Using MCQs for assessment of learning activities for Continuing Professional Development

Multiple Choice questions are the most commonly used type of assessment used for group 2 points. They easily assess learning objectives that are written in measurable terms *(see **Group 2 Learning Activities and Assessments)*** and appropriately and well-constructed MCQs can measure knowledge, comprehension, application and analysis.

Good MCQs are difficult and time consuming to construct – they must be well structured to ensure that:

- they are fairly assessing what is intended to be assessed

- they do not unintentionally 'provide' the answer to those who understand how MCQs work

- irrelevant sources of difficulty (eg complex question format, numeric data not stated consistently, the answer to one question depends on the answer to another etc) are avoided.

Ensure you identify what you are trying to assess before you start writing the question eg knowledge/recall or understanding/application. Each question should preferably assess application of knowledge rather than recall of an isolated fact, unless it is essential that the candidate know the particular fact.

The use of case studies is a good way to test application of knowledge. They do not have to be long to be effective.

Examples:

Knowledge/recall

What is the half-life of vancomycin in patients with normal renal function?
- A. 1 - 2 hours
- B. 4 - 6 hours
- C. 10 -12 hours
- D. more than 15 hours

Understanding/application

A 46-year-old female presents with complaints of a troublesome cough at night, nasal congestion and nasal itchiness. The symptoms have been present for the past few weeks. She states that she has nasal congestion most of the time but now the condition seems to have deteriorated.
She has been using oxymetazoline spray two puffs three times a day for the past two weeks. She has tried to use some tablets previously but has stopped them.

The patient:

- A. has perennial allergic rhinitis
- B. is allergic to house dust
- C. has a viral infection

Oxymetazoline:

- A. should only be used at night
- B. should be stopped
- C. is also available as an oral formulation

Writing effective and successful MCQs

<u>Components of MCQs</u>

MCQs consist of a ***stem*** and several ***options***. MCQ items present a problem or question in the stem of the question. The options provided are the possible answers and consist of a most-correct answer and up to four (usually) distracters or foils (incorrect answers). These need to be considered together when constructing the questions.

Example:

What is the chance of being correct if you select one of the following answers at random?

- **A. 10%**
- **B. 25%**
- **C. 50%**
- **D. 75%**

The stem is the question "*What is the chance of being correct if you select one of the following answers at random?*" The four available responses are the options. Option B is the correct answer and Options A, C and D are the foils or distractors.

<u>Words to be avoided</u>

Absolute terms such as *always, never, all* or *none* should not be used either in the stem or in the answer options. Words like *may, could be, associated with, is important* or *can* are clues for the correct answer and imprecise terms such as *seldom, rarely, occasionally, sometimes, few* and *many* are all relative terms and open to various interpretation.

Writing Stems

The stem should be written first and is best written as a complete sentence or question with the problem stated in the stem. Ideally the question should be answerable without having to read all the options.

eg *"What is the chance of being correct if you select one of the following answers at random?"* is better than ""*If you choose an answer to this question at random, the chance of being correct is...*"

Stems should be as short as reasonably possible but include all the relevant necessary information required to answer the question and not any superfluous or irrelevant information, nor should they be misleading or contain 'red herrings'. The stem should also include the common information required so that the options do not contain repetitive phrases:

eg Which of the following options would decrease *xxx* by 50%?

- A. Decreasing *abc* by 25%
- B. Decreasing *abc* by 50%
- C. Decreasing *abc* by 65%
- D. Decreasing *abc* by 80%

This would be better revised to:

By what percentage would *abc* need to be decreased to lower *xxx* by 50%?

- A. 25%
- B. 50%
- C. 65%
- D. 80%

Stems must be clear and unambiguous and written so that only one of the options can be validated and that option should be indisputably correct. When more than one answer contains some element of truth or accuracy, the candidate should be asked for the *best answer* rather than the *correct answer.*

Questions should ask for the *correct* answer rather than the wrong answer. *Avoid* phrasing questions like "Which of the following is not true?" or "All of the following except…" If a question has to be phrased like this, then the negative term should be highlighted (underlined, CAPITALISED, *italicised*) to ensure that it is obvious.

All questions must be independent of each other and not require the answer to one question to be necessary to answer another, or provide information in one question that gives the answer or clue to another question.

Writing Options

The best number of options is between three and five - you do not have to have the same number of options for each question.

Options should not include the phrases "*none of the above"* or *"all of the above".* The first causes problems if all the options are not absolutely true or false, and the second as only two options need to be recognised as correct for the option "all of the above" to be chosen as the correct answer.

Distractors/foils (the incorrect options) should be accurate and sensible statements that either do not fully meet the requirements of the question, or incorrect statements that appear reasonable to someone who has not learnt the material, but clearly incorrect. Implausible, nonsensical or trivial distractors should not be used.

Good distractors can often be identified by asking questions:

- What is this often confused with?'
- What is a common error interpreting this problem?
- What are common misconceptions in this area?

All options should be written in the same category as the correct answer ie all percentages, drug names, doses etc.

Write options that are grammatically consistent and logically compatible with the stem. All options should be as similar as possible to each other in terms of grammar, tense, length and complexity. The correct answer should not stand out because of the way it is phrased, or be conspicuously longer or shorter than the other options. Longer correct options are perhaps most common since it

is often necessary to add qualifiers to allow an option to be correct. These issues do not usually arise when the stem is written as a question.

Acronyms and abbreviations should be avoided unless they are clearly defined.

Options should be placed in logical and systematic order, if there is one ie alphabetical, numerical, chronological order, and be mutually exclusive eg if the options are ranges then the ranges should not overlap each other (1 - 2, 3 - 4, 5 - 6 NOT 1 - 2, 2 - 3, 3 - 4)

The positions of the correct answer should be randomised. Research shows that B or C is most often chosen by writers to place the correct option.

Summary of guidelines for writing effective MCQs[1,2]

Questions should:

- relate directly to the learning objectives for the activity
- test at the same level of learning as the objectives are designed to assess
- reflect different levels of learning (knowledge, comprehension, application and problem solving).
- reflect the relative importance of the topic within the activity
- be independent of each other

Stems should:

- provide a complete statement or question
- include only relevant information
- contain as much of the test question as possible
- be as short as possible (relative to the level of learning being tested)
- ask for the correct (not wrong) answer
- avoid absolute terms
- avoid imprecise terms
- avoid providing clues to the correct answer
- define acronyms and abbreviations
- be clear and unambiguous

Options should:

- follow logically and grammatically from the stem
- be similar in grammar, length and complexity
- follow a logical order
- have distractors that are plausible but clearly incorrect
- avoid *none of the above* and *all of the above*
- all be written in the same category
- be mutually exclusive
- vary the position of the correct answer.

[1] Collins J. Education techniques for lifelong learning: Writing multiple-choice questions for continuing medical education activities and self-assessment modules. RadioGraphics 2006;26:543-51.

[2] Constructing written test questions for the basic and clinical sciences, 3rd ed (revised) National Board of Medical Examiners 2002. Available from www.nbme.org/publications/item-writing-manual.html accessed 11August 2014