Physics 4810 / 7810 Week 5 - Learnin!

Day 9: Fa2008:
Knowledge in Pieces

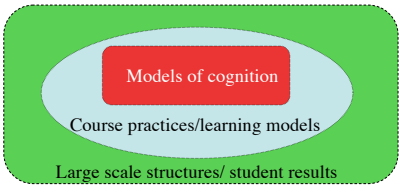
Review of where we are
A Little bit of where we are going
Knowledge in Pieces

and a word from your professor

- Y'all ROCK
- Seriously the level of discussion has elevated tremendously this week…
- Special thanks to those engaging in dialogue
- Lots of GREAT ideas showing up

T&L Summary- Week 5 : where are we?

Top down introduction
- practice based
- rise to concrete:



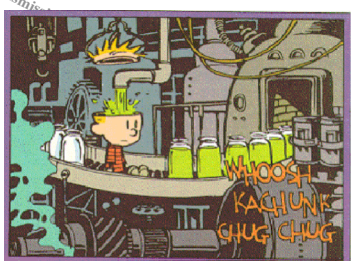
What about the level of practice

- Students are NOT learning what we expect.
- Difference between
  - active –engagement
  - traditional practices / passive students
- Variety of strategies to engage people:
  - study what they know coming in
  - address misconceptions
  - build connected representations

Trad'l Approach Theoretic Background

Individual ← Instruction via transmission — Content (E/M)

transmissionist



PER Theoretic Background

Individual ← Instruction via transmission — Content (E/M)

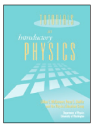
transmissionist

Individual (Prior knowledge) ↔ Construction constructivist — Content (E/M)

basic constructivist

PER Course Practice

- Tutorials



- Concept Tests / Peer Instruction
- JITT
- ILD

Cognitive underpinnings of practices

How to deal with Prior Knowledge:

- elicit -confront-resolve -- not really a cognitive model -- but basis for practice
- bridging -- step from p.k. to scientific knowledge

Models of cognition

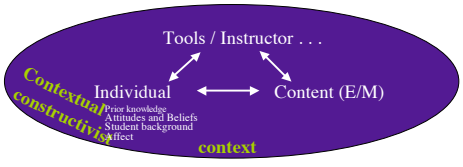
- Full blown concepts /mis-concepts--
  - Heavier objects fall faster
- Schema -- organized structures that give rise to concepts
- Phenomenological primitives -
  "phenomenological" = from experience
  "primitive" = basic / irreducible unit

Where are we going

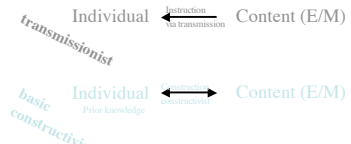
- Build back out …
- Realize there is more to education than "concepts"

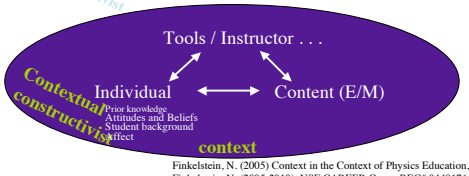
And more to cognition?

- In fact we can't really separate all of these because of *CONTEXT*



PER Theoretic Background



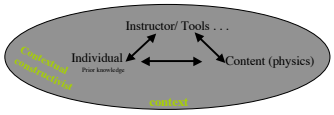


Finkelstein, N. (2005) Context in the Context of Physics Education, *IJSE*
Finkelstein, N. (2005-2010). NSF CAREER Grant: REC# 0448176

Theoretical Framework

Contextual Constructivism

i. tools mediate our understanding / cognitive processes
ii. context shapes how we might use these tools



Finkelstein (2005), adapted from Cole, M. (1996), Cultural Psychology

Tools allow thought

A Story of Galileo: 6 theorems of a genius

Theorem: If a moving particle, carried uniformly at constant s…e time interval r… of their distances.

(foll…

algebra

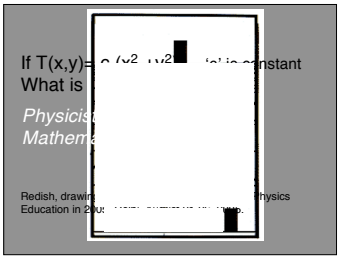
$$\frac{d_1 = r * t_1}{d_2 = r * t_2} \Rightarrow \frac{t_1}{t_2} = \frac{d_1}{d_2}$$

From diSessa (2000) *Changing Minds*

Meaning of tools

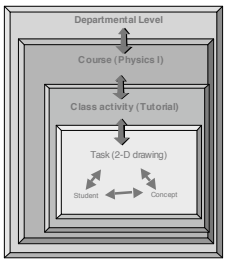
Evolutionary (biological):

And cultural:



Embedded Context(s)

Frames of Context



Finkelstein, N. (2005). *Int. J. Science Education.*

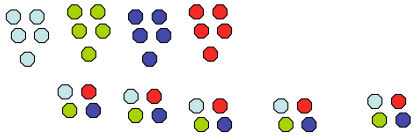
Now Time for Meaning Making

Redish & diSessa

- Burning questions?
- Clarifications

Jigsaw Approach

(i) Form groups of disciplinary expertise
(ii) Jigsaw / regroup into distributed expertise in order to solve broader problem



Redish Jigsaw

1) What are our goals for physics instruction?

2) What is social learning? Does it include lecture? Does technology affect it?

3) How can we teach students "how to use multiple representations and pick out the significant pieces of information from a problem?"

4) How do these theories of memory apply to teaching and learning?

5) What's better, bridging or cognitive conflict? What are their advantages/disadvantages? How would we implement bridging in tutorials?

Broad Question (from Redish)

Broad Question 1: We've seen evidence that *Tutorials* are very effective at teaching physics concepts. Why?

b) Is it because they're "well-written"? Is it because they encourage social learning? Is it the extra time spent?

a) Should we scrap lectures and focus on tutorials? Is it too expensive? Will it just be the "blind leading the blind", and therefore produce improper learning? What about un-social students?

diSesssa Jigsaw

1) Can you think of possible p-prims you have used or encountered? Have you ever had your p-prims challenged by instruction and learned as a result?
2) Is physics simply a way of reorganizing, clarifying, and expressing p-prims?
3) DiSessa notes a number of differences between p-prims and logic. Do you agree with his contrasts between the two? Are p-prims not logical?
4) How does the second section of the paper (on dinosaur cartoons) relate to the first? Why are these two sections in the same chapter?
5) Has anyone experienced one of diSessa's "rare events" that sparked your interest in physics in particular and science in general? Has anyone not experienced one of these events? If not, what got you interested in math and science?

Broad Question (from diSessa)

Broad Question 2: How do you make use of *p-prims* and *rare events* in the classroom?