

Analysis of Distractor Efficiency of the Multiple-Choice Comprehensive Examination for Technical-Vocational Pre-Service Students

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Abstract

This study investigated the distractor efficiency of 150 multiple-choice questions (MCQs) from a comprehensive examination for pre-service teachers. Data from a total of eighty-five graduating Bachelor of Technology and Livelihood Education students majoring in Home Economics were used in the analysis. Using LERTAP 5.0 for distractor analysis, the results revealed that 28.4% (128/450) of distractors were non-functional, resulting in 62% (93/150) of items showing moderate distractor efficiency. A further analysis linked moderate distractor efficiency to a predominance of lower-order thinking skills questions. These findings highlight a need for improved distractor design and a greater emphasis on higher-order thinking skills in MCQ construction to enhance the validity and effectiveness of the examination in assessing pre-service teacher understanding.

Keywords: Multiple-choice questions (MCQs), distractor efficiency, item analysis, higher-order thinking skills, assessment, pre-service teachers

INTRODUCTION

Multiple-choice (MC) testing is one of the most enduring and successful forms of educational assessment that remains in practice today (Shin, Go and Gierl, 2019). To make assessment as effective as possible, assessment items (questions) must be well developed so that the results provide useful evidence about student learning and help instructors identify students' strengths and weaknesses (Bai & Ola, 2017). The MC format marked a significant advancement in educational assessment by providing an objectively scored method that presents students with a structured task, requiring them to select the correct answer from a set of options, including one correct choice and multiple distractors (Gierl, Bulut, Guo, & Zhang, 2017). Multiple-choice questions (MCQs) in professional examinations is increasingly common for assessing students' knowledge (Mahjabeen, et al., 2017). Hence, a well-designed MCQs serve as an effective assessment tool, capable of covering a broad range of subject matter objectively across various cognitive levels. Also, they also reduce evaluator bias by minimizing subjective judgment during scoring. However, developing standardized MCQs is a time-intensive process. Poorly constructed MCQs can result in questions being either too easy or too difficult, failing to meet their intended purpose. Moreover, if the answer options do not adhere to standardized criteria, the test may undermine students' recall,

comprehension, or problem-solving abilities, instead encouraging guesswork.

A typical MC item consists of the stem and response options that includes a key or the correct answer and the wrong alternatives called distractors. Distractors are designed to challenge learners and differentiate between varying levels of comprehension (Sajjad, Iltaf, & Khan, 2020). Distractors in multiple-choice questions significantly affect their effectiveness, so teachers should monitor student responses to each distractor and modify those that receive minimal attention (Rejeki, et al., 2023).

Crafting multiple-choice items is a demanding task, especially when developing distractors, due to the extensive amount of work involved (Shin, Go and Gierl, 2019). In educational assessment, the efficiency of distractors plays a crucial role in evaluating students' understanding and knowledge. Effective distractors not only capture the attention of students but also contribute to a more precise measurement of students' abilities (Sharma, 2021). The analysis of distractor efficiency provides indicators of potential flaws in assessment items, revealing whether distractors are functioning as intended (Kumar & Tiwari, 2021). Despite their importance, distractor selection remains a significantly overlooked aspect of MCQ development (Aljabr et al., 2021; Haladyna & Downing, 1989).

A distractor is considered to be a good distractor when it attracts more examinees from the group of low achievers than the group of high achievers (Sharma, 2021). A weak or non-functional distractor should be re-evaluated, as the efficiency of a multiple-choice question is maximized when all distractors are functional and effective (Ansari, et al., 2022). Functioning distractors, selected by one or more examinees, serve as indicators of an item's effectiveness, while non-functioning distractors are those that any examinee does not choose. Crafting equally plausible options can be challenging, especially in end-of-semester exams, as distractor functionality, item-writing quality, and optimal number of options all interconnect to influence item quality, performance, and overall test results (Quaigrain & Arhin, 2017). The distractor is called a functional distractor (FD) if the number of students who chose it is $>5\%$. On the other hand, it is called a non-functional distractor (NFD) if the number of students who select it is $<5\%$ (Mahjabeen et al, 2017; Sharma, 2021). Hence, distractor efficiency (DE) of an item, which ranges from 0 to 100%, depends on the number of NFDs. It means DE values may be classified as 0%, 33.3%, 66.6%, or 100% based on the count of NFDs within an item (Sharma, 2021).

Good quality examinations are crucial for producing reliable data to assess student learning, guide program enhancements, and provide stakeholders with pertinent information (Alkhatib, Brazeau, Akour, & Almuhaissen, 2020). The current study aims to investigate the characteristics of effective versus nonfunctional distractors within MCQs on the comprehensive examination of preservice teachers given annually as an intervention for improved performance in the Licensure Examination for Teachers (LET). As reported in the study of Dayadaya & Sermona (2024), in the pilot implementation of this comprehensive examination, the students raised issues and concerns of the examination, including miskeying (correct answers were marked wrong), unclear item stem, and platform issues (difficulty accessing the test). To address these concerns, it is important to conduct an item analysis that includes evaluation of item difficulty, item discrimination and distractor efficiency.

This study is focused on evaluating distractor efficiency in the comprehensive examination provided to students by the university. Understanding the efficiency of these distractors can provide insights into question quality and the assessment process itself. By analyzing distractor performance, this research seeks to improve the construction of MCQs, ensuring they serve their purpose of accurately gauging student learning and comprehension.

OBJECTIVE OF THE STUDY

This paper aims to evaluate the distractor efficiency in the Comprehensive Examination for Technical-Vocational Pre-Service Students with the aim of improving the quality and validity of the examination, ensuring it more accurately measures the candidates' true understanding and readiness for the actual licensure examination.

METHODOLOGY

This study was conducted in a State University in Northern Mindanao, Philippines that offers a teacher education program in Technology and Livelihood Education. This study was conducted at a State University in Northern Mindanao, Philippines, which offers a teacher education program in Technology and Livelihood Education. The study utilized data from 85 graduating students in the Home Economics specialization of the Bachelor of Technology and Livelihood Education program (AY 2021-2022). The comprehensive examination comprised 150 multiple-choice questions covering major courses within the program, including Home Economics Literacy, Drawing Concepts and Strategies, Basic CADD Technical Drawing, Automotive Electricity, Drawing Tools and Animation, Crop Production, Cookery II, Housekeeping, Automotive Under Chassis/Power Train, Bread and Pastry Production, Entrepreneurship in Technology Education, Dressmaking, Food Processing, Food and Beverage Services, Commercial Cooking, Garment and Textiles, Beauty Care and Services, Preventative Maintenance/Laboratory, and Bartending. Each question had four response options, a correct answer and 3 distractors.

Item analysis was conducted using the Laboratory of Educational Research Test Analysis Package (LERTAP version 5.0), developed by Curtin University of Technology in 2000. The software's integrated functions allowed for the generation of comprehensive reports on item difficulty, discrimination indices, and distractor efficiency. This paper focuses on identifying patterns in distractor selection, specifically investigating which distractors were frequently and rarely chosen by students. In evaluating distractor efficiency, this study followed the classifications established by Sharma (2021) and Sajjad, Iltaf, and Khan (2020).

This paper is focused on identifying patterns in the distractor selection, specifically examining which distractors were frequently chosen and which were rarely selected by students. In analyzing distractor efficiency, this study adhered to classifications established by Sharma (2021) and Sajjad, Iltaf, and Khan (2020):

Table 1. Distractor efficiency levels

NO. OF NFDs PER ITEM	DE	Description
0 non-functional distractor	100%	High
1-2 non-functional distractors	33.3%- 66.6%,	Moderate
3 non-functional distractors	0%	Low

RESULTS AND DISCUSSION

A total of 450 distractors were identified from 150 multiple choice items out of which 128 were nonfunctional distractors (28.4%). Out of these 150 MC items, 93 items had moderate distractor efficiency and 57 (38%) had low distractor efficiency. This result is presented in Table 2.

Table 2. Distractor efficiency of items

No. of NFD	Distractor Efficiency	No. of Items	% of Items
0	High	57	38%
1-2	Moderate	93	62%
3	Low		

The results indicate that a significant number of distractors were nonfunctional that could have caused the majority of items (93, 62%) to have moderate distractor efficiency suggesting room for improvement in distractor design for some items. A considerable number of items (57, 38%) all three distractors were found to be functional. It is good to note that there were no items identified to have low distractor efficiency.

Table 3 presents a further analysis of items with moderate distractor efficiency, categorized by cognitive level according to Bloom's Taxonomy (Schreyer Institute for Teaching Excellence, n.d.). This taxonomy distinguishes between lower-order thinking skills (LOTS; Remembering, Understanding, and Applying) and higher-order thinking skills (HOTS; Analyzing, Evaluating, and Creating). The results indicate a predominance of low cognitive level items (80 of 93 items, 86%), while only 13 items (14%) demonstrated both moderate distractor efficiency and high cognitive levels.

Table 3. Distribution of items with moderate distractor efficiency across Bloom's cognitive domains and levels

Blooms Cognitive Domains	No. of Items	Cognitive Level	No. of Items	% of Items
Remember	44	Low	80	86%
Understand	32			
Apply	4			
Analyze	9	High	13	14%
Evaluate	3			
Create	1			

DISCUSSIONS

The analysis of 150 multiple-choice questions (MCQs) revealed a substantial proportion of non-functional distractors (NFDs) – 128 out of 450 (28.4%). This high rate of NFDs contributed to a majority of items (93/150, 62%) exhibiting only moderate distractor efficiency, highlighting a need for improved distractor design. While 38% (57/150) of items had high distractor efficiency, with all three distractors functioning effectively, no items fell into the category of low distractor efficiency. These findings suggest that while many items are adequately discriminating, a significant number could benefit from revision to enhance their effectiveness in assessing student understanding.

These results aligned with the study by Sajjad, et al. (2020) which found that a significant portion of their analyzed multiple-choice questions (MCQs) exhibited moderate to high distractor efficiency. Also, a notable finding was the prevalence of low cognitive level items, particularly among those with moderate distractor efficiency just as this study revealed.

The same result was also exhibited from the study of Ansari, et al. (2022), showing high proportion of items with moderate distractor efficiency and one of the flaws identified in these items was low cognitive

level.

These findings align with a common challenge in MCQ design: creating items that effectively assess higher-order thinking while maintaining good distractor functionality. The fact that items with moderate or low distractor efficiency were identified as having low cognitive levels indicates a potential overreliance on simpler recall-based questions rather than those that demand analysis, evaluation, or application of knowledge. This suggests a need for greater attention to crafting items that require higher-order thinking skills within the framework of well-designed distractors. The study highlights the importance of not only focusing on distractor efficiency but also addressing the cognitive level of the questions to improve the overall quality and validity of assessments.

CONCLUSION

This study revealed a considerable number of non-functional distractors (28.4%) in the analyzed multiple-choice questions (MCQs), leading to a majority (62%) of items exhibiting moderate distractor efficiency. Furthermore, a significant proportion (86%) of items with moderate distractor efficiency assessed lower-order thinking skills, highlighting a need for improved distractor design and a shift towards higher-order thinking skills assessment.

RECOMMENDATIONS

To enhance the quality and validity of future MCQs, a greater focus should be placed on improving distractor design to reduce the number of non-functional distractors. Additionally, efforts should be made to increase the proportion of items assessing higher-order thinking skills while maintaining effective distractor functionality, potentially through training or workshops on effective MCQ construction.

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