Teaching & Learning Engineering: a tango

Assessment

Nikos J. Mourtos

Professor & Chair, Aerospace Engineering
San Jose State University
Course Learning Objectives
(What should the students be able to do at the end of the course?)

Learning Activities
(How do my students learn best?)

Assessment
(What is acceptable evidence of learning?)

Content

Students

Classroom Assessment

Tests

Papers

Reports

Reviews

E-portfolio

Surveys

16 February 2017

Nikos J. Mourtos
Session Objectives

1. Identify the 3 types of assessment
2. 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, midterm exam, etc.)
Diagnostic Assessment

- **When?** At the beginning of a course.

- **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.
- **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.
- **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

Priorities and Assessment

- Worth being familiar with
- Important to know and do
- Enduring understanding

Traditional quiz/tests

Performance tasks and projects

16 February 2017
Nikos J. Mourtos
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.

16 February 2017

Nikos J. Mourtos
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 self-assessment!
- 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.
Airplane moves in a straight line at constant airspeed.
Mini-Lecture on Aerodynamic Lift

- A wing generates lift by pushing the air down.
- Newton’s 3rd law: action – reaction
- Newton’s 2nd law: $F = ma$
  or $L = m_{\text{air}} a_{\text{air}}$
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.
Which bird flaps its wings faster: a sparrow or an albatross. Why?
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”

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”

Pair & Team Task: 15 min

Develop diagnostic, formative, and summative assessment(s) for each of your CLO
Reflection on the workshop
5 min

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