

# Writing effective questions for assessment

The art (and science) of question writing

## **Learning Goals:**

After today's meeting, TAs should be able to...

- 1) Understand the advantages and disadvantages of different types of assessment questions
- 2) Create assessment questions that are clear and concise, and engage different levels of student cognition

What is the purpose of assessment?

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## **Formative assessment**

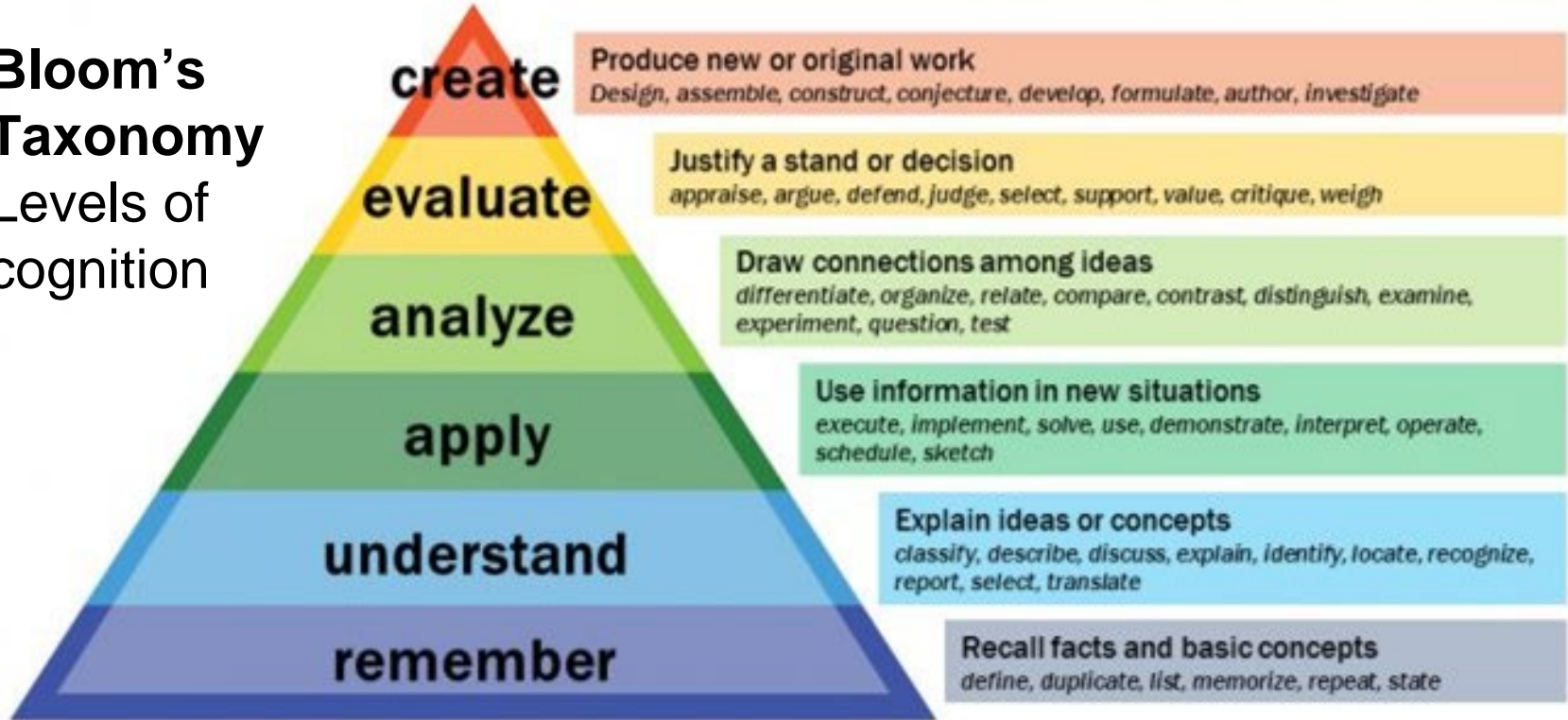
monitors student learning  
to provide ongoing  
feedback

## **Summative assessment**

evaluates student learning  
at the end of an  
instructional unit

# Defining what do you want the student to **do**

## Bloom's Taxonomy Levels of cognition



# Engaging different levels of cognition

Creating	
Evaluating	
Analyzing	
Applying	
Understanding	A virus has the following components [ _____ ]. <b>Explain</b> what type of virus this is likely to be.
Remembering	<b>List</b> components of the flu virus.

# Engaging different levels of cognition

Creating	Using your knowledge of the influenza virus, <b>design</b> a test to distinguish between two variants of influenza.
Evaluating	[Example of process to test for the flu]. <b>Justify</b> why this is the <i>best</i> process to test for the influenza virus.
Analyzing	How would you <b>distinguish</b> whether the patient is infected with the influenza virus vs. another common virus?
Applying	What tests could you <b>implement</b> to determine if a patient is infected with the influenza virus?
Understanding	A virus has the following components [ _____ ]. <b>Explain</b> what type of virus this is likely to be.
Remembering	<b>List</b> components of the influenza virus.

# Types of Questions

What you want the student to **do** will determine the type of question you should ask. Some common question types are:

- Multiple Choice (or Select All)
- True/False
- Short Answer

- How easy is it to prepare and grade this type of question?
- Will it allow me to diagnose student misconceptions?
- What level of cognition will it engage students in?
- Are there any structural limitations/pitfalls?



# Multiple choice/Select all

## Advantages

- Easy and quick to grade
- Can assess all levels of cognition
- Useful as a diagnostic tool (wrong choices can indicate misconceptions)
- Familiar to students

## Disadvantages

- Sometimes difficult and time-consuming to construct
- Encourages students to find the correct answer by process of elimination

# Revise the multiple choice question

Which of the following is a true statement?

- A. Mitochondrial genomes are relatively constant in content (i.e., types of genes present).
- B. Mitochondrial genomes are relatively constant in organization.
- C. Mitochondrial genomes are relatively constant in size.

Mitochondria evolved from free-living bacteria that could carry out oxidative phosphorylation. For this reason, they have circular genomes that reproduce independently of the nuclear genome. What characteristic is relatively constant in mitochondrial genomes across species?

- A. Content (i.e., types of genes)
- B. Organization
- C. Size

# Multiple choice pitfalls

Who gathered the data that helped reveal the structure of DNA?

- A. Francis Crick
- B. George Washington
- C. James Watson
- D. Rosalind Franklin
- E. Snoopy

Who received a Nobel Prize for discovering the structure of DNA?

- A. Francis Crick
- B. James Watson
- C. Rosalind Franklin
- D. A and B
- E. B and C
- F. A and C

The term hypothesis, as used in research, is defined as

- A. A conception or proposition formed by speculation or deduction or by abstraction and generalization from facts, explaining or relating an observed set of facts, given probability by experimental evidence or by factual or conceptual analysis but not conclusively established or accepted.
- B. A statement of an order or relation of phenomena that so far as is known is invariable under the given conditions, formulated on the basis of conclusive evidence or tests and universally accepted, that has been tested and proven to conform to facts.
- C. A proposition tentatively assumed in order to draw out its logical or empirical consequences and so test its accord with facts that are known or may be determined, of such a nature as to be either proved or disproved by comparison with observed facts.

# A few tips for construction

## Multiple Choice

- Write the correct response first, then the distractors (incorrect responses)
- Juggle the elements or variables of a correct response, or substitute a correct variable for one that students confuse it with to create distractors
- Make all responses grammatically parallel and about the same length

# True or False

## Advantages

- Usually easy to prepare and grade
- Can test a lot of material in a short time
- Can tap higher levels of cognition by having students correct false statements
- Useful as a diagnostic tool if students have to explain

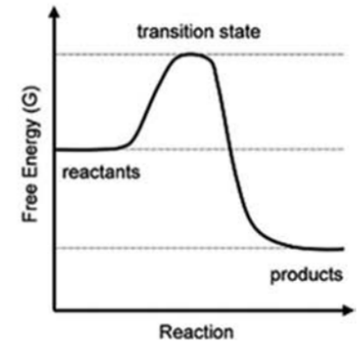
## Disadvantages

- High guessing factor
- May be difficult to think of unequivocally true or false statements
- Encourages instructors to test trivial factual knowledge
- Truly knowledgeable students may see too many nuances, multiple meanings, or conceive of exceptions

# Revise the True/False question

When an enzyme is added to a reaction, the reaction is always spontaneous. (True/False)

The diagram at right shows the free energy changes that occur during a chemical reaction. When a specific enzyme that catalyzes this reaction is added, the reaction goes from being non-spontaneous to spontaneous. (True/False)



The diagram at right shows the free energy changes that occur during a chemical reaction. When a specific enzyme is added that catalyzes this reaction, which of the following statements are true about the reaction? Select all that apply.

- The transition state energy level will decrease
- The energy level of the reactants will increase
- The energy level of the products will decrease
- The reaction will go from being non-spontaneous to spontaneous

# A few tips for construction

## True or False

- Focus each statement on a single idea
- Write positive statements (avoid negative or double negative)
- Avoid verbal cues (*usually, seldom, often, never, always, every*)

# Short Answer

## Advantages

- Easier to construct
- Can assess all levels of cognition
- Requires a command of vocab and problem-solving skills
- Very useful as a diagnostic tool
- Encourages instructors to give students individual feedback

## Disadvantages

- Time-consuming to grade
- Difficult to standardize grading due to variability across answers



# An example of a short answer question

*Prior knowledge:*

[Example from course that teaching assistants teach]

# A few tips for construction

## Short Answer

Be very specific and concise in identifying the task that students are to perform

- Identify all the key points students should address
- Instead of using *what*, *why*, or *how*, choose a descriptive verb that reflects what you want students to do

# Create your own question

Pick a current or upcoming topic from your course and identify a broad question related to the material (e.g. “How do you purify a protein?”)

On your own, revise this question to provide more focus (5 min)

- Write a statement answering the question - “what do I want my students to **do**?” (Bloom’s taxonomy)
- Use the Tips for construction to build your question

Share your question with a partner, and provide each other feedback. (5 min)

- Is the question clear and concise?
- What level of Bloom’s taxonomy does it ask students to engage with?
- Are there any ambiguities?

# Additional Tips

Consider the background of your students, and eliminate any unnecessary jargon

Papers, news articles, images, or every day observations can prompt a good question. Some common frameworks include:

- Describe setup, interpret data, predict results, etc. of an experiment
- What if a component broke, a step was skipped, or a mistake was made in a particular process?

If several questions on an assignment are based on a single scenario or set of information

- Minimize interlocking items
- A longer or more complex set-up = a longer series of questions (while still avoiding unnecessary information!)

## Exit Ticket:

+ What are you taking away from today's discussion of writing effective questions for assessment?

△ Is there anything you still have questions about?

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