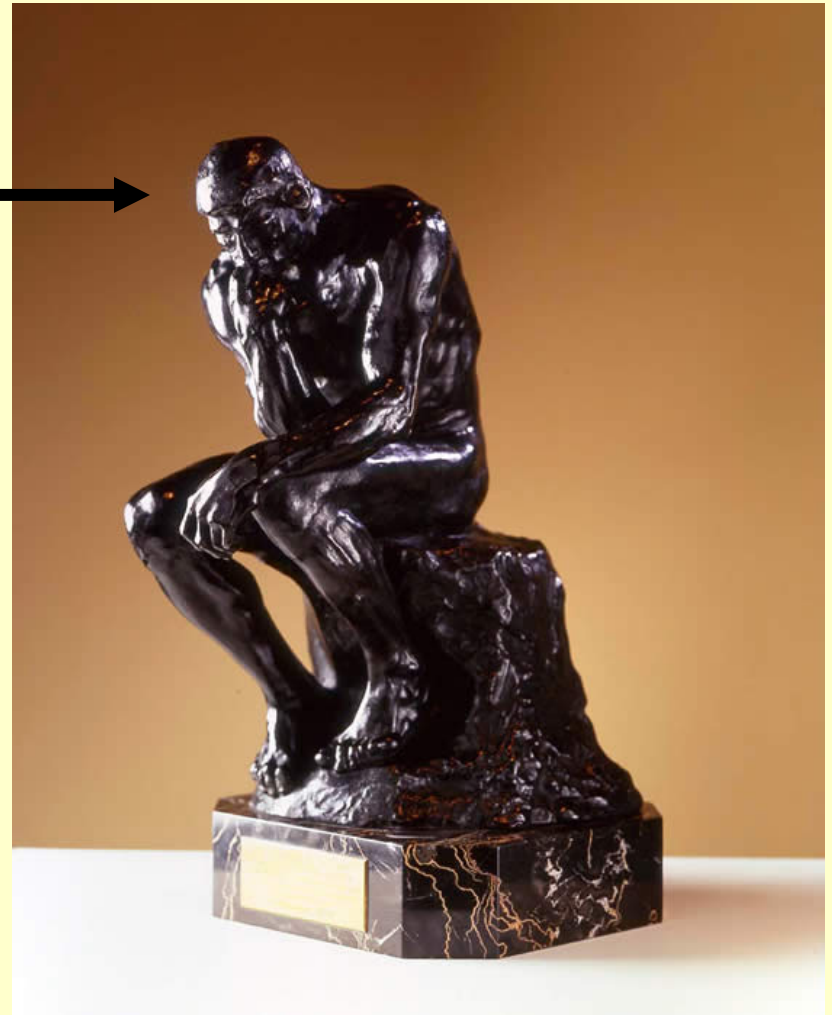


12th Annual Conference on Teaching and Learning

Making Thinking Visible

What's going on in
there? →

Bill Cerbin
12th Annual Conference
on Teaching & Learning
August 31, 2010



Making Students' Thinking Visible

Bring to the surface, externalize
the mental activity taking place as
students learn something

Problem: $1/2 + 1/3 =$

Answers of three elementary
school children

A. $2/5$

B. $2/5$

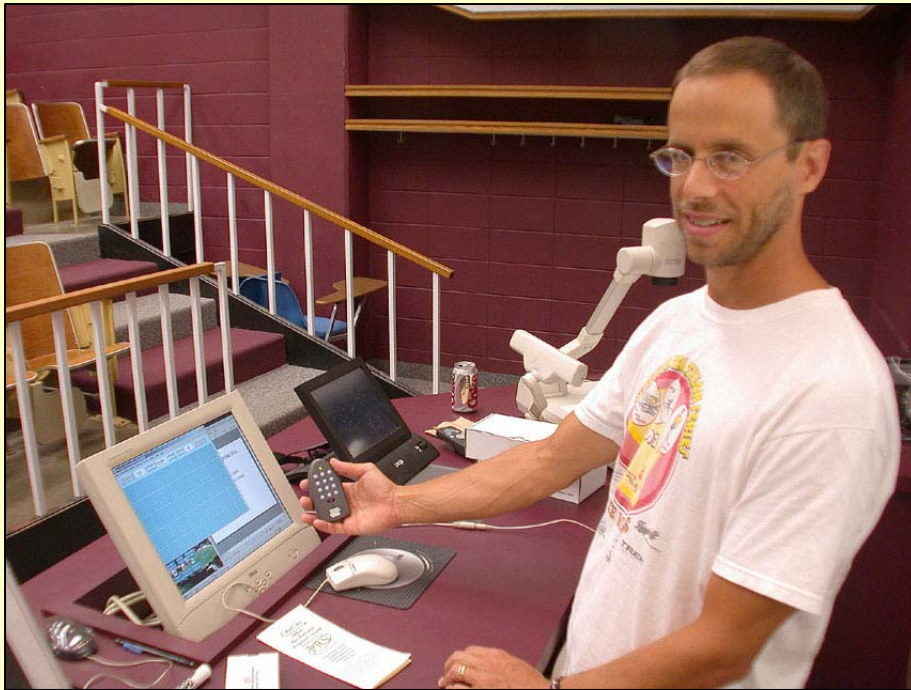
C. About $3/4$

The Thinking Behind the Answers

- A. First I added the numerators and got 2. Then I added the denominators and got 5. That gave me $\frac{2}{5}$.
- B. First I changed $\frac{1}{2}$ to 2.1 and then I changed $\frac{1}{3}$ to 3.1. Then I added $2.1 + 3.1$ and got 5.2. Then I changed this back to a fraction, $\frac{2}{5}$.
- C. Well, I don't know how to add the fractions. But I thought about how big the two fractions are. I imagined a pizza and what $\frac{1}{2}$ and $\frac{1}{3}$ of it would look like. It just seemed like if you added $\frac{1}{2}$ a pizza and $\frac{1}{3}$ of a pizza you'd get about $\frac{3}{4}$ of a pizza. I don't know if it's right, it's just kind of an estimate.



Making Student Thinking Visible in Large Biology Lectures



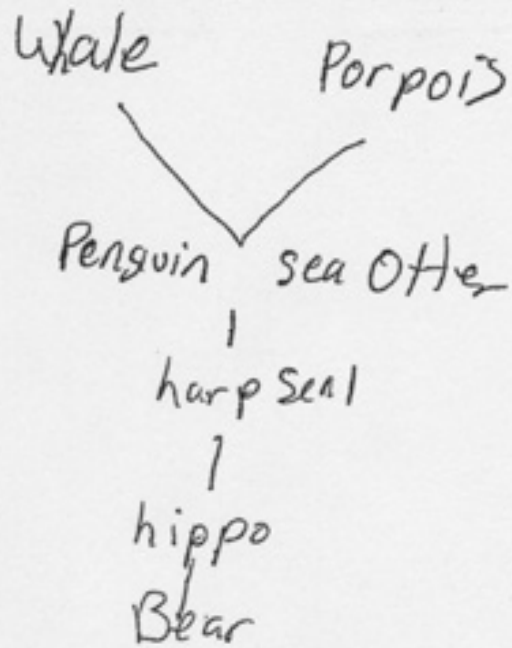
**UW-La Crosse Biology
Professor [Scott Cooper](#)**

Publication: [Problem Solving Modules in Large Introductory Biology Lectures Enhance Student Understanding](#)

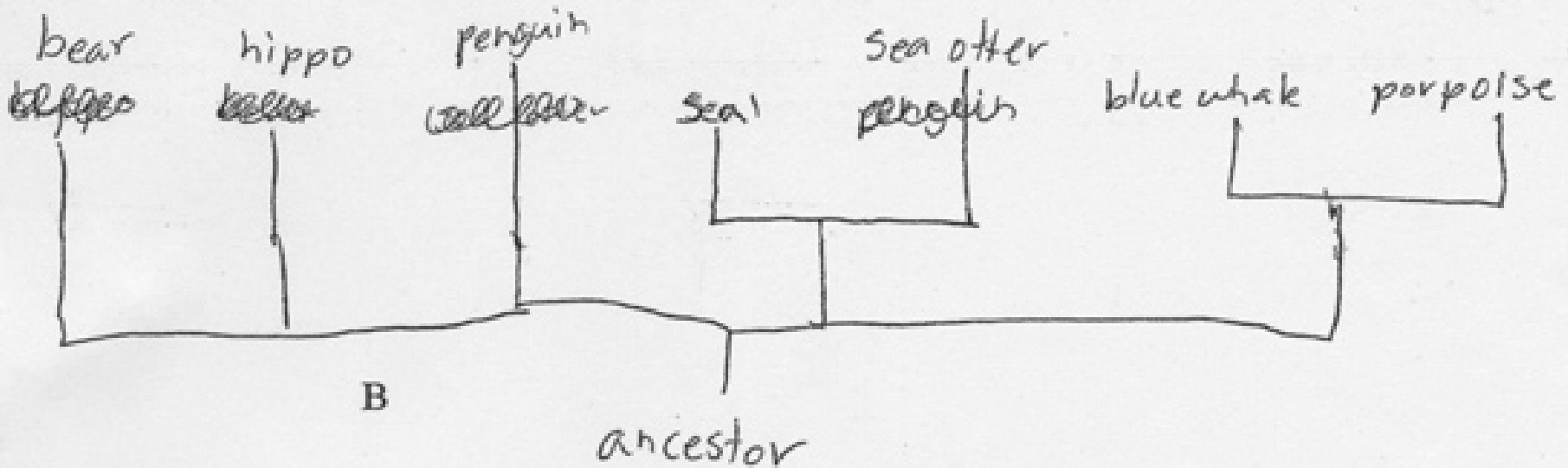
- Students work in small groups on a problem in class
- Collect student solutions
- Project several solutions on document camera
- Analyze and comment on solutions

Click on the image to see a video clip of Scott's class





B



B

Making Experts' Thinking Visible

. . . the processes by which a scholar makes sense of material--what I sometimes call the intermediate processes of cognition--are powerful teaching tools.

Sam Wineburg, [*Teaching the Mind Good Habits*](#)

On the Reading of Historical Texts by Sam Wineburg

How EXPERTS read historical texts	How NOVICES read historical texts
Seek to <i>discover context and know content</i>	Seek only to <i>know content</i>
Ask what the text <i>does</i> (purpose)	Ask what the text <i>says</i> ("facts")
Understand the <i>subtexts</i> of the writer's language.	Understand the <i>literal meanings</i> of the writer's language.
See any text as <i>a construction</i> of a vision of the world	See texts as <i>descriptions</i> of the world
See texts as <i>made by persons with a view of events</i>	See texts as <i>accounts of what really happened</i>
Assume <i>bias</i> in text	Assume <i>neutrality, objectivity</i> in text
<i>Consider word choice</i> (connotation, denotation) and <i>tone</i>	<i>Ignore word choice, tone</i>
<i>Compare</i> texts to judge different, perhaps divergent accounts of the same event or topic	<i>Learn the right answer</i>
Get <i>interested</i> in <i>contradictions, ambiguity</i>	<i>Resolve or ignore contradictions, ambiguity</i>
Check <i>sources</i> of document	Read the <i>document</i> only
Read like <i>witnesses to living, evolving events</i>	Read like <i>seekers of solid facts</i>
Acknowledge <i>uncertainty and complexity</i> in the reading, with qualifiers and concessions	Communicate <i>the truth</i> of the reading, sounding as certain as possible

Watch historians discuss how they evaluate different genres of primary evidence

History Matters

<http://www.historymatters.gmu.edu>

Showing Students How to Think More like a Mathematician

Find the derivative and simplify:

$$\begin{aligned} f(x) &= (4x-3)(x^2+2)^4 \\ f'(x) &= (4)(x^2+2)^4 + (4x-3)(4)(x^2+2)^3(2x) \\ &= 4(x^2+2)^3 [x^2+2 + (4x-3)(2x)] \\ &= 4(x^2+2)^3 [x^2+2+8x^2-6x] \\ &= \boxed{4(x^2+2)^3 [9x^2-6x+2]} \end{aligned}$$



UW-La Crosse Mathematics
Professor [Bob Hoar](#)

See more work by Bob Hoar
and his colleagues

<http://www.uwlax.edu/iiurl/>

Excellent Books and Articles about Student Learning

[*How People Learn: Brain, Mind & Experience*](#) by Bransford, Brown, & Cocking
(full text online)

[*How Students Learn: History, Mathematics & Science in the Classroom*](#) by
Donovan & Bransford (eds.) (full text online)

[*Historical Thinking and Other Unnatural Acts*](#) by Sam Wineburg

[*Taking Learning Seriously*](#) by Lee Shulman (full text online)

[*Making Differences: A Table of Learning*](#) by Lee Shulman (full text online)

[*Teaching the Mind Good Habits*](#) by Sam Wineburg (full text online)

[*Understanding by Design*](#) by Grant Wiggins & Jay McTighe

**Go forth and make thinking
visible**

Have a nice day