ABSTRACT

Writing high-quality test questions is not an easy task. This report offers a brief summary of how to write more effective multiple choice questions and reasoning questions based on the principles of adult learning theory. The intent of this article is to present a brief overview of information for readers at a formative level who are interested in basic question-writing tips.

The underlying principles of adult learning were described by Knowles. His basic learning theory was that adult learners (andragogy), as opposed to children (pedagogy), differed significantly in learning characteristics. He noted that adults are independent learners who want to take control of their own learning.

Adults bring a reservoir of experiences that provide a rich resource for learning. They are the most ready to learn when they experience a need to learn to cope with a real life task or problem. “Authentick” activity as noted by Merriam brings about the most significant learning. Adult learners want to apply whatever knowledge they gain and put it to work immediately. Adults tend to take errors personally and are more likely
to let mistakes negatively affect their self-esteem. Adults need to be able to integrate new ideas with what they already know. Tying new information to experience and current knowledge is critical for the efficient storage and retrieval of new information.

One of the ways the American Journal of Physical Medicine & Rehabilitation supports this androgenous concept of self-directed learning is by offering continuing medical education through CME articles, with test questions included for self-assessment and evaluation. This program requires not only excellent articles but also well written test questions. Writing good questions for self-assessment is somewhat more difficult than it might at first appear. Fortunately, most authors of articles can learn to write sound test questions by following a set of guidelines.

Good test question writing begins with identifying the most important information or skill that is to be learned. Good questions should be closely linked to the objectives of the article, should focus on important content that is relevant to the practice of the specialty, and should avoid testing the knowledge of medical “trivia.” Controversial items should also be avoided, especially when the knowledge is incomplete or the “facts” are seriously debated.

Determining the appropriate test questions can often be facilitated by reviewing the major subtopics of the article, as well as finding topic sentences that summarize main ideas or principles. Once this content information has been established, the key facts should be written down as simple declarative sentences. This creates a clear picture of what you want your reader to learn from the article.

The use of clinical vignettes can be an effective means of assessing application of knowledge. For example, instead of asking examinees to identify the muscles innervated by a cranial nerve, provide a set of physical findings and ask examinees to identify the most likely site of the lesion.

Patient and laboratory vignette questions offer several benefits. First, the “face validity” of the examination is greatly enhanced by the requirement of problem-solving. Second, items are more likely to focus on important information, rather than trivia. Third, it helps to identify those examinees who have memorized a substantial body of factual information but are unable to use that information effectively.

There are many types of test questions. Those that use problem-solving and critical reasoning are at a higher level of cognition than those questions requiring the examinee to only define, identify, or recall information. Multiple choice questions are often preferred, because they require analysis and understanding of content, allow a relatively quick response, and permit rapid and objective scoring.

MULTIPLE CHOICE QUESTIONS

Developing high-quality multiple choice questions requires some skill and considerable practice. The following suggestions are summarized from Raymond's Guide to Test Item Development.3

A multiple choice test item consists of a statement that presents a problem followed by a list of possible solutions. The statement, usually one or two sentences, is called the “stem.” The alternative solutions are referred to as the “options.” The correct answer is generally called the “keyed response,” and the remaining options are the “distracters.” There should be only one clearly correct option to the informed examinee. The distractor options can be written as the following: (1) plausible but incorrect; (2) correct but not pertinent to the problem posed in the question; (3) incorrect but related to the correct answer.

The question should generally be structured to ask for the correct answer, not a “wrong” answer. Negatively posed questions are recognizable by phrases such as “which selection is not true,” “all selections except,” or “which option does not apply.” Negative questions tend to be less effective and more difficult for the
participant to readily understand. Five options are typically considered to be the best number of choices to offer, and they should be generally homogeneous in terms of content level of detail and length. Options should “fit” with each other and with the question. For example, if you ask, “Which therapeutic modality is most appropriate for the treatment of chronic back pain?,” ensure that all five options ARE therapeutic modalities, with no options on other topics such as diagnostic tests. Two of the most common formats for multiple choice questions are direct questions and incomplete statements.

Direct Questions
This format simply requires the examinee to recognize the correct response to a direct question. One advantage of this format is that it states a single unambiguous problem. Beginning writers often prefer this format.

Direct Question Example
What is the average life expectancy of a patient with Duchenne muscular dystrophy?

- a. 12 years
- b. 20 years
- c. 6 years
- d. 50 years

Incomplete Statement
The incomplete statement format results from a revision of a direct question so that the examinee is asked to fill in the missing information in the statement or “stem.”

Incomplete Statement
The average life span is _____ years for a patient with Duchenne muscular dystrophy.

- a. 12
- b. 20
- c. 6
- d. 50

Avoid writing the incomplete statement as an undirected stem. This is a stem that does not present a clearly defined problem. The examinee is forced to read the options to determine the question.

Example of an Undirected Stem
Muscular dystrophy patients:

- a. live to age 12 years
- b. live to age 20 years
- c. live to age 6 years
- d. live to age 50 years
In general, an undirected stem can be avoided by following this rule: An item should be written so that the correct response can be generated without having to read the options. If the item cannot be answered with the options hidden from view, the stem needs to be revised.

Back to Top

A SUMMARY OF GUIDELINES FOR WRITING MULTIPLE CHOICE QUESTIONS

1. The stem and response options should be constructed so that there is only ONE best answer. Distracters should be plausible; they may be partially correct, but there must be clearly one best answer.

2. Whenever possible, five response options should be used. Implausible, trivial, or nonsense distracters should be avoided. Four good response options are preferred over the use of five options that include a nonsense distractor.

3. Make the distracters appear as similar as possible to the correct answer in terms of grammar, length, and complexity. There is a common tendency to make the correct answer substantially longer than the distracters—a clue to the test-wise examinee.

4. The use of “Each of the following is correct EXCEPT” or “Which of the following is LEAST likely” is generally discouraged, because this format requires the examinee to switch from positive to negative thinking. Care should always be taken to avoid double-negatives.

5. “All of the above” should not be used as an option.

6. Using “None of the above” as an option should be used sparingly, if at all. It should only be used when it seems logical to avoid naming the correct response among the options.

7. Use clear and concise language and keep information that applies to all options in the stem. Do not repeat this information in the options.

8. Avoid trick questions. The goal is to help the examinee determine the extent of learning, not to block the process.

9. Avoid options that include offensive or unfair material to selected groups of examinees. Make sure any references to gender or race are necessary.

10. Remember to vary the placement of the correct option so the correct answer is not always in the same position among the options.

Back to Top

REASONING QUESTIONS

As learning concepts become more complex, measurement needs to be appropriately increased in complexity to accurately determine what has been learned. A reasoning item involves a cognitive process of three or more steps. It requires the examinee to recall information, to interpret the information, and then to apply the information to reach a conclusion.

Reasoning questions can be more challenging to construct and score, but they offer important learning opportunities. Merriam 2 noted that in the area of health care, developing critical thinkers is of the utmost importance.

Just as in the development of multiple choice questions, the critical content to be learned should be written down as declarative sentences. Key words, issues, or solutions that are essential to the answer should be noted. The examiner must determine in advance what specific information should be included in the examinee’s analysis or explanation. This process yields more standardized and objective scoring. To assist the test writer in deciding when a reasoning question is appropriate, the most common themes are listed below:

* Determine the effect or result of a development
* Compare, contrast, or identify the common factor
* Draw a conclusion from the data
* Provide an illustration or example
* Identify what is essential or necessary
* Explain the changes
* Apply a principle
* Determine the implication of a decision
* Identify the most reasonable next step

When deciding what test question will best measure understanding of content, it is helpful to consider the verbs used in the objectives at the beginning of the article. They can be strong indicators of the kind of item that will best measure the understanding of that objective. For instance, the verb “recognize” indicates a memory item. In contrast, if the objective refers to the examinee being able to “relate” clinical findings, this implies a three-step process. Examinees must recall what they know about the content, interpret the information, and draw conclusions.

Examples of common reasoning verbs are as follows: analyze, assess, calculate, categorize, compare, conclude, contrast, demonstrate, derive, diagnose, differentiate, discriminate, distinguish, estimate, evaluate, explain, extrapolate, generalize, predict, relate.

**TRUE AND FALSE QUESTIONS**

True and false questions are generally discouraged, because frequently the distinction between “true” and “false” is not clear, and the ambiguity gets in the way of valid assessment. The National Board of Medical Examiners no longer includes the true and false format on its examinations.

**SUMMARY**

Tests are a powerful influence on learning. They identify the key concepts to be learned. They motivate students to study. They also identify areas of deficiency that suggest a need for further learning.

In developing a self-assessment test, keep in mind that the goal is to HELP the participant focus on major content rather than on extraneous or unimportant details. Questions should be written clearly and concisely. When writing CME questions, it is almost always helpful to ask a colleague to read your article, respond to the questions, and offer feedback.

The goal for authors of an educational activity, such as a CME article with a self-assessment test, should be to ASSIST the participants in meeting their educational goals, rather than to deter the process. The best questions are written when you remember that adult learners prefer their learning activities to be self-directed, clearly defined, and relevant to their professional needs. Adult learners are problem-oriented and appreciate learning activities that tie theory to practice.

**REFERENCES**


Key Words: Test Question Writing; Continuing Medical Education; Self-Assessment; Adult Learning