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Constructing Written Test Questions for the Basic and Clinical Sciences

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Instruments of Written Assessment

- Open-ended question (“free-response,” “constructed-response,” and “supply-type” items) types
 - Very short answer questions
 - Short-answer/essay questions (SAQs)
 - Modified Essay Questions (MEQs)
- Fixed Response/Multiple-choice question types
 - Single-best answer
 - True/false
 - Extended-matching items (EMIs)
 - Key features

❖ categories of test items

1. **Objective items** which require students to select the correct response from several alternatives or to supply a word or short phrase to answer a question or complete a statement.
2. **Subjective or essay items** which permit the student to organize and present an original answer.

❖ categories of test items

1. Objective items

- multiple choice
- true-false
- matching
- Completion (very short answer)

2. Subjective or essay items

- short-answer essay
- extended-response essay
- problem solving (modified short essay)
- performance test items

Learning objectives

- To define and identify the characteristics of all open ended, positive supply questions (short answer and essay questions) as tools of written assessment in medical education.
- To learn how to construct each type of these questions.
- To consider advantages and limitations of these types of questions

Supply-type” items

Introduction

- Subjective test items are very versatile tools for assessing student learning.
- Again, there is a tendency for educators to believe that their development is simple and straightforward, but writing high-quality items requires a lot of practice.

Recent Trends:

HARDEN'S BLOG: MCQs are dead,

Posted: Jul 05, 2019 by [Ronald M Harden](#)

- **MCQs are dead**

I have been thinking a lot about assessment recently and that we need a fundamental change with regard to the tools we use and our overall approach. As John Cookson argued at the end of a recent ESME Online course, “MCQs have had their day and we need to move to Very Short Answer Questions”. This is a move I have previously promoted.

- The evidence is now clear that Very Short Answer Questions (VSAQs) where the learner responds to the question in one, two, or a limited number of words rather than selecting from a list of choices as in a MCQ offers major advantages.

Very short Answer Questions (VSAQs)

It is a more valid assessment tool and reflects the clinical decision process without the cuing that is inherent in the MCQ.

It eliminates the possibility of answering an item simply by chance. The VSAQ is more challenging and provides better discrimination than the MCQ.

In line with a move to authentic curricula we need to include open book exams and pay more attention to portfolio assessment.

In line with competency-based education we need to look at the implications of mastery learning for assessment and the use of badges and certificates. Professor Leonard Cassuto described the impact changes in assessment, including the use of certificates had on his course (<https://www.chronicle.com/article/Outcomes-Based-Graduate/246501>).

❖ Very short-answer question differs from short-answer essay

- Each VSAQ will usually consist of the question, a space for the candidate to provide an answer and the mark allocation for the question. A clinical scenario may be used to provide background information pertinent to the question.
- **When properly created, the very short-answer question (VSAQ) format is a RELIABLE, CONSTRUCTED-RESPONSE assessment tool.**

Very-short-answer questions: reliability, discrimination and acceptability

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Colin McVillo,⁵ Joanne Harris¹ & Karim Meenan^{1, 2}

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CONCLUSIONS The VSAQ format demonstrated high reliability and discrimination and items were perceived as more authentic. The SBAQ format was associated with significant cueing. The present results suggest the VSAQ format has a higher degree of validity

Example of an item showing the five response options in a single-best-answer question (SBAQ) format (left) against the acceptable variations of the correct answer that will automatically gain a mark in the very-short-answer question (VSAQ) format (right).

- A 24-year-old woman reports 2 months of lethargy, dizziness, weight loss and nausea. She has type 1 diabetes and reports erratic blood sugars and one episode of loss of consciousness. She has hyperpigmentation in her palmar creases and her oral mucosa. Her temperature is 36.8°C, pulse rate 101 bpm, blood pressure 78/61 respiratory rate 16 breaths minute¹ and oxygen saturation 99% breathing air. Her capillary blood glucose is 3.2 mmol/Litre.
- Investigations
- Sodium: 129 mmol/L (135–146)
- Potassium: 5.4 mmol/L (3.4–5.0)
- Urea: 7.7 mmol/L (2.5–7.8)
- Creatinine: 67 μmol/L (50–95)
- **What is the most likely diagnosis?**

What is the most likely diagnosis

MCQ

- A Addison's disease
- B Congenital adrenal hyperplasia
- C Cushing's disease
- D Hypothyroidism
- E SIADH (syndrome of inappropriate antidiuretic hormone secretion)

VSAQ

- Alternative Correct answers:
- Addison's disease
 - Addison's
 - Adrenal insufficiency
 - Primary adrenal insufficiency
 - Hypoadrenalism

Very short-answer question differs from short-answer essay

- A distinction should be made between completion—often referred to as fill-in-the-blank—and short answer questions.
- With very short answer (completion questions) the response is usually one or two words that fit on a line provided by the tester.
- Completion items are especially useful in assessing mastery of factual information when a specific word or phrase is important to know.
- They preclude the kind of guessing that is possible on MCQ items since they require a definite response rather than simple recognition of the correct answer. Because only a short answer is required, their use on a test can enable a wide sampling of content.

Very short answer (Insert and completion)

- The commonest form of completion questions is one where the student is required to add one or two words to complete an incomplete statement correctly.
- Where the missing words are in the body of the statement to be completed, it is usually called an insert type.
- A completion type is where the words are required at the end of the statement.

Very short answer (Insert and completion)

- The use of insert or completion questions is not, however, limited to written statements or clinical cases and can be used to prepare extremely good questions based on incomplete maps, drawings, diagrams, formulae, calculations, and the like.
- an online assessment management system, allows questions to be posed on an electronic platform in a VSAQ format requiring answers of one to four words

Suggestions For Writing Completion Test Items

1. Omit only significant words from the statement.

❖ Undesirable:

- Every atom has a central _____ called a nucleus.

❖ Desirable:

- Every atom has a central core called a(n) _____.

2. Do not omit so many words from the statement that the intended meaning is lost.

❖ Undesirable:

- The _____ were to Egypt as the _____ were to Persia and as _____ were to the early tribes of Israel.

❖ Desirable:

- The Pharaohs were to Egypt as the _____ were to Persia and as _____ were to the early tribes of Israel.

3. Avoid obvious clues to the correct response.

❖ Undesirable:

- Most of the United States' libraries are organized according to the _____ decimal system.

❖ Desirable:

- Which organizational system is used by most of the United States' libraries?
_____.

4. Be sure there is only one correct response.

❖ Undesirable:

- Trees which shed their leaves annually are _____.

❖ Desirable:

- Trees which shed their leaves annually are called _____.

5. Avoid grammatical clues to the correct response.

- If the indefinite article is required before a blank, use **a(n)** so that the student does not know if the correct answer begins with a vowel or a consonant.

❖ Desirable:

- A subatomic particle with a negative electric charge is called a(n) _____.

6. If possible, put the blank at the end of a statement rather than at the beginning.

❖ Undesirable:

- _____ is the measure of central tendency that is most affected by extremely high or low scores.

❖ Desirable:

- The measure of central tendency that is most affected by extremely high or low scores is the _____.

Examples For Writing Completion Test Items

- Among safety rules of vacuum extraction, the cup should be applied on the vertex as near as possible to and the head must be completely delivered, with no more than pulls.
- The sensations from distension of the perineum during second stage of labour are conveyed by
- Contrary to mediolateral episiotomy, Midline episiotomy carries the risk of.....
- A high level of hCG in the second trimester is the most sensitive marker for
- In the second trimester (over 13 weeks), the most accurate ultrasound parameter at determining actual gestational age is

Examples For Writing Completion Test

- A newborn 5-minutes after labour who has a vigorous cry, a heart rate of 110, active movement of all four extremities, grimacing with stimulation, and has bluish body, hands and feet, will have an Apgar score of
- When the active phase progress was presented as a line before the alert line on the partograph, the progress of labour is considered
- Iron deficiency anemia during pregnancy is defined as hemoglobin below.....
- Pregnancy is Post term when it goes beyondweeks.

Examples For Writing Completion Test: clinical Vignette

- A 55-year-old woman has a hysterectomy and bilateral salpingo-oophorectomy for abnormal uterine bleeding. Histologic examination of the ovaries shows small atretic follicles.
- The most likely cause of these histologic findings is(Apoptosis)

Examples For Writing Completion Test: clinical Vignette

- **A 35-year-old woman, gravida 3, para 2, at 39 weeks' gestation, comes to the labor and delivery ward with contractions. Past obstetric history is significant for two normal spontaneous vaginal deliveries at term. Examination shows the cervix to be 4 centimeters dilated and 50% effaced. The patient is contracting every 4 minutes. Over the next 2 hours the patient progresses to 5 centimeters dilation. An epidural is placed. Artificial rupture of membranes is performed, demonstrating copious clear fluid. 2 hours later the patient is still at 5 centimeters dilation and the contractions have spaced out to every 10 minutes.**
- **The most appropriate next step in management? Is to give**
(Intravenous oxytocin infusion)

Examples For Writing Completion Test: clinical Vignette

- During a football game, a player sustains a powerful blow to the lateral side of his weight-bearing leg. He experiences excruciating knee pain and is unable to walk. The three structures most likely to be injured are theand
.....and

(anterior cruciate and medial collateral ligaments and the medial meniscus)

Examples For Writing Completion Test: clinical Vignette

- An arteriogram is performed on a patient with atherosclerosis. Luminal narrowing of Would compromise blood flow through the renal arteries.
- (Abdominal aorta)

Examples For Writing Completion Test: clinical Vignette

- A 42-year-old man undergoes surgery for medullary carcinoma of the thyroid. After the surgery, he complains of a “noisy quality” to his voice. This condition was most likely caused by damage to.....
- (The recurrent laryngeal nerve)

Examples For Writing Completion Test: clinical Vignette

- During an automobile accident, a person sustains a “broken neck” and dies after a small bony fragment is driven into his spinal cord. this fragment is most likely derived from.....
- (Axis)

How to design a good Short Answer Question?

- Identify topic/concept/learning objective that requires exploring of different aspects such as diagnosis along with reasons to arrive to the diagnosis.
- Construct a statement /clinical vignette on the concept and link questions to it. It can be constructed to allow them to be posed in both SBAQ and VSAQ formats without any change to their content.
- Select appropriate wordings for each.
- Items are written with short case descriptions and test a range of cognitive processes, including clinical reasoning, decision making and knowledge recall.
- They should be independently reviewed to minimise construction errors.

How to design a good Short Answer Question?

- Design short answer items which are appropriate assessment of the learning objective
- Make sure the content of the short answer question measures knowledge appropriate to the desired learning goal
- Express the questions with clear wordings and language which are appropriate to the student population
- Ensure there is only one clearly correct answer in each question
- Ensure that the item clearly specifies how the question should be answered (e.g. Student should answer it briefly and concisely using a single word or short phrase? Is the question given a specific number of blanks for students to answer?).
- Consider whether the positioning of the item blank promote efficient scoring.

How to design a good Short Answer Question?

- Write the instructions clearly so as to specify the desired knowledge and specificity of response.
- Set the questions explicitly and precisely.
- Direct questions are better than those which require completing the sentences.
- For numerical answers, let the students know if they will receive marks for showing partial work (process based) or only the results (product based), also indicated the importance of the units.
- Let the students know what your marking style is like, is bullet point format acceptable, or does it have to be an essay format?
- Prepare a structured marking sheet; allocate marks or part-marks for acceptable answer(s).
- Be prepared to accept other equally acceptable answers, some of which you may not have predicted.

Tips for writing good short answer items:

Type of question	Avoid	Do use
All short-answer	<ul style="list-style-type: none">• Trivia• Long / complex sentences	<ul style="list-style-type: none">• Your own words• Specific problems• Direct questions
Fill-in-the-blank	<ul style="list-style-type: none">• Taking out so many words that the sentence is meaningless	<ul style="list-style-type: none">• Prompts that omit only one or two key words at the end of the sentence

Summary

- In a short answer question, the student types in a word or phrase in response to a question (that may include a image). Answers may or may not be case sensitive. The answer could be a word or a phrase, but it must match one of your acceptable answers exactly. It's a good idea to keep the required answer as short as possible to avoid missing a correct answer that's phrased differently.
- The [Quiz](#) and [Lesson](#) modules, formative assessment and summative ones all may have both short answer question types.

Open-ended question
("free-response,"
"constructed-response," and
"supply-type" items) types

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Short-answer essay (SAQs)

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SHORT ANSWER TYPE

- Short answer type questions are the type, that can be answered by a word or a few sentences.
- It uses a direct question.

CHARACTERISTICS of SHORT ANSWER TYPE

- Comes between objective and essay type.
- Can be answered in very few sentences.
- Is highly thought provoking.
- Can cover a wide range of content.
- It contains objectives individually like knowledge, understanding, synthesis, application, analysis and evaluation.

ADVANTAGES of Short Answer Questions

- It is useful in interpreting diagrams, charts etc.
- They are **relatively fast to mark** and can be **marked by different assessors**, as long as the questions are set in such a way that all alternative answers can be considered by the assessors.
- **Improved objectivity** as the marking scheme can be structured and predetermined.
- Higher chance for assessment of clinical reasoning.
- They can be used as part of a formative and summative assessment, as the structure of SAQs are very similar to examination questions, students are more familiar with the practice and feel less anxious.
- Unlike MCQs, there is **no guessing** on answers, students must supply an answer.

DISADVANTAGES of Short Answer Questions

- Accuracy of assessment may be influenced by handwriting/spelling skills.
- There can be time management issues as SAQs are not as easy to complete or score as MCQ or true-false questions.

LIMITATIONS

- It leads to rote learning.
- Personal bias of teacher and students are involved.
- It can not test the expression ability of students.
- Writing skill can not be measure properly.

LIMITATIONS

- Appropriate selection of words is essential.
- Construction of vignette and the key require careful deliberation.
- If breadth of knowledge is to be tested, MCQs are a better option.

Suggestions while constructing

- Avoid the irrelevant clues.
- Ensure that tests measure more than the memorization of factual knowledge.

❖ What is an essay / structured essay / modified essay type question?

An Essay question is a type of evaluation system which permits the examinee (student) to write in his own words a free and extended response to the problem presented and thus reveals information regarding the student's mental process.

❖ short-answer essay

➤ Question Structure

- Verbs such as “explain,” “outline,” “define” and “compare” tend to lead to longer whereas “list” and “name” lead to shorter essay.
- The question must give an explicit expectation of what information is required in the response?
- E.g List FIVE appropriate medications to

❖ Improving SAEQs

Poor SAEQ

You see a 45-year-old man in your office for headaches. The man has six children between the ages of 1 month and 10 years. He is not on any medications. He denies the use of alcohol or recreational drugs. He is not currently sexually active. The headaches started one year ago and have been increasing in frequency. They now occur four to six times per month. With each headache he misses three to four days of work. You suspect he suffers from migraine.

- a) List SIX features of migraine.
- b) List TWO medications for migraine.

Improved SEAQ

You see a 45-year-old man in your office for headaches. The headaches started one year ago and have been increasing in frequency. They now occur four to six times per month. With each headache he misses three to four days of work. You suspect he suffers from migraine.

- a) List FOUR clinical features of migraine. (2 marks)
- b) List TWO prophylactic medications for migraine. (2 marks)

❖ This SAEQ has been improved by:

- a) being more directive and less general so candidates can provide answers you expect
- b) removing excess wording that does not contribute to the question. Clinical scenarios appear to make the question more relevant but are optional.
- c) indicating the score allocation to the candidate.
- Note that the number of responses requested significantly changes the difficulty of the question.

❖ This SAEQ has been improved by:

a) clarifying the expectations for the candidate.

b) focusing the intent of the question (test important clinical knowledge (other congenital anomalies associated with agenesis of the pectoralis muscle) rather than obscure facts (definition of Poland syndrome).

The answer key is more reliable when decisions can be made ahead of marking time in situations where there may be confusion.

Poor SAQ	Improved SAQ
List the clinical features found in Poland syndrome. (Four marks)	List FOUR clinical features found in Poland syndrome (agenesis of the pectoralis muscle). (Four marks)

❖ Improving SAEQs

Poor SAEQ

51 year old man is diagnosed with Barrett's esophagus.

A List 3 treatment options that you would recommend? (6)

B Outline the pathogenesis of Barrett's esophagus. (8)

C List the factors that aggravate gastroesophageal reflux disease. (4)

D List 2 benefits and disadvantages to the long-term health of this patient of enrolling him in a surveillance program. (2)

Improved SAEQ

51 year old man is diagnosed with Barrett's esophagus.

A What are 3 treatment options that should be pursued? (6)

B List 4 steps in the pathogenesis of Barrett's esophagus. (8)

C List 2 factors that aggravate gastroesophageal reflux disease. (4)

D List 2 benefits to the long-term health of this patient of enrolling him in a surveillance program. (2)

E List one ongoing clinical issue that needs to be addressed pertaining to the long-term health of this patient of enrolling him in a surveillance program. (2)

❖ This SAEQ has been improved by:

- a) Removing the use of the word “outline” as it implies an essay type question. Verbs such as “outline”, “describe”, “summarize”, etc. should be avoided in SAQs.
- b) Not asking for opinions. Candidates should not be asked to state their preference for treatment, tests etc. (what would you do?) as such an answer could reflect common practice or available options in a particular environment, rather than the correct approach.
- c) Stating the number of responses in the question that reflect answer expectations.
- d) Using direct questions when possible.
- e) Be careful when using the word ‘and’ because it may indicate that more than one question is being asked. Be clear what is expected.

❖ SAEQ (short-answer essay) Quality Checklist Review

1. Does the question clearly outline what is to be evaluated?
2. Does the candidate have clear expectations of what they should write?
3. Can raters consistently mark the question?
4. Questions are in-line with their objectives.
5. Questions are realistic and relevant for the purpose of the exam.
6. Candidates have clear expectations of what they should write for each question/sub-question.
7. Questions are direct.

❖ SAEQ (short-answer essay) Quality Checklist Review

8. Questions/sub-questions have a single focus.
9. Wording is clear and unambiguous.
10. Questions are not short/long essay questions.
11. Questions use action verbs such as 'List' or 'Name', when appropriate.
12. Words such as 'Discuss', 'Describe', 'Summarize' and 'Outline' are avoided.
13. Qualifiers such as 'most likely' and 'best' are used when necessary.
14. Questions limit the length of answers or specify a restriction when needed.

❖ SAEQ (short-answer essay) Quality Checklist Review

15. Questions specify the number of elements required.
16. Questions that focus on numbers are avoided (if used, they must have a clearly defined marking key and candidates must know how marks are allocated, i.e. if/how many marks are given for the answer/calculation/both).
17. Visual guidelines are provided to indicate how long an answer is expected.
18. Questions are not dependent on answers to other questions.
19. The number of marks for each question, sub-question, and each element required (e.g. list THREE...) are specified.
20. The mark allocation reflects the importance of each question.
21. Questions are at an appropriate level of difficulty and describe relatively plausible situations.

❖ SAEQ (short-answer essay) Quality Checklist Review

❖ Scenarios/Vignettes

22. Vignettes are not disproportionately long in relation to the value of their questions.

23. Cues are not provided in the vignettes.

24. Vignettes are at an appropriate level of difficulty and describe relatively plausible situations.

❖ SAEQ (short-answer essay) Quality Checklist Review Model Answers

- Marks are allocated to each sub-question and answer alternative.
- Marks allocated to answer alternatives reflect the value of those alternatives in relation to other answer alternatives (e.g. excellent answer (2), good answer (1.5), acceptable answer (1)...).
- The answer key is designed to ensure reliable scores.
- Marks allocated to questions/sub-questions reflect the importance/difficulty of those questions/sub-questions in relation to the other questions on the exam.
- Model answers are comprehensive.

❖ When to use Essay type Questions

- To assess students' **understanding of subject-matter content.**
- To assess students' **abilities to reason with their knowledge of a subject.**

❖ How should these Questions be constructed

1. Questions should be clear & specific & exact
limit should be set

2. **Avoid:** What do you think?
What is in your opinion?
Discuss?

Instead use: Enlist, Enumerate, Define,
Compare & contrast, State your reasons,
Describe.

3. **Match** the question to specific learning objective.
Communicate clearly to the students what is
expected.

❖ How should these Questions be constructed Cont....

4. Use **simple, clear and straight** forward language
5. No options- as better comparison But if options they should be from same topic and should match the difficulty level.
6. In "Write briefly..." type of questions qualify **how briefly into number** of words or lines of standard paragraphs (NOT PREFEERED).
7. **Scoring system:** Split the total marks allotted to each part of the question topic. May be indicated in the paper (e.g. 1+1+3+5).

❖ **Traditional Essay type Questions**

Discuss immunodeficiency disease. (10 marks)

❖ **Structured Essay type Questions**

Write an essay on primary immunodeficiency disease focusing on its classification, causes, clinical manifestations and laboratory diagnosis. (10)

❖ Modified Essay Question (MEQ)

A 3 days old neonate presents with H/o jaundice noted at 48 hours of age. Baby is full term and weighs 3 Kg. On examination, he looks pale & has a palpable spleen. Rest of the examination is normal.

- Q1. What are possible causes of this type of presentation?
- Q2. Which investigations will you order to arrive at the diagnosis?
- Q3. The bilirubin has been reported as 20 mg%. What would be your next line of action?
- Q4. If this baby is not managed well what can be the long term sequelae? (2+2+2+2)

Designing marking schemes for essay questions

- **Write a model answer for each question, if the subject matter permits.**
 - This can be a useful first step towards identifying the mark-bearing ingredients of a good answer.
 - It also helps you see when what you thought was going to be a 30-minute question turns out to take an hour!
 - If you have difficulties answering the questions, the chances are that your students will too!
 - Making model answers and marking schemes for coursework assignments can give you good practice for writing exam schemes

Designing marking schemes for essay questions

- **make each decision as straightforward as possible.** Try to allocate each mark so that it is associated with something that is either present or absent, or right or wrong, in students' answers.
- **aim to make your marking scheme usable by a non-expert in the subject.** This can help your marking schemes be useful resources for students themselves, perhaps in next year's programme.
- **aim to make it so that anyone can mark given answers, and agree on the scores within a mark or two.** It is best to involve colleagues in your piloting of first-draft marking schemes. They will soon help you to identify areas where the marking criteria may need clarifying or tightening up.

Designing marking schemes for essay questions

- **allow for 'consequential' marks.** For example, when a candidate makes an early mistake, but then proceeds correctly thereafter (especially in problems and calculations), allow for some marks to be given for the ensuing correct steps even when the final answer (or in cases/clinical problems, the diagnosis) is quite wrong.
- **pilot your marking scheme by showing it to others.** It's worth even showing marking schemes to people who are not closely associated with your subject area. If they can't see exactly what you're looking for, it may be that the scheme is not yet sufficiently self-explanatory. Extra detail you add at this stage may help you to clarify your own thinking, and will certainly assist fellow markers.

Designing marking schemes for essay questions

- **look at what others have done in the past.** If it's your first time writing a marking scheme, looking at other people's ways of doing them will help you to focus your efforts.
- **learn from your own mistakes.** No marking scheme is perfect. When you start applying it to a pile of scripts, you will soon start adjusting it. Keep a note of any difficulties you experience in adhering to your scheme, and take account of these next time you have to make one.

❖ Summary

- Use to assess students' understanding of subject-matter content and abilities to reason.
- Types: Traditional, Structured & Modified EQs.
- Recommended Action Words: Write, List, Define, Explain, Describe, Compare and Contrast, Enumerate, Classify.
- Criteria: Relevance, Validity, Reliability, Objectivity.



