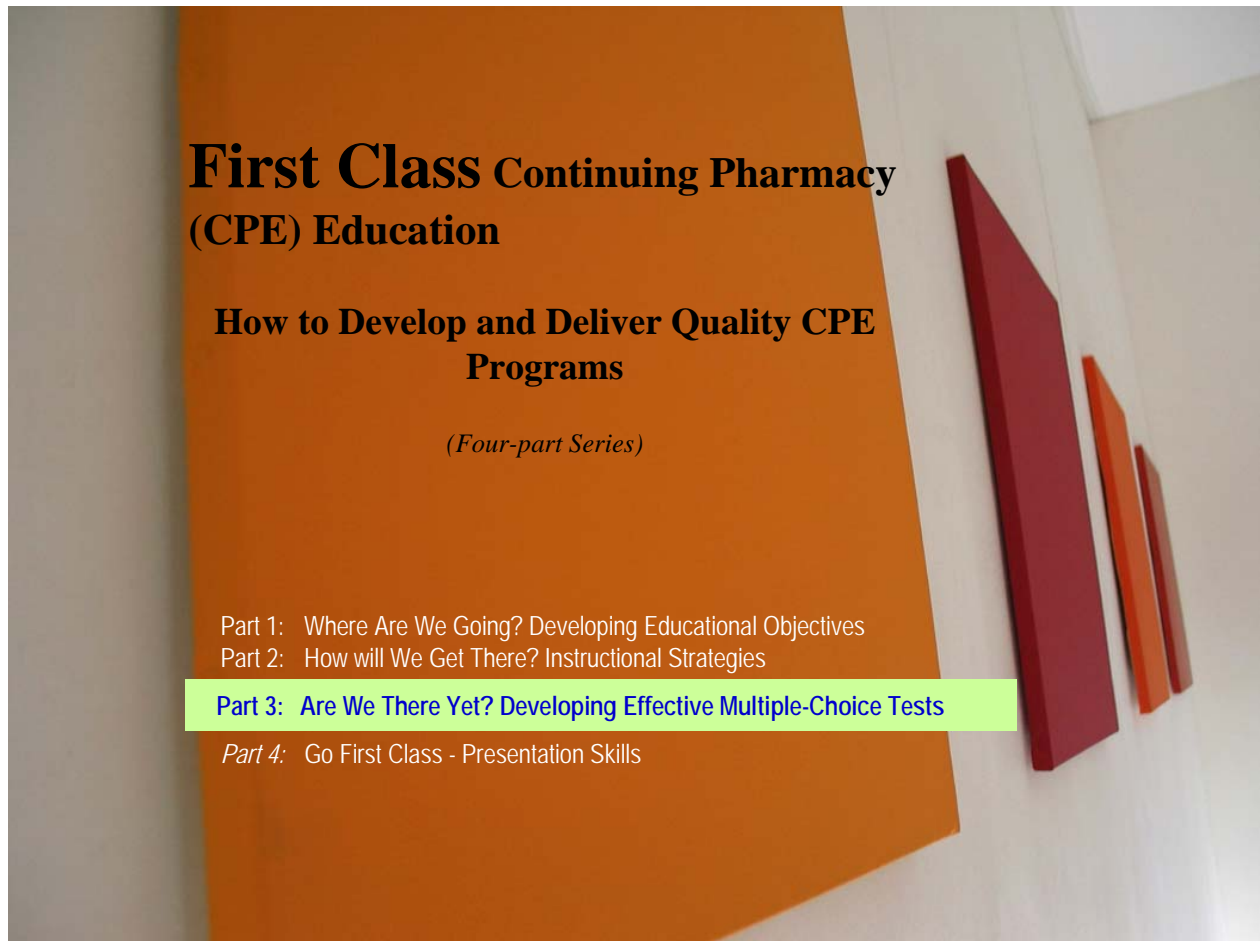


Part 3
Are We There Yet?
Developing Effective Multiple-Choice Tests



**First Class Continuing Pharmacy
(CPE) Education**

**How to Develop and Deliver Quality CPE
Programs**

(Four-part Series)

Part 1: Where Are We Going? Developing Educational Objectives
Part 2: How will We Get There? Instructional Strategies

Part 3: Are We There Yet? Developing Effective Multiple-Choice Tests

Part 4: Go First Class - Presentation Skills

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“The great aim of education is not knowledge but action.”
--- Herbert Spencer



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Are We There Yet? Developing Effective Multiple-Choice Tests in Pharmacy Continuing Education

Introduction

How do you know when you are “there”? The answer to “Are we there yet?” for an education program lies in whether or not you have achieved the objectives. An assessment, or test, lets you know if your learners have achieved the objectives you defined for them, or how well they have achieved them.

But there is a catch. If the assessment is flawed it may give you incorrect information. Questions may be asked that weren’t taught in the program or are not relevant to the learning tasks. A learner who knows the material may not do well on a test if questions are confusing or inadvertently misleading. Another learner who hasn’t grasped the material might do well if a test gives unintended clues to correct answers. Well designed assessments get to the truth: Has the learner achieved the objectives or not?

Unfortunately, probably every person reading this has had the experience of taking poorly designed tests. While this chapter won’t make you an expert on test development, it will give you key skills for developing better quality pharmacy continuing education tests. It will give you the “inside scoop” on easy-to-avoid errors that are commonly made. Because of their widespread use in continuing pharmacy education, only multiple-choice tests will be covered.

Objectives

By the end of this chapter you will be able to:

1. Explain the importance of effective educational assessment.
2. Define key criteria for effective tests and test questions.
3. Explain how to determine what to test.
4. Describe guidelines for fair and effective test weighting and length.
5. Identify common flaws in multiple-choice questions.
6. Identify corrections for common flaws in multiple-choice questions.

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Disclosure: Faculty disclosed they have no financial interest in and/or affiliation with any external organizations in relation to this continuing education program.

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What to Include in a Test

What should you ask about in a test? Many people approach this task by asking whatever comes to mind or choosing material for which it is easy to construct a question.

A test should assess the learner's achievement of the education program objectives. So what should you test? **Test the objectives.** You can't have a good test without good objectives. For this reason, if you haven't completed Part 1, now is the time to read it. Writing good objectives is the first step to designing a good test.

Each objective should have test questions associated with it. Each question should be testing a particular objective. It is important to be able to identify what objective a question is testing and to know if a question is actually testing the objective that it is developed to assess.

Review the example below. Read the objective in the left column. Then read the question beside it. Notice whether or not the question actually tests the objective.

Example:

Does the question test the objective?

Objective	Question	Yes or No
Identify when bias is present in a study.	Which of the following is the most common type of bias?	No
Identify when bias is present in a study.	Is bias present in the attached study?	Yes

In the first example, the question tests an objective like, "Describe the types of bias." The second question tests the stated objective, which is more complex. To find out if a person can detect bias in a study, they need to demonstrate this by looking at a study (or an appropriate excerpt or summary) and make the determination. Multiple-choice questions need not be simple recall of facts. Seek to develop questions that require the test taker to simulate as closely as possible what the objective describes. This will make the assessment more meaningful.

Try this exercise. Determine whether the question tests achievement of the given objective.

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Exercise:

Does the question test the objective?

Objective	Question	Yes or No
Given a description of a diabetes patient, identify appropriate therapeutic recommendations.	Diabetes is most commonly found in which populations?	
Given a description of a patient, identify appropriate therapeutic recommendations.	Which of the following is an appropriate therapeutic recommendation for Mr. Johnson (description attached)?	

See the answers at end of this section.

Test Weighting

Since you are testing the objectives, how many questions should be asked for each objective? First, it is important to recognize that you should test each objective. Poorly designed tests may leave some objectives completely untested while others get over-tested. This is unfair test "weighting."

What should you do if you feel an objective shouldn't be tested? Then it is not important enough to be an objective. Revise your objectives to reflect what is important for the learners to learn. Then test each objective to ensure that they learned it.

Fair test weighting means that each objective is tested. Does this mean that each objective should have the same number of questions? Not always.

Here is a recommended formula for determining how many questions to ask per objective. Start with planning to ask three questions per objective. Then adjust this based on these three factors:

- Importance
- Complexity
- Amount of material

Let's say you have one objective that is relatively simple to learn, such as a definition, for example, "Define 'pharmaceutical care.'" Another objective may be more complex, important and take more time to teach, such as designing a medication regimen for a patient. Testing whether or not the learner can identify the correct definition of pharmaceutical care may require only one question. To determine whether the learner can design an appropriate medication regimen is more complex and requires more questions to

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assess a learner's ability to perform the objective successfully. It may be more appropriate to ask four or five questions on this objective.

Try this exercise. Which of these two objectives needs more test questions?

1. List physical assessment procedures that are routinely conducted for ambulatory patients with hypertension.
2. Given the results of a physical assessment of an ambulatory patient with hypertension, accurately interpret the results.

The second objective needs more test questions because interpreting lab test results is a more complex, important and time-consuming task to teach than memorizing a list of physical assessment procedures.

Test Length

How long should a test be? People frequently ask, "How many questions do you want?" For the most part, test length is determined by the number and complexity of objectives. Figure out how many questions each objective needs to be fairly assessed and this will lead you to your test length. However, a minimum number of questions is important. Too few questions may lead to an unfair assessment so think in terms of a minimum of 15 questions for most programs.

Test Item Writing Guidelines

A test question is effective if a test taker gets the answer:

RIGHT

if they know the answer

and

WRONG

if they don't know the answer.

When either of these don't happen, what goes wrong? There are two categories of problems that may occur. Confusion or distraction in the question may cause a test-taker who knows the material to miss a question. On the other hand, unintended clues to the correct answer may enable a test-taker who doesn't know the correct answer to select it anyway. The test writing guidelines below help avoid both of these problems.

Guidelines for Avoiding Confusion and Distraction

These guidelines will help ensure that learners who know the answer to a question will not inadvertently select the wrong answer due to ambiguity, confusion or distraction in the question.

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We'll now look at a series of questions that contain a flaw that may create confusion or distraction for test-takers. See if you can identify what the flaw is.

Guideline #1

What is potentially distracting in this question?

Which of the following characteristics of inhaled anesthetic agents is conferred by resistance to metabolic degradation to trifluoroacetate?

- a. *Lack of hepatotoxicity.*
- b. *Lack of nephrotoxicity.*
- c. *Lack of seizures.*
- d. *Lack of respiratory irritation.*

The test-taker must read the words "lack of" four times. This can be a distraction from finding the correct answer. Consider this revision to this question:

A lack of which of the following characteristics of inhaled anesthetic agents is conferred by resistance to metabolic degradation to trifluoroacetate?

- a. *Hepatotoxicity.*
- b. *Nephrotoxicity.*
- c. *Seizures.*
- d. *Respiratory irritation.*

Guideline #1: Avoid repetition of words or phrases in the response options by rewording the stem of the question.

Guideline #2

What may be confusing in this question?

It is not ethical for a pharmacist to

- a. *Not refer to a patient's chart to determine a new dosing regimen for an antibiotic.*
- b. *Discuss with a patient why a physician has prescribed a certain medication.*
- c. *Contact the local antichoice group to report that a patient has asked about abortion.*
- d. *Discuss a patient case with other health professionals at an educational meeting, while keeping the patient's identity private.*

A double negative occurs in option "a." Double negatives are confusing and should be avoided, such as in the example below:

It is not ethical for a pharmacist to

- a. *Omit checking a patient's chart to determine a new dosing regimen for an antibiotic.*
- b. *Discuss with a patient why a physician has prescribed a certain medication.*
- c. *Contact the local antichoice group to report that a patient has asked about abortion.*
- d. *Discuss a patient case with other health professionals at an educational meeting, while keeping the patient's identity private.*

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Guideline #2: Avoid double negatives.

Guideline #3

What might cause misunderstanding in this question?

Which of the following is not a characteristic of an effective test question?

- a. Use of "all of the above" as a response option.
- b. One clearly correct answer.
- c. Avoids use of double negatives.
- d. Stem and response options are grammatically consistent.

If a negative is accidentally overlooked, a test-taker who knows an answer may miss the question. In this example, "not" could be overlooked. To avoid this problem, use of negatives should be minimized and, when used, highlighted. Highlighting can be in the form of bold, italics, capitals, underlining or some combination of these features as long as special attention is drawn to the negative, such as in the revision below.

*Which of the following is **not** (or "NOT" or "not") a characteristic of an effective test question?*

- a. Use of "all of the above" as a response option.
- b. One clearly correct answer.
- c. Avoids use of double negatives.
- d. Stem and response options are grammatically consistent.

Guideline #3: Minimize use of negatives and highlight negatives when they are used.

Guideline #4

What is confusing in this question?

An effective multiple-choice test question has which of the following characteristics?

- a. Has a clear best answer.
- b. Avoids unintended clues to the correct answer.
- c. Avoids highlighting of negatives.
- d. Makes frequent use of negatives in the question and response options.

Test questions should have a clear best answer. In the example above, there are two correct answers, "a" and "b." The revision below avoids this problem.

An effective multiple-choice test question has which of the following characteristics?

- a. Has a clear best answer.
- b. Includes well-placed clues to the correct answer.
- c. Avoids highlighting of negatives.
- d. Makes frequent use of negatives in the question and response options.

Guideline #4: Ensure that test questions have a clearly best answer.

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Guidelines for Avoiding Unintended Clues to the Correct Answer

Sometimes it is possible to correctly guess the answer to a test question even when you don't know the answer. This happens when the question contains unintended clues to the correct answer. Review the following examples to see if you can guess the correct answer, identify the unintended clue, and apply the guideline that will help you avoid this type of unintended clue when you write test questions.

Guideline #5

Can you guess the answer to this question?

After motivating and educating a patient to quit smoking, a pharmacist should refer that patient to the:

- a. Appropriate behavior change program for that patient as determined by discussing the various available options with the patient.*
- b. National quit line, 1 800 QUIT NOW.*
- c. Least expensive program that they can find.*
- d. Internet to do a search for local programs.*

What is a clue in this item? Response option "a" is longer and more complex than the other choices.

After motivating and educating a patient to quit smoking a pharmacist should refer that patient to the:

- a. Appropriate behavior change program.*
- b. National quit line, 1 800 QUIT NOW.*
- c. Least expensive program that they can find.*
- d. Internet to do a search for local programs.*

The response options are now of similar length and complexity, eliminating the clue to the correct answer.

Guideline #5: Ensure that all test question response options are similar in length and complexity.

Guideline #6

In the following question, can you see that one of these response options is incorrect without knowing the answer to the question? Which one and why?

**A 60-year-old alcoholic derelict in status epilepticus is brought to the emergency department by the police. After ascertaining that the airway is open, what is the first agent that should be administered?*

- a. Glucose with vitamin B1 (thiamine.)*
- b. Computerized tomography (CT) scan of the head.*
- c. Phenytoin.*
- d. Diazepam.*

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The question asks what agent should be administered but option “b” is not an agent. This makes the question easier than intended since the test-taker has only 3 options to choose from instead of the intended 4.

Guideline #6: Ensure that there is consistency between the stem of the question and all of the response options.

Guideline #7

What is a clue in this item?

Characteristics of an effective test item are

- a. Clarity.*
- b. Conciseness.*
- c. Correct grammar.*
- d. Grammatical consistency and brevity.*

In this example, the stem of the question is stated as a plural (“Characteristics” and “are.” However, only “d” is stated as a plural. This gives a clue that “d” is the correct answer. To avoid this problem the question could be rewritten as:

A characteristic of an effective test item is

- a. Clarity.*
- b. Conciseness.*
- c. Correct grammar.*
- d. Grammatical consistency.*

Guideline #7: Ensure that test questions are grammatically consistent between the question stem and response options.

Guideline #8

What is a clue in this item?

A cat is superior to a dog because it is more

- a. Clean.*
- b. Dignified.*
- c. Independent.*
- d. All of the above.*

Studies have demonstrated that when “all of the above” is a response option, it is almost always the correct answer. Test-takers can easily guess the correct answer by choosing “all of the above.” In fact, studies have shown that questions containing “all of the above” are completely invalid questions. For this reason, “all of the above” should never be used as a response option. “All of the above” is frequently used in test questions largely because questions with “all of the above” are much easier to write. They eliminate the need to create incorrect yet believable response options. However, resist the temptation and avoid its use so that your questions will be meaningful.

Guideline #8: NEVER use “all of the above” as a response option.

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Exercise:

Directions: Identify the flaw in these questions. Write a correction and compare it to the revisions on page 11.

1. In the sample test item below, what is the flaw? How can it be corrected?

Which of the following factors is most likely to contribute to the cost-effectiveness of antithrombotic drug regimens used for VTE treatment?

- a. The use of the s.c. route of administration instead of the i.v. route.*
- b. The use of an adjusted-dose regimen.*
- c. The use of laboratory monitoring.*
- d. The use of a low-cost drug.*

- a. Repetitive wording in answers.
- b. Correct answer is longer.
- c. Question is grammatically inconsistent with some of the answers.
- d. There is no clearly best answer.

2. In the sample test item below, what is the flaw? How can it be corrected?

Pharmacists can promote the need for behavioral counseling for smoking cessation by explaining to a patient that

- a. Smoking is a very complex behavior so only smokers who clearly understand this can successfully quit.*
- b. All smokers have psychological problems that require going to a counselor.*
- c. Quitting smoking is like learning any new behavior.*
- d. In order to do it successfully you need a plan that teaches you how to cope with your triggers to smoke.*

- a. Correct answer is longer.
- b. Question is grammatically inconsistent with some of the answers.
- c. There is no clearly best answer.
- d. Grammatical errors are present.

3. In the sample test item below, what is the flaw? How can it be corrected?

*Which of the following is **not** correct regarding test questions?*

- a. Use of "all of the above" is not consistent with guidelines.*
- b. The distracters should not be longer than the correct answer.*
- c. Someone who knows the material should get the item right.*
- d. Someone who doesn't know the material should get the item wrong.*

- a. Question is grammatically inconsistent with some of the answers.
- b. There is no clearly best answer.
- c. Use of negative.
- d. Use of double negative.

4. In the sample test item below, what is the flaw? How can it be corrected?

Which of the following is not correct regarding test questions?

- a. Use of "all of the above" should be minimized.*

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- b. *The correct answer should be about the same length as the distracters.*
 - c. *Someone who knows the material should get the item right.*
 - d. *The question and answers should be grammatically consistent.*
- a. "Not" should be highlighted in the question.
 - b. Question is grammatically inconsistent with some of the answers.
 - c. There is no clearly best answer.
 - d. Use of double negative should be avoided.
5. In the sample test item below what is/are the flaw(s)? How can it/they be corrected?

Which of the following has been found to have a beneficial effect on general health?

- a. *Exercise.*
 - b. *Healthy diet.*
 - c. *Vitamins.*
 - d. *All of the above.*
- a. No clear correct answer.
 - b. Use of "all of the above".
 - c. Grammatical error(s) present.
 - d. A and B.

Field Testing

Insurance: Field testing checks for undetected flaws.

- Flaws in questions are often undetected by authors and experts who already know the material.
- Field testers should be representatives of the intended audience for the program/test. They should not be experts who already know the material.

Answers to Exercises

Exercise:

Does the question test the objective?

Objective	Question	Yes or No
Given a description of a diabetes patient, identify appropriate therapeutic recommendations.	Diabetes is most commonly found in which populations?	No
Given a description of a patient, identify appropriate therapeutic recommendations.	Which of the following is an appropriate therapeutic recommendation for Mr. Johnson (description attached)?	Yes

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Possible Revisions to Exercise Examples

1. *The use of which of the following factors is most likely to contribute to the cost-effectiveness of antithrombotic drug regimens used for VTE treatment?*
 - a. *The s.c. route of administration instead of the i.v. route.*
 - b. *An adjusted-dose regimen.*
 - c. *Laboratory monitoring.*
 - d. *A low-cost drug.*

2. *Pharmacists can promote the need for behavioral counseling for smoking cessation by explaining to a patient that*
 - a. *Only smokers who clearly understand the complexity of smoking this can successfully quit.*
 - b. *All smokers have psychological problems that require going to a counselor.*
 - c. *In order to quit smoking you need a plan that teaches how to cope with triggers to smoke.*

3. *Which of the following is **not** correct regarding test questions?*
 - a. *Use of "all of the above" should be avoided.*
 - b. *Response options should be of similar length and complexity.*
 - c. *Someone who knows the material should get the item right.*
 - d. *Someone who doesn't know the material should get the item wrong.*

4. *Which of the following is **not** correct regarding test questions?*
 - a. *Use of "all of the above" should be minimized.*
 - b. *The correct answer should be about the same length as the distracters.*
 - c. *Someone who knows the material should get the item right.*
 - d. *The question and answers should be grammatically consistent.*

5. *Which of the following has been found to have a beneficial effect on general health?*
 - a. *Exercise.*
 - b. *Diet pills.*
 - b. *The "Grapefruit Diet."*
 - d. *The "Ice Cream Diet."*

*From: PSAP V Editorial Board, "Constructing Written Test Questions for the Basic and Clinical Sciences", adapted from: Case SM, Swanson DB. National Board of Medical Examiners, 3750 Market Street, Philadelphia, PA 19104, 1996.

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