Physics 4810 / 7810 Week 2 - Getting Going

Day 3: Fa2008
- Field Sites
  - Phys 1110 excused at 5p
- Starting Out:
  - Redish
  - McDermott
  - Van Heuvenlin

Why's this important?

Why physics education?

Why education *in general*?

What IS education, anyway?

Why's this important?

The [National] Commission [on Mathematics and Science Teaching for the 21st Century] is convinced that the future well-being of our nation and people depends not just on how well we educate our children generally, but on how well we educate them in mathematics and science specifically" –

Before It's Too Late – pg. 4 - Sept 2000

Why's this important?

In March 2001, the U.S. Commission on National Security/21st Century …. on which I served warned that the crisis in scientific research and education is the second greatest threat facing American national security. In fact, the 14 bipartisan members unanimously agreed that the 'inadequacies of our systems of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we might imagine.' The Commission went on to assert that only a nuclear or biological weapon released in an American city [is] a greater threat

-Newt Gingrich, open letter to Congress, May 2005

Rising Above Gathering Storm

Congressional charge (2005):

What are the top 10 actions, in priority order, that federal policymakers could take to en… comp…

4 Re…

#1: 10… SC…

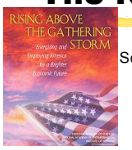
#3: BEST AND BRIGHTEST IN SCIENCE AND ENGINEERING HIGHER EDUCATION

#4: INCENTIVES FOR INNOVATION

AUG 9, 2007

Public Law No: 110-69
The America COMPETES Act
Investment in Science and Science Education

The National Story: PER



Science Education receiving national attention
(*Gathering Storm*: 2 of 4 major national recommendations are education oriented)

Research in Science Education (PER) is a fundamental form of investment in the future
NSF Funding EHR ($816M); MPS (new $$)

Physics is leading the way for sciences
Growing -- 125 faculty; 10 programs of CU size
Established journals, conferences, community

APS physics Physical Review Special Topics
Physics Education Research

Physics Education Research

- APS: 99.2 RESEARCH IN PHYSICS EDUCATION
  (Adopted by the Council, 21 May 1999)
  In recent years, physics education research has emerged as a topic of research within physics departments. ... The APS applauds and supports the acceptance in physics departments of research in physics education.

Why is this course PHYS and not EDUC?

- Discipline based issues, focus on specific content.
- SOE focus on K-12.
- Audience is other physicists.
- But maybe it SHOULD be cross-listed!?

A metacognitive pause

- Claim
  We seek /take a scientific approach to science education
  (Redish, Wieman many others)
- We will discuss this - in what ways …
- Take one cue for certain in this class
  - JUSTIFY CLAIMS
  - CITE Articles
  - Personal experience is great (it's how we know things)
  - HOWEVER: plural of anecdote is not *anecdata**
    - from Beichner in PER book
    - "Let's see the studies!" (adapted: Mike Mullan)

What are goals physics class?

- According to these authors
- According to you
- Who is responsible in the classes & for what?

Redish

- The students we are teaching have changed.
- The goals we want to achieve with these students have changed.
- We know much more today about how students learn than we used to.
- We have more tools to work with: both technology and new learning environments than we used to.

I organize my discussion of these points around two questions:
1. Who are we teaching and why?
2. Why Physics Education Research (PER)?

Nice place to start

- 1. Who are we teaching and why?
  2. Why Physics Education Research (PER)?
- What ways to the authors agree / disagree?

Metaphors in Physics Educ

Figure 1.3 The fact that something "comes back as we sent it out" does not mean that much has "gotten through to the student," especially if students possess a large inertia!

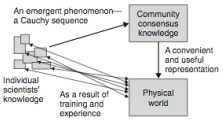
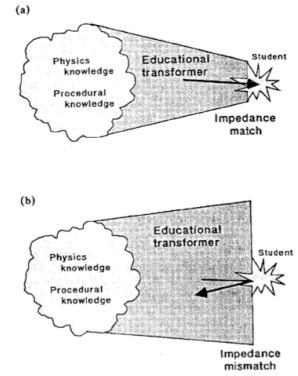


Figure 1.4 Representation of the process of building the scientific map of the physical world.



What are Redish's caveats?

McDermott

- What's the difference between inductive and deductive?
- Note Structure of Argument
  - Quantitative understanding insufficient
  - Coherent Conceptual Framework not typical
  - "Deep seated difficulties cannot be overcome by assertion"
  - Reasoning Ability generally does not result
    - ?? What does McDermott mean by "reasoning ability"
  - Lack of connections (concepts, reps and real world)
  - Teaching by telling does not work
- Solution?
- What is McDermott's Definition of Meaningful Learning?

Van Heuvelen

- Note statements are cited!
- p.891 c1, "Instead of … we might encourage studets to think of the problem statement as …"
  - What does this say about how we (should) teach?
- What are 3 reasons of lack of qualitative understanding by students?

How does Van Heuvelen suggest we educate?

Typical Classroom- today

Earliest Known Example of a Schoolroom from Sumer, circa 3000 BCE

MIT Studio Physics- John W. Belcher*

Active classes make active students (on task)

* http://www-caes.mit.edu/research/teal/index.html