Best Practices to Evaluate Student Learning
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GOAL: Teach you to use assessment to teach better.

OBJECTIVES:

1. To understand how feedback and reflection can increase self-learning.
2. To employ group learning to help students evaluate themselves.
3. To be able to write questions that evaluate different levels of understanding.
4. To understand your role in connecting lecture with graded assignments.
Active Learning Can Increase Learning

62 courses, 6452 physics students testing interactive strategies vs. traditional lecture

538 students split into a traditional lecture group and a deliberative practice group.

Average learning gain = (post-pre)/(100-pre)

Active Learning Exercise 1: Reflection and Feedback

pH Strip/Titration activity
Active Learning Can Increase learning ... maybe?

33 instructors and courses
pre/post assessment on evolution concepts

\[
\frac{(Post-Pre)}{SD_{pre}}
\]

Effect size

Active learning exercises per week
What Makes Active Learning Work (or not)?

In your group, think about what factors might underlie the variation in active learning gains.
How People Learn

Engage with material

Existing knowledge and framework

Dissonance

Construction of new knowledge

Active Learning Exercise 2

Amino Acid Statement Correction

• Work 2 minutes alone
• Then work with your group
Group Feedback is Crucial for Learning

Study of small group learning
- 10 year study across STEM disciplines

![Bar graph showing mean final grades for minority and majority groups. The graph compares workshop and non-workshop conditions, with higher grades for the workshop condition.]
Activity 2 Debrief: Using Feedback

In your groups, please discuss the following question:

**How did this activity allow for evaluation?**

**Teacher:**
- Identify student knowledge/skill deficiencies
- Modify subsequent learning activities
- Focus away from grading 😞 and onto learning 😊

**Student:**
- Clarify what good performance is (goals, expected standards)
- Assess their own knowledge/skills
- Assess their peers’ knowledge/readiness
- Promotes the development of self-assessment
The Montillation and Use of Traxoline

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.

1. What is traxoline?
2. Where is it montilled?
3. How is traxoline quaseled?
4. Why is traxoline important?
What Types of Thinking are Involved?

A. The function of the GTPase activity of G-proteins is: _____________________

B. Cholera toxin modifies the G-protein by transferring ADP-ribose to an arginine residue in the GTPase active site. What is the most likely outcome?

C. Based on the data, what mutation(s) are possible in the variant cells? Explain your reasoning.

Left and Center: Wild-type and variant cells were incubated with only GTP (con), with epinephrine and GTP (epi), or with cholera toxin and GTP (CT).

Right: Binding of radioactive epinephrine to wild-type (solid squares) and variant cells (triangles).
Bloom’s Taxonomy of Cognitive Processes

- **Remember**
  - Recalling information
  - Recognizing, listing, describing, retrieving, naming, finding

- **Understand**
  - Explaining ideas or concepts
  - Interpreting, summarizing, paraphrasing, classifying, explaining

- **Apply**
  - Using information in another familiar situation
  - Implementing, carrying out, using, executing

- **Analyze**
  - Breaking information into parts to explore relationships
  - Comparing, organizing, deconstructing, interrogating, finding

- **Evaluate**
  - Judging based on criteria
  - Experimenting, checking, hypothesizing, critiquing, justifying

- **Create**
  - Generating new ideas, products, or ways of viewing things
  - Designing, constructing, planning, producing, inventing

Anderson and Krathwohl (2001) *A Taxonomy for Learning, Teaching, and Assessing*
Active Learning Exercise 3: Higher Order Questions

Ribosome Strip Sequence
Activity 3 Debrief: Higher Order Questions

Work with your group to design a question that could test higher-order concepts for this activity.
Higher Order Questions Lead to Deeper Student Understanding, which Lasts Longer

Study of long-term conceptual understanding after deep (vs. superficial) questions:

- Compare test scores given in the middle of the course and at 8 to 101 weeks later

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1/3 of a grade better
Your Role in Connecting to Lecture

Lecture Goals: We know the concepts and questions we want students to know and understand

- Active Learning Activities
- Help create new knowledge

Lecture

Objective 1

Objective 2

Objective 3

Section

Grades

- Tests, P-sets, Papers
- Demonstrate knowledge
Conclusion: Take Home Messages

1. Activities require **reflection/feedback** for maximal learning gains.

2. Group work provides essential feedback for the **student** and **teacher**.

3. Assessment questions should **span** higher and lower order levels of understanding.

4. You as a TF are crucial for **bridging and connecting** lecture with graded assignments.
Your Task for This Afternoon

1. Discuss your group’s topic.
   - Agree on the context in which the activity could be taught.
   - What particular areas of the topic might be challenging?

2. Write learning goals and objectives for your topic.

3. Decide what you want the students to understand and be able to do to demonstrate their knowledge?

4. Develop a 15-minute teaching activity.

5. Teach the activity to another group:
   - 15 minutes of teaching
   - 15 minutes of feedback.
Every Activity Requires Reflection

- Explain answers and reasoning
- Discuss differing ideas
- Identify what was confusing
- Identify what you needed to know
How People Learn

PRIOR KNOWLEDGE

DISSONANCE

CONSTRUCTION OF NEW KNOWLEDGE

Foundations. Borasi and Fonzi, National Science Foundation.