Confessions of a converted lecturer

Active Teaching and Learning Faculty Seminar Michigan State University, Lansing, MI, 17 March 2004

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Ready-to-Us Resources

STRUCTION NOT AND NOT

A User's Manual









Outline

• Problem

Cause

Remedy

- 340,000 students take
- introductory physics
- each year



about 1% of these get

a bachelor's degree

in physics



Of the 4,100 students with



about 28% go on to get a

Ph.D. in physics...





What about the

other 299...?



What do we know

about these

students?



Some disturbing symptons:

- frustration
- lack of understanding
- lack of basic knowledge

They know the jargon:

- circular motion
- barometric pressure
- light radius
- something to the power times ten to the something

They are aware of their lack of knowledge:

- I graduated from college, but I didn't study astronomy
- It's been a while since I've had physics

They are aware of their lack of knowledge:

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...and they don't care!

Should we worry?

We'd better!

"I took four years of science and four years of math...

A waste of my time, a waste of the teacher's time, and a waste of space...

You know, I took physics.

For what?"





lectures focus on delivery of information

education is not just information transfer



education is not just information transfer



education is not just information transfer











R.R. Hake, Am. J. Phys. 66, 64 (1998)

only one quarter of maximum gain realized



R.R. Hake, Am. J. Phys. 66, 64 (1998)

not transfer but assimilation of information is key

conventional problems reinforce bad study habits



conventional problems reinforce bad study habits

Calculate:

(a) current in $2-\Omega$ resistor

(b) potential difference

between P and Q



are the basic principles understood?



are the basic principles understood?

- When S is closed, what happens to:
- (a) intensities of A and B?
- (b) intensity of C?
- (c) current through battery?
- (d) potential difference across
 - A, B, and C?
- (e) the total power dissipated?












Give students more responsibility for gathering information...

Give students more responsibility for gathering information... so we can better help them assimilate it.

Includes Class-Tested, Ready-to-Use Resources

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A User's Manual

Main features:

- pre-class reading
- in-class: depth, not 'coverage'
- ConcepTests

ConcepTest:

- 1. Question
- 2. Thinking
- 3. Individual answer
- 4. Peer discussion
- 5. Revised/Group answer
- 6. Explanation

is it any good?

first year of implementing PI



first year of implementing PI



first year of implementing PI









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what about problem solving?







So better understanding leads to better problem solving!

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(but "good" problem solving doesn't always indicate understanding!)

Conclusion



Conclusion



Funding:

National Science Foundation

for a copy of this presentation:

http://mazur-www.harvard.edu

Peer Instruction: discussion and 'brains-on' demonstration

Ready-to-U

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Outline

Some options:

- Let's try it!
- Feedback methods
- Research: providing the basis for change
- Problems with problems
- Resources
- Barriers to reform

Consider a rectangular metal plate with a circular hole in it.



Consider a rectangular metal plate with a circular hole in it.

When the plate is uniformly heated, the diameter of the hole

- 1. increases.
- 2. stays the same.
- 3. decreases.



The distance between the atoms increases uniformly

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A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.



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After the boulder sinks to the bottom of the pond, the level of the water in the pond is

- 1. higher than
- 2. the same as
- 3. lower than

it was when the boulder was in the boat.

When we hold a page of printed text in front of a mirror, the text on the image in the mirror runs from right to left:

The New York Times
Let's try it!

When we hold a page of printed text in front of a mirror, the text on the image in the mirror runs from right to left:

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Why is it that right and left are interchanged and not top and bottom? Because:

- 1. the mirror is oriented vertically.
- 2. we have two eyes in the horizontal plane.
- 3. the Earth's gravitation is directed downward.
- 4. a habit we have when looking at images in a mirror.
- 5. It only appears to run from left to right.

Let's try it!

Consider an object that floats in water, but sinks in oil. When the object floats in water, half of it is submerged.



Let's try it!

Consider an object that floats in water, but sinks in oil. When the object floats in water, half of it is submerged.



If we slowly pour the oil on top of the water so it completely covers the object, the object

- 1. moves up.
- 2. stays in the same place.
- 3. moves down.



Show of hands:

easy, but only moderately effective

Flashcards: simple and effective



Flashcards: simple and effective



Meltzer and Mannivanan, South Eastern Louisiana University

Infrared transmitters (PRS): easy collection of data



Infrared transmitters (PRS): easy collection of data





Kristy Beauvais, Concord Carlisle High School

near future: wireless classroom







Evaluate assessment by comparing

student performance on various kinds of problems













who benefits from the ConcepTests?



who benefits from the ConcepTests?



even the best students are challenged



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On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

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Requires:

Assumptions Developing a model Applying that model

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Requires:

Applying a (new) model

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Requires:

Using a calculator

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Resources



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Information on Just-in-Time-Teaching:

- Prentice Hall book
- http://www.jitt.org


Resources

Videos:

- Thinking together
- From questions to concepts

http://www.ankerpub.com



Resources

Course management:

http://deas.harvard.edu/ilt



Challenges:

- skepticism
- growing pains
- limited circle of influence

Two things to watch out for

After changing, things might get *worse* before they get better!



Better understanding leads to *more* — not fewer — questions!

(must recognize confusion as step towards understanding)

Things to do:

- take data
- motivate students
- be prepared for initial adjustments

Funding:

National Science Foundation

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