Physics 4810 / 7810 Week VIII - more than "content" !

Day 13: Fa2008:
What's all the fuss about Metacognition?
What's the implication of the Hidden Curriculum?

Class-updates:
- feedback forms
- projects

Structural Update

- De-Emphasis on trad'l content:
  - No chapter summaries
  - More YOU doing design for classroom (e.g. design a hw problem)
  - Bring texts to class
- Schedule update- on web
- Too much reading. I like the reading a lot, but this long reading and with the other two papers is too much.
- Start to scale -back (a wee bit) on weekly work to let you emphasize projects…
- Projects: if you don't have (enough) feedback from me… ASK ME!

Project work

- Coordinating Surveys
  - High school
  - Phys 1110

  Elsewhere?

Clarifying points from readings

- What is MMSU
- I want to know how to interpret the R value. I remember in my math classes that we considered R values in the 0.9 and above range as strong correlation. Not R=0.63
- What are normalized learning gains?
- How would you determine if there was a causal relationship between beliefs and interest?
- I wonder how many students just answer "Neutral" all the way down.
- 2) What is the FMCE? How does it compare to the FCI?

Theory of the obvious?

- The bulk of what I got out of this paper is pretty intuitive.
- Was anyone else saying "duh" a lot while reading the article?

What are the implications of student expectations?

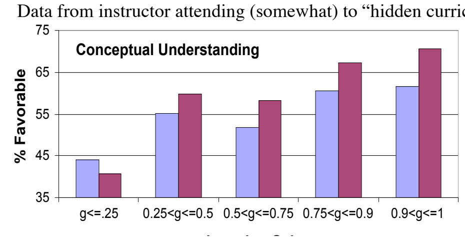
- If I were to design a class that was inclusive (of diverse student backgrounds), promoted student interest and engagement, best prepared students for future classes, what do the following data sets have to say about what I focus on?

4 Groupings

- Dataset #1: conceptual understanding
- Dataset #2: course / major (and distribution)
- Dataset #3: gender and course/major
- Dataset #4: "splits" - what you think, vs what a physicist would think.

Dataset #1

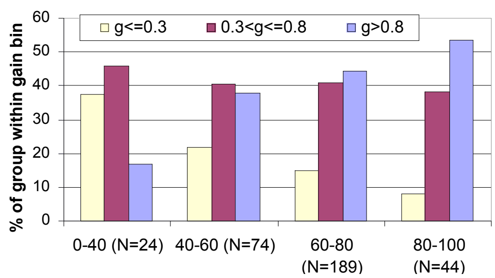
Data from instructor attending (somewhat) to "hidden curriculum")



Low learning gain <---------> high learning gain

Blue= **pre** Red= **post**

Dataset #1b



low <--------------------------------------> high

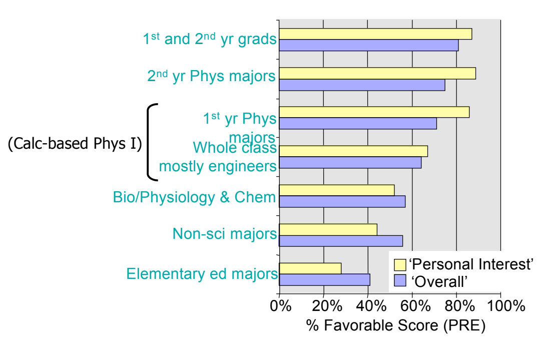
Dataset #2

TABLE 2. Correlations between beliefs (Overall and Personal Interest) and science course selection

	Course Type	School Type/Term	Dominant student population	No. of students w/ CLASS	Beliefs %favorable$ Overall Pre	Overall Post	Personal Interest Pre	Personal Interest Post
Physics	Non-Sci-I	CU/Fa03	non-sci	77	56%	57%	44%	46%
	Non-Sci-II	CU/Sp04	non-sci	34	71%	73%	61%	67%
	Alg-I	CU/Fa04	pre-meds	313	56%	58%	49%	53%
	Calc-I (all)	CU/Sp04	engineers	416	64%	66%	72%	71%
	Calc-I (all)	CU/Fa04	engineers	400	64%	58%	67%	56%
	Calc-I (phys maj only)	CU/Fa04	phys maj	35	71%	69%	86%	82%
	Soph. Level Phys	CU/Sp05	phys maj	69	75%		89%	
Chemistry	Enviro.Chem	CU/Fa04	Env. and non-sci	79	50%	44%	49%	35%
	Gen.Chem-I (all)	CU/Fa04	bio/physiology	461	51%	45%	49%	39%
	Gen.Chem-I (chem. maj only)	CU/Fa04	chem. majors	45	54%	50%	62%	49%
	Honors Gen Chem-I	CU/Fa04	biochem/chem.	20	73%	67%	78%	75%
	Junior Level Chem	CU/Fa04	physical chem.	16	69%	63%	71%	68%

I=1st semester, II=2nd semester; $ typical standard deviation for 'Overall' is ~16%. Uncertainties for the Personal interest range from ~1% for 400 students to ~5% for 16 students. Stat. significant shifts in color. See text.

Dataset #2b



Dataset #3

Student ABs by gender

TABLE 3. Comparison of mens' and womens' beliefs about science

	Belief Category	Physics Majors (Calc I–Fa04) Men	Physics Majors (Calc I–Fa04) Women	Engineers (Calc I–Sp04) Men	Engineers (Calc I–Sp04) Women	Engineers (Calc I–Fa04) Men	Engineers (Calc I–Fa04) Women	Biology Majors (Alg I–Fa04) Men	Biology Majors (Alg I–Fa04) Women
Physics	Personal Interest: Pre (Shift)	85 (-6)	89 (0)	73 (0)	67 (-5)	73 (-12	61 (-10	59 (+2)	38 (+10)
	Real World Conn.: Pre (Shift)	80 (+1)	89 (+6)	74 (+2)	64 (+4)	72 (-4)	64 (-2)	62 (+17	44 (+20)
	Prob. Solv. Confidence: Pre (Shift)	68 (+1)	86 (-16)	N/A	N/A	76 (-11	70 (-16	78 (-1)	61 (-2)
	Belief Category	**Chem Majors (Honors Chem I) Men**	**Chem Majors (Honors Chem I) Women**	**Chem Majors (Gen Chem I) Men**	**Chem Majors (Gen Chem I) Women**	**Engineers (Gen Chem I) Men**	**Engineers (Gen Chem I) Women**	**Biology Majors (Gen Chem I) Men**	**Biology Majors (Gen Chem I) Women**
Chemistry	Personal Interest: Pre (Shift)	83 (-10)	77 (-10)	65 (-8)	60 (-17	48 (-11	60 (-25	53 (-12)	50 (-11)
	Real World Conn.: Pre (Shift)	80 (-7)	77 (-10)	57 (+3)	58 (-10	45 (-5)	56 (-14	48 (-11)	44 (-3)
	Prob. Solv. Confidence: Pre (Shift)	80 (-10)	91 (-10)	60 (-1)	72 (-11	71 (-25	65 (-5)	57 (-7)	57 (-7)

Dataset #3b

Gender Differences

			Men	Women
	Alg-based	Overall	63	55
		Personal Interest	62	42
		Real World Connection	72	55
			(N=115)	(N=191)
Physics Majors	2nd year	Overall	83	80
		Personal Interest	92	94
		Real World Connection	88	95
	3rd year	Overall	82	88
		Personal Interest	89	100
		Real World Connection	89	100
	4th year	Overall	78	94
		Personal Interest	82	94
		Real World Connection	77	92
			(N=130)	(N=18)

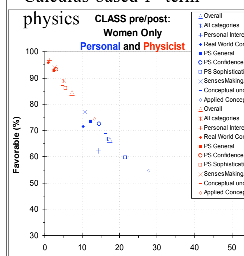
Dataset #4

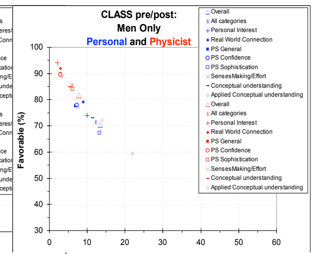
Students responded to CLASS survey in two ways:

PERSONAL = "What do you believe?"

PHYSICIST = "What would a physicist say?"

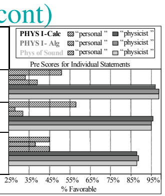
Calculus-based 1st term physics



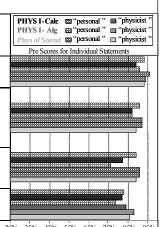


Dataset #4 (cont)

% of Students Who "Split" PHYS I-Calc	PHYS I-Alg	Phys of Sound	Statements (expert response)
48%	67%	60%	3. I think about the physics I experience in everyday life. (agree)
41%	67%	64%	25. I enjoy solving physics problems. (agree)
49%	56%	52%	36. There are times I solve a physics problem more than one way to help my understanding. (agree)



% of Students Who "Split" PHYS I-Calc	PHYS I-Alg	Phys of Sound	Statement (expert response)
5%	7%	8%	29. To learn physics, I only need to memorize solutions to sample problems (disagree)
8%	11%	12%	23. In doing a physics problem if my calculation gives a result very different from what I'd expect, I'd trust the calculation rather than going back through the problem. (disagree)
8%	14%	13%	26. In physics, mathematical formulas express meaningful relationships among measurable quantities. (agree)
11%	15%	13%	10. There is usually only one correct approach to solving a physics problem. (disagree)



Group Reporting

- Conceptual understanding
- Distribution and course
- Gender
- Personal-view vs "What a physicist thinks"

JIGSAW

- If I were to design a class that was inclusive (of diverse student backgrounds), promoted student interest and engagement, best prepared students for future classes, what do the following data sets have to say about what I focus on?

How do these messages get sent?

"People respond to incentives … How do we get students to develop the "right" incentives?"

Homework Example from 121

Schoenfeld Approach

- What are you doing?
- Why are you doing it?
- How does it help?

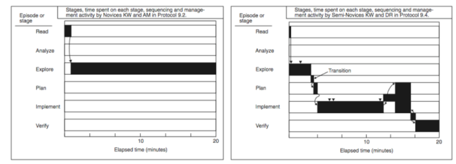


Figure 3.4 Sample plots of student activities in solving math problems in Alan Schoenfeld's metacognitive math class. Small triangles mark metacognitive statements [Schoenfeld 1985].

Teaching Metacognition

- Does it have to be explicit?
- What about implicit framing, or apprenticeship?

What are Schoenfeld's 4 Approaches to MCcompetence

- Videotapes (watching students learn)
- Teacher as Role Model
- Whole Class Problem Solving with teacher as control
- Problem Solving in Small Groups * (possibly assigning roles: see FN 7