Active-Engagement Classroom Practices: Joyful Experiences and Hard-Learned Lessons

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http://www.physics.oregonstate.edu/portfolioswiki

Non-Content Goals

- Professional Development
- Metacognition

You might also want to consider these non-content goals:

- Computer visualization
- Lecture
- Small whiteboard questions
- Writing assignments
- Demonstrations

Pedagogical Strategies

- Kinesthetic activities
- Small-group problem-solving
- Computer visualization
- Integrated laboratories
- Writing assignments
- Small whiteboard questions
- Lecture
- Demonstrations

Use an appropriate mix of lecture AND active-engagement.

- The Instructor:
  - Paints big picture.
  - Inspires.
  - Covers lots fast.
  - Models problem-solving.
  - Makes connections.
- The Students:
  - Focus on sub-tickets.
  - Experience depth.
  - Slow, but in depth.
  - Practice speaking.
  - Practice problem-solving.
  - Control questions.
  - Make connections.

Team Approach to Curriculum Development

- Every faculty member is on 2 of 3 teams: lower division, upper division, and graduate.
- Teams meet every 3 weeks.
- Teams include tenured faculty, instructors, TA’s, teaching postdocs.
- The support of the Department Chair is crucial to the functioning of teams.
- Teams coordinate to discuss:
  - what content is important for the bigger picture (full curriculum),
  - overarching goals to emphasize in the courses,
  - curricular assessment and changes,
  - what students struggled with,
  - what students can be expected to know when moving from one course to the next.

Setting Goals/Assessment

Conceptual Understanding

- Pedagogical strategies
- Scaffolding 
- Problem Solving
- Assessment
- Activities

Curriculum Development Projects in Physics at OSU

GPHYS PHYSICS EDUCATION RESEARCH GROUP: Includes a complete overview of our large-enrollment introductory sequence for pre-engineers. Interactive-engagement is facilitated via incorporation of physics education research-based curriculum, a complete lecture hall, and a new SCALE-UP classroom.

PARADIGMS IN PHYSICS: Restructures the upper division curriculum to be more modern, flexible, and inclusive. The content is reordered to present physics the way professional physicists organize their own expertise knowledge. Pedagogical applications include small-group learning, project-based courses, and technology-based visualization activities.

VECTOR CALCULUS BRIDGE PROJECT: Uses geometric reasoning to bridge the divide between the way vector calculus is taught in physics and the way it is taught by other scientists, especially physicists.

New Department Culture

- Curricular improvements are not lost as heroes burn out.
- Traditional faculty, contingent faculty and TA’s have support for continual improvements in their teaching.
- Large-enrollment, lower-division courses are no longer a burden to be shunned.
- Assessment happens naturally.

Collaborations Outside the Department

- with a college of education research group can:
  - allow for more specialized research expertise,
  - share assessment responsibilities,
  - support TA development and peer evaluation of teaching.
- with a College of Education can:
  - support programs for future teachers,
  - with local community-college can:
    - provide a larger development group,
    - bring increased support from funding agencies,
    - facilitate transferability of courses,
- with other physics education research groups can:
  - provide a larger development group with specialized expertise,
  - provide larger student numbers to assess reform in small enrollment.

New Space for Active Large-Enrollment Active Engagement.

- Tables seat 3 groups of 3.
- One laptop for each group.
- Starboards project student work.
- Frictionless surface

Use an appropriate mix of lecture AND active-engagement.

- Flexibility
- Many short upper-division courses rather than year-long sequences allow us to tailor the major for students with diverse career goals.
- Teaching content courses with modern pedagogical strategies allow us to address the needs of pre-service teachers within our major.
- Several active-engagement intro sections will allow us to have separate versions, e.g. for at-risk or honors students.

Pedagogical Strategies

- Kinesthetic activities
- Small-group problem-solving
- Computer visualization
- Integrated laboratories
- Writing assignments
- Small whiteboard questions
- Lecture
- Demonstrations

Whatever works.

- Move away from templates.
- Problem-solving confidence.
- What is your job as a physicist?
- What is the purpose of your education?
- What is a physicist as a professional development.
- Writing and speaking like a physicist.
- Problem-solving confidence.
- Moving away from templates.

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