Original Article

# Enhancing Assessment Integrity: The Role of Plausible Distractors in Multiple-Choice Question Design

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## Abstract

**Objective:** The study aims to untangle the intricate relationship between distractors in MCQs and their impact on learning and assessment outcomes within the constructivist framework in medical education.

**Methods:** At Niazi Medical and Dental College (NMDC), Sargodha, the Midterm exam period was different in the 3rd, 4th, and 5th-year MBBS (total sample size is 320); therefore, the time period for assessment was five (05) months from May to September 2024. Each sessional year in conventional learning has four (04) different subjects for assessments with equal numbers of MCQs posing a single best answer(SBA), that is, 45 MCQs in all subjects except Pharmacology and Pathology, which have 65 MCQs per subject in the midterm assessment. The total average of Non-Plausible Distractor (NPDs) was 1500 options (40%), which was later used as new 300 MCQs, leading to questions in the stem for the next summative assessment.

**Results:** The exploration of question production exposed that across the papers counted in this study, the regular number of PDs per Item (<5% of the cohort) was 1.91. In total, 600 MCQ-SBA with 3000 options (2400 distractors and 600 correct responses) were examined. The reassembly of 300 MCQs with 1,500 options was then supplemented with well-constructed PDs, and the results were remarkable. After applying the paired sample t-tests, the result was remarkable (p= .000).

**Conclusions:** For MCQs to effectively assess advanced medical education, distractors must be plausibly related to the content being tested, challenging yet not misleading, and relevant to the curriculum.

**Key words:** Assessment, Critical Thinking, Design, Exam, Medical education, Medical Students, Plausible, Questions.

## Introduction

In undergraduate medical education, the selection of plausible distractors in MCQs was a critical aspect of designing effective assessments.[1] To ensure that distractors are challenging yet reasonable, several strategies can be employed to select them thoughtfully. Besides, one strategy was to draw distractors from common student misconceptions or frequently made errors. By identifying key misunderstandings that students may have, educators can create distractors that reflect these misconceptions, making them plausible alternatives to the correct answer. This approach not only tests students' knowledge but also helps address and rectify their misconceptions.[2] Whereas another strategy was to ensure that distractors are similar in length and grammatical structure to the correct answer. Distractors that are obviously shorter, longer, or grammatically different from the correct answer may make it too easy for students to eliminate them, reducing the effectiveness of the question.[3] By maintaining consistency in length and structure, educators can make distractors more challenging and improve the overall quality of the MCQs. Additionally, incorporating clinical scenarios or real-life examples into distractors can enhance their plausibility. By grounding distractors in practical contexts that students may encounter in their future medical practice, instructors can make the options more relatable and engaging. This approach not only tests students' knowledge but also helps them develop critical thinking skills by applying theoretical concepts to practical situations.[4]

Overall, the strategic selection of plausible distractors was essential in undergraduate medical education MCQ examinations to create challenging and effective assessments that accurately evaluate students' understanding and critical thinking abilities. Nonetheless, the incorporation of distractors in Multiple Choice Questions (MCQs) was a pivotal component in the craft of medical education assessments. The predictive value of these distractors, when analyzed through the lens of constructivist theories, offers fascinating insights into their utility and effectiveness in not only assessing the depth of student understanding but also in facilitating deeper learning.[5]

Similarly, constructivist theories posit that learning is an active, constructive process where learners build new knowledge upon the foundation of previous understandings. In the context of MCQs in medical education, distractors—that is, the incorrect options provided alongside the correct answer—are not merely tools to gauge a student's ability to recall facts but can serve as critical elements in this constructive process. Well-designed distractors challenge students to apply critical thinking and discriminative reasoning, thus adhering to the constructivist principle of active engagement with the material.[6] Four different methods are used in building MCQs distractors that ensure the difficulty of exam design. First, *Level of Difficulty:* The difficulty level of MCQs can be determined by how plausible the distractors are. If the incorrect options are very obviously wrong or too similar to the correct answer, the question may be too easy. On the other hand, if the distractors are well-crafted and closely related to the correct answer, it can indicate a more challenging question.[7] Second, *Focus on Key Concepts:* The distractors selected can provide clues about the key concepts being tested. Distractors are often based on common misconceptions or related concepts, so analyzing them can help students understand what specific knowledge or skills are being assessed.[8] Third, *Critical Thinking Skills:* In exams where critical thinking and application of knowledge are important, distractors may be designed to challenge students' ability to analyze information and make logical deductions. Complex distractors that require deeper understanding can indicate a focus on higher-order thinking skills,[9] and fourth, *Assessment of Learning Objectives:* The design of distractors can reflect the learning objectives of the exam. If the distractors align closely with specific learning outcomes, it suggests that the exam was structured to assess those objectives directly.[10]

By applying these methods current study uses those distractors as new multiple-choice items. Analyzing the distractors in MCQs can provide valuable insights into the exam design, difficulty level, focus on key concepts, and emphasis on critical thinking skills in medical education assessments. Hence, this study micro-analyzed the distractors' primary function with aims to untangle the intricate relationship between distractors in MCQs and their impact on learning and assessment outcomes within the constructivist framework in undergraduate medical education.

## Materials And Methods

Designing the exam was a difficult part, where applying a high level of MCQs that include plausible distractors (PDs), which predict authenticity, was not an easy task for assessors. At Niazi Medical and Dental College (NMDC), Sargodha, the mid-term exam period was different in all sessions; therefore, the time period for assessment was five (05) months from May to September 2024. Each sessional year has four (04) different subjects for assessments with equal numbers of MCQs posing a single best answer(SBA) with five (5) option choices. Therefore, 45 MCQs in all subjects except Pharmacology and Pathology, which have 65 MCQs per subject in the midterm assessment. Out of 3000 options' distractors, 2400 (80.0%) were Plausible Distractors (PD) and zero (0%) were Non-plausible Distractors (NPD), (Key 600). Whereas, from the remaining MCQs, the total average of Non-Plausible Distractor (NPDs) was 1500 options (40%), which was later used as new 300 MCQs, leading in question in the stem for the next summative assessment. Hence, the present study uses a convenient sampling technique,[11] for 1500 plausible students' misconception from their mid-term exams in 2024 from traditional teaching' sessions-3$^{rd}$ (n=111), 4$^{th}$ (n=102), and 5$^{th}$(n=107)-year MBBS (total sample size is 320 students) of Niazi Medical and Dental College, Sargodha, Pakistan (NMDC) and used them in next summative assessment examination that is Continuous Assessment Test (CAT). Ethical Review Board (ERB letter #: NMDC/DRC/09-35/24-ERB, dated: April 10$^{th,}$ 2024) exempted this study from the institutional review board of Niazi Medical and Dental College, Sargodha. After the collection, the data were uploaded on SPSS version 23, to analyze the descriptive statistics for each variable along with the mean, standard deviations (S.D), and paired sample t- tests (significant p-value is less than 0.01 level) were applied.

## Results

In a microanalysis focusing on the distractors' primary function within multiple-choice questions (MCQs) in the context of undergraduate medical education and the constructivist framework, this study delves into the nuanced relationship between distractors and their influence on learning and assessment outcomes. The characteristic features of the MCQs load distribution in the session-wise were presented in a table.1 below.

**Table 1: Characteristic Features of Midterm Exams' MCQs loads in Session-Wise (n=320)**

| MCQs Loads in session-wise | MCQs (n=45) | MCQs (n=65) | Total MCQs |
|---|---|---|---|
| 3rd year student (n=111) | 45x2 papers = 90 | 65x2 papers = 130 | 220 |
| 4th year student (n=102) | 45x3 papers = 135 | 65x1 papers = 65 | 200 |
| 5th year student (n=107) | 45x4 papers = 180 | ------ | 180 |
| **Mean (S.D)** | | **200 (20)** | |

The exploration of question production exposed that across the papers counted in this study, the regular number of PDs per Item (<5% of the cohort) was 1.91. In total, 600 MCQ-SBA with 3000 options (2400 distractors and 600 correct responses) were examined. See table 2 for more details below

**Table 2: Frequency of Plausible Distractors (PDs) and Non-Plausible Distractors (NPDs) in MCQ-SBA in Midterm Exams 2024**

| No. of MCQs with PDs and NPDs (n=600) | Options N = 3000 (100 %) |
|---|---|
| MCQ-SBA with 4 PD and 0 NPD | 2400 ( 80%) & 0 ( 0%) |
| MCQ-SBA with 3 PD and 1 NPD | 1800 (75%) & 600 (25%) |
| MCQ-SBA with 2 PD and 2 NPD | 1200 (50%) & 1200 (50%) |
| MCQ-SBA s with 1 PD and 3 NPD | 600 (25%) & 1800 (75%) |
| MCQ-SBA s with 0 PD and 4 NPD | 0 (0%) & 2400 (80%) |
| Total average NPD of MCQ-SBA | 6000/4= 1500 (40%) |

The reassembling of 300 MCQs with 1500 options was then added with well-constructed PDs, and the results were remarkable. See table 3 below.

**Table 3: Reassembled MCQ-SBA in Continues Assessment tests(CAT) with all Plausible Distractors (PDs) ( No. of Students = 320)**

| No. of MCQs (n= 300) | Options N = 1500 (100 %) | |
|---|---|---|
| MCQ-SBA with 4 PD and 1 SBA | 1200 ( 80%) & 300 (20%) | Mean = 0.012 S.D = 1.68 |
| No. of MCQ-SBA with 4 PD and 0 NPD with difficulty level more than 2 and less than 5 = 15 | 75 (5%) | |

Since these are SBA (Single Best Answer) questions with 4 Plausible Distractors (meaning 5 options total: 1 correct + 4 distractors and 0 non-plausible distractors), the probability of guessing correctly was 1/5 or 20%, which indicates that there was a 3.75-fold increase in the score compared to what would be achieved by random chance. This indicates that the students' knowledge significantly influenced the outcome. This differentiation was fundamental in advanced education, where deep understanding and the application of complex concepts are crucial. This represents a massive 80-fold refinement in item quality. Later on, after applying the paired sample t-tests, the result was remarkable (p= .000). See table 4 below.

**Table 4: Paired Samples t-test (N=320)**

| Pair the MCQs with PD and NPDs (n= 900 MCQs) | Mean (S.D) | Correlation | t (df) | P value Sig. |
|---|---|---|---|---|
| No. of MCQs with PDs and NPDs Set I (n=600) – No. of MCQs with PDs and NPDs Set II (n= 300) | 8.25 (2.50) | 1.000 | 58.93 (319) | <0.001 |

*A significant p-value is less than 0.01.*

The S.D of 2.50 represents the variability in individual student performance, and the t value of 58.93 was far beyond the critical value (approximately 1.96). This means the probability that this result happened by luck was virtually zero (P<.0001). Based on the table-4, there was a statistically perfect positive and linear correlation (r=1.000, p<.001) between the two described sets of MCQS with PDs and NPDs. Which indicate that the predictive value of well-constructed distractors lies in their ability to distinguish between students who understand the material comprehensively and those who rely on surface-level knowledge or guessing (3.75-fold increase confirmed student knowledge rather than test-taking guesswork.

## Discussion

This study incorporates psychometric analysis into MCQ development and enhances the predictive value of distractors. Moreover, the feedback loop created by evaluating the performance of distractors offers an opportunity for continuous curriculum development.[12] It highlights trends in student understanding and misinterpretation, allowing for targeted instructional strategies. The strategies used in this study to develop plausible distractors show a positive shift (t value 58.93 indicates the difference between the two sets was significant, P<.001). Additionally, this study outcome reveals that distractors play a crucial role in MCQs by challenging students to think critically and differentiate between plausible but incorrect options and the correct answer. These findings were similar to another study, which described that understanding the primary function of distractors was essential for designing effective assessments.[13] Nonetheless, the department of medical education (DME) is meticulously involved with the respective departments to integrate a plausible distractor role. Distractors have the potential to enhance learning outcomes by promoting deeper engagement with the material. This study outcome reveals that from poorly built MCQs to good quality level build (mean=0.012, S.D. = 1.68) MCQs. This outcome was similar to another study, which points out that by analyzing how distractors are constructed and how they align with educational objectives, instructors can tailor assessments to better evaluate students' understanding and application of concepts.[14] Furthermore, the present study works within the constructivist framework, where learners were actively involved in creating their own understanding of knowledge through reflective thinking and hands-on experiences, which points to a 3.75-fold increase in response that was similar to another study's assessment outcomes.[15,16] Besides, through microanalysis, educators can unravel the intricate relationship between distractors in MCQs-SBA and their effects on learning and assessment outcomes. In addition, the present study also includes examining the cognitive processes involved in selecting distractors, considering how they align with educational goals, and exploring strategies to optimize their impact on student learning. This strengthened the previous study results.[17]

By conducting a microanalysis within the constructivist framework, this study can gain a deeper understanding of how distractors function in MCQs and leverage this knowledge to enhance the quality of assessments and promote meaningful learning experiences in undergraduate medical education.

## Conclusions

When viewed through the constructivist lens, the distractors in MCQs hold considerable predictive value in the realms of student assessment and instructional enhancement in undergraduate medical education. They are not mere foils to the correct answer but are instrumental in shaping the constructive process of learning, offering insights into student understanding and guiding teachers in refining their teaching strategies. Embracing the full potential of distractors necessitates a thoughtful approach to MCQ design and a commitment to probing the depths of student understanding, thereby enriching the educational journey of medical students.

In advanced medical education, where the stakes are high and the material is complex, the strategic development and analysis of distractors in MCQs can significantly contribute to the quality of education and the competency of future medical professionals. Therefore, the considered creation and analysis of distractors was not just a question of exam design; it was a cornerstone of educational excellence in the medical field. This study recommends future MCQs design, which involves AI and machine learning algorithms, in order to reach the new era of soft skills assessment within MCQs design.

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## Author Information

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## References


1. Puthiaparampil T, Rahman MM, Gudum HR, Brohi IB, Lim IF, Saimon R. How to grade items for a question bank and rank tests based on student performance. MedEdPublish. 2020;9(1): https://doi.org/10.15694/mep.2020.000260.1
2. Shin J, Guo Q, Gierl MJ. Multiple-choice item distractor development using topic modeling approaches. Front Psychol. 2019;10:1-14. https://doi.org/10.3389/fpsyg.2019.00825
3. Amo-Salas M, Arroyo-Jimenez MDM, Bustos-Escribano D, Fairén-Jiménez E, López-Fidalgo J. New indices for refining multiple choice questions. J Probab Stat. 2014;2014. https://doi.org/10.1155/2014/240263
4. Farooq MZ, Mashood S. Quality assurance of multiple-choice questions test through item analysis. Life and Science. 2023;4(4):7. https://doi.org/10.37185/LnS.1.1.315
5. Testa S, Toscano A, Rosato R. Distractor efficiency in an item pool for a statistics classroom exam: assessing its relation with item cognitive level classified according to Bloom's taxonomy. Front Psychol. 2018;9:1-12. https://doi.org/10.3389/fpsyg.2018.01585
6. Kurtz JB, Lourie MA, Holman EE, Grob KL, Monrad SU. Creating assessments as an active learning strategy: what are students' perceptions? A mixed methods study. Med Educ Online. 2019;24(1):[Missing metadata]. https://doi.org/10.1080/10872981.2019.1630239
7. Ansari M, Sadaf R, Akbar A, Rehman S, Chaudhry ZR, Shakir S. Assessment of distractor efficiency of MCQS in item analysis. Prof Med J. 2022;29(5):730-4. https://doi.org/10.29309/TPMJ/2022.29.05.6955
8. Hingorjo MR, Jaleel F. Analysis of one-best MCQs: the difficulty index, discrimination index, and distractor efficiency. J Pak Med Assoc. 2012;62(2):142-7.
9. Bitew SK, Deleu J, Develder C, Demeester T. Distractor generation for multiple-choice questions with predictive prompting and large language models. In: Joint European Conference on Machine Learning and Knowledge Discovery in Databases. Cham: Springer Nature Switzerland; 2023 Sep 18. p. 48-63. https://doi.org/10.48550/arXiv.2307.16338
10. Ludewig U, Schwerter J, McElvany N. The features of plausible but incorrect options: distractor plausibility in synonym-based vocabulary tests. J Psychoeduc Assess. 2023;41(7):711-31. https://doi.org/10.1177/07342829231167892
11. Memon MA, Thurasamy R, Ting H, Cheah JH. Convenience sampling: a review and guidelines for quantitative research. Journal of Applied Structural Equation Modeling. 2025;9(2):[Missing metadata]. https://doi.org/10.47263/JASEM.9(2)01
12. Benjamin AS, Bawa S. Distractor plausibility and criterion placement in recognition. J Mem Lang. 2004;51(2):159-72. https://doi.org/10.1016/j.jml.2004.04.001
13. Taladngoen U, Esteban RH. Assumptions on plausible lexical distractors in the redesigned TOEIC question-response listening test. LEARN J. 2022;15(2):802-29.
14. Velou M, Ahila E. Refine the multiple choice questions tool with item analysis. IAIM. 2020;7(8):80-5.
15. Shakurnia A, Ghafourian M, Khodadadi A, Ghadiri A, Amari A, Shariffat M. Evaluating functional and non-functional distractors and their relationship with difficulty and discrimination indices in four-option multiple-choice questions. Educ Med J. 2022;14(4):55-62. https://doi.org/10.21315/eimj2022.14.4.5
16. Ha LA, Yaneva V, Baldwin P, Mee J. Predicting the difficulty of multiple choice questions in a high-stakes medical exam. In: Proceedings of the 14th Workshop on Innovative Use of NLP for Building Educational Applications (BEA 2019). Association for Computational Linguistics; 2019. p. 11-20. https://doi.org/10.18653/v1/W19-4402
17. Kurdi G, Leo J, Matentzoglu N, Parsia B, Sattler U, Forge S, et al. A comparative study of methods for a priori prediction of MCQ difficulty. Semant Web. 2021 Mar 9;12(3):449-65. https://doi.org/10.3233/SW-200390