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.

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.

Solution: Go to ISEE!

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?”
  “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?”

• 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!

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

What now?
• 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.

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!

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Ready to do Research

Vs.

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and then…

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