Incorporating Educational Innovation into the Classroom

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Framework for an Intervention

The Idea

Resources

Design Intervention (including assessment plan)

Implementation

Assessment/Evaluation/Go Public

Conversations

Observation

Colleagues

Education Specialists

Students

Presentation

Workshops

Literature

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Outline

• My goal
  – You are not novices in engineering education – you are here for a reason
  – Provide you with a flavor of some of my experiences
    • Spawn some ideas in you
    • Sensitivity to some issue
    • Serve as a resource

• Where do the students fit in?
• Advocacy
The Idea (Examples)

1. Classroom Response Systems
2. Lecture Capture
3. Desktop Module Development
4. Student Lab Design
5. CAT Analogs
6. Study Guide Analysis
Did you tell your students where you were going and why you were going?

1. Yes
2. No
1. Classroom Response Systems

• They are somewhat ubiquitous now, though they have been around for about 40 years in some fashion.
• There are a lot of ways to use CRS in the classroom.
• Benefits in my classroom
  – When the question slide comes up at the beginning of class, that signifies the beginning of class
    • They become silent on their own
  – Used to identify and remediate common conceptual errors
    • From previous classes, quizzes or exams
  – Those who get the most correct win a prize (book, special T-shirt, etc) → students don’t want to be late or miss class because of this
2. Lecture Capture

- A program that captures what you put on your screen (normally via a Tablet)
  - Journaling program (writing on the “board”)
  - Excel
  - Other programs
- Send to a server and students have almost immediate access to the lecture
  - If they missed class
  - Use to help HW
  - Study for exams
3. Desktop Module Development

“If students have a strong voice in deciding which problems they want to work on, they will likely be engaged in the problems they select, and will likely think deeply about the material, with attendant benefits.”


• Design/Budget/Build/Present
  – Thermodynamics course
  – Student-selected thermodynamics concept
  – Fit on a desktop
  – Multiple-usage (in the future)
  – Previous year students help assess the value
  – Some projects built on previous year’s projects

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Dehumidifier Comparison

Year 1

Year 2

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4. Student Lab Design

- For a lab course, students design the lab experiences that the other students in the class receive
  - Main lab → they work on this for 2/3 of the semester
  - Cross-labs → they have lab experiences designed by the other groups (1/3 of the semester)
- Bio-mass → Ethanol (separations course)
  - Questions to answer:
    - What bio-mass to use?
    - Where to get the bio-mass?
    - How to get the cellulose from the lignocellulose?
    - How can I make the fermentation occur quicker?
    - Etc?
5. CAT Analog Design

- Transfer is “the ability to identify and use concepts and procedures in analogous but novel situations”
  - Think of students solving a math problem in a math class, but not recognizing how to solve the same resulting problem (with different variables) in an engineering class.

- Obtaining transfer is difficult
  - Famous army fortress attack and radiation for a tumor study (Gick and Holyoak, 1983)

- **Research question**: Will HW problems in ENGR that employ the same concepts as a critical thinking assessment test (CAT) result in improved scores on those problems?
One CAT analog example

• Correlation is not causation

• My problem:
  – Related fish kill increase at a river to the use of an auxiliary landfill
  – Provided a detailed question and background asking for interpretation of the data

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A scientist working at a government agency believes that an ingredient commonly used in bread causes criminal behavior. To support his theory the scientist notes the following evidence.

- 99.9% of the people who committed crimes consumed bread prior to committing crimes.
- Crime rates are extremely low in areas where bread is not consumed.

Do the data presented by the scientist strongly support their theory? Yes ___ No ___

Are there other explanations for the data besides the scientist's theory? If so, describe.

Result: No transfer on any of the problems

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6. Study Guide Analysis

[Image of the page with mathematical equations and diagrams related to chemical reactions and thermodynamics.]
6. Study Guide Analysis

- Can you learn something about how students construct knowledge via study guide examination?
- Motivated by the idea, attended RREE workshop in 2005
  - Almost no literature on this subject
    - “study guides” are termed “crib notes”
      - Studies indicate use had no impact on grades
      - Some reduction of test anxiety
- Worked with C&I faculty on campus
  - Helped design the intervention
  - Included interviews after tests 1 and 3, focus groups after test 2
    - Students didn’t know their grade
- Results
  - Different strategies for completion of guides
  - They complete the guides by themselves; helpful for them to go through the “focus group” exercise
  - Students put on the guides what they knew and not what they didn’t know
Where do the students fit in?

- My first few years of teaching I implemented more active approaches in the classroom
  - Problem-based strategies (recorder, skeptic, etc.)
  - Group HW
  - Etc.
- My early year evaluations were deflating
  - “TA would be better and cheaper”
  - “Dr. Visco doesn’t realize we don’t have 20 hours to spend on HW”
  - “I like beans”
  - A parent of a student even complained!
- ASEE Summer School in 2002
  - James Newell (Rowan) gave some tips that I interpreted as “how to show concern for your students”
    - This was the missing piece for me. I assumed the students knew I cared, because I cared.
Where do the students fit in?

• I did not change my teaching style, but changed how I demonstrated concern.
  – Gave students a biography of myself and asked the same of them
    • Helped establish a rapport with students
  – Forced students to pick up their first quiz in my office
    • Defeats the “I didn’t know where your office was” excuse
  – Had office hours in a classroom (facilitates students coming to ask questions)
  – One minute muddy/clearest points on Fridays (addressed on Mondays)
  – Explained why I was using active learning in the classroom and what the literature said on the subject
  – Evaluations went from 3.0 out of 5.0 to 4.8 out of 5.0 in “excellence of instructor”
  – Comments even changed to both acknowledge the challenging course and the instructor “cared”

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Empower Students

• Do your students know why you are not in class these next few days?
  – They would certainly like to know that their instructor is getting professional development to do their job more effectively → model “life long learning”
• Perhaps allow students to design their own grading schemes (weight of exams, HW, quizzes, projects, etc.) from a template.
  – Hint: Almost no one will make a change, but they are thankful for the opportunity
• Student designed lab experiences, resurrection points on exams, buy-in when taking a non-standard approach in the classroom
Advocacy: It is up to you...

- You can find calls for special training in education for engineering faculty from the early 1900’s.
- One of the participant outcomes for this symposium is for you to “become agents of change to help advance the U.S. capacity for engineering education innovation”
- How can you be an agent of change?
  - There about 25,000 engineering faculty in the US, though there are around 50 or so of you in this room.
  - Think global, act local (and global, when you can!)
  - Role models for other faculty (both more and less experienced)
    - Talk to that young (or experienced) faculty member you work with on your technical research about education issues.
  - What do you consider when serving on a search committee?
    - Does a faculty candidate have 50 literature citations in their research interest, but not a single one in their educational interests?