Planning Formative Assessment

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This is a modified version of a “Teaching Assessment Workshop” given in August 2011.
This is a modified version of the U of A Centre for Teaching and Learning Teaching Enhancement Series Lesson: “Learner Outcomes” found at: http://www.ctl.ualberta.ca/Teaching_Services/TES_Docs/TES_Resources.html
Portions of the presentation prepared by Deb Moore, “What are classroom assessment techniques(CATS)” have been used from: http://www.uky.edu/IRPE/assessment/classroomtech.html
Today’s Plan!

1. Goals

2. Learner Outcomes, Formative Assessment Debrief

3. Planning Formative Assessment

4. Reflection
Definitions

• The **goal (or aim)** of a module or program is a broad general statement of teaching intention, i.e. it indicates what the teacher intends to cover in a block of learning. For example, the aim of a module could be “to introduce students to the basic principles of atomic structure” or “to provide a general introduction to the history of Ireland in the twentieth century”. Bologna, p.5

• **Learner outcomes** are statements of what a learner is expected to know, understand, and/or be able to demonstrate after completion of a process of learning. Bologna, p.5 (what should the student be able to **do**)

• **What’s the difference between a goal and an outcome?** Primarily it is the granularity of the statement. A goal is a more overarching statement and outcomes tend to be the things students would **do** that show they have attained the stated goal.
Setting the Stage: Teaching Goals

• Look at your **Teaching Goals Inventory** (TGI)
• Your TGI shows the relative importance you place on different clusters of learning:
  • Higher order thinking skills
  • Basic academic success skills
  • Discipline specific knowledge and skills
  • Liberal arts and academic values
  • Work and career preparation
  • Personal development

• Poll
Identify your goals

• What are 3-4 important teaching goals you intend to achieve in your course? Write them down!
  – E.g. In this course we will:
    • Develop ability to synthesize and integrate information and ideas (TGI#5)
    • Develop ability to work productively with others (TGI#36)
    • Learn terms and facts of this subject (TGI#18)
    • Learn concepts and theories in this subject (TGI#19)

Teaching goals inform intended learner outcomes...
Learner Outcomes: What should the student be able to do?

• Outcomes should be written with:
  – Specific and common language
  – Focused on a concept, task, skill, or ability
  – Best matched to a cognitive level
  – Indication of level of performance
  – A timeline (arguments for and against)

• Outcomes are intended – who knows what the student will actually learn?
Example 1:
You will know about the subcortical nuclei of the brain

VS.

• The student will be able to identify the numbered structures on this coronal section of the brain.

Content adapted from David Rayner: http://www.gradstudies.ualberta.ca/profdev/Modules/Comm_LearningObjectives.pdf
Benjamin Bloom created a taxonomy of measurable verbs to help us describe and classify observable knowledge, skills, attitudes, behaviors and abilities. The theory is based upon the idea that there are levels of observable actions that indicate something is happening in the brain (cognitive activity). By creating learning objectives using measurable verbs, you indicate explicitly what the student must do in order to demonstrate learning.

<table>
<thead>
<tr>
<th>KNOWLEDGE</th>
<th>APPLICATION</th>
<th>COMPREHENSION</th>
<th>SYNTHESIS</th>
<th>EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>List</td>
<td>Describe</td>
<td>Complete</td>
<td>Argue</td>
<td>Appraise</td>
</tr>
<tr>
<td>Name</td>
<td>Explain</td>
<td>Compare</td>
<td>Arrange</td>
<td>Arrange</td>
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<td>Recall</td>
<td>Express</td>
<td>Contrast</td>
<td>Assess</td>
<td>Appraise</td>
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<td>Record</td>
<td>Identify</td>
<td>Construct</td>
<td>Assess</td>
<td>Appraise</td>
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<td>Relate</td>
<td>Recognize</td>
<td>Evaluate</td>
<td>Conclude</td>
<td>Appraise</td>
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<td>Repeat</td>
<td>Restate</td>
<td>Compose</td>
<td>Conclude</td>
<td>Appraise</td>
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<td>State</td>
<td>Tell</td>
<td>Interpret</td>
<td>Estimate</td>
<td>Appraise</td>
</tr>
<tr>
<td>Tell</td>
<td>Translate</td>
<td>Examine</td>
<td>Create</td>
<td>Argue</td>
</tr>
<tr>
<td>Underline</td>
<td>Use</td>
<td>Manage</td>
<td>Judge</td>
<td>Argue</td>
</tr>
</tbody>
</table>

Verbs that demonstrate **Critical Thinking**
Icebreaker

• What is the difference between assessment of learning and assessment for learning?
• Provide an example of each.
Write the intended learning outcome that the above assessment is likely testing?
Learning Outcomes: This Workshop

• Recall the 3 phases of the Formative Assessment Cycle.
• Recall at least 3 Classroom assessment techniques (CATs)
• Discuss the merits and shortcomings of multiple CATs (formative assessment methods).
• Effectively choose an aligned learning outcome to target using CATs, then identify a question.
• Be able to name and explain to a colleague how 2 CATs can be used to address an identified learning outcome.
• Critique formative assessment tools, and imagine how you might modify 2 CATs for your own learner outcome(s).
What are Classroom Assessment Techniques (CATS)?

Use of small-scale data gathering techniques conducted continuously by teachers to determine what students are learning in a given class.

Low threshold activities which can inform gaps in instruction.
What are the Characteristics of CATS?

• usually ungraded and anonymous
• learner centered
• teacher directed
• mutually beneficial
• formative
• context-specific
• ongoing
Potential Impact of CATs

- Find out **what** and how your students are thinking
- **Clarify** your goals for your course or class session
- Obtain information for class session **design**
- Get **feedback** to make mid-course corrections
- Become **exposed** to how students learn your discipline and identify means to respond to different learning styles
- **Increase** active and cooperative learning
- **Change** the classroom norms for asking questions and admitting deficiencies in understanding
- Help students become **self-aware** of their learning
- Allow students to make mid-course **corrections**
- Push students to take their knowledge **further**
- Leave behind a trail of information that can be use for post-course **improvement** (for students and teacher)
Common Problems

• Using only one CAT
• Only using a CAT once
• Not feeling free to adapt the CAT to fit your course
• Not helping the students see how the data are being used by you or can be used by them
• Not making some portion of feedback-type data public
• Over-complicating the data collection or summarization
What are Some Important Tips for New Users?

• Target only a few ideas/concepts
• Limit student response time
• Read a sample of responses but not all
• Use verbal feedback or visual summary
Challenges to Using CATs Online

- Additional motivation needed to ensure that students complete CATs
- Additional time may be needed for completion of CATs
- Students may be in different stages of course
- Courses may need to be more structured and sequenced to properly use CATs
- Students do not experience the same learning environment

Interactive examples of some common CATs

Based on Angelo and Cross (1993)
Activity 1: Background Knowledge Probe

Classroom Assessment
a) Have never heard of this
b) Have heard of it, but don’t really know what it means
c) Have some idea what this means, but not too clear
d) Have a clear idea of what this means and can explain it

Teaching Goals Inventory
a) Have never heard of this
b) Have heard of it, but don’t really know what it means
c) Have some idea what this means, but not too clear
d) Have a clear idea of what this means and can explain it
Focused Listing

- **Purpose:** This tool helps determine what learners recall about a specific topic, including the concepts they associate with the central point. Working in pairs can help students build their knowledge base and clarify their understanding. This technique can be used before, during, or after a lesson.

- **Steps:** Ask students to write the key word at the top of a page and within a set time limit (usually 2-3 minutes) to jot down related terms important to understanding that topic.
Activity 2: Focused Listing

On the lines below, please list 5-7 words or short phrases that describe/define what the phrase “Classroom Assessment” means to you.

________________________________________________________________________________________________________________________________________________________________
Assessment of Focused Listing

• Compare students' lists with a master one you have generated, looking at both the quantity and quality of their responses.

• Categorize responses into "related" or "unrelated" or "appropriate" or "inappropriate" stacks.

• Consider compiling a master list and having students then sort them by categories.
Focused Listing

A Sample Response

Classroom Assessment is

- Learner-centered
- Teacher-directed
- Formative
- Context-specific
- Usually ungraded and anonymous
- Simple and quick to do
- Rooted in good practice
Minute Paper

Please answer each question in 1-2 sentences.

1. What was the most useful or meaningful thing you learned during this session?

2. What question(s) remain upper-most in your mind as we end this session?
The Muddiest Point

What was the muddiest point in this session? (In other words, what was least clear to you?)
Activity 3: Pro & Con Grid

Directions: Considering everything you know about CA at this point, what do you see as the most important pros/cons, or costs/benefits of using this approach. List at least 3 important cons(costs) and at 3 pros(benefits) below.

<table>
<thead>
<tr>
<th>Advantages of CATS</th>
<th>Disadvantages of CATS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
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</tbody>
</table>
One Sentence Summary

Directions: To create a one-sentence summary, 1st answer all of the questions below in relation to your topic. Then weave your separate answers into 1 (or 2) summary sentences.

Topic: ________________________________

Who?
Does/Did/Will Do What?
To/For Whom/What?
How?
When? Where?
Why?
Approximate Analogies

Directions: Note the relationship between 2 underlined terms below. Fill in the blanks that follow to create an (approximate) analogy to the terms Teaching and Learning.

Teaching is to Learning (approximately) as

....._______________ is to ________________.
Directed Paraphrasing

Directions: In no more than 1-2 concise sentences, define what learning is. Write a definition that will make sense to your colleagues. But try, at the same time, to go beyond the (ho-hum) obvious and give them something to think about.

Learning is. . .

________________________________________________________________________________________________________________________________________________________
Application Cards

• Students give one or more real-world applications for an important principle, generalization, theory, or procedure.

  Examples:
  – (Business) Stephen Covey recommends “Win-win performance agreements”: give two specific applications, one related to current news and one related to your own life.
  – (Law) Give a concrete example of the concept “due process.”

• The responses can be sorted as “unacceptable,” “marginal,” “adequate,” or “excellent.”
Activity 4:

Applications Card

DIRECTIONS: Please take a moment to recall the ideas, techniques, and strategies we've discussed – and those you've thought up – to this point in the session. Quickly list as many possible applications as you can. Don't censor yourself! These are merely possibilities. You can always evaluate the desirability and/or feasibility of these application ideas later.

Interesting
IDEAS/TECHNIQUES
from this session

Some possible
APPLICATIONS of those
ideas/techniques to my work

Angelo: http://www.ctl.ualberta.ca/documents/WorkshopI.pdf
Group Informal Feedback on Teaching (GIFT)

Directions: Please write brief, honest—and legible—answers to the questions below. (No names please.)

1. What are the 1 or 2 specific things your instructor does that help you learn in this course?

2. What are the 1 or 2 specific things your instructor does that hinder or interfere with your learning?

3. Please give your instructor 1 or 2 specific, practical suggestions on ways to help you improve your learning in this course.
The Formative Assessment Cycle

“CATs PIR”
The Assessment Planner

In summary, when you create the plan for your Classroom Assessment Project, you should describe the assessment strategy you plan to use, making sure that your description answers the following questions:

1. What “assessable” question are you trying to answer?
2. What specific Classroom Assessment Technique or instrument(s) will you use to collect data?
3. How will you introduce the assessment activity to students?
4. How will you integrate it into ongoing classroom activities?
5. What technique will you use to collect feedback?
6. Realistically, how much time can you devote to this project?
7. Will that be enough time to accomplish what you are planning?
8. What will a successful outcome look like?
9. What is the minimum outcome that you would consider worthwhile?
10. What steps can you take to “build in” success?

Example: The phases of the cycle

Course: SECOND-SEMESTER CALCULUS

TGI Goal: To help students develop effective problem-solving skills (Goal 3)

Using the One-Sentence Summary to develop a course-specific goal:

Who: I (the calculus teacher)

Does what: want to develop my students’ skill at figuring out which questions to ask next

To/for whom: (my students)

When: when they don’t know how to solve a problem

Where: in their homework assignments

How: by teaching them a variety of techniques for getting “unstuck,”

Why: so that they can become more effective, independent problem solvers.

Course-specific goal in sentence form:

I (the instructor) want to develop my students’ skill at figuring out what questions to ask next when they don’t know how to solve a problem in their homework assignments by teaching them a variety of techniques for getting “unstuck,” so they can become more effective, independent problem solvers.

Angelo and Cross (1993) pg 43-44.
Example: The phases of the cycle (cont’d)

Possible Classroom Assessment Projects to answer the questions above:

Phase 3

- Prepare three or four problems of increasing difficulty, ranging from one that I expect all students to be able to solve to one that I expect no students to succeed in solving. Give students the problem set, along with instructions to indicate when and where, and explain why they have become “stuck” when they cannot solve one of the problems. Read through the responses and look for patterns, as well as for particularly good explanations to share with the class as examples of problem-solving reasoning.

- Provide students with a problem set, as above, but ask them to explain—step-by-step, in writing—how they successfully solved one of the “easy” problems. Look for particularly clear explanations to share with the class, as well as for patterns in the problem-solving approaches used.

- Give the students one or two quite difficult problems, letting them know that I realize they may not be able to solve them. Ask the students to work the problems as completely as possible and, if and when they get stuck, to write down the questions they ask themselves as they try to get “unstuck.” Present some of the most illuminating questions to the class and help them see when and how to ask themselves questions that will serve as problem-solving “levers.”

Angelo and Cross (1993) pg 43-44.
Activity 5: What would you do?

• Analyze the proposed assessment plans in the sample calculus example above, paying close attention to determining answers for questions 5-10 from the above Assessment Planner.

5. What technique will you use to collect feedback?
6. Realistically, how much time can you devote to this project?
7. Will that be enough time to accomplish what you are planning?
8. What will a successful outcome look like?
9. What is the minimum outcome that you would consider worthwhile?
10. What steps can you take to “build in” success?

Adapted from: Angelo and Cross (1993) p. 49.
**Exhibit 4.1. A Checklist for Avoiding Problems with Classroom Assessment Projects.**

<table>
<thead>
<tr>
<th>Choosing a Goal</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is it the right size?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it precisely stated?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it relatively easy to assess?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it worth assessing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it actually taught in class?</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Choosing an Assessment Technique</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is it appropriate to your goal?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can you integrate it into your usual class activity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is it reasonably simple?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will it contribute to learning?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Applying the Assessment Technique</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you tried it yourself?</td>
<td></td>
<td></td>
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<tr>
<td>Have you done a run-through with a colleague?</td>
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<tr>
<td>Have you made the purpose clear to students?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you made the process clear to students?</td>
<td></td>
<td></td>
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<tr>
<td>Did you provide the necessary practice to students?</td>
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<td></td>
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<tr>
<td>Have you allowed enough time to apply the technique?</td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Analyzing the Data</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did you plan how you are going to analyze the data?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you collected a reasonable amount of data (not too much)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is your analysis reasonably simple?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you allowed enough time to do the analysis?</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Responding to the Results</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you planned your response?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you made your feedback explicit to students?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you presented your response appropriately?</td>
<td></td>
<td></td>
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<tr>
<td>Does your response fit into what you have planned for the class?</td>
<td></td>
<td></td>
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<tr>
<td>Have you presented the good and the bad news?</td>
<td></td>
<td></td>
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<tr>
<td>Have you tried to accomplish a reasonable change?</td>
<td></td>
<td></td>
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<tr>
<td>Have you allowed time to respond adequately?</td>
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</tbody>
</table>

Angelo and Cross (1993) pg . 59
This is a Classroom Assessment Technique, not a quiz!

You are supposed to tell your boss how long to process some flat 1018 steel plate in a carburization furnace. He tells you that the plate will be in a furnace at a temperature of 893K in an atmosphere of carbon monoxide/carbon dioxide (equivalent carbon concentration of 0.8wt%). He would like the treatment to achieve a carbon content of 0.34wt% at a depth of 200 microns. The diffusivity of carbon in steel at the temperature in question is 2.44x10⁻¹¹ m²/s.

Circle the equation(s) you can use to solve this problem.

\[
J = -D \left( \frac{\partial C}{\partial x} \right) \quad \left( \frac{\partial C}{\partial t} \right) = D \left( \frac{\partial^2 C}{\partial x^2} \right)
\]

\[
x_{\text{eff}} \approx \gamma \sqrt{Dt} \quad \left( \frac{C(x,t) - C_o}{C_s - C_o} \right) = 1 - \text{erf} \left( \frac{x}{2\sqrt{Dt}} \right)
\]
Using the information you have in the problem statement fill in the grid below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Units</th>
<th>Value from problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x )</td>
<td></td>
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<td></td>
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<td>( t )</td>
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<td></td>
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<td>( C_s )</td>
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<td></td>
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<tr>
<td>( C_0 )</td>
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<td></td>
</tr>
<tr>
<td>( C(x,t) )</td>
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<td></td>
<td></td>
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<tr>
<td>( D )</td>
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<td></td>
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<tr>
<td>( \gamma )</td>
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</tbody>
</table>

For the previous sample CAT, the following higher order learning skills were primarily targeted:

- develop ability to synthesize and integrate information and ideas
- problem solving skills
- analytic skills

along with the following teaching goals:

- improve ability to follow directions, instructions and plans
- learn to evaluate methods and materials in this subject

**Notes:** Three of the four equations listed can be used to solve the problem.

**The data collected from the CAT is listed below:**

*16 students handed in the CAT (out of 22)*

- 5 students circled only 1 equation (100% chose 1 of the 3 correct answers)
- 7 students circled 2 equations (86% chose 2 of the three correct answers)
- 4 students circled 3 equations (75% chose 3 of 3 correct answers)

- 10 students had 4 or less blank spaces out of 21
- 6 students did not attempt to answer 11 or more questions out of 21
Figure 1. a) Number of students as a function of unanswered spaces; b) Mean number of correct answers, $N_c$, versus the number of spaces left unanswered. Error bars are one standard deviation.

How would you interpret the collected data with respect to the teaching goals? Is the data meaningful?

What would you do to change the CAT to make it more effective?
ANGELO’S SEVEN AXIOMS
OF
CLASSROOM ASSESSMENT

Don't ask if you don't want to know.

Don't collect more data than you can easily and quickly turn into useful information.

Don't simply adopt methods and techniques from others, adapt them to your subject and students.

Before using a CAT, always ask yourself: How might responses to this question help me and my students improve learning? (If you can't answer that, the assessment is probably not worth doing.)

Take advantage of the "Hawthorne Effect."
Let students know why you are using CATs and how you hope it will benefit them. You'll be more likely to find what you're looking for.

Remember: If an assessment is worth doing, it's worth teaching students how to do it well.

Make sure to close the "feedback loop" by letting students know what you've gleaned from their Responses -- and how you and they can use that information to improve learning.

Angelo: http://www.ctl.ualberta.ca/documents/Workshop1.pdf
Wrap-up

• Please fill out and hand in the Feedback form
Questions/Comments?