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Review Article

How-to-guide for writing multiple choice questions for the pharmacy instructor



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ABSTRACT

Background: Writing multiple choice questions (MCQ) takes a lot of practice. Often, pharmacy practitioners lack the training to write effective MCQ. Sources for instruction in effective MCQ writing can be overwhelming with numerous suggestions of what should and should not be done. **Purpose:** The following guide is prepared to serve as a succinct reference for creation and revision of MCQ by both novice and seasoned pharmacy faculty practitioners. **Methods:** The literature is summarized into 12 best practices for writing effective MCQ. Pharmacy specific examples that demonstrate violations of best practices and how they can be corrected are provided. **Implications:** The guide can serve as a primer to write new MCQ, as a reference to revise previously created questions, or as a guide to peer review of MCQ.

Introduction

Multiple choice questions (MCQ) are utilized as the standard testing assessment for pharmacy licensing, specialty certifications, and continuing education programs. This type of assessment is widespread primarily due to ease of scoring, objectivity, reliability, and capability to assess outcomes at different cognitive levels including knowledge, application, and evaluation.^{1,2} While these benefits are evident with well-written MCQ, a large proportion of questions utilized within collegiate didactic curricula have item writing flaws (IWF), or errors, that may reduce their quality and reliability.^{3–9} A majority of the literature in health care curricula evaluating IWF has found 50–75% of MCQ utilized in assessments have IWF.^{4–7,9–13} Although the data in pharmacy compared to other health care fields are sparse, two studies evaluating assessments in pharmacy demonstrated that 51.8–78.3% of MCQ contained one or more IWF.^{9,14}

While it may seem as though a question with an IWF would either benefit or penalize knowledgeable and unprepared test-takers alike, evidence may suggest otherwise.^{5,7,9,15–17} A poorly written question can confuse or penalize the knowledgeable test-taker, and it may reward the unprepared test-taker by unintentionally providing logical cues that make the correct answer apparent. The consequence of these scenarios is the inability to discriminate between high-achieving students and low-achieving students, reducing reliability and validity of the assessment.^{3,5,7} Furthermore, poorly written questions with IWF may assess reading comprehension or reading stamina of the test-taker rather than content. If a curriculum, course, or high-stakes assessment includes numerous questions with IWF, the ability to adequately and appropriately assess student performance is impacted.⁵

Resources that provide guidance in writing better MCQ are available, but the drawback of these documents is their length and the

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sheer number of rules that need to be digested, remembered, and followed.^{18–26} The most notable and referenced guide to MCQ construction is A Taxonomy of Multiple Choice Item-Writing Rules,¹⁹ which contains 43 item writing rules. Even with the resources available, the majority of MCQ utilized in health professions education have IWF.^{4–7,9–12,14} One possible explanation is that faculty, without appropriate training, may create questions similar to those they have seen in their own education and experiences, thereby perpetuating common IWF.^{27,28} For example, a study evaluating IWF in the New England Journal of Medicine for continuing medical education found at least three violations of best practices in each of the 40 questions evaluated.¹³ If faculty utilize these assessments as a model for MCQ creation, it is not surprising that MCQ utilized throughout curricula also contain various IWF. Faculty development addressing MCQ creation guidelines is instrumental to reduce the number of IWF, and may be beneficial to faculty regardless of their time in practice.^{28,29} Another possible explanation for frequent IWF is the difficulty in understanding and applying the information in these resources. This how-to-guide was created to provide a clear and concise document for faculty development purposes. It condenses the numerous rules into 12 best practices, provides pharmacy specific examples, and serves as an easy reference for creating or editing quality MCQ. The goal of this guide is to help pharmacists create quality assessments that test the intended content and avoid rewarding unknowledgeable students for being test-wise.

Aligning Objectives and Assessments

Before creating a multiple choice question, it is imperative to align the assessment with intended objectives. This alignment should occur with both content and desired cognitive level of competency a student is expected to achieve through completion of the course or lecture. As a topic is introduced and reinforced throughout the curriculum, it is expected that a student will first form a fundamental knowledge base and then, through application of the material, demonstrate mastery. Bloom's Taxonomy³⁰ defines six levels of cognitive behavior associated with this hierarchical learning. For the purpose of writing multiple choice questions, these levels can be simplified into three defined concepts: knowledge and recall; interpretation and application; and problem solving and evaluation.^{21,31}

Assessments need to be aligned with course content objectives and written in such a way as to test the appropriate level of mastery as defined by the simplified Bloom's Taxonomy. Table 1 describes the simplified Bloom's Taxonomy as it relates to writing multiple choice questions. It provides examples of questions for each level of learning as well as common verbs associated with that level of cognition. Ensuring objectives are written at the desired level of mastery and then aligning MCQ with the objectives will allow for a fair and balanced assessment of the students.

While this guide focuses on the creation of MCQ, this method of assessment may not be appropriate for all learning situations. There are various assessment methods designed to assess the various domains of learning (psychomotor, cognitive, and affective). It is important to align the assessment method with desired outcomes. For example, a MCQ may be utilized to assess a student's knowledge about communication practices, but it cannot effectively evaluate how that student communicates with a patient.

MCQ Writing Best Practices

As mentioned above, multiple choice questions are utilized in a variety of assessments due to their ease of grading, reliability, and objectivity. These apparent advantages of MCQ are only realized when they are written appropriately. Table 2 provides a list of best practices for creating quality MCQ. These rules are divided into those that apply to the question as a whole, the stem, and the answer choices (see Fig. 1 for common definitions of MCQ components). The following section will explain each of these best practices in more detail.

Table 1
Cognitive levels of objectives used to correlate with multiple choice questions

Level of learning	Definition	Example(s)	Common objective verbs
Level 1 Knowledge/recall	Requires the student to recognize and understand terms, concepts, and understand the relationship between one piece of information and another.	Recognize a definition of a concept Recognize a MOA Identify an ACEI Identify side effects	Define, repeat, record, list, recall, name, relate, underline, translate, restate, discuss, describe, explain, express, identify, report, review, tell
Level 2 Interpretation/ application	Student must determine how and why something is done. May require analysis of given material in relation to a definition. It builds upon the depth of knowledge and theory.	Recognize an example of a term instead of a definition Compare side effects of different medication classes	Interpret, apply, employ, use, demonstrate, practice, illustrate, schedule, differentiate, analyze, calculate, compare, contrast, debate, relate, solve, categorize
Level 3 Problem solving/ evaluation	Requires synthesis of elements into a comprehensive whole. Students often have to reorganize information in conjunction with practical conceptual knowledge.	Recommend a therapeutic plan for a patient Select the best therapeutic option for treatment of a disease state	Compose, plan, propose, design, formulate, arrange, assemble, create, organize, judge, recommend, revise, select, assess, eliminate

MOA, mechanism of action; ACEI, angiotensin-converting enzyme inhibitors.

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