A Conversational Approach to Teaching about Nuclear Power

Jason Donev
Physics & Astronomy
Natural Sciences
Yuen-ying Carpenter
Natural Sciences

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 1\textsuperscript{st} year model

- Had developed 1\textsuperscript{st} 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?

- 1\textsuperscript{st} midterm went up 15\% points
- 2\textsuperscript{nd} & 3\textsuperscript{rd} 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.