“How do you know your students are learning?”

As you enter, list on the board:
• the forms of student assessment you currently use.

Optional
• your goals for this session …
How do you know your students are learning?

Why does student engagement matter?

Adriana Signorini
Center for Research on Teaching Excellence
Students Assessing Teaching and Learning
Learning Outcomes

By the end of this session, you’ll be able to …

• Describe some elements of the learning cycle presented.

• List some classroom assessment tools which you are not using but could improve learning in your courses.

• Identify the benefits of interactive-engagement and dare to give these activities a try.
What is assessment (of student learning)?

1. Establish goals for student learning (expressed as learning outcomes)
2. Determine the evidence: the work students will do to demonstrate their learning
3. Design & provide intentional learning experiences (curriculum & pedagogy)
4. Gather & review evidence of student learning
5. Draw conclusions about student learning achievements in the aggregate
6. As necessary, act on the results to improve student achievement of learning goals

Hybrid of Suskie (2009), the CIRTL Teaching-as-Research (TAR) framework, and Backward Design (McTighe & Williams, 1998)
What are the class learning outcomes?

Statements that focus on the outcomes we expect of students to do when they complete the course or class lesson

**BLOOM'S TAXONOMY**

- **Knowledge**: Recall of information; Discovery; Observation; Listing; Locating; Naming
- **Comprehension**: Understanding; Translating; Summarising; Demonstrating; Discussing
- **Application**: Using and applying knowledge; Using problem solving methods; Manipulating; Designing; Experimenting
- **Analysis**: Identifying and analyzing patterns; Organisation of ideas; recognizing trends
- **Synthesis**: Using old concepts to create new ideas; Design and invention; Composing; Imagining; Inferring; Modifying; Predicting; Combining
- **Evaluation**: Assessing theories; Comparison of ideas; Evaluating outcomes; Solving; Judging; Recommending; Rating

https://reflectionedu.files.wordpress.com/2012/05/blooms_taxonomy.jpg
Bloom's Taxonomy

Verbs: appraise, assess, criticize, defend, evaluate, justify, support
Evaluation

Verbs: compile, create, develop, generalize, integrate, propose
Synthesis

Verbs: analyze, compare, contrast, differentiate
Analysis

Verbs: apply, carry out, construct, demonstrate, operate, produce, use
Application

Verbs: comprehend, condense, describe, discuss, distinguish, interpret, locate
Comprehension

Verbs: define, describe, identify, label, list, match, name, outline, recall, recognize, reproduce, select, state
Knowledge

6 Levels in the Cognitive Domain of the Taxonomy

Judge the value of material
Formulate new structures from existing knowledge and skills
Understand both the content and structure of material
Use learning in new and concrete situations
Grasp the meaning of material
Remember previously learned material
Information at each level
### Verbs useful for stating learning outcomes

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Understand</th>
<th>Apply</th>
<th>Analyze</th>
<th>Evaluate</th>
<th>Create</th>
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<tr>
<td>define</td>
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<td>solve</td>
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<td>reframe</td>
<td>design</td>
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<td>apply</td>
<td>compare</td>
<td>criticize</td>
<td>compose</td>
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<td>interpret</td>
<td>illustrate</td>
<td>classify</td>
<td>evaluate</td>
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<td>paraphrase</td>
<td>modify</td>
<td>contrast</td>
<td>order</td>
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<td>appraise</td>
<td>combine</td>
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<td>infer</td>
<td>judge</td>
<td>formulate</td>
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<td>compare</td>
<td>change</td>
<td>separate</td>
<td>support</td>
<td>invent</td>
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<td>match</td>
<td>differentiate</td>
<td>choose</td>
<td>explain</td>
<td>compare</td>
<td>hypothesize</td>
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<tr>
<td>recognize</td>
<td>discuss</td>
<td>demonstrate</td>
<td>select</td>
<td>decide</td>
<td>substitute</td>
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<tr>
<td>select</td>
<td>distinguish</td>
<td>discover</td>
<td>categorize</td>
<td>discriminate</td>
<td>write</td>
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<td>extend</td>
<td>experiment</td>
<td>connect</td>
<td>recommend</td>
<td>compile</td>
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<td>predict</td>
<td>relate</td>
<td>differentiate</td>
<td>summarize</td>
<td>construct</td>
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<td>sketch</td>
<td>divide</td>
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<td>complete</td>
<td>order</td>
<td>convince</td>
<td>integrate</td>
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<td>construct</td>
<td>point out</td>
<td>defend</td>
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<td>interpret</td>
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<td>survey</td>
<td>grade</td>
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<td>advertise</td>
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<td>infer</td>
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<td>appraise</td>
<td>predict</td>
<td>rewrite</td>
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<td>relate</td>
<td>produce</td>
<td>break down</td>
<td>rank</td>
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<td>score</td>
<td>adapt</td>
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<td>teach</td>
<td>conclude</td>
<td>select</td>
<td>anticipate</td>
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<tr>
<td>omit</td>
<td>translate</td>
<td>act</td>
<td>correlate</td>
<td>test</td>
<td>arrange</td>
</tr>
<tr>
<td>read</td>
<td>ask</td>
<td>administer</td>
<td>criticize</td>
<td>argue</td>
<td>assemble</td>
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<tr>
<td>recite</td>
<td>cite</td>
<td>articulate</td>
<td>deduce</td>
<td>conclude</td>
<td>choose</td>
</tr>
<tr>
<td>record</td>
<td>discover</td>
<td>chart</td>
<td>devise</td>
<td>consider</td>
<td>collaborate</td>
</tr>
<tr>
<td>report</td>
<td>generalize</td>
<td>collect</td>
<td>diagram</td>
<td>critique</td>
<td>collect</td>
</tr>
</tbody>
</table>
Activity: Analyze a Learning Outcome (L.O.)

Choose one of the following two L.O.s:

1) Analyze it in relation the criteria for useful L.O.s.

2) Propose revisions as you feel appropriate.

3) Share your analysis with the rest.

L.O. 1: At the conclusion of this course, students will understand basic statistical analysis.

L.O. 2: At the conclusion of this course, students will be familiar with academic writing and speaking practices.
Checklist for creating learning outcomes:

☐ Does the learning outcome identify what students will be able to do after the topic is covered?

☐ Is it clear how you would test achievement of the learning outcome?

☐ Do chosen verbs have a clear meaning?

☐ Is the verb aligned with the level of cognitive understanding expected of students? Could you expect a higher level of understanding?

☐ Is the terminology familiar/common? If not, is knowing the terminology a goal?

☐ Is it possible to write the outcome so it is relevant and useful to students (e.g. connected to their everyday life, or does it represent a useful application of the ideas)?
Key Class Assessment Activities

Wk 1: Needs Assessment

Week 4 to 8: Mid-Course Feedback

Fall Semester

Final Course Evaluation
Needs Assessment

- Pre/ Post Test
- Entry Survey

Prior Knowledge
Attitudes
Values

Your class expectations:
OH, studying time, specific requirements, etc.

Campus Resources:
Library/ Tutoring/ Mentoring/ STEM Center, etc.
Mid-Course Feedback

- It will benefit the same students who provide the feedback (Bullock, 2003).
- It provides opportunities for students to comment on specific behaviors or pedagogical strategies that are not covered by the standard end-of-semester evaluation questions.
- It provides the potential to improve end-of-semester evaluations and increase student exam performance (Overall and Marsh, 1979).
- Students respond positively when their comments result in changes to the course, leading to improved student attitudes about the class and/or instructor (Keutzer, 1993).
Assessment Process: An Example

1. **Outcome**: Write a technical report
2. **Evidence**: Technical reports
3. **Design**:
   - Write reports weekly guided by rubric.
   - Detailed feedback provided consistent with rubric.
   - Track students’ use of feedback.
4. **Gather evidence, draw conclusions, act on results**:
   - Mid-semester: examines students improvements, finds students using feedback are improving more than others.
   - Shares this with class to motivate use of feedback to improve.
   - Continues to provide detailed feedback through multiple avenues.

5. **Draw conclusions about student learning achievements in the aggregate**
6. **As necessary, act on the results to improve student achievement of learning goals**
1. **Establish goals for student learning (expressed as learning outcomes)**
2. **Determine the evidence: the work students will do to demonstrate their learning**
3. **Design & provide intentional learning experiences (curriculum & pedagogy)**
4. **Gather & review evidence of student learning**
Assessment as planning cycle

1. Setting goals
2. Developing strategies
3. Outlining tasks
4. Evaluating success
Assessment as pedagogy

Instructional activities selected to

- facilitate development of and
- to reveal (to the teacher and the students)

student learning in relation to instructional goals.

- Evidence of student learning is abundant.

- Harvest it intentionally and strategically.
Relationship of grading & assessment

**Grading**: Summarizes learning demonstrated by an *individual* student, with feedback providing insight into and supporting his/her *individual* learning.
Relationship of grading & assessment

Assessment: Summarizes learning demonstrated by a population of students to provide insights into how well the educational opportunity (class, course, program) is serving students as a whole.

Ex. What might this tell us?

Results from a mid-semester research paper:

- 60% of students scored as proficient or better in use of citations and evidence in argument.
- 40% scored below proficient.
Assessment is “teaching to the test” (Suskie, 2009)

Requires

• Assessments that are designed to be worth teaching to
• Intended learning outcomes that are higher level
• Opportunities for practice with specific, targeted feedback to students on what doing well, and what to improve
Essentially assessment is a form of research

Assessment paradigm

- Outcome
- Instructional Activities/Curriculum
- Collect & analyze evidence of student learning. Draw conclusions, revise instruction or outcomes.

Research paradigm

Hypothesis: what students will be able to do

Experimental Design

Gather data and draw conclusions about hypothesis
Assessment is “action research” (Suskie, 2009)

Assessment as Action Research*

- Specific to local environment & student body
- Intended for local improvement
- Data/evidence are sufficiently valid and reliable so as to be “good enough,” “trustworthy enough” to act on

Empirical Research

- Pursue generalizable results (theories)
- High quality design and data to meet test of peer review

*Suskie, 2009
Classroom Assessment Techniques (CATs)

- Minute Paper
- Chain Notes
- Memory Matrix
- Directed paraphrasing
- One sentence summary
- Exam Evaluations
- Application cards
- Student-generated test questions

Large and Small Classes Assessment Tools

Creating: Group work
Evaluating: Debate
Analyzing : Clicker questions
Applying: Student Presentations – Pop quizzes
Understanding: Role playing / Just-in-time teaching
Remembering: Memory Matrix

The George Washington University: http://tlc.provost.gwu.edu/classroom-assessment-techniques
Challenges to Implementing Interactive Activities

- Students resistance to participation (e.g. stop coming to class, start discussing their weekend plans)
- Expectations of content coverage
- Lack of instruction/instructor time
- Class size, or room layout
- Influence on teaching evaluations
- Additional time for curriculum (re)design
Quantifying student behavioral engagement based on teaching practices in a large class

Results from a large introductory oceanography course:
Classroom observations were conducted during 27 lectures in a first year Oceanography course with an enrollment of 170 students and two course instructors. The observer sat in one of nine sections in the classroom, and obtained observations from each section at least three times in the semester. A total of 720 engagement observation points were recorded through the semester.

Figure 1: Student engagement over a lecture period based on teaching activities

Data from a typical class period reveal activities that are more and less engaging for students (Figure 1). The instructor also gets a snapshot of what student engagement looked like over the 50-minute lecture period and can easily see where to make changes.

Figure 2: Student engagement based on instructional activity averaged over the semester for each instructor

Overall observation data show that student engagement is strongly correlated to teaching practices. Two instructors with varying teaching experience show the same trends in student engagement based on teaching practices. On average, the most engaging activity is clicker questions and clicker question follow-up and the least engaging are instructor lecture, summaries, and learning goals.
Quantifying student behavioral engagement based on teaching practices in a large class

**TABLE 1**

<table>
<thead>
<tr>
<th>Behavioral Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engaged</strong></td>
<td></td>
</tr>
<tr>
<td>Listening</td>
<td>Student is listening to lecture. Eye contact is focused on the instructor or activity and the student makes appropriate facial expressions, gestures, and posture shifts (i.e., smiling, nodding in agreement, leaning forward).</td>
</tr>
<tr>
<td>Writing</td>
<td>Student is taking notes on in-class material, the timing of which relates to the instructor’s presentation or statements.</td>
</tr>
<tr>
<td>Reading</td>
<td>Student is reading material related to class. Eye contact is focused on and following the material presented in lecture or preprinted notes. When a question is posed in class, the student flips through their notes or textbook.</td>
</tr>
<tr>
<td>Engaged computer use</td>
<td>Student is following along with lecture on computer or taking class notes in a word processor or on the presentation. Screen content matches lecture content.</td>
</tr>
<tr>
<td>Engaged student interaction</td>
<td>Student discussion relates to class material. Student verbal and nonverbal behavior indicates he or she is listening or explaining lecture content. Student is using hand gestures or pointing at notes or screen.</td>
</tr>
<tr>
<td>Engaged interaction with instructor</td>
<td>Student is asking or answering a question or participating in an in-class discussion.</td>
</tr>
</tbody>
</table>

**TABLE 2**

<table>
<thead>
<tr>
<th>Behavioral Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disengaged</strong></td>
<td></td>
</tr>
<tr>
<td>Settling in/packing up</td>
<td>Student is unpacking, downloading class material, organizing notes, finding a seat, or packing up and leaving classroom.</td>
</tr>
<tr>
<td>Unresponsive</td>
<td>Student is not responsive to lecture. Eyes are closed or not focused on instructor or lecture material. Student is slouched or sleeping, and student’s facial expressions are unresponsive to instructor’s cues.</td>
</tr>
<tr>
<td>Off-task</td>
<td>Student is working on homework or studying for another course, playing with phone, listening to music, or reading non-class-related material.</td>
</tr>
<tr>
<td>Disengaged computer use</td>
<td>Student is surfing web, playing game, chatting online, checking e-mail.</td>
</tr>
<tr>
<td>Disengaged student interaction</td>
<td>Student discussion does not relate to class material.</td>
</tr>
<tr>
<td>Distracted by another student</td>
<td>Student is observing other student(s) and is distracted by an off-task conversation or by another student’s computer or phone.</td>
</tr>
</tbody>
</table>
Learning Outcomes

By the end of this session, you’ll be able to …

• Describe some elements of the learning cycle presented.

• List some classroom assessment tools which you are not using but could improve learning in your courses

• Identify the benefits of interactive-engagement and dare to give these activities a try.
Resources

- Assessment at UC Merced: http://assessment.ucmerced.edu/
This website provides assessment related information for academic and non-academic program on campus.
- Carl Wieman Science Education Initiative at the University of British Columbia: http://cwsei.ubc.ca/
Resources aim at improving undergraduate science education. Consider the following tools: Classroom Observation Protocol, Teaching Practices Inventory, Student Engagement Observation Protocol and Learning Attitudes about Science Surveys
- Writing Great Clicker Questions: Faculty Workshop cwsei.ubc.ca/resources/
- Resources by Discipline: University of Michigan, CRLT: http://www.crlt.umich.edu/tstrategies/disciplinaryresources
- CRTE: Teaching Resources: http://crte.ucmerced.edu/
- SATAL Program: Offer trained undergraduates who can assist you with data collection, analyzes and reporting.
Many thanks to….

• Laura Martin for sharing the assessment cycle slides

• Belinda Braunstein’s feedback during presentation rehearsal.
25+ question stems framed around the early, non-revised Bloom's Taxonomy

**CRITICAL THINKING SKILLS**

<table>
<thead>
<tr>
<th>1</th>
<th>Knowledge</th>
<th>Knowledge</th>
<th>Problem/Solution</th>
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<td>Application</td>
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<td>4</td>
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<td>Synthesis</td>
<td>Synthesis</td>
<td>Synthesis</td>
<td>Synthesis</td>
</tr>
</tbody>
</table>

### Knowledge
- Recall/Regurgitate facts without understanding.
- Exhibits previously learned material by recalling facts, terms, basic concepts and answers.

### Comprehension
- To show understanding finding information from the text: Demonstrating basic understanding of facts and ideas.

### Application
- To use in a new situation. Solving problems by applying acquired knowledge, facts, techniques and rules in a different way.

### Analysis
- To examine in detail. Examining and breaking information into parts by identifying motives or causes; making inferences and finding evidence to support generalisations.

### Synthesis
- To change or create into something new. Compiling information together in a different way by combining elements in a new pattern or proposing alternative solutions.

### Evaluation
- To justify. Presenting and defending opinions by making judgements about information, validity of ideas or quality of work based on a set of criteria.

### Key words:
- Choose
- Observe
- Show
- Ask
- Expend
- Outline
- Act
- Employ
- Practice
- Analyse
- Examine
- Prioritize
- Adapt
- Estimate
- Plan
- Agree
- Disprove
- Measure
- Analyse
- Compare
- Critically
- Conclude
- Devise
- Decide
- Describe
- Evaluate
- Objective
- Predict
- Argue
- Effective
- Perceive
- Award
- Evaluate
- Objective
- Rule
- Consider
- Conclude
- Choose
- Give reasons
- Rate
- Design
- Maximise
- Tabulate
- Provide
- Select
- Compare
- Grade
- Consider
- How do we select
- Judge
- Defend
- Justify
- Determine
- Mark

### Bloom’s Taxonomy: Questions framed around Categories
- Can you list three...?
- Can you recall...
- Can you select...
- How did... happen?
- How is it...
- How would you describe...
- How would you explain...
- How would you show...
- What is it...
- When did...
- When did... happen?
- What was...
- Which one...
- Who was...
- Who were the main...
- Why did...

<table>
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<th>Outcomes:</th>
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<td>Describing</td>
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<td>Identifying</td>
<td>Label</td>
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<td>List</td>
<td>List</td>
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<td>Locating</td>
<td>Quiz</td>
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<td>Naming</td>
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<th>Actions:</th>
<th>Outcomes:</th>
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<tr>
<td>Label</td>
<td>Exemplification</td>
</tr>
<tr>
<td>Label</td>
<td>Label</td>
</tr>
<tr>
<td>Inferring</td>
<td>Label</td>
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<tr>
<td>Interpreting</td>
<td>Providing</td>
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<tr>
<td>Paraphrasing</td>
<td>Reasoning</td>
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<tr>
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<td>Show and tell</td>
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<tr>
<td>How would you use...?</td>
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<tr>
<td>What examples can you find to...?</td>
</tr>
<tr>
<td>How would you solve...?</td>
</tr>
<tr>
<td>Using</td>
</tr>
<tr>
<td>How would you show your understanding of...?</td>
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<tr>
<td>What approach would you use to...?</td>
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<tr>
<td>How would you apply what you learned to develop...?</td>
</tr>
<tr>
<td>What other way would you plan to...?</td>
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<td>What would result if...?</td>
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<table>
<thead>
<tr>
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<td>What changes would you make to solve...?</td>
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<tr>
<td>How would you improve...?</td>
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<tr>
<td>How would you change...?</td>
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<td>What would you change...?</td>
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<tr>
<td>What would you change...?</td>
</tr>
</tbody>
</table>

### Questions:
- Do you agree with the actions/outcomes...?
- What is your opinion of...?
- How would you prove/disprove...?
- Can you analyse the data from this problem...?
- What would you do...?
- How would you approach...?
- How would you change...?
- What would you change...?
- What would you change...?
- What would you change...?
- What would you change...?