What do you want them to learn?
Aligning learning goals and assessments

Jenny Knight, Department of Molecular, Cellular and Developmental Biology
University of Colorado, Boulder

At the end of this workshop

You will be able to...
- Compare different kinds of learning goals
- Communicate your learning goals for a particular topic
- Use Bloom's Taxonomy to characterize your goals
- Write and evaluate assessments that are aligned with your goals

Thinking about learning

- 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?

Buzzword: Metacognition

We need to know when our students have misconceptions and what they are
- Private Universe
  http://www.learner.org/resources/series28.html
- If a camera crew making a documentary on student misconceptions were to question your students at the end of your course or the end of medical school, what would you be most embarrassed to find out that they didn't know?
  These should be your goals

Learning Goals are different than a syllabus

Syllabus/Topic List
- Material covered in sequential list

Learning goals:
- Outcome and student oriented:
  - Identifies what students will be able to do as a result of learning
  - Defines what students are expected to learn
  - Must be measurable

Learning Goals (for a whole course) can be broad. At the topic or lecture level, the learning objectives (outcomes) should be more specific

Kinds of Learning Goals/Objectives

CONTENT:
- Explain, apply, analyze, and predict outcomes using knowledge about subject

SKILLS:
- Reason, problem solve, evaluate, critique.
- Scientific skills: design a hypothesis, design or interpret an experiment, create a graph or a diagram

HABITS OF MIND/BELIEFS:
- Think like a scientist/doctor/etc. Use alternative representations, problem solve, compare and contrast, strategize, justify

AFFECTIVE:
- Appreciate, enjoy, value. Recognize that the behavior of the world around you is not magical and mysterious, but rather can be understood and predicted using certain fundamental principles.

Which of these kinds of goals do you usually assess?
Which would you like to do a better job assessing?

Handout
What should students know or be able to do by the end of your course?

How will you know if they get there?

What will you do to get them there?

Outcomes should drive Assessment and Instruction

Learning objectives

Summative Assessments

Formative Assessment (Learning Activities)

Bloom’s Taxonomy of the Cognitive Domain

1. Factual Knowledge: remember and recall factual information
   - Define, List, State, Label, Name, Describe
2. Comprehension: demonstrate understanding of ideas, concepts
   - Describe, Explain, Summarize, Interpret, Illustrate
3. Application: apply comprehension to unfamiliar situations
   - Apply, Demonstrate, Use, Compute, Solve, Predict, Construct, Modify
4. Analysis: break down concepts into parts
   - Compare, Contrast, Categorize, Distinguish, Identify, Infer
5. Evaluation: think critically about and defend a position
   - Judge, Appraise, Recommend, Justify, Defend, Criticize, Evaluate
6. Synthesis: transform, combine ideas to create something new
   - Develop, Create, Propose, Formulate, Design, Invent

Higher level: Require deeper conceptual understanding

Examples

Human Genetics for non-majors

Course-level learning goal

Specific learning objective

Content: Demonstrate how meiosis leads to diversity in the next generation

Skills: Solve problems using genetics terminology and concepts

Predict the probability of generating sperm and egg cells with specific chromosomal makeup.

Explain how these cells are produced

---

Original L.G.

Problems

Describe how the process of extracting information from genetic material is regulated at each step of conversion of DNA to RNA to protein.

Advantages

Low level goal—explicitly encourages students to memorize the steps from DNA to protein

New L.G.

Problems

Propose two different ways that an abnormal protein could be made in a cell, resulting in disease symptoms.

Advantages

Higher level goal—encourages student to think about how proteins work, how they are produced, and how they can be altered by mutations in DNA.
Work on Learning Goals

For a course you teach:

- Write down a course level goal (overarching)
- Write one or two class-level objectives that fit under this course level goal (these are goals you would expect students to achieve in unit)
- For each of the class-level objectives, match up an assessment question that you can remember (or create a new one)
- After 5-10 minutes, find a partner. Share your learning goals and questions with each other

Use handouts to help

With your partner, consider the following questions as you work:

1. Does the level (Bloom’s) of your goal match the level and intent of your question?
   - Compare the current wording of the LG to the guidelines provided: identify the level of this LG
   - If they do not match, revise the learning goal or the question

2. Do you still like the learning goal you started with? Is it at too high or too low a level?
   - Try to write a goal at a different level (either higher or lower)
   - Write a corresponding question that is aligned with the revised goal
      (you may find the Blooming Biology Tool handout helpful)

Share the process of creating learning goals with the group

- What was the exam question you started with?
- What was your original LG?
- How did the goal change through discussion?
- What was difficult about this process and what did you learn through your discussion?

How can we keep ourselves honest?

- Communicate goals to students
- Test them at the same cognitive level that was communicated in the goals
- Give them a chance to practice: formative assessment

Alignment – an example:

Broad Learning Goals:
- Understand the process of science
- Use basic principles of evolution to solve problems

Measurable Outcomes

Summative Assessment (Exams)

Formative Assessment (Instruction)

Interpret graphs
Apply Darwin’s postulates to new scenarios

Interpret which of Darwin’s postulates are represented in the graphs, and explain

Create a graph that depicts one element of natural selection