Icebreaker:

Break up into **groups of 5-6** and share:
- Name
- Department
- An example of a memorable homework or exam question.*
- How did that question enhance learning in the course?

*Either from your experiences as a student OR as an instructor.
In this session, we will:

- Compare advantages and disadvantages of different question formats.
- Discuss and apply best practices for question design.
- Create a multiple choice question which goes beyond simple recall of information.
- Design an open-ended question which measures both content mastery and higher-order cognitive abilities.
Ingredients of an Effective Exam

Valid, Reliable, Recognizable, Realistic

EXAM

OUTCOMES

Svinicki, 1999
Learning Outcomes

- What are the primary ideas, skills and behaviors student should acquire?
- What kind of question would best test for these learning outcomes?
- Does my homework, quiz, or exam actually assess my desired learning goals?
Bloom’s Taxonomy: Levels of Learning

- Knowledge
- Comprehension
- Application
- Analysis
- Evaluation
- Synthesis

What is your exam testing?

(Bloom, 1956)
What are the **advantages** and **disadvantages** of multiple choice versus open-ended questions?

Brainstorm on your own, then share your ideas with your neighbor(s).
# Multiple-Choice Questions

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be used to assess broad range of content in a brief period.</td>
<td>Difficult and time consuming to design good questions.</td>
</tr>
<tr>
<td>Skillfully written questions can measure higher order cognitive skills.</td>
<td>Possible to assess higher order cognitive skills, but most items assess only knowledge.</td>
</tr>
<tr>
<td>Can be answered and scored quickly.</td>
<td>Some correct answers can be guesses.</td>
</tr>
<tr>
<td>Reliable grading criteria</td>
<td></td>
</tr>
</tbody>
</table>

Piontek, 2008 (adapted from Worthen, 1993).
Open-Ended Questions
(Sequential Problem-Solving or Essay)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be used to measure higher order cognitive skills and conceptual understanding.</td>
<td>Time consuming to answer/score.</td>
</tr>
<tr>
<td>Relatively easy to write questions.</td>
<td>Difficult to grade reliably.</td>
</tr>
<tr>
<td>Difficult for respondent to get correct answer by guessing.</td>
<td>Limited range of content can be sampled during the exam.</td>
</tr>
<tr>
<td>Allows assessment of process and metacognition.</td>
<td>Dependence on sequence makes offering partial credit challenging.*</td>
</tr>
<tr>
<td></td>
<td>Poorly written questions test only “plug-and-chug” not conceptual understanding.*</td>
</tr>
</tbody>
</table>

* Sequential Problem-Solving

Piontek, 2008 (adapted from Worthen, 1993).
Break up into groups of 3-5

Recommend structural/phrasing changes that make your question more clear.

Identify the level on Bloom’s Taxonomy assessed by your question.

Modify your question to assess a higher level on Bloom’s Taxonomy.
Principles for Question Design

- Questions that assess only memorization reinforce the idea that content is learning.
- Design questions that ask *why* content matters.
- Provide students with information and then test their ability to apply that information using skills gained in the course.
Testing Higher Order Thinking with Multiple Choice

Patient WC was admitted for third-degree burns over 75% of his body. The attending physician asks you to start this patient on antibiotic therapy. Which one of the following is the best reason why WC would need antibiotic prophylaxis?

a) His burn injuries have broken down the innate immunity that prevents microbial invasion.

b) His injuries have inhibited his cellular immunity.

c) His injuries have impaired antibody production.

d) His injuries have induced the bone marrow, thus activated immune system

(Jeong Park, U-M College of Pharmacy, personal communication, February 4, 2008)
Nuts and Bolts of Multiple Choice

- Is the stem stated as clearly, directly, and simply as possible?
- Is the problem described fully in the stem?
- Is there irrelevant information?
- Is the stem stated positively? (Avoid NOT)
- Are distractors plausible?
- Are answers parallel in grammatical structure, length, and complexity?
- Are the options short? Are complex answers avoided?
- Are correct answers spread around? (A, B, C, D)

Piontek, 2008.
Find a group of **3-5 people** in your discipline:
[ Life Sciences, Physical Sciences, Social Sciences, Engineering ]

Select a **question topic** which is familiar to most in your group (suggestions provided).

Design **2-3 learning outcomes** around your topic.

Create a **multiple choice question** on your topic which assesses a higher order cognitive ability beyond declarative knowledge.

Create an **open-ended question** which allows students to demonstrate their thought process and problem-solving skills.
Wrap up: Your experiences today!

- Learning Outcomes and Bloom’s Taxonomy.
- Open-ended and multiple choice questions each have unique advantages.
- Basic practices for clear, well-written questions.
- Design of multiple-choice and open-ended questions which assess higher-order cognitive skills in your discipline.

Please turn in EVALUATIONS before you leave.
Further Reading

- Overview of Testing and Grading Issues: http://www.crlt.umich.edu/tstrategies/tsgi
  http://www.lifescied.org/content/7/4/368.full
- “Confessions of a Converted Lecturer,” Eric Mazur.
  http://www.math.upenn.edu/~pemantle/active-papers/Mazurpubs_605.pdf
- “Asking Good Test Questions,” Resources from CTE.
  http://www.cte.cornell.edu/teaching-ideas/assessing-student-learning/asking-good-test-questions.html
QUESTIONS?

Presenters: John Foo, Kendra Letchworth-Weaver
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