



CONSTRUCTING EFFECTIVE MCQs

Dr S. O. Malomo

FWACP (Fam Med)

Goal and learning objectives

- To provide us with necessary information to be able to construct MCQs that are fair, clear, concise and ***measure the learning objectives in the training curricula***

At the end of the lecture participants will be able to:

- Plan MCQs
- Construct MCQs
- Evaluate MCQs for flaws
- Provide feedback to residents



Outline

- Introduction
- Planning the MCQs
- Writing the MCQ stem
- Drafting the Lead-in
- Composing the options
- Editing to avoid flaws
- Providing feedback

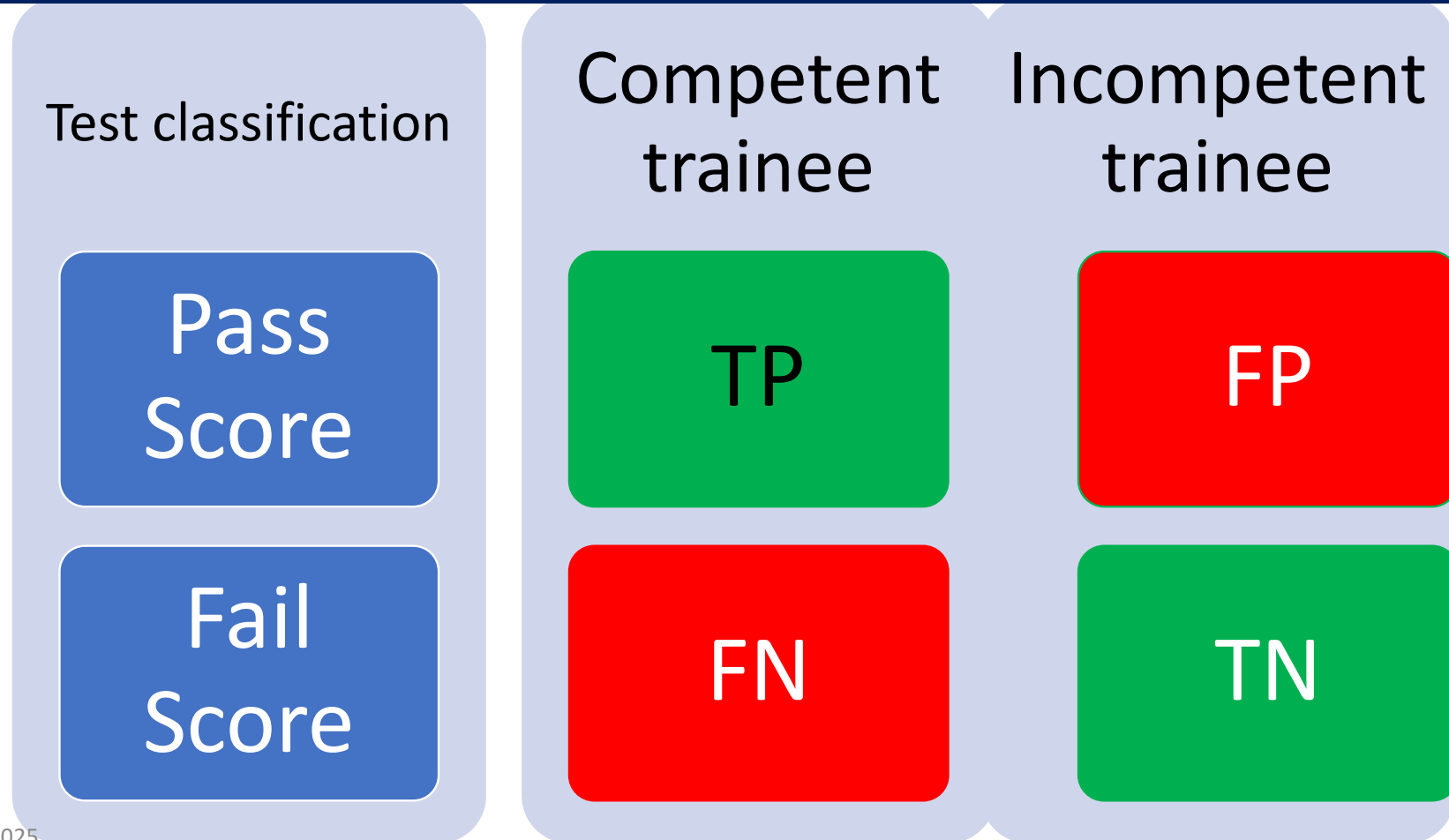


Functions of the College

- Organization of professional specialist postgraduate medical training.
- **Certification of specialists in various disciplines through a program of examinations**
- Accreditation of training institutions for conducting postgraduate medical training for the Fellowship of the College.
- Advisory role to the government.
- Provision, through its Fellows of specialized health care.



Examiners' concern: Misclassifications

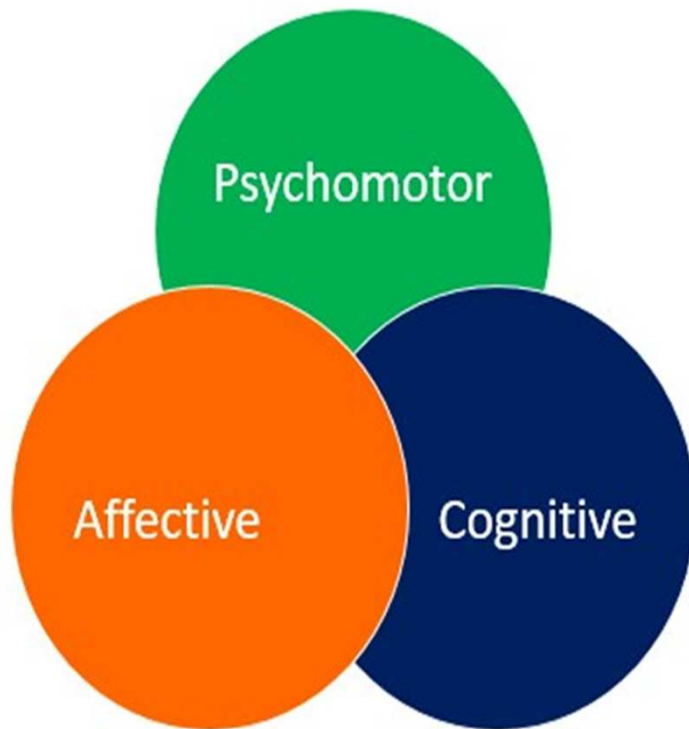


“Students can
escape bad
teaching, but
they can’t
escape bad
assessment”

David Boud 1995



Domains of Learning



Cognitive

- Intellectual skills, cognitive strategy and verbal information

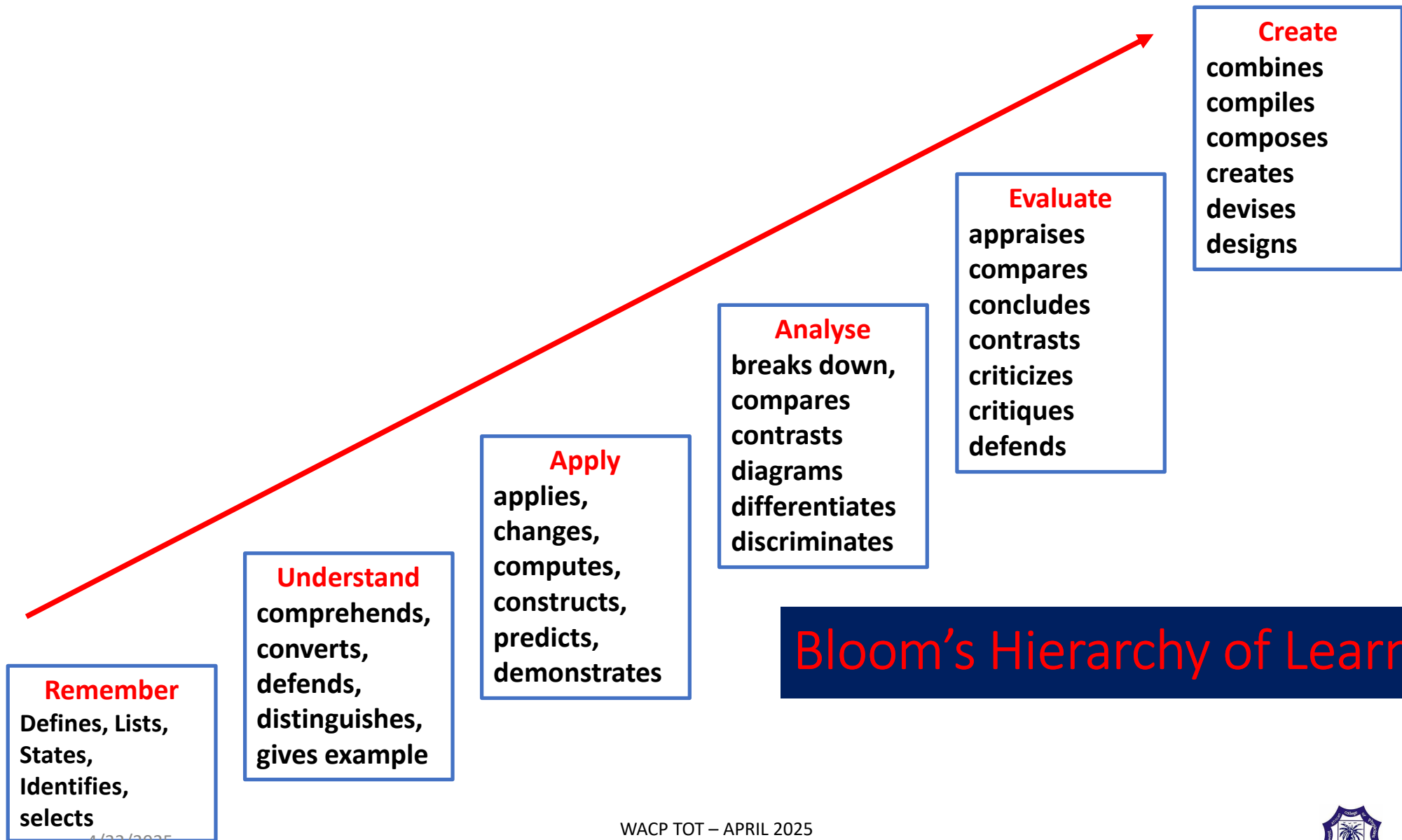
Psychomotor

- Physical actions, reflexes, interpretive movements and hand-eye coordination

Affective

- Affective skills and disposition for appropriate emotions and responses



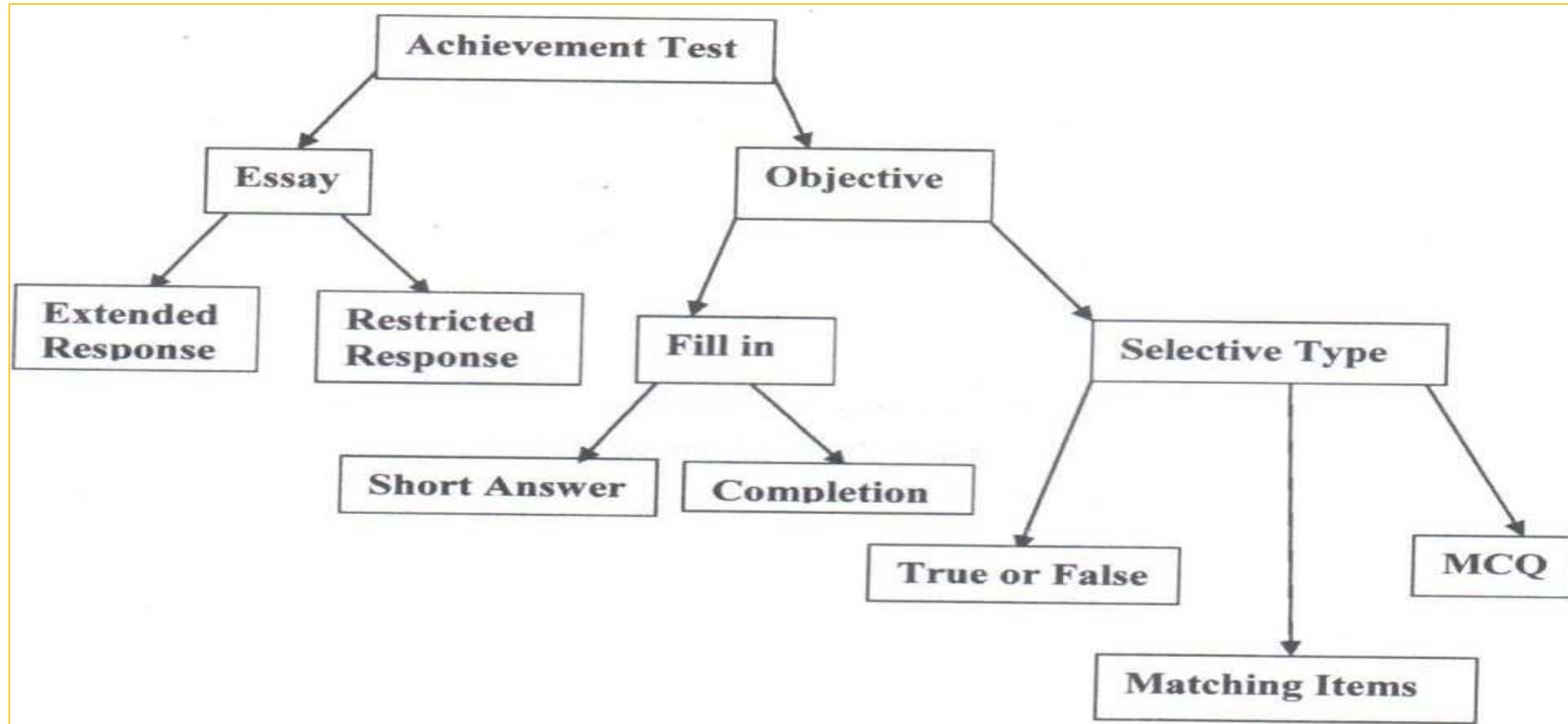


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FORMATS OF TEST



PROCESSES INVOLVED IN THE DEVELOPMENT OF TEST

- Behind every examination that measures whether a doctor is qualified, are rigorous test development processes.
- Major preoccupation of a Test Developer should be how to develop a test that is **valid, reliable, fair and secure**.
 - **Development and Review of Syllabus/Table of Specification**
 - **Construction of Test Items – SME**
 - **Editing and Moderation of Test Items**
 - **Authoring**
 - **Trial Testing**
 - **Banking**
 - **Deployment**



Multiple choice questions

- ***A multiple-choice question (MCQ) is composed of two parts: a stem that poses a problem and a set of alternatives or possible answers that contain a key that is the best answer to the question and a number of distracters that are plausible but incorrect answers to the question (Cohen and Wollack 2000)***



(Dis) or Advantages of MCQs

Advantages:

- Feasible: easy to mark; can be done in a class period
- Versatile: can cover a wide range of topics taught
- Versatile: tests wide range of higher order of learning
- Reliable; Valid

Disadvantages:

- Tendency for test takers to guess
- Time consuming to set
- Distractors may expose test takers to false information which may interfere with learning



MCQs in WACP examinations

- The MCQ has come to stay as a major assessment method in our examinations.
- Trainers need to use them for formative assessment of residents.
- The trainers and examiners also need to contribute MCQs into the Faculties questions bank.
- Faculties need to build a large pool of questions in the bank
- This presentation will attempt to remind us of some basic principles in constructing valid MCQs



Effective MCQs

- An effective mcq test item is one that validly test the specific learning outcome that it was meant to test
- An effective mcq paper is one that test an adequate sample of the subject and learning outcomes contained in the course curriculum based on a carefully developed table of specification/blueprint
- Such a paper will test the overall objectives of the course.



Planning the MCQ

- Working materials – Faculty curriculum, Test blueprint/Table of specification and relevant standard resource materials.
- Thorough review the Curriculum and learning objectives to be assessed.
- Subjects to be tested must be derived from the curriculum
- Competencies to be tested under each subject must be those stated in the learning objectives under that subject.



Table of specification – Memb CBT

s/n	Course Content & Membership Rotations	% Of Overall Content	Rotations (in weeks)	Credit Units	No of MCQs	Level 1 14%	Level 2 72.5%	Level 3 13.5%
1	Family Med (+ LM & PC)	12.0	12	12	24	4	17	3
2	Surgery	12.0	12	12	24	4	17	3
3	Maternal Health	12.0	12	12	24	4	17	3
4	Internal Medicine	8.0	8	8	16	3	11	2
5	Mental Health	8.0	8	8	16	3	11	2
6	Child Health	8.0	8	8	16	3	11	2
7	Accident & Emergency	8.0	8	8	16	3	11	2
8	Ophthalmology	4.0	4	4	8	1	6	1
9	Anaesthesia	4.0	4	4	8	1	6	1
10	Radiology	4.0	4	4	8	1	6	1
11	Com. Med & PHC	4.0	4	4	8	1	6	1
12	ENT	2.0	4	2	4	-	3	1
13	Laboratory Medicine	8.0	8	8	16	3	11	2
14	Oral Health	2.0	2	2	4	-	3	1
15	Research Methodology	2.0		2	4	-	3	1

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Planning the MCQ

- Learning objectives guide and direct student's learning experience while the MCQ assesses student's performance
- Clear and concise learning objectives deliver clear and concise MCQs
- A Learning Objective is a clear, concise and specific statement of observable student behaviors that can be evaluated at the conclusion of the learning activities.



Fam Med learning objectives on acute appendicitis

- **Discuss** the aetiology, pathophysiology, clinical features, diagnosis, investigations, treatment, surgical procedures and prevention
- **Carry out** the clinical competences of history taking, physical examination, investigations and diagnosis
- **Conduct** appropriate pre-operative, operative and post-operative management

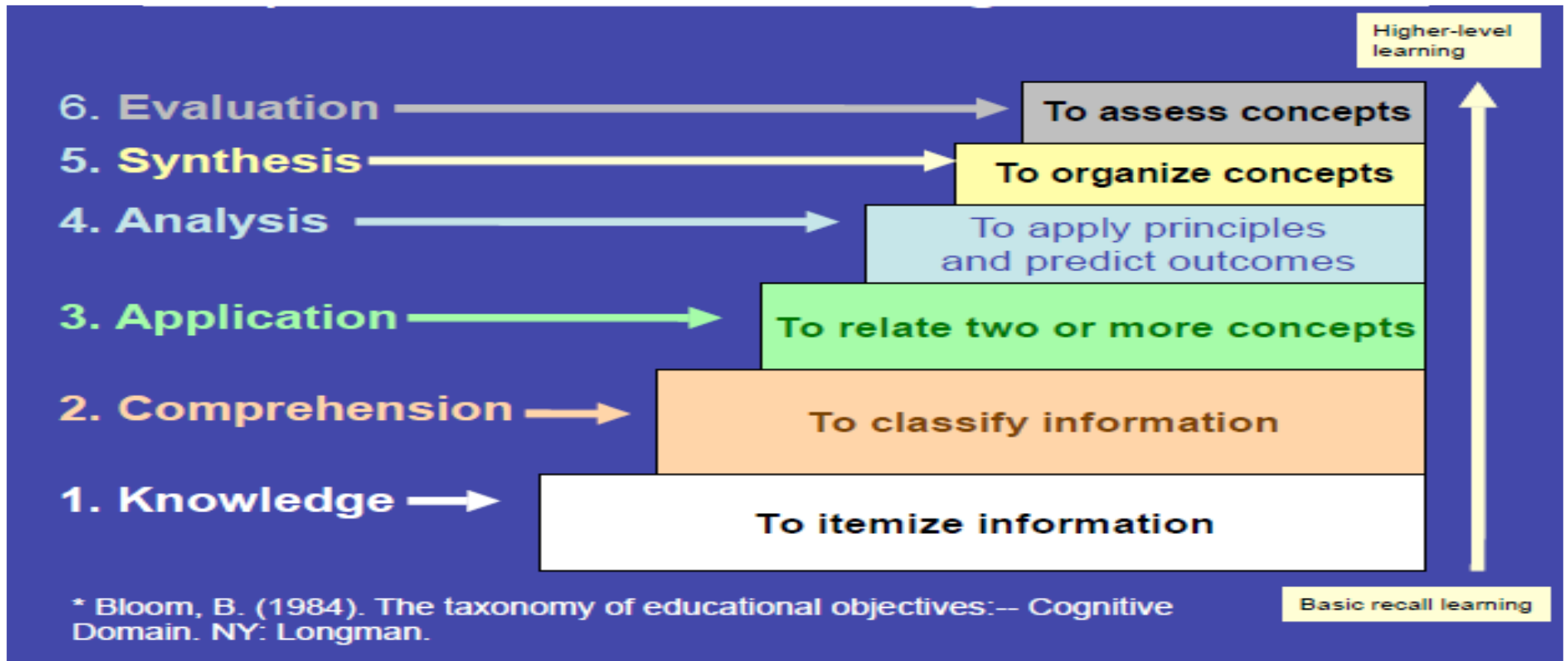


Planning the MCQ

- If the learning objectives of a subject is not clear and concise, it is better to stop and rewrite the objectives before proceeding to write MCQs.
- Determine a cognitive level
 - Level 1 - Recall and comprehension
 - Level 2 – Application and analyzing
 - Level 3 – Evaluating and sythesizing



Planning the MCQ



Structure of the MCQ

Simple

Long Stem: A MCQ item stem should contain all the relevant facts and be relatively long.

Lead-in: Asks the question

- A. Short Option
- B. Short Option
- C. Short Option
- D. Short Option

Case clusters

One patient presentation serves as a stem for several questions

A Lead - in

- Key
- Distracters

Another Lead - in

- Key
- Distracters



Extended matching items

Another format of MCQ is the Extended Matching items:

- A list of options on specific aspect of a subject(8-26) which will serve several questions that will follow
- A Lead – in for the questions to come
- Several patient presentations as a stems:
 - ✓ Scenario 1
 - ✓ Scenario 2
 - ✓ Scenario 3



Writing the MCQ stem

- The stem should give clear background to the question or problem to be addressed
- Easy to understand and free from ambiguity
- Focused on the core question
- Clearly indicate what the test taker needs to know or do to answer the question correctly
- Directly linked to the learning objective being assessed.
- Answering the item correctly must indicate competence in that learning outcome
- Focus on application – should test application of medical knowledge rather than just recall
- Clinical relevance – should present problems that would be encountered in clinical practice
- The best stems are real life encounters in the clinic, emergency, ward rounds, laboratories, diagnostic units, procedure rooms, theatre etc.
- May include socio-demographic data, presenting complaints, relevant history, physical findings, diagnostic studies, initial treatment etc depending on the learning outcome to be tested.



Writing the MCQ stem

- While the stem should provide all necessary information needed to answer the question it should avoid unnecessary details
- The stem should focus on specific clinical problem or concept
- It could end with an incomplete statement that the candidate needs to complete with the correct answer
- Problem/Solution Evaluation -- present a problem and proposed solution



Drafting the lead-in

- The lead in is the part of the question that follows the stem which instructs the candidate on what he needs to do to answer correctly.
- The stem presents the scenario or background information, while the lead-in specifies the task or question to be answered.
- It is often in the form of a question to be answered or a phrase to be completed
- The lead in should clearly concisely, and unambiguously convey the task or direction to the candidate



Drafting the lead-in

- It should directly relate to the stem
- It should allow the candidate to answer the questions without relying solely on the answer options
- The lead-in and stem should provide a complete and focused question that can be answered even without looking at the options
- There should be no place for trick questions

Sample Lead-ins

- What is the most likely diagnosis?
- What is the most appropriate course of action?
- Which of the following is the best explanation....

- *To test if the lead-in actually asks what you want to question, give the stem and the lead-in to a colleague without the options and see if the colleague's answers are similar to your options.*



Composing the options

- **The stem with the lead-in should be such that the test taker can provide possible answers without looking at the options**
- In fact, the only reason we are providing options in mcqs is to ease marking!
- **If an mcq item needs options before it can be understood or before possible answers can be provided, this is a proof that it is a bad mcq.**
- Options are the possible answers presented to the candidate
- They include the correct answer (Key) and incorrect but plausible answers to distract the candidate (distracters)
- Write the key (the one best answer) first
- Keep options similar in length, grammar, and style
- Ensure all options are plausible to make the question challenging
- Vary the position of the key
- Avoid 'all of the above' and 'none of the above'
- Use common student errors
- Avoid obviously wrong options



Composing the options

- Distracters serve to challenge the candidates' understanding and differentiate those who know the correct answer from those who don't or those who have partial knowledge
- Distracters ensure the validity and reliability of the assessment
- Characteristics of a good distracter:
 - plausible: should seem like a reasonable answer:
 - common student mistakes
 - a recurrent misconception about the topic
 - too general option, that is too broad to answer the question
 - too specific option, option focuses on one detail in the stem
 - not obviously wrong



Editing to avoid flaws

Edit for Test-wiseness: Student answers based on test-taking skills -

- Grammatical cues
- Logical cues
- Absolute terms
- Long correct answer
- Repeating word
- Convergence strategy

Edit for irrelevant Difficulty: question is difficult because of -

- Long, tricky and complicated stems
- Inconsistent data
- Unparallel language in options
- Illogical order of options
- “None of the Above” option
- Answer hinged to another item
- Imprecise terms



Providing feedback

- Provide an answer feedback sheet where each question is answered correctly with supporting information.
- This reinforces those who got it right and redirects those who got it wrong.
- Feedback should be appropriate, helpful and encouraging
- The Faculties should also make sample MCQs available to residents for practice along with answers and explanatory notes.
- Feedback should also be given to trainers who developed and submit questions to the Faculty



Evaluating quality of MCQs

- Cover test
- Difficulty index (0.3 – 0.7)
- Discriminatory index (> 0.2)
- Distractor effectiveness
- Peer review
- Internal consistency reliability
- Item analysis software
- Alignment with learning outcomes
- Standard setting for Pass/Fail decision



Evaluation of questions

Concerning Paget's disease of the nipple which of the following statements is **FALSE**?

- A. It carries a worse prognosis
- B. It forms 1% of all breast cancers.
- C. It is a primary carcinoma of the ducts
- D. It is a very uncommon form of breast cancer

Which of the following is **NOT** a cause of vitamin B12 deficiency?

- A. Resection of terminal ileum
- B. Intrinsic factor deficiency
- C. Blind-loop syndrome.
- D. Resection of ascending colon



Evaluation of questions

You have designed a study in which you will compare variables from the data collected from school children.

Which is an example of discrete variables?

- A. Gender of the students
- B. Height of the students
- C. The class the students are in
- D. Weight of the students

- A 72yr old woman with history of hypertension presents to you with a 2-day history of shortness of breath and cough. On examination, she was tachypneic and has crackles in the lungs bilaterally. Her oxygen saturation is 88% on room air.

What is the most likely diagnosis?

- A. Bronchial asthma
- B. Chronic bronchitis
- C. Hypertensive heart disease
- D. Pulmonary oedema



Evaluation of questions

- A 25-year-old man presents to the emergency department with a 1-week history of fever, headache, and stiff neck. Physical examination reveals meningeal signs. A lumbar puncture is performed, and the cerebrospinal fluid analysis shows elevated protein and low glucose. What is the most likely etiology of this patient's illness?
 - A. Group B Streptococcus
 - B. Neisseria meningitidis
 - C. Staphylococcus aureus
 - D. Streptococcus pneumoniae
- A 45-year-old man with a history of smoking presents to the clinic with a 3-month history of progressive shortness of breath. On examination, he has a barrel chest and hyperinflation of the lungs. His pulmonary function tests show a significantly reduced FEV1/FVC ratio. What is the most likely diagnosis?
 - A. Bronchial asthma
 - B. Bronchogenic carcinoma
 - C. Chronic bronchitis
 - D. Pulmonary tuberculosis



Recommendations

- Deliberate quality improvement programme on our assessment methods and tools across faculties
- Training and retraining of Examination committees on best practices in assessments: to be cascaded to Faculty examiners and trainers
- Acquire necessary software and expertise in CBT deployment, test items analysis, and questions banking
- Facilitate and mandate faculties to develop sustainable mechanisms for generating quality questions from examiners and trainers.
- Develop a secure database (bank) of standardized questions that have passed quality checks for all faculties



Summary

- Planning the MCQs
- Writing the MCQ stem
- Drafting the Lead-in
- Composing the options
- Editing to avoid flaws
- Providing feedback



References

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Thank you for your participation!

