurately reflect student's knowledge and true understanding of the content.[15,16] Therefore, such item flaws should be identified to improve the overall exam quality.

The distractor efficiency of the item also has impact on its difficulty and discriminatory index. The higher the numbers of NFDs in an item the lower will be its discriminatory index and may render the MCQs more difficult.[17] The overall test scores would also improve if the Items with average difficulty and high discriminating power with maximum functioning distractors are incorporated in the exam.[18]

The qualitative analysis of the items can be done in terms of their content and form. Such analysis of MCQs with moderate to low distractor efficiency has not been researched extensively.[7] The objective of this study is to identify the items with low to moderate efficient distractors and find the item writing flaws that are responsible for negatively affecting the distractor efficiency of MCQS. This study will help the educators and test developers to identify the potential flaws in constructing the MCQs that negatively impact the overall standard of the assessment.

MATERIAL & METHODS
This study was conducted at Rawal College of Medicine Islamabad, SZAMBU. The data was based on Archived item- analysis report from a sendup exam MCQ paper (2020) of 3rd year MBBS class. The study was carried out from April 2021 to June 2021. All the data used in this study belong to the Faculty of Rawal College of Medicine. Permission was obtained from the Institutional review board for utilizing the data. It was analyzed to determine the distractor efficiency (DE) of items, in a total of 140 MCQs. This study used the MCQs papers and their OMR (Optical mark recognition) item analysis for the number of functional and non-functional distractors per item. The DE was calculated manually. The only criterion used for selection of MCQs papers was their availability. DE was categorized as low (3-4 NFDs), medium (1-2 NFDs) and high (0 NFD). Item flaws of the MCQS with low to medium distractor efficacy were also analyzed. Item flaws were investigated with reference to item writing guidelines proposed by Haladyna et al.[6] The flaws identified were grouped as, within option flaws, alignment flaws between options and stem/ lead-in and other flaws i.e items with low cognitive level and unnecessary complicated stem or options.

RESULTS
A total of 140 MCQs with 5 options each were included in the study. The total number of distractors were 700. Out of which the number of non-functional distractors were 118 (16.8%).

Out of 140 MCQs, distractor efficiency was high in 58 (41%), moderate in 75 (54%) and low in 7 (5%). (Table-I). Out of 82 items with low to moderate distractor efficiency, 33 items had one or more item writing flaws either in the option choices or their alignment with the stem and lead in. Out of the remaining 49 items, 21 items were identified with other flaws that include items with low cognition level or with complicated stems whereas no item writing flaw was found in 21 items (27%) (Table-II).

No. of Non-Functional Distractors	Distractor Efficiency	No. of Items
0	High 100%	58(41%)
1-2	Moderate 50-70%	75(54%)
3-4	Low <50%	7(5%)

Table-I. Distractor efficiency of items included in the study.

Within Option Flaws n (%)		Alignment Flaws Between Option and Stem Lead-in n (%)		Other Flaws n (%)	
Distractor non Homogenous in length	2(2.4%)	Linguistic cues	8(10.0%)	Low cognitive level items	13(16.0%)
Distractor non-homogenous in content	5(6.0 %)	Logic cues	10(12.0%)	Unnecessary complicated/unfocused stems	8(10.0%)
Distractors composed series of true and false statements	3(4 .0%)	Limited or possible irrelevant distractors	5(6.0%)	No item writing flaws	21(27.0%)

Table-II. Frequency of item writing flaws in low and moderate distractor efficiency items.

DISCUSSION

MCQ is an effective assessment tool for evaluation of a student's cognitive skills and his or her understanding of a topic. However, construction of MCQs is an intricate and time taking process. It should be a very comprehensive and well thought out exercise so that it can fulfil the requirements of an integrated curriculum. Item analysis and identification of different flaws, on regular basis, provide an opportunity to develop a good question bank and improve the quality of MCQs.[19]

We found 41% items with high DE, 54% items with moderate DE, while 5% items showed low DE. When we compared our results with other local studies, we found a similar proportion of distractor efficiency (DE) in most studies. An item analysis done in 2020 with 31.6% NFDs calculated 38% items with high DE, 42% with moderate DE and 20% with low DE.[7] Another study carried out in a medical institute in Islamabad demonstrated a comparable proportion of DE, 25% items with a high DE, 46% items with a moderate DE and 25% items exhibiting low DE.[8]

However, another analysis also showed dissimilar results, 52% high DE items, 34% with moderate DE and 14% of low DE.[20] Interestingly, when various international studies were examined for comparison, most of them depicted a much larger proportion of items with a high DE which is in contrast to our study as well as other local studies. An item analysis done in the pharmacology department of a medical school in India demonstrated 83% MCQs with high DE, 11.6% with moderate DE and 1.6% with low DE.[19] Another research done in India calculated 62.5% items with a high DE and only 12.5% and 7.5% items were with a moderate and low DE respectively.[21] An item analysis done on 1073 MCQs in Saudi Arabia in a medical institute also found 33.7% MCQ with high DE, 16.5% with moderate DE and only 6.5% with low DE.[22] However, an international study by Kumar and Dev reported results (40% items with moderate DE) that were quite similar to our study results.[23] A post hoc analysis done on 350 items in Malaysia in 2021 also demonstrated 50-68% items with moderate distractor efficacy.[13]

These variations in results may be due to the reason that our institution is still in the process of developing a good question bank and is making continuous efforts to bring a significant improvement in quality of MCQ by identifying more common item flaws and correcting them. It is expected that in the near future, this goal will be achieved by continuing item analysis and evaluation.

Our study identified some common item writing flaws which should be kept in mind while constructing MCQs. Most common item writing flaw was a low cognitive level (16%). This observation is in accordance with the findings of some other studies such as in a study done by Sajjad et al also calculated items of low cognitive level (40%) as most common item flaw.[7] Another study done in Lahore also demonstrated C1 level recall questions (84.4%) in an exam paper of Physiology. Same study showed 51.1% low cognitive level items in a biochemistry exam.[24] Comparable results were demonstrated in another item analysis with 61.6% items of low-level recall type.[25] The second most common item writing flaw was logic cues (12%) which was similar to the study by Sajjad et al., (12.5%)[7] Other studies showed stem defects as the most common item writing flaw (85%) and items with non-homogenous length (20.6%) as second most common item writing flaw.[25] However, we found 27% items without any item flaws. Other studies reported 20%, 28%, and 20.5% items with no writing flaws respectively.[24,7]

LIMITATIONS OF STUDY
A significant limitation of this study is that it has analyzed only a single paper from one department for item flaw identification and calculation of distractor efficiency. The major flaws that negatively impact distractor efficiency include the items with low cognitive level, unnecessary complicated stems, logic cues, linguistic cues, irrelevant distractors and distractors with non-homogenous length and content.

CONCLUSION
This analysis found out that distractor efficiency of MCQ items was moderate to high. The major flaws that negatively impact distractor efficiency include the distractors with low cognitive level, unnecessary complicated stems, logic cues, linguistic cues, irrelevant distractors and distractors with non-homogenous length and content.

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2	Rabia Sadaf	Discussion and conclusion writing.	
3	Aisha Akbar	Analysis, Interpretation of data.	
4	Sabahat Rehman	Proof reading, Critical evaluation.	
5	Zunnera Rashid Chaudhry	Analysis Interpretation of data.	
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