

Teaching-as-Research: How I learned that educational research is not all that different from my usual lab experiment

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Motivation

I have developed and currently teach two classes:

1. BME 510: Intro to Tissue Engineering
2. BME 601: Political, Ethical, Social, and Global Issues in Biomedical Engineering

Both cover topics of stem cells, gene therapy, and tissue engineering, but involve very different approaches to teaching these issues

BME 510:
Traditional approach

Vs.

BME 601:
'Contextual' approach

Solution:
Go to ISEE!

What I wanted to find out: Does teaching via a 'contextualized approach' (BME 601), improve student learning outcomes by making the course material more interesting/relevant to students? And, would this approach be particularly useful in teaching to and motivating diverse audiences?

My first obstacle: Despite years of research training, I had no experience in using my classroom as a research lab.

The ISEE Workshop (aka: the Pre-Lab exercise)

What I wanted to find out:

- How do I write a good educational research question?
- What educational research methods are appropriate for rigorously testing my hypothesis?

The results:

- Minor evolution of research question:

"How does presenting engineering-based content in a social/political/ethical context affect student comprehension of content and their motivation to learn more?"

- Connected hypothesis and research question to relevant educational theory (Contextual Learning Theory, Hull et al., 1993)
- Developed initial assessment materials to rigorously test hypothesis
- Connection to diversity: Relates to overall social and cultural diversity by using contextualized approach to make course material more personally relevant to more diverse groups of individuals with different backgrounds and experiences
- Saw a baby panda, visited D.C. sights, and made some cool new friends
- With lots of ISEE community support and ed. research knowledge under my belt, I was excited and ready to start my study!



"How does presenting engineering-based content in a social/political/ethical context impact student learning of these topics when compared against teaching these same topics via a traditional (decontextualized) approach?"



Ready to do Research

Iteration (aka: this is feeling very familiar...)

So, the experiment did not produce the expected results. It suffered from the usual problems:

- Lack of a good control condition
- Different baseline levels for the different treatment conditions
- Experiments not optimally designed to test given hypothesis

What to do now?

- Re-evaluate research question: Are we still asking what we intend to ask? Answer: **Yes**.
- Re-evaluate experimental design: Are we setting up the experiment in the best way to test our hypothesis? Answer: **No**.
- Comparing across two different courses with two different student populations introduces complications. Re-design study to evaluate different teaching approaches within the same course.

Conclusion: Just another day in the lab!

Implementation (aka: time to run the experiment!)

- Obtained project assistant/intern (via DELTA program) to help with study
- Finalized assessment materials for both courses
- Administered a combination of pre- and post-tests, surveys, and elicitation tasks to students

and then...

Data Analysis (aka: the point where you realize that you're going to have to re-run your experiment)

- Analyzed data...but the results were inconclusive
- Identified one fundamental problem of study design: students who take BME 601 have different learning goals than those who take BME 510 (i.e. they are not as interested in learning about technical content)
- Other potential problems: do the assessment materials do a good job of addressing our research question?
- **An Unexpected Outcome:** Sometimes you end up answering an entirely different question than you originally intended! We acquired very interesting data on methods of teaching engineering ethics. I will be delivering a talk entitled "Fostering Moral Imagination in Biomedical Engineering" at the Annual Meeting of the Society for Ethics Across the Curriculum, Dublin, Ireland, Nov. 15-17, 2007.

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