A Conversational Approach to Teaching about Nuclear Power

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The big student response:
Why can’t we have this in every class?

Philosophy

- Increase engagement
- Improve transparency
- Use ideas 1st year pedagogy in upper division

Added this year

- Checkpoint system
- Rubrics
- Guided peer feedback on projects

Introduction to nuclear power

- Energy science students & Physics majors
- 3rd year course, only nuclear course
- 7 → 18 students (thanks CNS!)

Was: Lectures

- Interact by asking questions of students
- Students did a reactor presentation
  - Spontaneous fight about reactors
- Strong student evaluations
- People got enthused about nuclear power

Now: checkpoints

- lecturing ~5 minutes/week
- Series of questions, students answer in lab book
- ‘Checked out’ in groups of 3-7
- Full marks for completion (30% of total)

Adapted from 1st year model

- Had developed 1st year ‘labatorials’
- Huge improvements
  - Better test scores
  - Improved student evaluations
- TAs did checkpoint system for ‘labatorials’
- Formative vs. summative assessment

Allowed for in depth talks

- Students didn’t just nod when I talked
- Discussed topics with all the students
- Tailor the questions to the students.
- Track how student progress

- They **ask** questions

Topics

- Thermo (what is pressure up to heat engines)
- Why is energy important?
- The nucleus, how it was discovered, what it’s made of.
- Radioactive decay
- Chart of the nuclides
- Fission
- Neutron economy
- Enrichment
- Reactor types

What happened?

- 1st midterm went up 15% points
- 2nd & 3rd midterm harder than ever before
- Final showed deep understanding

- Asked questions requiring literature searches

And

- They came here
- They want to present here next year
- Summer reading course on nuclear power
- Senior projects on nuclear power

Improve in the future

- Better question sheets
- Better syllabus
- Better overall grade percentages
- Keep groups the right size
- More efficient use of time

To sum up

- Increasing engagement is improving learning
- Students will learn if challenged appropriately
- Extensive work has been done on improving first year courses, that work can be used to improve upper division courses.