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A Short Guide to MCQs and EMQs

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Introduction

MCQs and EMQs belong to the same family of test methods (technically known as selected-response item formats) and it is generally accepted that when well-written they are the most reliable of all assessment instruments.

I have developed an approach whereby, if required, MCQs and EMQs can be written together and also several questions testing the same domain can be produced. Both of these qualities are important in building an item bank.

Despite being relatively easy to write, poor MCQs and EMQs abound. There are six main reasons for the prevalence of poor items:

1. Obsolete, non-validated or inappropriate formats are used.
2. Items test simply the recall of facts, rather than application of knowledge.
3. Items test trivial, obscure or irrelevant material.
4. Wording is over-complicated (eg double - or even triple – negatives) or uses imprecise terms such as 'associated with' 'often' etc.
5. There is no clear 'best' answer.
6. The option list is not homologous but a mixture of, for example, diagnoses, medications, clinical signs etc.

MCQs

Although a multitude of MCQ formats have come and gone over the last 50 years or so, it is generally agreed that one is far superior to any of the others. This is the 1 from 5, single best answer (SBA) type. Apart from a variation – the 1 from 4 format, which is popular in N America (but potentially less reliable because of the greater chance of a candidate guessing the correct answer), all other designs are now considered obsolete. The single best answer format comprises a *question stem*, which is usually just one sentence long, although it can be a little longer. Wherever possible the question stem should be a clinical problem or vignette in order to test the application of relevant knowledge. The question stem is followed by a list of 5 *options*. **These must be homologous (eg all antibiotics) and set out in a logical (alphabetic or numeric) order.** Thus, a typical MCQ would look like this:

The anatomy of a multiple choice question

1. *This is the question stem. If possible it should be a short clinical vignette of one or two sentences, but not just a word or two.*
 - a) *this is option a*
 - b) *this is option b*
 - c) *this is option c*
 - d) *this is option d*
 - e) *this is option e*

Options a to e are short (often just a single word) homologous (eg all antibiotics, lab tests etc) and arranged in a logical order (alphabetic, numeric).

EMQs

EMQs were originally developed as a replacement for short answer questions (SAQs) because they can be machine-marked and they offer the same list of options to all candidates. Both of these factors are important:

- Mechanical marking is more accurate and very much quicker and cheaper than manual marking. This improves the utility of the method by making more effective use of resources.
- Providing the same option list to all candidates prevents the problem that, if left to their own devices, candidates often provide answers in SAQs that are partially correct, but might not be included in the answer key. This can lead to various inconsistencies between examiners (for example, some examiners might award some marks to such an answer even though it is not included in the answer key, whereas other examiners might not; or in other instances examiners might differ in their judgements about how to reward one partially correct answer compared with another). This, in turn, impairs the reliability (and, hence, utility, of the exam. On the other hand, not awarding any marks to a partially correct answer because it does not happen to be in the answer key might penalise the candidates, which will impair the validity and overall utility of the assessment.

Reliability and validity are important positive characteristics of EMQs because they 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 or a lengthier piece of analysis and clinical reasoning. This is because typically an EMQ question stem is more detailed than that in an MCQ. The stem 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, graphs, dental charts, pictures (eg radiographs or photographs), lab reports etc. The stem is followed by a list of options (this must be more than 5, is usually 10 to 20, but might be even more). Candidates are asked to select a specified number of responses from the option list. This can be more than one, but the number must be specified – the instructions should not give vague details such as ‘select up to four options’. (NB – EMQs requiring more than 1 answer are usually harder to write than those requiring a single best answer).

EMQs are often written in sets, to be used together in the same exam, where the same theme and option list is used for two or more different vignettes.

Structure of EMQs

EMQs have a specific structure, just as MCQs do. Candidates are orientated by being given the **theme** for each set of EMQs, followed by a **lead-in statement** explaining what the candidate is being asked to do. This is followed by the **option list**, set out in a logical (alphabetic or numeric) order. Finally, the **vignettes** are given. Thus, a typical EMQ would look like this:

Theme: Infections

Lead-in statement: For each patient with an infection, select the single most appropriate antibiotic from the option list. Each option might be used once, more than once, or not at all.

Option list:

- a) antibiotic a
- b) antibiotic b
- c) etc.....

1. (Clinical vignette describing the patient, infection etc – eg “a 50-year old farm worker presented at A&E with an injury to his right foot, which he spiked with a garden fork 3 days ago. He complained of...(describe complaints)...On examination...(describe findings). You take a swab for microbiological investigations and blood for FBC, ESR and blood cultures and the injury is dressed appropriately.

The most appropriate antibiotic to use at this stage, while awaiting laboratory results, is....

2. (Clinical vignette describing the next patient, infection etc)

3. (Clinical vignette describing the next patient, infection etc)

Important tips for writing good MCQs and EMQs

MCQs and EMQs are reasonably easy to write for most clinical specialties, but the way in which examiners traditionally set about the task can prove to be very hard work and usually results in rather poor items. I have developed the tips below put them into practice with examiners from many medical and dental specialties – and they work! Please try to use them:

- **Base questions on the curriculum.** The assessment programme must sample the curriculum widely – and potentially everything in the curriculum could be in the exam. However, if something is not in the curriculum it must not be in the exam.
- **Testing time is precious - do not waste it on trivia** – concentrate on essential and important topics, but you can also include some supplementary material.
- **Try to write in pairs or (even better) small teams.** These items are much harder to write alone and lone writers are more prone to making mistakes.
- **Don't write exam items when you are tired** – they are too important.

- **It is a good idea to write MCQs and EMQs together from the same option lists.** Aim to write more than 1 MCQ and, if possible, more than 1 EMQ from each list of options. This then gives ‘matched’ items testing in the same domain for use in different diets of the exam, which is extremely useful in producing an item bank.
- **Try to avoid EMQ sets where there is a ‘cascade’ effect,** ie where the candidate has to get each item correct in order to get the next one right. It is difficult (but not impossible) to write items like this that are fair and defensible, but it is always better to keep it simple!

- **Produce MCQs and EMQs using the following steps** (which is not the same order that most examiners use – but this works much better!):
 - **Decide on the theme** (eg infections)
 - **Produce a provisional option list** of *more than 5 items* for an MCQ and *at least 8* for an EMQ.
 - **Select one item from the option list** (or the number needed for an EMQ if it is more than one) and write a vignette to which it (or they) would be the best answer.
 - **Add 4 further items** from the provisional option list to make the 5 needed for an MCQ. For EMQs it is usually possible to use all of the remaining options in the final list.
 - **Arrange options in a logical order** (usually alphabetical or ascending numerical).
 - **Check** to make sure that the intended best answer really is clearly the best answer.

For MCQs, give the item to other people without identifying the intended best answer to ensure that they agree with you. If there is genuine doubt, replace the confusing option(s) with spares from the original option list.

In almost every EMQ it should be possible to correctly answer without looking at the options at all. This is one of the acid-tests for a good EMQ. If there is doubt about any options in an EMQ, remove the confusing ones from the list.

A final hint:

1. The ‘best’ option(s) must be just that – the best option(s). However, they do have to be the *only* correct answer, but must be clearly better than the rest. By the same token, other options in the list do not have to be absolutely false (in fact, it is much better if they are not) but they must be clearly less good than the ‘best’ answer. *Eg if the ‘best’ answer is ‘b’ the profile might be:*

<i>absolutely true</i>	b	a	c d	e	<i>completely false</i>

Further reading

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