Excellence in Teaching Series

Small Teaching Strategies

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About me

• PhD in mechanical engineering from Purdue
• Architectural engineering on Scott campus since 2014

Courses taught:

- HVAC Fundamentals (AE 310)
- HVAC Design (AE 415)
- Hydraulics laboratory (CIVE 319)
- Thermodynamics (ME 200)
- Heat Transfer (ME 420)

Teaching professional development:

- ARISE Learning by Design (2018)
- ASCE ExCEEd Teaching Workshop (2019)
- Classroom Observation Protocol for Undergraduate STEM (COPUS) (2019)
Methodology

- Engineers: data driven – need solid empirical evidence
  - Very difficult to obtain
  - Highly unconstrained problem
  - “Typical student” changes over time

- My basis
  - Professional development content
  - Three years, 4-6 sections of a course, experimented with methods
  - Unofficial feedback from former students
Teaching Strategies – High level

• If you’re committed, you’ll succeed
  • Believe effective teaching is important, value student success

• Give up on wishing how students should be
  • They won’t be like you were
  • Won’t read material before class, won’t do ungraded homework
  • Many will cheat if possible
  • Currently, want an easy A (or B or C)
  • In the future, they’ll value the knowledge
Teaching Strategies – High level

• Optimization objective function:

Maximize students’...

   Knowledge of topic?
Teaching Strategies – High level

• Optimization objective function:

Maximize students’…

Knowledge of topic
Performance on final?
Teaching Strategies – High level

• Optimization objective function:

Maximize students’...

  Knowledge of topic
  Performance on final
  Appreciation of course?
Teaching Strategies – High level

• Optimization objective function:

Maximize students’...

  Knowledge of topic
  Performance on final
  Appreciation of course
  Teaching evaluations?
Teaching Strategies – High level

• Optimization objective function:

Maximize students’…

Knowledge of topic
Performance on final
Appreciation of course
Teaching evaluations
Success in 5-10 years
Teaching Strategies – Specific

• Board notes
  • Surveyed class: PPT with printed notes, Doc. Cam/Tablet, or Whiteboard? → **Whiteboard**
  • Consistent use of color to represent something
    • E.g. Red = Need to memorize, Green = not in textbook

• Learn every student’s name ASAP
  • First assignment: send me .jpg with your face and name

• Joke around
  • Best if students *enjoy* coming to class
  • “Your giant disco-dancing robot needs 3500 kW of power...” or “your moose is running at 15 m/s with a mass of 400 kg...”
Teaching Strategies – Specific

• Mnemonics
  • Stefan-Boltzmann: Dancing constant $5.67 \times 10^{-8}$ W/m$^2$-K$^4$

• Break the lecture up with
  • Short video
  • Show-n-tell items
  • Think-pair-share
  • Walk around building

• For remote teaching
  • Edit the videos (pause to switch colors, show picture, etc.)
  • Radio-button quiz every 5-10 minutes
Teaching Strategies – Specific

• No laptops or devices in class
  • Distracting, disrespectful

• Students with kids
  • Bring ‘em if you need
  • Phone/text is OK

• Homework every class (due a week later)

• Create new homework problems every year

• TA: grade homework and upload solutions
  • If short of time, don’t grade all problems
Teaching Strategies – Specific (tests)

• Grade tests yourself
  • To learn what’s working, what’s not
  • Use Gradescope

• Closed book and Open Book tests
  • Closed book the class before the open book

• Have Test A and Test B
  • Collate them before you go to class

• Use a seating chart for tests
  • Helps learn students’ names!