

CE CRAFT CORNER

Advance Your Writing Skills: Craft Effective Multiple-Choice Questions for Continuing Education Activities

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ABSTRACT

Health care professionals are required to participate in continuing education activities to maintain their competency and improve their clinical skills. These educational activities are often developed by medical writers who create the course content and postactivity multiple-choice questions (MCQs). The MCQs align with the learning objectives and assess the learners' comprehension of the information and their ability to apply the knowledge in a clinical setting. The MCQs also help evaluate the educational outcome of the activity and guide future educational programs. Medical writers can craft high-quality MCQs for continuing education activities by following key recommendations that enhance knowledge and build skills in medical professionals, effectively contributing to improved patient care. This article offers an overview of the recommendations for writing effective MCQs for continuing education activities.

INTRODUCTION

Continuing medical education (CME) activities for physicians and continuing education (CE) activities for other health care professionals supplement knowledge, build skills, and integrate changes into the clinical environment.¹ These educational activities often include pre- and post-tests that identify learners' areas of strength and weakness and determine whether the activity's learning goals have been reached.²

The National Board of Medical Examiners (NBME), the organization responsible for developing national medical licensing exams and medical educational assessment tools, recommends multiple-choice questions (MCQs) as the optimal format for testing the knowledge of new information.³ These questions are a reliable assessment tool because they allow for quick marking of a large number of tests, remove interexaminer bias in marking, and provide data about performance in specific areas.² However, MCQs cannot evaluate creativity or fully mimic real-world situations in which learners must think of the correct answer without prompts.⁴

Medical writers who develop content for CME/CE activities are often responsible for writing the associated MCQs. Although writing an MCQ might seem straightforward, crafting an effective MCQ that appropriately tests the application of new knowledge takes careful consideration. A high-quality MCQ should prompt learners to use high-level cognitive thinking to answer correctly. Conversely, a poorly written MCQ can confuse learners with irrelevant information or cue savvy test-takers into guessing the correct answer.³ Medical writers can enhance the learning experience and improve the educational outcome of a CME/CE activity by following established MCQ writing recommendations from the NBME Item-Writing Guide and similar resources.

CONSIDERATIONS FOR MCQs IN CME/CE

An effective MCQ for a CME/CE activity must test at the same cognitive level as its associated learning objective.⁵ The NBME determined that the cognitive level of a learning objective can be separated into 2 basic categories based on the cognitive task required of the test-taker. These categories are recall of a fact and application of knowledge.³ The MCQs that test the recall of a fact simply assess rote memory, whereas MCQs that test the application of knowledge require the learner to interpret the new information and apply this information in a clinical setting.³ Most CME/CE activities include application-based learning objectives and require high-level MCQs.⁶

OUTLINE OF A MULTIPLE-CHOICE QUESTION

A basic MCQ consists of a stem and multiple answer options. The singular correct option is called the keyed response, and the incorrect options are called distractors.⁶ The appropriate number of answer options is debatable and can vary depending on the level of assessment and information tested.⁶

Stem

The stem can be a standalone question or a vignette with a lead-in statement or question. The stem should include all the relevant information and be as succinct as possible to avoid the learner having to read it multiple times.³ Ideally, the learner should be able to cover the answer options with their hand and come up with the correct answer on their own after reading the stem.^{2,3,7}

When crafting a stem, medical writers should ensure that the information is clear to avoid misleading the learner into answering incorrectly.⁶ Medical writers should avoid absolute terms (eg, *always*, *never*, *all*, or *none*) because few medical situations are absolute.⁶ Vague and imprecise terms (eg, *may*, *could*, *often*, and *usually*) are also not recommended because they are not consistently defined or interpreted by the learner.⁶ The learner may become confused trying to guess the writer's personal definition of the vague or imprecise term, which can lead to the learner guessing an incorrect option or arguing the merits of incorrect options.^{2,3}

The stem should be positively worded. Negative phrases (eg, *not*, *least likely*, and *except*) should be avoided in the stem. A negative phrase that is highlighted using bold and capitalized letters may still be misread by the learner, who may then choose an incorrect answer.³ Also, a negatively phrased question requires the learner to switch from looking for the best option to looking for the worst option. Choosing the worst option does not mimic typical reasoning in the clinical environment in which the standard approach is to rule out incorrect options.²

Vignettes

To test application-based skills in CME/CE activities, the optimal format for an MCQ stem is a clinical vignette. Clinical vignettes, the preferred format of several medical licensing examinations, can identify a learner who has memorized facts but is unable to apply the information effectively.^{5,6} To write a good vignette for an MCQ, a medical writer needs to be familiar with the learners' language and base knowledge on the subject. This way, the medical writer can ensure that the vignette gets to the point without including unnecessary information or explanations.

A clinical vignette presents information in a real-world scenario that the learner will likely experience in the workplace.² The scenario often begins with presenting relevant patient information, including signs and symptoms, diagnostic study results, and recent treatments. Then, the scenario finishes with a decision-making question.³ Vignettes can be effective without being lengthy. Succinct vignettes have short reading times, avoid confusing the learner with irrelevant facts, and often mimic a real-world conversation in the clinical environment.⁶

Answer Options

After the stem, the second part of an MCQ consists of the answer options, including the keyed response and distractors. The keyed response includes the important information that the CME/CE provider wants the learner to understand. The keyed response must be indisputably correct and referenced from a reliable source.⁶ Writing the keyed response is typically straightforward, whereas creating effective distractors can pose a challenge. The distractors must be plausible but less correct than the keyed response.³ For this reason, distractors should be related to or fall into the same category as the keyed response and represent common errors encountered by learners in the workplace.^{3,6}

The distractors and keyed response must have similar structure and grammar to prevent a savvy test-taker from detecting the keyed response without knowing the correct answer.² To craft high-quality answer options without structural or grammatical errors, medical writers should follow these three recommendations. First, the answer options should be the same length as each other. A common mistake when writing an MCQ is to add extra information in the keyed response as a last-ditch effort to teach.³ Second, all relevant information should be included in the stem so phrases are not repeated or defined in the answer options.² Third, the answer options should have a subject-verb agreement with the stem.³ Inconsistent use of plurals or tenses can lead learners to match the grammar of the keyed response to the stem.³

A good tactic to catch grammatical and structural errors is to read each answer option out loud after reading the stem to ensure the language is a good fit.³ A final note about answer options is that the choices of "all of the above" and "none of the above" should be avoided, as these phrases effectively turn the MCQ into a true-false question (Box 1).^{3,6}

Box 1. Guidelines for writing high-quality MCQs^{3,6}

Include	Avoid
• Clear, concise questions or statements • Only relevant information in the stem • One correct and referenced keyed response • Plausible distractors in the same category as the keyed response • Answer options similar in length and grammar • Key information the learner should take away from the activity	• Incomplete or unclear questions or statements • Negatively worded stem • Vague or imprecise words in the stem • Answer options with different lengths or grammar • Answer options with incorrect subject-verb agreement with the stem • "None of the above" or "all of the above" options

MCQs, multiple choice questions.

EXAMPLE PROCESS OF CRAFTING A HIGH-QUALITY MCQ

The following scenario demonstrates the creative process involved in crafting a poor MCQ and a good MCQ for a CME activity on liver imaging for radiologists. The medical writer must craft a high-quality MCQ to support the learning objective of: differentiate between hepatic adenoma and focal nodular hyperplasia on an magnetic resonance imaging (MRI) image. This high-level learning objective requires the radiologist to apply information about the radiological appearance of liver pathologies to determine the correct diagnosis. An effective MCQ should support this high-level learning objective with a clinical vignette that prompts the learner to apply knowledge.

Below are examples of a poor MCQ and a good MCQ for this learning objective. The poor MCQ example is a simple question that tests only information recall (Box 2). This MCQ requires recall of the pathophysiology of focal nodular hyperplasia but does not require the learner to apply this knowledge to a diagnosis.

Box 2. Poor MCQ

Which liver pathology is characterized by an overgrowth of liver cells?

- a. Adenoma
- b. Meningioma
- c. Endometriosis
- d. **Focal nodular hyperplasia**

MCQ, multiple choice question.

Additionally, this poor MCQ includes subquality answer options that could clue a savvy learner to choose the correct answer without knowing the information. For example, two of the distractors (b and c) are not liver pathologies, so they can be eliminated. Also, the keyed response (d) stands out from the other options because the phrasing directly matches the phrasing in the stem. The word hyperplasia in the keyed response is the medical term for the words overgrowth of cells in the stem, which is basic knowledge for a physician.

In contrast, the good MCQ example supports the learning objective with a clinical vignette (Box 3). The vignette includes relevant information about the patient's demographics and symptoms, along with a description of the radiological characteristics of the lesion. The language used in the vignette is tailored to the audience, and the concise lead-in question is a common question that radiologists would encounter in the clinical environment. The answer options are all plausible liver pathologies, and they are written concisely with no extra words to confuse the learner.

Box 3. Good MCQ

A 38-year-old woman without symptoms had an abdominal MRI with a hepatobiliary contrast agent to further characterize a liver lesion found incidentally on ultrasound. On the MRI images, the lesion showed hyperintensity to the surrounding parenchyma in the late arterial phase with rapid washout in the venous phase and isointensity on the 20-minute delayed series.

What is the most likely diagnosis of this lesion?

- a. Adenoma
- b. Hemangioma
- c. Hemochromatosis
- d. **Focal nodular hyperplasia**

MCQ, multiple choice question; MRI, magnetic resonance imaging.

ASSESSING EDUCATIONAL OUTCOMES

Results from the postactivity MCQ test should be assessed to evaluate the medical writer's MCQ writing skills, guide revisions of the current activity, and provide insights for developing future activities.^{2,3} The posttest MCQ assessment includes analyzing the quality of each MCQ and the overall quality of the activity. First, the quality of each MCQ can be assessed by observing the number of correct answers. An MCQ that is too easy or too difficult should be edited so the MCQ can appropriately test the learner's application of knowledge. Second, the answer options of each MCQ should be analyzed to determine their performance. For example, if any distractors were not chosen, then that distractor may not be plausible or may have a structural flaw.³ In such cases, the distractor should be rewritten to a higher standard.³

The overall quality and long-term educational impact of the CME/CE activity can be assessed using Moore's framework or Kirkpatrick/Barr's framework.⁸ Both frameworks combine the MCQ test results with surveys, learner-reported data, interviews, and clinical observations to assess levels of educational outcomes related to learner satisfaction, knowledge, competence, and performance.⁹ The highest levels of educational outcomes showing a lasting impact of the CME/CE activity include improvements in health care quality, and patient and community health outcomes.⁹

CONCLUSION

Medical writers are instrumental in the development of CME/CE activities by crafting MCQs that support the educational content. When writing an MCQ, medical writers should follow the established recommendations of what to include and avoid in the stem and answer options and ensure the MCQ matches the cognitive level of the

associated learning objective. By following these recommendations, medical writers can produce high-quality MCQs that use clinical vignettes to evaluate the learners' ability to apply new information from the activity to a clinical situation. Then, the results of the MCQ test can be used to assess the effectiveness of each question and the overall educational impact of the CME/CE activity. The CME/CE activities that have the greatest educational impact enhance knowledge and build skills in medical professionals, leading to changes in the clinical environment and ultimately improving patient care. Medical writers interested in further developing their MCQ skills are encouraged to review the resources provided below.

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RESOURCES

- NBME Item-Writing Guide
<https://www.nbme.org/item-writing-guide>
- ACCME CE Educator's Toolkit
<https://www.accme.org/ceeducatorstoolkit>

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