ENGAGING STUDENTS IN LEARNING IN LARGE CLASSES

Putting research on learning to practical use

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AGU, Fall 2012
Challenges: Engagement

Quotes from the pre-workshop survey:

• How to make a 300 person class more interactive and alive.

• I'd like to address how to engage students during my time with them to promote deep understanding of concepts.

• How to get my students to increase their problem solving and higher order thinking skills.

• Balancing conceptual knowledge and content with skills/methods/approaches to solving problems especially quantitative skills.

• How to give students in a large class setting the opportunity to interact and participate in lecture learning the way a small class setting allows for.

• Teaching students with diverse backgrounds. How do I equilibrate to a common standard that is above that of the weakest student? Example: Engineers may find the quantitative content of my lecture primitive while geographers will struggle with equations and concepts.
Research-based Keys to Success

• Use active learning pedagogies, such as
  • Interactive lectures (e.g. think-pair-share, ConcepTests, interactive demonstrations, lecture tutorials, Just in Time Teaching)
  • Cooperative learning (e.g. jigsaws, peer teaching, cooperative exams)
  • Flipped classrooms
• Provide formative feedback, early and often
Engaging Students in Learning

"What is often called 'deep learning,' the kind that demands both understanding and remembering of relationships, causes, effects and implications for new or different situations simply cannot be made easy. Such learning depends on students actually restructuring their brains and that demands effort." (Leamnson, 2002, p.7).

How can we engage our students in deep learning?
Pose questions and problems for them to solve.
This can take many forms:

- Interactive lectures
  - Think-pair-share
  - ConcepTests
  - Interactive demonstrations
  - Lecture tutorials
  - Just-in-Time Teaching (JiTT)

- Cooperative/collaborative learning
  - Jigsaws
  - Peer teaching
  - Cooperative exams

- Studio teaching
- Flipped classrooms
Engaging Students in Learning

Quick polls:

1. How many of you use one or more of the methods mentioned below?
   - Think-pair-share
   - ConcepTests (aka “clicker questions”)
   - Interactive demonstrations
   - Lecture tutorials
   - Just-in-Time Teaching (JiTT)
   - Jigsaws
   - Peer teaching
   - Cooperative exams

2. How many of you have tried one or more of those methods and discontinued them?

3. How many of you worry that making your lecture more interactive requires teaching less content?
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Interactive lectures (e.g. Mazur, 1997; Hake, 1998; McConnell et al. 2006)

- **Think-pair-share**: pose a question; have students think about it (individually); have students discuss their answers with a neighbor; ask the class to share their thoughts

What does this graph tell us about the eruption behavior of Old Faithful geyser?

**Eruption duration vs. previous eruption interval, Old Faithful**
Think-pair-share: What are some of the barriers that prevent you from incorporating (more) interactivity in your large classes?

Answers:
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Interactive lectures
- **ConcepTests (clicker questions)** (e.g. Mazur, 1997; McConnell et al. 2006): Follow a lecture segment with a conceptual test question to see whether students “got it.”

![Image of Earth from space]

**What was the phase of the moon, as seen from Earth?**
- A. Full
- B. New
- C. Quarter
- D. Crescent
- E. Gibbous

**Was the moon waxing or waning?**
- A. Waxing
- B. Waning
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Interactive lectures

- **Interactive demonstrations** (e.g. Couch et al., 2004): Student predict, experience, and then reflect.

Image from http://www.coshoctoncounty.net/agency/swcd/educationinformation.php
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Interactive lectures

• **Lecture tutorials** (Kortz, Smay, and Murray, 2008): Follow a lecture segment with a worksheet of conceptual questions that students can answer independently or in small groups.

• Walk around the classroom helping students who are stuck. Where that is impractical (because of the classroom set up), encourage students to ask their neighbors for help when stuck.

• Review key points when students have finished the tutorial.
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Interactive lectures
• **Just-in-Time Teaching (JiTT)** (Simkins and Maier, 2010): Students answer online questions, with answers due a few hours before class. The instructor reviews students’ responses prior to class and addresses topics or concepts that students struggled with during lecture. If warranted, an in-class activity may be devised to help students grasp the concept.

For an environmental science class, after students complete a reading assignment:

What are some of the biological effects of dam removal (good and bad)?

Image from http://commons.wikimedia.org/wiki/File:Three_Gorges_Dam_09(2).jpg
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Cooperative/collaborative learning: Randy’s Mauna Loa CO2 exercise ([http://serc.carleton.edu/introgeo/interactive/examples/co2.html](http://serc.carleton.edu/introgeo/interactive/examples/co2.html))

1. Each group of ~4 students graphs a handful of data points (CO2 levels vs. dates) and makes predictions based on them:
   - Draw a line through your data; predict when CO2 will be twice its original value.
2. Show students what the graph looks like when you use all of the available data.
3. Ask students why their predictions varied (from group to group) so much.
4. Give a brief lecture on interannual and intrannual CO2 variation.
Resources

Teaching large classes:
- http://serc.carleton.edu/teachearth/site_guides/largeclass.html
- http://serc.carleton.edu/NAGTWorkshops/intro/large_classes.html
- http://serc.carleton.edu/NAGTWorkshops/earlycareer/teaching/LargeClasses.html

Motivating students:
- http://serc.carleton.edu/NAGTWorkshops/intro/motivation.html
- http://serc.carleton.edu/NAGTWorkshops/metacognition/largeclasses.html

Engaging students in learning:
- And many more, here: http://serc.carleton.edu/sp/library/pedagogies.html

Assessment in large classes:
- http://serc.carleton.edu/NAGTWorkshops/assess/lgclass.html
References


