Teaching & Learning Engineering: a tango

Assessment



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Session Objectives

Identify the 3 types of assessment
 Design at least one assessment tool for each type of assessment for your course

Why Assess?

- 1. Ensure the continuous improvement of the course / program
- 2. Identify students' strengths / weaknesses.
- 3. Assist student learning.
- 4. Ensure the effectiveness of a particular instructional strategy.
- 5. Improve overall teaching effectiveness.
 6. Communicate with and involve students.
 7. Satisfy accreditation agencies (ABET, WASC,...)

What is assessment?

The collection and analysis of data to inform changes that will improve an outcome.

Quick Write: 1 min

Write down 5 different types of assessment you plan to use to grade students in your course (e.g. lab report, <u>midterm exam, etc.)</u>

Diagnostic Assessment □ *When?* At the beginning of a course. \Box Why? (a) Ascertain, prior to instruction, student strengths, weaknesses, knowledge, and skills. (b) Adjust the curriculum to meet students' needs. *Example:* Fluid Mechanics Concept Inventory Thermal Concepts Inventory

Formative Assessment □ When? Any time during a course. U Why? To inform quick changes in course delivery to improve student learning during a particular course offering. Types: ✓ Student surveys • Long • Short ✓ Authentic – based on graded student work • In-class assignments / quiz Homework assignments • Midterms

Summative Assessment

- When? At the end of a course.
- \Box Why?
 - Check whether CLOs are met provide accountability,
 - ✓ Inform more substantial changes in course delivery.
- Based on cumulative learning experience.

Example: Comprehensive final exam / final course project report

Quick Write: 1 min

Sort your assessments:
Diagnostic
Formative
Summative

Assessment Continuum Understanding: develops over time Assessment: collection of evidence over time



Observation Lothe

Informal checks

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Priorities and Assessment

Worth being familiar with

Traditional_s quiz/tests

Important to Know and do

Performance tasks and projects

Enduring understanding

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Assessment at the Start of a Session

- The minute paper: students write in their journals:
- The most interesting / important thing from their reading assignment.
- An outstanding question from their reading assignment.
- □ Share in class.
- Quiz.

Assessment at the End of a Session

The minute paper / reflection:

- □ The most interesting / important thing from today's session.
- □ An outstanding question.
- □ The muddiest point.
- In no more than 3 concise sentences summarize what you' ve learned about ________ so that you could explain it to a friend.
- □ List 5 7 words / short phrases, which will define what means to you.

List the key knowledge or skills you have learned in this session. Then list some possible applications to your own life!
 Discuss with a partner / share in class.

Periodically collect and assess student journals.

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Cooperative Learning as an Assessment Tool

Students work in small groups to solve problems / answer questions / write a paper / etc.

- Feedback from peers = input for selfassessment!
- Frequent in-class feedback from instructor = input for self-assessment!

Assessing Team Skills: Group Processing List 2 things your team did well while working together. □ Write down 1 thing each member did, which helped your team.

Write down 1 thing your team needs to improve, so you can be more efficient next time.

Peer Reviews - Rubric

Rubrics

A set of guidelines for rating student work that describes what is being assessed, provides a scoring scale, and helps us correctly place work on the scale.

Examples:
 Problem - Solving
 Project Evaluation
 Design of Experiments

Classroom Assessment Project Cycle Phase 1: Plan

Step 1: Choose a class.
 Step 2: Focus on an "assessable" question about student learning.
 Step 3: Design a project to answer that question.

Classroom Assessment Project Cycle Phase 2: Implement

Step 4: Teach the target lesson.
Step 5: Collect data (tests, etc.)
Step 6: Analyze / interpret data.

Classroom Assessment Project Cycle Phase 3: Respond

Step 7: Formulate an appropriate response to improve learning.
 Step 8: Implement changes.
 Step 9: Re-assess student learning
 Step 9: Evaluate effects on teaching and learning.

Mini Lesson Learning Objective: Explain how wings generate lift.

Diagnostic Assessment

- A. Wings generate lift by pushing air up.
- B. An airplane needs an engine to generate lift.
- C. The slower a plane flies, the more lift the wing generates.



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Mini-Lecture on Aerodynamic Lift □ A wing generates lift by pushing the air down. □ Newton's 3rd law: action – reaction \Box Newton's 2nd law: F = m a $L = m_{air} a_{air}$ $\mathbf{0}^{\mathbf{r}}$

Formative Assessment

The larger a wing is:
a. The more lift it generates.
b. The less lift it generates.
c. The amount of lift a wing generates is independent of its size.

Formative / Summative Assessment

Which bird flaps its wings faster: a sparrow or an albatross. Why?



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Flying Analogy



No corrections during final approach 🛞



Summative Assessment Examples

- Comprehensive final exam / course project; based on cumulative learning experience.
- Oral Presentation
- CLO Score Analysis
- Outcome Analysis
- Course Assessment Summary = the Sum of All the Outcome Analyses for the Course

Assigning Student Grades

Old Paradigm ✓ Norm-referenced (i.e. graded on the curve) ✓ Multiple choice exams New Paradigm ✓ Criterion-referenced ✓ Possible for every student to earn an A or a B ✓ Typically portfolios & performances (e.g. AIAA DBF)

Assigning Student Grades

"It is not a symbol of rigor to have grades fall into a "normal" distribution, rather, it is a symbol of failure – failure to teach well, to test well, and to have any influence at all on the intellectual lives of students"

Milton, O., Pollio, H.R. & Eison, J.A. (1986). Making sense of college grades. San Francisco: Jossey-Bass, p.225

Assigning Student Grades

"If we are effective in our instruction, the distribution of achievement should be very different from the normal curve. In fact, we may even insist that our educational efforts have been unsuccessful to the extent that the distribution of achievement approximates the normal distribution"

Bloom, B.S., Madaus, G.F., & Gastings, J.T. (1981). Evaluation to improve learning. New York, NY: McGraw-Hill, p.52

Pair & Team Task: 15 min Develop diagnostic, formative, and summative assessment(s) for each of your CLO

Sharing

Reflection on the workshop 5 min

The most interesting thing you' re taking away.
 Unanswered questions ?