



Contents lists available at ScienceDirect

Currents in Pharmacy Teaching and Learning

journal homepage: www.elsevier.com/locate/cptl

Research Note

A psychometric analysis of a newly developed summative, multiple choice question assessment adapted from Canada to a Middle Eastern context

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ARTICLE INFO

Keywords:

Psychometric
Multiple choice
Assessment
Student performance
Test performance

ABSTRACT

Introduction: Accreditation necessitates that assessment methods reflect the standards established by the accrediting body. The process of adapting assessments to a new context can present unique challenges with uncertainty around psychometric defensibility of the adapted exam.

Methods: A psychometric analysis of a summative multiple-choice-question (MCQ) assessment, adapted from Canada, for graduating pharmacy students from a Canadian accredited program in Qatar was conducted. Rates of difficult items, item discrimination measured by point biserial correlation (rpb), and non-functioning distractors (NFDs) were calculated to identify deficiencies and challenges with an adapted exam. Challenges encountered throughout the adaption process and recommendations were documented.

Results: Overall score of a 90-item, four option, MCQ exam ranged from 46.7% to 78.9% (mean of 61.9%). For difficulty, there were 17 items with less than 30% of students answering correctly, while 29 items had unacceptable or poor discrimination (rpb < 0.1). NFDs occurred in 78 items with 49 containing at least two NFDs.

Discussion and conclusions: Difficulty of the exam was deemed acceptable yet discriminator ability requires improvement. The high frequency of questions with NFDs suggests that faculty have difficulty developing plausible distractors for an adapted MCQ exam. This could be due to a lack of training or requirement for inclusion of too many distractor options. While it is feasible to implement an assessment adapted from a different learning environment, measures need to be taken to improve psychometric defensibility. The high number of questions with NFDs indicates that the current method of exam development does not encourage the incorporation of functional distractors.

Introduction

Assessment is a fundamental component to the overall teaching and learning process. It can be used formatively to identify areas of student weakness before program completion, or in a summative context to determine if students achieved intended program learning outcomes.¹ In either case, educators must ensure that tools for assessment are developed with valid evidence to support

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Received 27 September 2017; Received in revised form 12 February 2018; Accepted 10 May 2018

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intended interpretations, especially when determining pass-fail decisions.² This is especially true for high stakes assessments, such as exit-from-degree or entry-to-practice exams, where failure can result in negative consequences for the candidate.^{3,4}

Pharmacy education is developing worldwide, largely due to an emphasis on achieving domestic or international accreditation for professional programs.⁵⁻⁷ Accreditation standards set by accrediting bodies require strong assessment processes, both in formative and summative contexts.^{8,9} As such, assessment practices must be revisited on a regular basis to ensure quality is maintained and intended assessment outcomes are achieved. Recent studies have demonstrated differing approaches to evaluate and monitor validity of high stakes assessment but there is a gap in the literature regarding analysis of implemented exams, especially within international settings.^{10,11} However, research has shown that simply adapting assessment policies and procedures from other contexts does not guarantee validity within the new setting.^{12,13}

As cross-cultural adoption of summative assessments carries a high risk of introducing bias, adaptation by improving the cultural appropriateness of the assessment is the most pertinent.¹⁴ Measures of adapting an assessment aim to promote fairness within the new cultural context it is applied while providing the opportunity to make comparisons amongst differing populations.¹⁵ Adaptation of an assessment can also save time and resources needed to develop a completely new assessment.¹⁵ While there is currently no clear agreement on minimum standards or best practices for cross-cultural assessment adaptation, a framework to guide researchers in the test adaptation process has been developed.^{14,16} Within this framework, assessment developers are encouraged to conduct a field test to analyse test items (e.g., using classical or modern item analysis procedures), test and subtest reliabilities, and factor structure of the test.¹⁶

Development of multiple-choice-question (MCQ) exams for adapted assessments is known to be a difficult task for faculty members.¹⁷ This may be especially true in international settings, where the language of questions differs from the faculty member's own primary language or there is a lack of experience writing questions designed to assess higher cognitive functions, rather than simple memorization. It is therefore important as a quality assurance measure to continually assess questions for validity and reliability, especially for high stakes assessments.¹¹ Different indices, such as difficulty and discrimination, are available through psychometric item analyses to aid identification of problem questions or those requiring revision prior to reuse.³ Therefore, our major research question of this pilot study was to determine strengths and weaknesses of a summative MCQ assessment adapted using development policies from a Canadian context into a Middle Eastern context.

Study aim

This pilot study describes the development and comprehensive evaluation of a final summative MCQ exam for graduating pharmacy students in Qatar adapted from a Canadian context. Specifically, in the context of a summative assessment adapted from Canadian Accreditation Standards to a different cultural environment, we sought to: (1) determine difficulty of questions and the overall exam, (2) assess the ability of test items to discriminate amongst examinees, and (3) assess the frequency of functioning distractors and investigate the relationship between the numbers of functioning distractors per item with other item psychometric characteristics.

Based on the knowledge gained from this analysis, our secondary aim was to identify challenges for developing a summative assessment adapted to a different cultural context.

Methods

We conducted a psychometric item analysis to determine performance characteristics of multiple-choice items on an exit-from-degree (summative) exam. The exam was blueprinted to the Canadian Council for Accreditation of Pharmacy Programs (CCAPP) program learning outcomes. These outcomes are also mapped to the curriculum as a whole. The purpose of developing and evaluating this summative exam was to achieve accreditation Standard 34: "The faculty must establish principles and methods for the formative and summative assessment of student achievement."⁸ Criterion 34.2 states, "Psychometrically sound, objective structured, or performance based assessments must be used in the overall assessment plan at regular intervals in a student's progression through the program to confirm achievement of educational outcomes and professional competencies" which is requested of accredited institutions.⁸ This exit-from-degree, summative exam aimed to assess a student's competency of subject material exposed throughout the four-year professional program. This summative assessment was adapted to resemble "Part I" of the two-part Pharmacy Examining Board of Canada which is required for graduating pharmacy students to successfully pass to gain licensure in Canada.¹⁸ Exam content included material proportional to the content from both undergraduate clinical and non-clinical pharmacy courses. Eighteen faculty members were appointed to develop five to 10 exam questions based on their area of expertise. Each test item developed was then reviewed by the assessment committee at the college of pharmacy prior to administration. Once finalized, the exam consisted of 100 MCQs with three distractors and one true answer. It was administered to all 25 students in their final semester of study over three hours and counted as 10% of the final grade of a two-credit course. This analysis was conducted in the 2016/2017 academic year.

Data were obtained for examinees' selected response (one out of four possible options) for each item and entered in a Microsoft Excel[®] spreadsheet. We excluded 10 calculation-based items, and therefore analyzed a total of 90 MCQ items and their respective distractors (270 total). We excluded calculation-based items because we anticipated that all examinees would answer these questions correctly as these skills are expected to have been mastered before the time of the final summative assessment. These questions would have provided minimal insight into performance characteristics (i.e. would not be able to discriminate between high and low scoring examinees).

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