Acknowledgments

• Clarissa Dirks, Evergreen State College
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Assessment Learning Outcomes

Participants will be able to:

- Use Bloom’s Taxonomy to evaluate assessments
- Use the principles of backward design to align learning outcomes with both formative and summative assessments
- Distinguish between formative and summative assessments
- Explain how formative assessment enhances student learning
- Describe the relationship between formative assessment and active learning
**THE MONTILLATION AND USES OF TRAXOLINE**

<table>
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<tr>
<th>It is very important to learn about traxoline. Traxoline is a new form of zionter. It is montilled in Ceristanna. The Ceristannians found that they could gristerlate large amounts of fervon and then bracter it to quasel traxoline. This new, more efficient bracterillation process has the potential to make traxoline one of the most useful products within the molecular family of lukizes snezlaus.</th>
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<tr>
<td><strong>QUIZ:</strong></td>
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<tr>
<td>1. What is traxoline?</td>
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<tr>
<td>2. Where is it montilled?</td>
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<tr>
<td>3. How is traxoline quaseled?</td>
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<td>4. Why is traxoline important?</td>
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BLOOM’S TAXONOMY MAY BE USED FOR EVALUATING ASSESSMENTS

Higher cognitive orders (HOCS)

Lower cognitive orders (LOCS)

Benjamin S. Bloom *Taxonomy of educational objectives*. Published by Allyn and Bacon, Boston, MA. Copyright (c) 1984 by Pearson Education.
What % of higher order Bloom’s level questions would you expect to find on an typical intro bio exam?

A. 0-20
B. 21-40
C. 41-60
D. 61-80
E. 81-100
Aligning with Bloom’s Taxonomy

• Use Bloom’s Verbs to categorize your assessment questions (page 20 of your booklet)
• Write learning outcomes that are aligned with your summative assessment questions
• Swap with a neighbor and check Bloom’s levels and alignment
• Give suggestions to increase the Bloom’s level if necessary?
Discussion

• How was your alignment?

• Were the learning outcomes that matched your questions the same as the ones that you have for your students?
Edu-Speak Demystified:

• Summative assessments
  – Exams, papers, presentations
  – Typically occur at the end of teaching
  – Usually major part of grade for the class

• Formative assessments
  – Classroom assessments, homework, online assignments
  – Occur during the teaching event
  – Provide regular feedback to both the instructor and the students during the learning process
So, how do we know what we know?
“… because as we know, there are known knowns; things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don’t know we don’t know.”

Donald Rumsfeld
“Ongoing assessment plays a key role – possibly the most important role – in shaping classroom standards and increasing learning gains.”

Black and Wiliam, 1998
Think-Pair-Share

- How do you know when you know something?
- How do you know when your students know something?
- How do your students know when they know something?
EnGaugements

• When you ask a student to do something, they are simultaneously engaged in learning and can gauge their progress by whether or how well they can perform.

  – Handelsman et al. Scientific Teaching.
Formative assessments help students confront misconceptions.
As the acorn grows into the tree, from where does the majority of the biomass come?

A. Air (pink)
B. Soil (yellow)
C. Water (green)
D. Sun (blue)
Formative assessments aid construction of new knowledge
Based on your understanding of natural selection and traits that vary along a continuum, explain the changes that occurred in the tree and dinosaur populations over time?

These represent the average for an entire population.
Formative assessments gauge students’ progress during learning
Darwin at the Olympics

• Work with your group to modify the 100-meter dash such that it would become an example of natural selection.
Representative answers

• “Add hurdles”
• “Make the runners run over rocky, uneven ground to select for the ones with best balance and speed”
• “Release a tiger behind the runners”
• “Kill the losers”
• “Only the first two runners across the finish line can reproduce”
Reflection

• What did you learn or experience in the role of student?
• What feedback did the assessments offer the students?
• How do you think this feedback compares with a traditional lecture classroom?
## Alignment

<table>
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<tr>
<th>Learning Goal</th>
<th>Learning Objective</th>
<th>Assessment</th>
<th>Learning Activity</th>
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<tbody>
<tr>
<td><strong>What will students learn?</strong></td>
<td>If they have learned it, what will students know and be able to do?</td>
<td>How will students demonstrate they know it or are able to do it?</td>
<td>What will students do to learn it?</td>
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<tr>
<td>Students will understand the transfer of information from DNA to proteins</td>
<td>Students will be able to predict changes in amino acid sequences caused by mutations</td>
<td>Students will predict the new amino acid sequence that results from a mutation in a given gene sequence</td>
<td>Students will be given a sequence of normal DNA and resulting amino acid sequence and must identify the reading frame, template/coding strands to predict amino acid changes due to mutations</td>
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Poison Pop and PKU (phenylketonuria)

- Genetic disorder - mutation in a liver enzyme that converts phenylalanine $\rightarrow$ tryosine
- High [phenylalanine] becomes toxic to developing neurons
- Each week that PKU remains undetected = 3 point drop in IQ
- New-borns are tested at birth (Guthrie Test)
Group Activity: List three things that you know or need to know to answer the following question.

Genetic diseases, like PKU, confirmed that there is a link between DNA and proteins. Below is a DNA molecule and the amino acid sequence that would result when ribosomes translate the DNA sequence. Which nucleotides are responsible for this particular sequence of amino acids?

- $3'$CGTTTTTACCAAACCGAGTACTGAG5'$
- $5'$GCAAAAATGGGTTTGGGCTCATGACTC3'$
- TRP-PHE-GLY-SER
Determining direction and reading frame: If tryptophan (Trp) is the first amino acid in a protein sequence, you should look for _________ in the DNA.

1. ACC 3→5 in the coding strand
2. ACC 3→5 in the template strand
3. ACC 5→3 in the coding strand
4. ACC 5→3 in the template strand
5. TGG 3→5 in the coding strand
6. TGG 3→5 in the template strand
7. TGG 5→3 in the coding strand
8. TGG 5→3 in the template strand
Group work: Which nucleotides are responsible for this particular sequence of amino acids (this sequence of a.a.s comes from the middle of a protein)? Identify the template strand and reading frame.

- 3’CGTGGTACCAAAACCGAGTGGTGAG5’
- 5’GCACCATGGTTTGGCTCACCACACTC3’
- TRP-PHE-GLY-SER
Homework – determine the effect of the mutant on the amino acid sequence and predict the possible consequences for protein function.

- Normal #1
- #256  GGLAFRVF
- 5'-GGGATTTTCTTGGGTTGGCCTGGCCTTCCGAGTCTT-3'
- 3'-CCCTAAAGAACCCACCGGACCGGAAGGCTCAGAA-5'

- Mutant #1a, Found in Swiss sisters and their offspring.
- 5'-GGGATTTTCTTGGGTTGGCCTGGCCTTCCAAGTCTT-3'
- 3'-CCCTAAAGAACCCACCGGACCGGAAGGTTTCAGAA-5'
Practicing Backward Design

• You don’t have to throw away all of your old materials and start from scratch!

• Think about a topic or set of slides or activities that you already use in class.
What is the objective of the activity? (e.g., transmit information, help students understand a concept, practice a critical thinking or science process skill, change an attitude or behavior…)

Can the students do it on their own?

Yes.
- Is it necessary to support learning goals?
  - Yes. Make it an OOC class activity
  - No. Lose it.

No.
- Is it something students should figure out for themselves?
  - Yes. Ask Don’t Tell! Make it a IC activity
  - No. Provide for students as part of an IC activity
Summary

• Summative assessment drives learning because it is attached to the grade.
• Formative assessment is one of the most important strategies for aiding/improving learning.
• Alignment between learning goals/outcomes, summative assessments and formative assessments/active learning is key!