Creating Multiple-Choice Questions That Test Critical Thinking

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INTRODUCTIONS

- Name
- Department
- One unique fact about yourself?
- What brought you here today?
- Confidence in creating good MC questions?
  - A=not at all confident
  - B=some what confident
  - C=pretty confident
  - D=very confident
AGENDA

- Multiple-choice question (MCQ) basics
- Bloom’s Taxonomy
- Incorporating Bloom’s Taxonomy into MCQs for higher-order (critical) thinking

LEARNING OBJECTIVES

- Identify components of MCQs
- Understand & apply the different levels of Bloom’s Taxonomy
- Create MCQs that contain higher levels of Bloom’s
CREATE YOUR OWN MCQ

- Take a moment and create your own multiple choice question.
- Some ideas for topics:
  - You!
  - Florida State University
  - Your research area

Multiple choice question

1. Rick Astley’s never gonna:
   - Give you up
   - Let you down
   - Run around and
   - Desert you
   - All of the above

Question Stem
Options
Distractors
Correct
To ensure the quality of multiple-choice questions, _____.

A. include several correct answer options
B. include qualifiers and absolutes
C. make some of the options and distractors negative
D. make all options and distractors similar in length
To ensure the quality of multiple-choice questions, _____.

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MCQ BASICS

- Responses, options, choices

To ensure the quality of multiple-choice questions, _____.

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To ensure the quality of multiple-choice questions, _____.

A. include several correct answer options
B. include qualifiers and absolutes
C. make some of the options and distractors negative
D. make all options and distractors similar in length
3. Find x.

Here it is.
MC ITEM FORMATS: INCOMPLETE STATEMENT

- Two formats
- Format 1: The student must select the option that correctly completes the stem

The capital of Florida is located in

a. Orlando.
b. Miami.
c. Jacksonville.
d. Tallahassee.
**MC ITEM FORMATS: INCOMPLETE STATEMENT**

- Format 2: The student must select the word or words that are missing from the statement

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The capital of _________ is located in Tallahassee.

  a. Alabama  
  *b. Florida  
  c. Georgia  
  d. Mississippi
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MC ITEM FORMATS: SCENARIO

- The student must answer by evaluating and drawing conclusions about the scenario provided.

John and Mary Smith left Jacksonville, Florida headed for Miami, Florida at 8:00 am. They are traveling in a car at a speed of 50 miles per hour. Assuming they drive straight through without any stops, and the distance between Jacksonville and Miami is 250 miles, at what time will they arrive in Miami?

a. 12:00 noon  
b. 1:00 pm  
c. 2:00 pm  
d. 3:00 pm
MC ITEM FORMATS: GRAPHICS

- Students must reference the provided graphic to answer

In the map of Florida depicted above, which city is the arrow pointing to?

a. Orlando
b. Miami
c. Jacksonville
d. Tallahassee
Returning to the MCQ that you created at the beginning of the workshop, how might you revise it to meet the guidelines we’ve discussed?
PIE BREAK!

ARE MULTIPLE CHOICE EXAMS AN ACCURATE MEASURE OF ONE'S KNOWLEDGE?

A. Yes
B. A and C
C. A and B
D. All of the above
CRITICAL THINKING

- Bloom’s Taxonomy Explained

Handout: Levels of Learning & Bloom’s Taxonomy

- Higher order learning that can be tested with MCQs

- Highest level: not appropriate for MCQs

- Lower order learning is what MCQs most often target
1. Who is the author of "Das Kapital"?
   A. Mannheim
   B. Marx*
   C. Weber
   D. Engels
   E. Michels

- Indicate which level of Bloom’s this question tests:
  - A – Analyzing
  - B – Applying
  - C – Remembering
  - D – Understanding
MCQS FOR LOWER-ORDER THINKING

- Remembering – recalling information

Learning Outcome: to recall the author of a specific book.

1. Who is the author of "Das Kapital"?
   A. Mannheim
   B. Marx*
   C. Weber
   D. Engels
   E. Michels

(Carneson, Delpierre, & Masters, 1996)
2. Reliability is the same as:
   A. consistency.*
   B. relevancy.
   C. representativeness.
   D. usefulness.

- Indicate which level of Bloom’s this question tests:
  - A – Analyzing
  - B – Applying
  - C – Remembering
  - D – Understanding
MCQS FOR LOWER-ORDER THINKING

- Understanding – Identifying examples of a given term, concept, or principle.

  Learning Outcome: to identify the meaning of a term.

2. Reliability is the same as:
   A. consistency,*
   B. relevancy.
   C. representativeness.
   D. usefulness.

(Gronlund, 1998).
MCQS FOR LOWER-ORDER THINKING

- Understanding – Interpreting the meaning of an idea, concept, or principle.

Learning Outcome: to interpret the meaning of an idea.

3. The statement that “test reliability is a necessary but not sufficient condition of test validity” means that:
   A. a reliable test will have a certain degree of validity.
   B. a valid test will have a certain degree of reliability. *
   C. a reliable test may be completely invalid and a valid test completely unreliable.

   (Gronlund, 1998).
MCQS FOR HIGHER-ORDER THINKING

Three approaches:
1. Real-world scenarios
2. Analysis of visuals
3. The answer plus the reason why
In the diagram below, parallel light rays pass through a convex lens and converge to a focus. They can be made parallel again by placing a:

A. Concave lens at point B.
B. Concave lens at point C.
C. Second convex lens at point A.
D. Second convex lens at point B.

- Indicate which level of Bloom’s this question tests:
  - A – Creating
  - B – Evaluating
  - C – Analyzing
  - D – Applying
MCQs for Higher-Order Thinking

- Analyzing – Analyzing charts, data to support conclusions.

Learning Outcome: to predict effects of lenses on light trajectory.

6. In the diagram below, parallel light rays pass through a convex lens and converge to a focus. They can be made parallel again by placing a:

![Diagram of light rays passing through a lens]

A. Concave lens at point B.
B. Concave lens at point C.
C. Second convex lens at point A.
D. Second convex lens at point B.
1. Suppose you are given two clay balls of equal size and shape. The two clay balls also weigh the same. One ball is flattened into a pancake-shaped piece.

*Which of these statements is correct?*

a. The pancake-shaped piece weighs more than the ball
b. The two pieces still weigh the same
c. The ball weighs more than the pancake-shaped piece

2. *because*

a. the flattened piece covers a larger area.
b. the ball pushes down more on one spot.
c. when something is flattened it loses weight.
d. clay has not been added or taken away.
e. when something is flattened it gains weight.

- Indicate which level of Bloom’s the **first part** of the question tests:
  - A – Creating
  - B – Evaluating
  - C – Analyzing
  - D – Applying
MCQS FOR HIGHER-ORDER THINKING

- Applying – Using information, rules, and procedures in concrete situations.

1. Suppose you are given two clay balls of equal size and shape. The two clay balls also weigh the same. One ball is flattened into a pancake-shaped piece.

   *Which of these statements is correct?*
   a. The pancake-shaped piece weighs more than the ball
   b. The two pieces still weigh the same
   c. The ball weighs more than the pancake-shaped piece

2. *because*
   a. the flattened piece covers a larger area.
   b. the ball pushes down more on one spot.
   c. when something is flattened it loses weight.
   d. clay has not been added or taken away.
   e. when something is flattened it gains weight.
1. Suppose you are given two clay balls of equal size and shape. The two clay balls also weigh the same. One ball is flattened into a pancake-shaped piece.

Which of these statements is correct?
- a. The pancake-shaped piece weighs more than the ball
- b. The two pieces still weigh the same
- c. The ball weighs more than the pancake-shaped piece

2. because
- a. the flattened piece covers a larger area.
- b. the ball pushes down more on one spot.
- c. when something is flattened it loses weight.
- d. clay has not been added or taken away.
- e. when something is flattened it gains weight.

- Indicate which level of Bloom’s the second part of the question tests:
  - A – Creating
  - B – Evaluating
  - C – Analyzing
  - D – Applying
MCQS FOR HIGHER-ORDER THINKING

- Evaluating – Justifying a decision or a course of action.

1. Suppose you are given two clay balls of equal size and shape. The two clay balls also weigh the same. One ball is flattened into a pancake-shaped piece.

   Which of these statements is correct?
   a. The pancake-shaped piece weighs more than the ball
   b. The two pieces still weigh the same
   c. The ball weighs more than the pancake-shaped piece

2. Because
   a. the flattened piece covers a larger area.
   b. the ball pushes down more on one spot.
   c. when something is flattened it loses weight.
   d. clay has not been added or taken away.
   e. when something is flattened it gains weight.
QUESTIONS?
WRAPPING UP

Thank you
RESOURCES

- Bothell, Timothy. Brigham Young University. 14 Rules for Writing Multiple Choice Questions. 
  https://testing.byu.edu/handbooks/14%20Rules%20for%20Writing%20Multiple-Choice%20Questions.pdf


- Clark, Chris. Writing Multiple Choice Test Items. 
  https://kaneb.nd.edu/assets/162168/mult_choice.pdf

- Teaching and Learning Services, McGill. Workshop: Designing Effective Multiple-Choice Questions. 

- University of Oregon Teaching and Learning Center. Writing Multiple Choice Questions that Demand Critical Thinking. 
  https://kaneb.nd.edu/assets/261652/mc_critthink.pdf