

A BRIEF GUIDE TO WRITING MCQS AND EMIS

Introduction

This short guide is intended to familiarise those involved in writing questions with the structure of Multiple Choice Questions (MCQs) and Extended Matching Items (EMIs) as well as provide helpful tips that lead to well written questions.

When MCQs and EMIs have been well written they are reliable and valid forms of assessments. Well constructed MCQs result in objective testing that can measure knowledge, comprehension, application and analysis. In order to generate valid scores well written questions satisfy two basic criteria:

1. They must address important content
2. They must be structurally sound, avoiding flaws that benefit the test-wise examinee and flaws of irrelevant difficulty.

Recall vs Application

MCQs and EMIs could be categorised according to those that test either recall of isolated facts (lower level learning) or application of knowledge (higher level learning). While there may be a place for recall items those which test application are preferable as they allow assessment of both an examinee's information base and their ability to use that information. A question that provides a vignette with specific patient information and asks the examinee to choose the most appropriate management is an example of an item that test problem solving ability.

In addition to assessing application of knowledge patient vignettes offer several benefits:

- They increase the validity of the exam as they require problem solving
- Such items are more likely to focus on important information, rather than trivia
- They help to discriminate between examinees who have memorised facts but are unable to synthesise and use the information effectively.

MCQs

It is generally agreed that the 1 in 5, single best answer type is far superior to any other multiple choice formats. An example of an MCQ is given in Table 1 below. A well constructed MCQ should consist of:

1. **The question stem.** The stem is usually just one or two sentences long. Wherever possible the question stem should be a clinical problem or vignette in order to test the application of relevant knowledge
2. **A lead in statement (optional)** explaining what the examinee is being asked to do. The lead in statement is sometimes included in the question stem
3. **Five options** set out in a logical (alphabetic or numeric) order.

Table 1
Example of an MCQ

Question Stem	You are teaching medical students about the differences between physiological Prion protein and pathological Prions which lead to the development of variant Creutzfeld-Jakob disease.
Lead in (Optional)	Which one of the following would you tell them about PrPsc (Prion Protein Scrapie)? It has a:
Options	a) amino acid sequencing difference b) bovine origin c) covalent bond difference from PrPc (normal Prion protein) d) higher beta sheet content* e) origin from infected blood

Important issues in writing MCQs

- 1) Issues relating to 'test-wiseness'. The 'test-wise' examinee can answer the question correctly based on their test taking skills alone by identifying various cues from the way the question is constructed.
 - Absolute terms such as 'never' and 'always' should not be used in options. This is because things are not usually 'never' or 'always' the case. Items that are less absolute are more likely to be true
 - Long correct answer: The correct answer is longer, more specific or more complete than others. Item writers tend to pay more attention to the correct answers than to distracters and this increases its visibility
 - Word repeat: A word or phrase being included in the stem and in the correct answer increases the likelihood that the examinee will guess the correct answer
 - The correct answer is not likely to be the outlier. For example, in numeric options the correct answer is more often the middle number than the extreme value.
- 2) Issues relating to irrelevant difficulty. The following issues make the question difficult for reasons unrelated to the trait that it is the focus of the assessment.
 - Items should not be long and complicated as reading speed is not being assessed. Decisions on stem length should be made in accord with the purpose of the item. Long options are only beneficial if examinees are required to interpret and synthesize information
 - Frequency terms (e.g. rarely, usually) should not be used in the options. Research shows that vague frequency terms are not consistently defined or interpreted, even by experts
 - 'None of the above' should not be used as an option. This turns the item into a true/false question. This could be replaced with 'no drug should be given at this time' where possible as this is similar but more specific
 - Do not write any questions of the form 'Which of the following statements is correct?' or 'Each of the following statements is correct EXCEPT'. These questions are unfocused and tend to have heterogeneous options.

EMIs

EMIs tend to be more valid than MCQs and can also be very reliable. They are more valid because they can test a more detailed application of knowledge and clinical reasoning skills. Typically, an EMI question stem is more detailed than that in an MCQ. It is usually in the form of a clinical vignette, which might also contain details such as the results of lab investigations or physical findings. It can also be supplemented with diagrams, pictures (eg radiographs or photographs), lab reports etc.

An example of an EMI is given in Table 2 overleaf. A well-constructed EMI should consist of:

1. a **theme**
2. the **option list**, set out in a logical (alphabetic or numeric) order
3. **lead-in statement** explaining what the examinee is being asked to do
4. At least three item **stems, usually clinical vignettes** describing the patient, infection etc.

Table 2
Example of an EMI

Theme	Drug Interactions
Options list	A) Amitriptyline B) Bupropion C) Fluoxetine D) Lithium E) Olanzapine F) Quetiapine G) St John's Wort H) Venlafaxine
Lead in statement	Which of the above medications may cause clinically significant drug interactions in each of the following vignettes?
Stems	<ol style="list-style-type: none"> 1. A 60 year old man on Warfarin has come back from a trip abroad when he developed some psychiatric symptoms. He was prescribed one of the above drugs. Which ONE of the above drugs would lead you to send him for an urgent INR? Correct answer: G 2. A young woman wants to start the combined oral contraceptive pill. You advise her that she will need to change which ONE of the above psychotropic medications, so as not to decrease the effectiveness of the pill? Correct answer: G 3. A 50 year old man with life-long psychiatric disorder is prescribed an ACE inhibitor for hypertension. He has been stable from the point of view of his psychiatric symptoms and you do not wish to change his treatment regime. With which ONE of the above drugs is most likely to cause a possible interaction? Correct answer: D

Steps for Writing Good MCQs and EMIs

1. Identify the theme
2. Produce a provisional option list of more than 5 items for an MCQ and at least 6 for an EMI
3. Select one item from the option list (or the number needed for an EMI if it is more than one) and write a vignette to which it (or they) would be the best answer
4. Add 4 further items from the provisional option list to make the 5 needed for an MCQ. For EMIs it is usually possible to use all of the remaining options in the final list
5. Arrange options in a logical order
6. Review the items. Give the item to colleagues without identifying the intended best answer to ensure that they agree with you. If there is genuine doubt, for an MCQ replace the confusing option(s) with spares from the original list; for an EMI remove confusing options from the list.

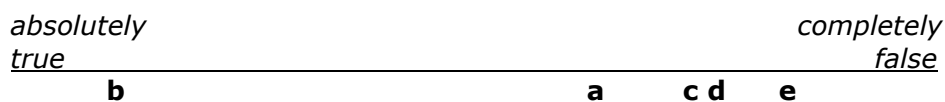
Options and Distracters

Extra care and attention must be paid to the options list. The difficulty and ability of a question to discriminate between high and low achievers is significantly affected by the appropriateness of the correct option and the quality of the distracters. Each incorrect option should be plausible but clearly incorrect. Implausible, trivial or nonsense distracters should not be used. Ideal options represent errors commonly made by examinees.

Distracters can be conceived by asking:

- What do people usually confuse this entity with?
- What is a common error in interpretation of this finding?
- What are the common misconceptions in this area?

Options must be able to be laid out along a single continuum from most correct to least correct. The most correct answer should be indisputably correct. This continuum can be diagrammed as follows:



Options should be homogeneous (e.g all diagnoses, tests, treatments). They should be able to be rank ordered from least to most true along a single dimension. The options list should not be a mixture of, for example, diagnoses, medications and clinical signs.

Tips for Writing Good Questions

- Do not waste important testing time on trivia. Concentrate on essential and important topics
- Aim to write more than 1 MCQ and, if possible, more than 1 EMI from each list of options. This then gives 'matched' items testing in the same domain for use in different diets of the exam
- Try to avoid EMI sets where there is a 'hinging' effect where the examinee has to get each item correct in order to get the next one right. It is difficult (but certainly not impossible) to write items like this that are fair and defensible
- When more than one option has some element of truth or accuracy but the keyed response is the best, the examinee should be asked to select the 'best answer' or 'most appropriate answer' rather than the 'correct answer'
- The level of reading difficulty should be kept low using simple language so that the item is not a test of the examinee's reading ability
- As a general guide, examinees can complete between one and two multiple choice items per minute. Items that significantly exceed this time to complete should be closely examined as to whether they are unnecessarily verbose or confusing
- Vignettes do not have to be long to be effective. Verbosity, extraneous material and 'red herrings' should be avoided.

References

- Case SM, Swanson DB. (2002). Constructing written test questions for the basic and clinical sciences. Philadelphia: National Board of Examiners.
- Fenderson BA, et al. (1997). The Virtues of Extended Matching and Uncued Tests as Alternatives to multiple choice questions. *Human Pathology* 28: 526 – 532.
- McCoubrie P. (2004). Improving the fairness of multiple-choice questions: a literature review. *Medical Teacher* 26: 709-712
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