Measuring What Students Know: Writing Effective MCQ Questions
What Can Student Assessments Do?

• Communicate important content and skills
• Provide basis for grading, passing, graduation
• Identify students with inadequate knowledge
• Identify areas of inadequate knowledge for remediation
• Motivate students to master content and skills in school and promote life-long learning in practice
Implications of Assessment

• Assessment is a critical tool in meeting curriculum goals

• Thus, there should be clear mapping between:
  Assessments;
  Knowledge, skills, and performance to be mastered;
  Course goals and objectives; and
  Curriculum goals and objectives
Basic Test Item Formats
Two General Categories

- Constructed-response formats
  - Short-answer Items
  - Essay Questions
  - Oral Exams
- Defined response formats
  - True/False
  - Multiple Choice Questions
  - Pick-N
  - Extended matching
Defined-Response Formats
True & False Items

- SEEM easy to write
- Most options do not fall at the extremes of the “truth” continuum

<table>
<thead>
<tr>
<th>Completely false</th>
<th>X</th>
<th>X</th>
<th>X</th>
<th>X true</th>
</tr>
</thead>
</table>

- The way to a man’s heart is through his:
  - T F Aorta
  - T F Pulmonary arteries
  - T F Pulmonary veins
  - T F Stomach

- Unless options are unambiguous, true-false are often more difficult than one-best-answer (e.g., MCQ) formats
Common Problems in True & False Items

- Tend to emphasize recall of isolated facts
- Stem is unclear
- Options contain vague terms
- Options are partially correct
Multiple Choice Questions

• Most common testing format
• “Select one best answer”

| Completely false | x | x | x | x | x | x | Completely true |

• Writing distractors is the hard part
  • “Each of the following is correct EXCEPT…”
• Use of multiple “truth” dimensions
Example of Multiple Truths

• Which of the following is true of pseudogout? (select the one best answer)
  A. It occurs frequently in women
  B. It is seldom associated with acute pain in a joint
  C. It may be associated with a finding of chondrocalcinosis
  D. It is clearly hereditary in most cases
  E. It responds well to treatment with allopurinol
Inheritance

Gender (A)

Rx

False

E

B

C

True

Associations
Pick-N

- Good alternative to MCQs with “all of the above,” “none of the above,” “A and D,” and “…EXCEPT…” options
- “Select all that are true” vs. “select the two best alternatives”
- Cognitively equivalent to a multiple true-false question
  - Can share some of the problems of true-false format, e.g., ambiguous truths, if framed as “Select all that are true”
A diet that is very low in major minerals (calcium, phosphorus, potassium, magnesium, iron) may be a contributing factor in the development of:

A. hypertension, osteoporosis, anemia
B. cancer, coronary heart disease, renal failure
C. obesity, gastrointestinal malabsorption, diabetes
D. none of the above
A diet that is very low in major minerals (calcium, phosphorus, potassium, magnesium, iron) may be a contributing factor in the development of: (select the best 3 answers)

A. anemia
B. cancer
C. coronary heart disease
D. diabetes
E. gastrointestinal malabsorption
F. hypertension
G. obesity
H. osteoporosis
I. renal failure
Extended Matching

A. Abdominal aneurysm  
B. Appendicitis  
C. Bowel obstruction  
D. Cholecystitis  
E. Colon cancer  
F. Constipation  
G. Diverticulitis  
H. Ectopic pregnancy - ruptured  
I. Endometriosis  
J. Hernia  
K. Kidney stone  
L. Mesenteric adenitis  
M. Mesenteric artery thrombosis  
N. Ovarian cyst -- ruptured  
O. Pancreatitis  
P. Pelvic inflammatory disease  
Q. Peptic ulcer disease  
R. Perforated peptic ulcer  
S. Pyelonephritis  
T. Torsion

• For each patient with abdominal pain, select the most likely diagnosis.
1. A 25-year-old woman has sudden onset of persistent right lower abdominal pain that is increasing in severity. She has nausea without vomiting. She had a normal bowel movement just before onset of pain. Examination shows exquisite deep tenderness to palpation in right lower abdomen with guarding but no rebound; bowel sounds are present. Pelvic examination shows a 7-cm, exquisitely tender right sided mass. Hematocrit is 32%. WBC is 18,000/mm3. Serum amylase activity is within normal limits. Test of the stool for occult blood is negative.

2. An 84-year-old man in a nursing home has increasing poorly localized lower abdominal pain recurring every 3-4 hours over the past 3 days. He has no nausea or vomiting; the last bowel movement was not recorded. Examination shows a soft abdomen with a palpable, slightly tender, lower left abdominal mass. Hematocrit is 28%. WBC is 10,000/mm3. Serum amylase activity is within normal limits. Test of the stool for occult blood is positive.
Writing effective defined response items
Technical Flaws

• Word repeats (#1)

1. The primary purpose of the stam is to remove the
   a. carm
   b. denton
   c. menice
   d. stam bar
Technical Flaws

• Logical cues (#2 & 4)

2. Which of the following is most closely associated with the Pikesburgh Agreement
   a. Stephen Douglas
   b. Robert E. Lee
   c. Abraham Lincoln
   d. James Madison
Technical Flaws

• Logical cues (#2 & 4)

4. How many pounds of pressure are exerted by a callam?
   a. 2.6
   b. 150
   c. 260
   d. 2600
Technical Flaws

• Convergence strategy (#3)

3. Which of the following pairs has won the greatest number of Abby awards?
   a. Jones & Smith
   b. Smith & Taylor
   c. Smith & White
   d. White & Allen
Technical Flaws

• Grammatical cues (#5)
5. The stanon is aided by a 
   a. anstel 
   b. immon 
   c. octal 
   d. port
Technical Flaws

• Absolute terms (#6)

6. The stanon frequently overheats because
   a. all anstels are belious
   b. no immon is directly fectitious
   c. ports are always actial
   d. the octal is usually casable
Technical Flaws

• Long correct answer (#7)

7. Stamation normally occurs when the
   a. anstels rupture
   b. immon falls and thedenton is in place
   c. octal rotates easily
   d. ports pass over the carm
Technical Flaws - Irrelevant Difficulty

- Options are long, complicated, or double
- Numeric data are not stated consistently (e.g., 0-20%, 35%, greater than 60%, 90%)
- Terms in the options are vague (e.g., “rarely,” “usually”)
- Language in the options is not parallel
- “None of the above” is used as an option
- Stems are tricky or unnecessarily complicated
- The answer to an item is “hinged” to the answer of a related item
General Guidelines

• Write items only on important concepts — avoid trivia
• Make sure the item can be answered without looking at the options
• Include as much of the item as possible in the stem
  Ideal item shape = long stem, short options
• Avoid superfluous information
General Guidelines

• Avoid “tricky” and overly complex items
• Avoid absolutes ("all" "never" "always") in options
• Avoid negatively phrased items
• Put options in alphabetical order
• Get a review from a typical user or at least a colleague
General Guidelines

• Write options that are:
  • Grammatically consistent
  • Logically compatible
  • Similar length
  • Plausible