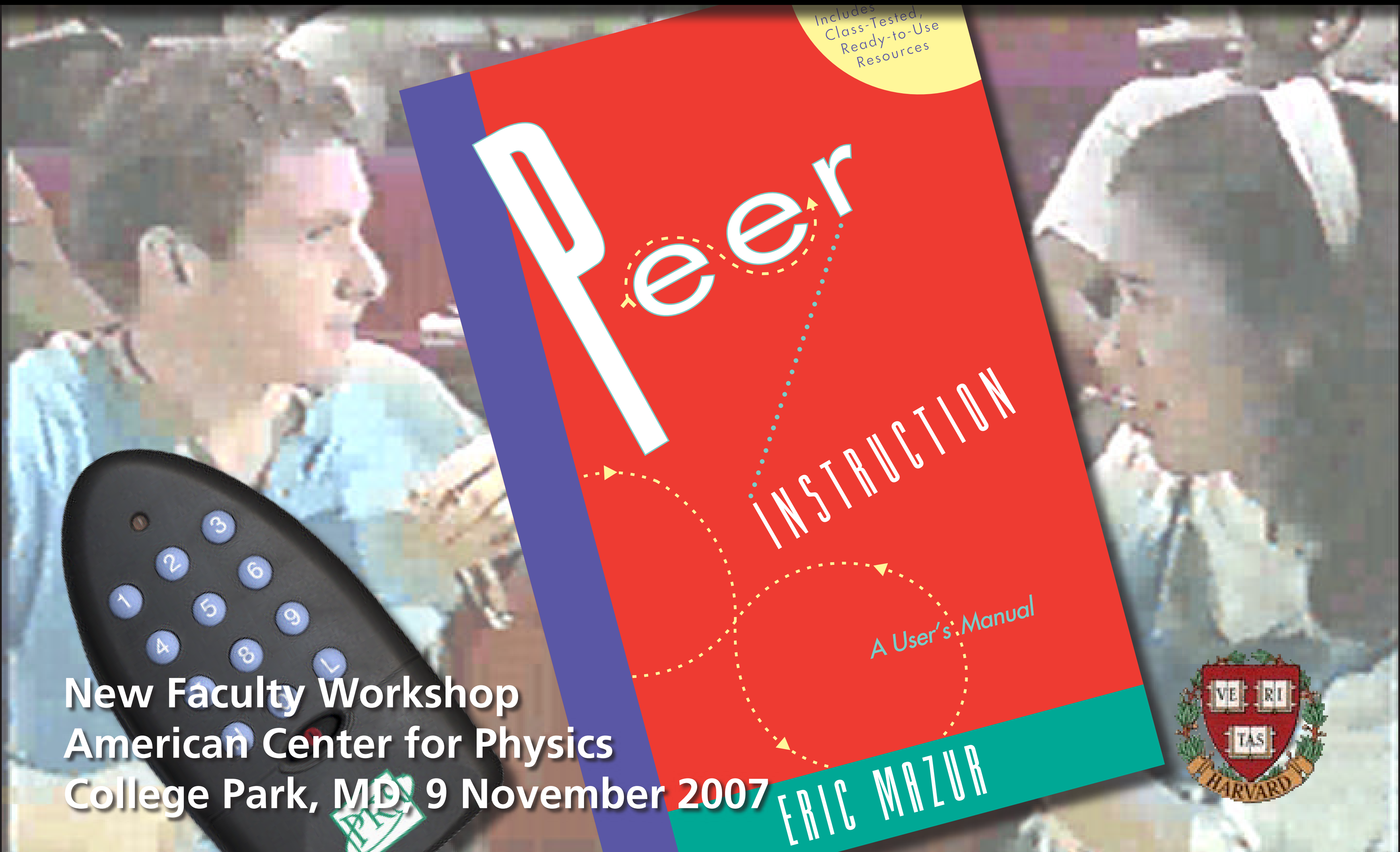
Peer Instruction Workshop



New Faculty Workshop
American Center for Physics
College Park, MD, 9 November 2007

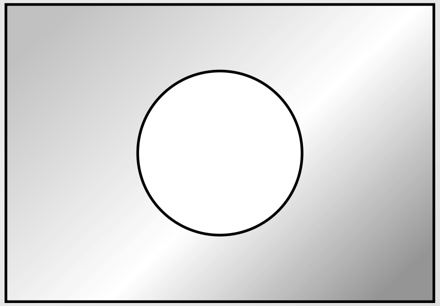
Outline

Some options:

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

Let’s try it!

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



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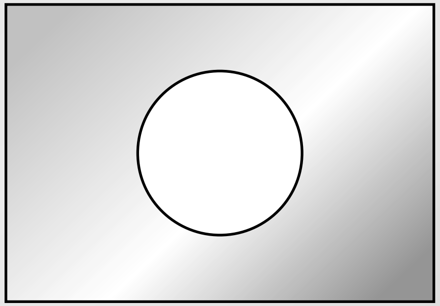


When the plate is uniformly heated, the diameter of the hole

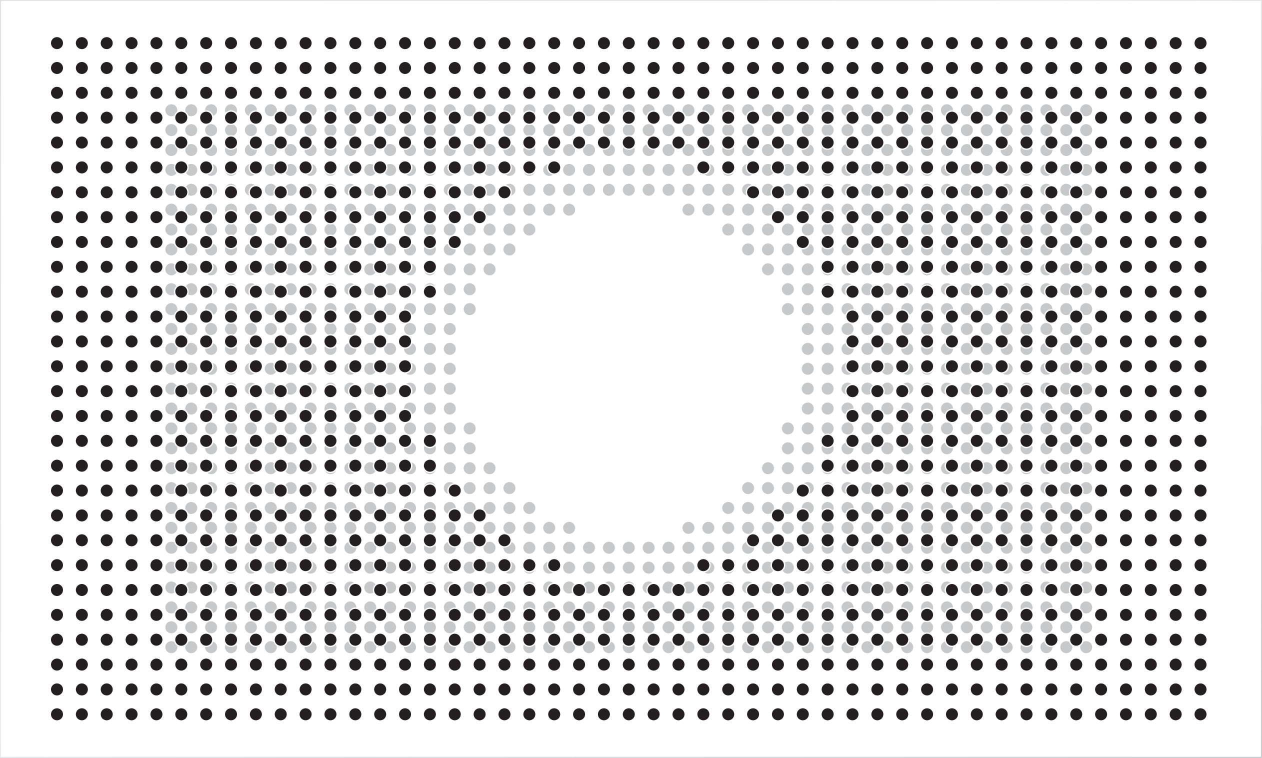
1. increases.
2. stays the same.
3. decreases.

Let’s try it!

It’s easy to fire up the audience!

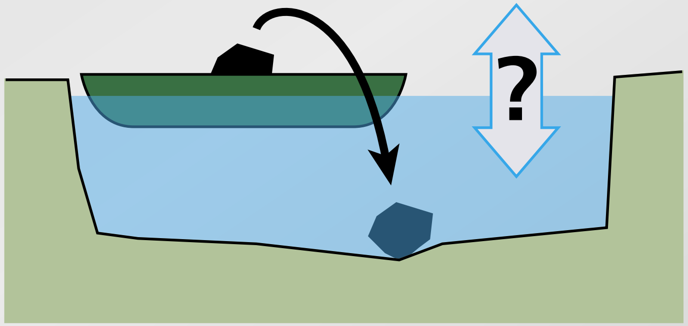
Let’s try it!

The distance between the atoms increases uniformly



Let's try it!

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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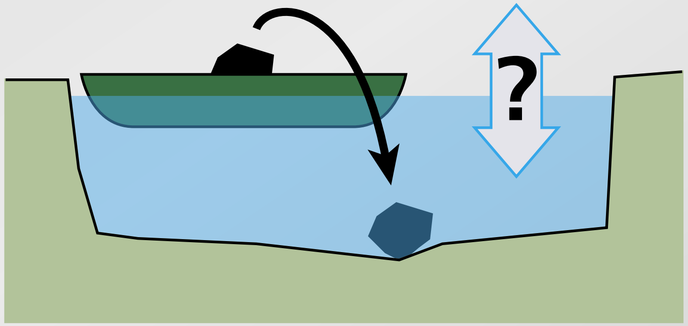


After the boulder sinks to the bottom of the pond, the level of the water in the pond is

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

it was when the boulder was in the boat.

Let’s try it!

We all make mistakes!

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:

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:

The New York Times

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

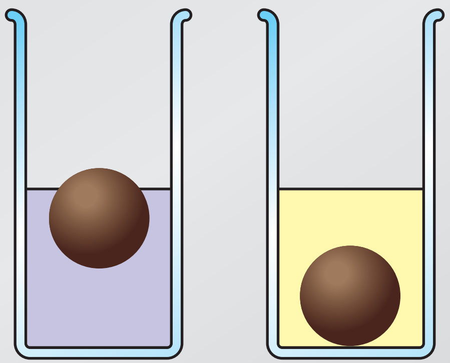
1. **the mirror is oriented vertically.**
2. **we have two eyes in the horizontal plane.**
3. **the Earth's gravitation is directed downward.**
4. **a habit we have when looking at images in a mirror.**
5. **It only *appears* to run from left to right.**

Let's try it!

It's "simple" only if you know the answer

Let's try it!

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



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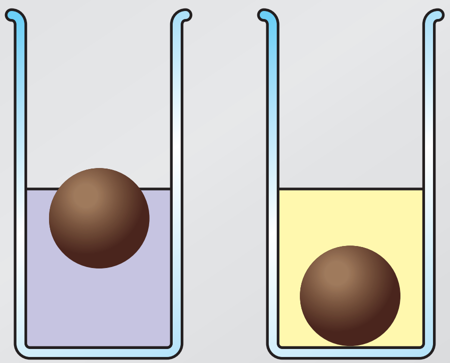
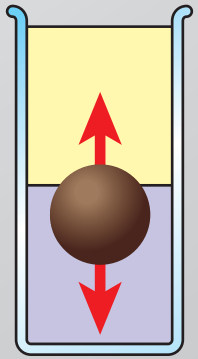


If we slowly pour the oil on top of the water so it completely covers the object, the object



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

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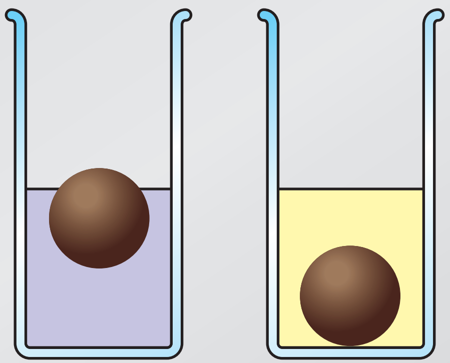

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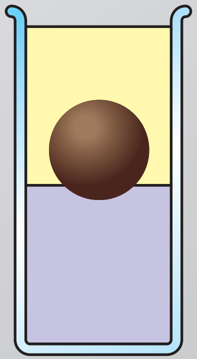


Let's try it!

It's easy to make simple demonstrations fascinating!

Developing ConcepTests

Good ConcepTests:

- are based on student difficulties
- focus on single concept
- cannot be solved by "plug and chug"
- are clear and concise
- are of manageable difficulty

Developing ConcepTests

Try writing a ConcepTests on the following topic:

The acceleration due to gravity is constant

Developing ConcepTests

A ball is thrown downward (not dropped) from the top of a tower.

After being released, its downward acceleration is:

1. greater than *g*
2. exactly *g*
3. smaller than *g*

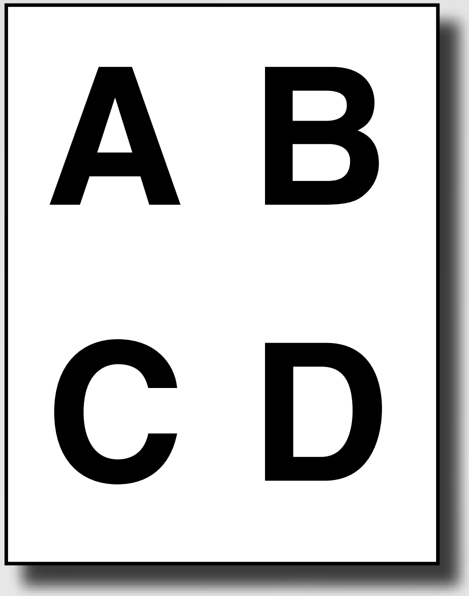
Feedback methods

Show of hands:

easy, but only moderately effective

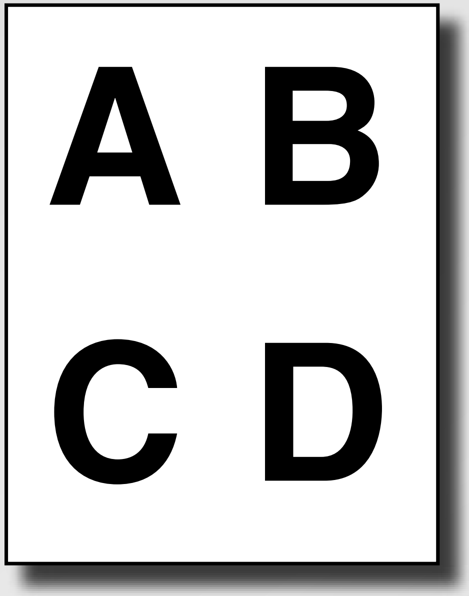
Feedback methods

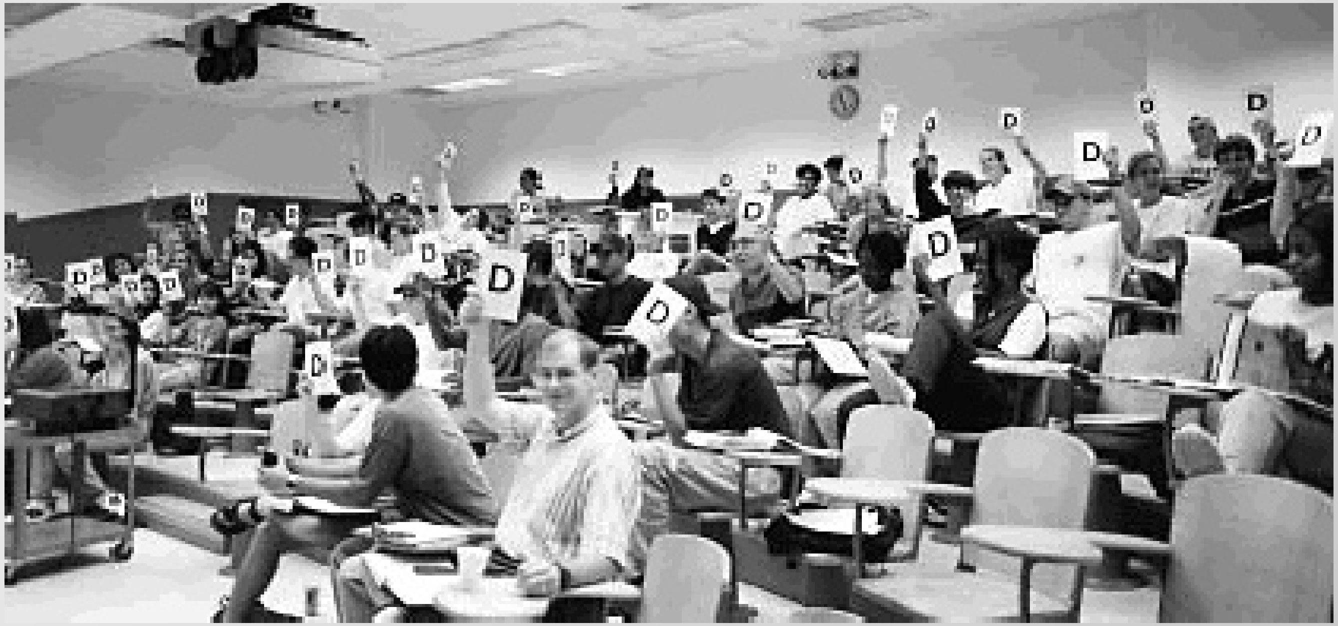
Flashcards: simple and effective



Feedback methods

Flashcards: simple and effective





Meltzer and Mannivanan, South Eastern Louisiana University

Feedback methods

Infrared transmitters (PRS): easy collection of data

Feedback methods

Infrared transmitters (PRS): easy collection of data

Kristy Beauvais, Concord Carlisle High School

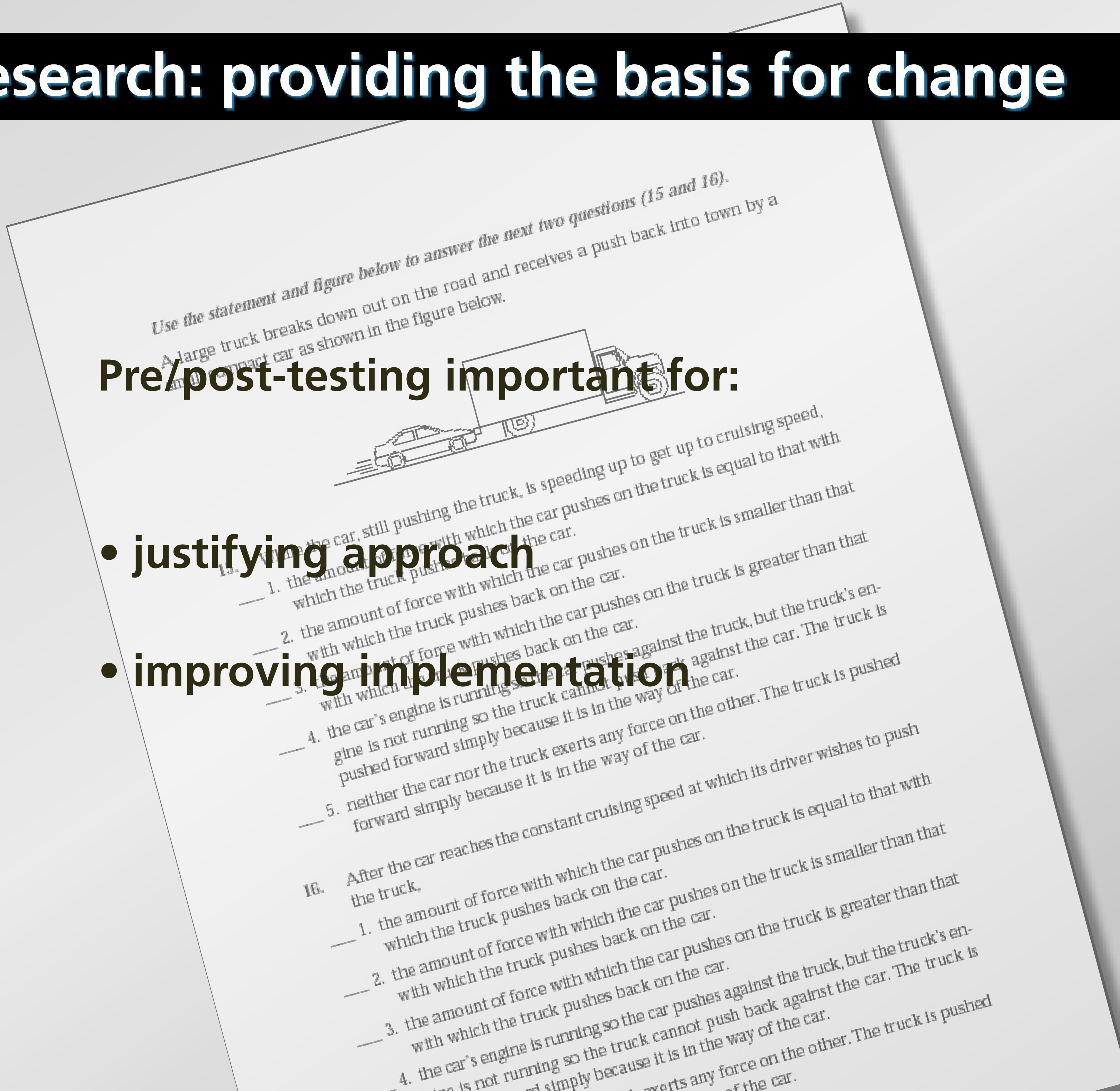
Feedback methods

near future: wireless classroom

Research: providing the basis for change

Pre/post-testing important for:

- justifying approach
- improving implementation


Use the statement and figure below to answer the next two questions (15 and 16).

A large truck breaks down out on the road and receives a push back into town by a small compact car as shown in the figure below.

15. While the car, still pushing the truck, is speeding up to get up to cruising speed,

___ 1. the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.

___ 2. the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the car.

___ 3. the amount of force with which the car pushes on the truck is greater than that with which the truck pushes back on the car.

___ 4. the car's engine is running so the car pushes against the truck, but the truck's engine is not running so the truck cannot push back against the car. The truck is pushed forward simply because it is in the way of the car.

___ 5. neither the car nor the truck exerts any force on the other. The truck is pushed forward simply because it is in the way of the car.

16. After the car reaches the constant cruising speed at which its driver wishes to push the truck,

___ 1. the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.

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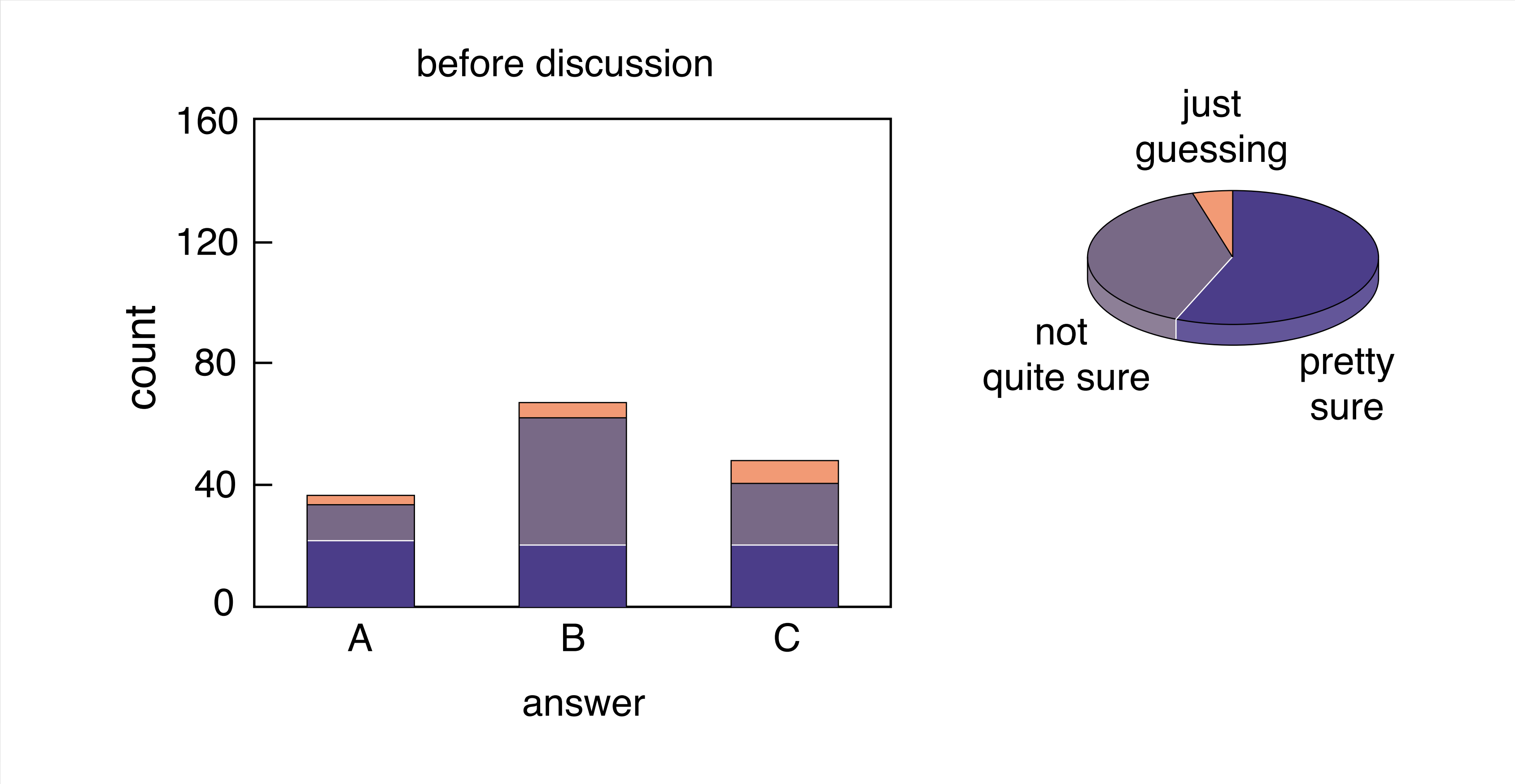
Research: providing the basis for change

Evaluate assessment by comparing

student performance on various kinds of problems

Research: providing the basis for change

ConcepTest data



Research: providing the basis for change

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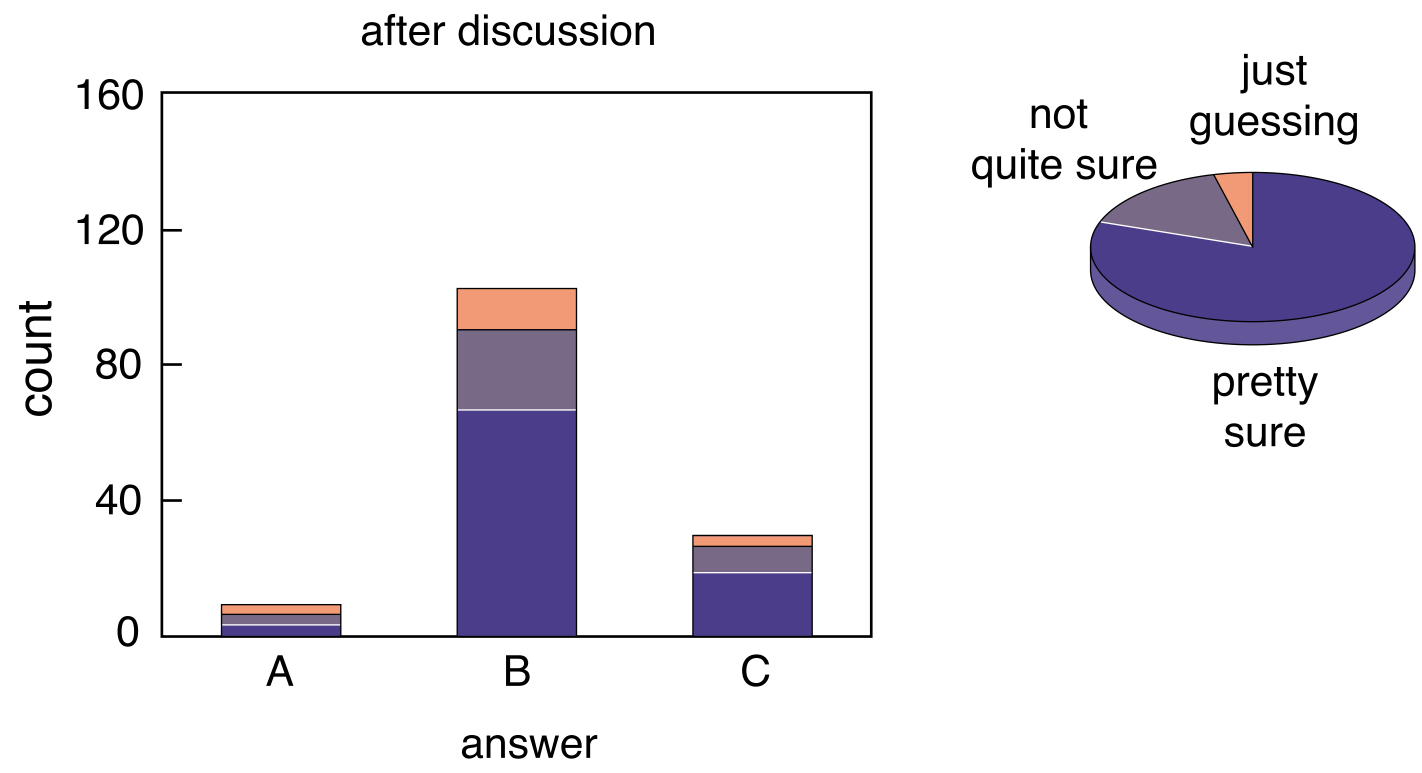

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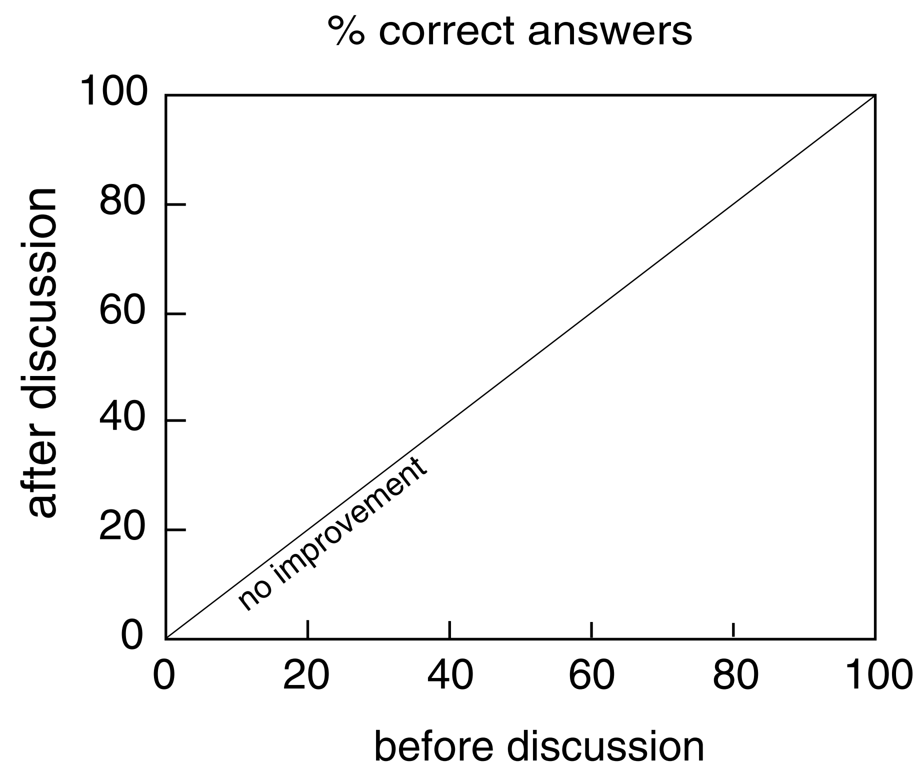

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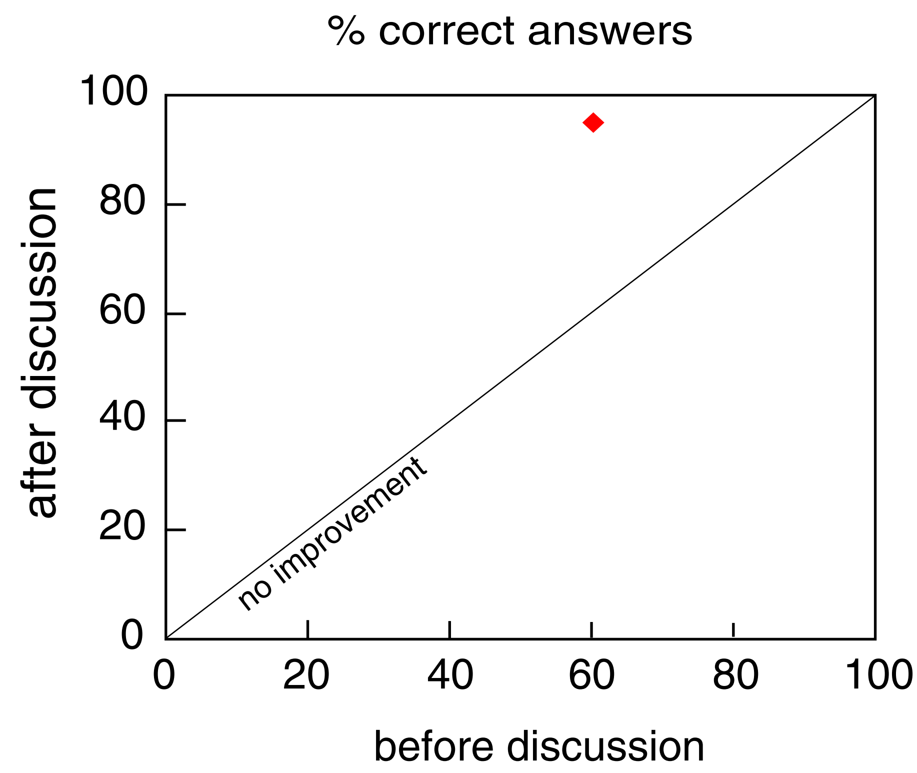

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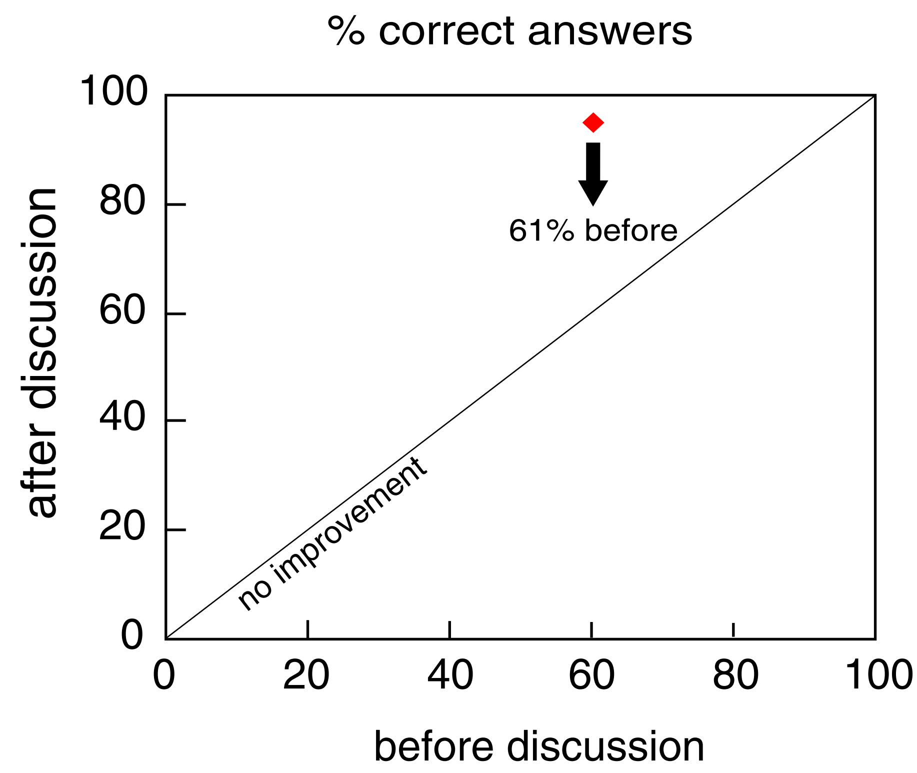

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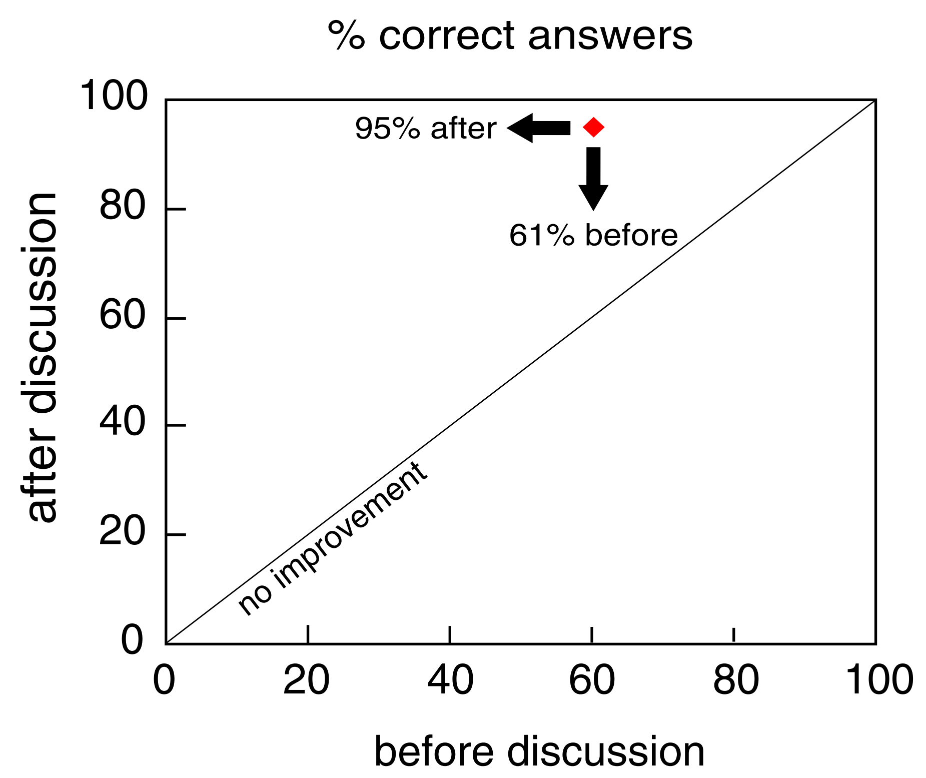

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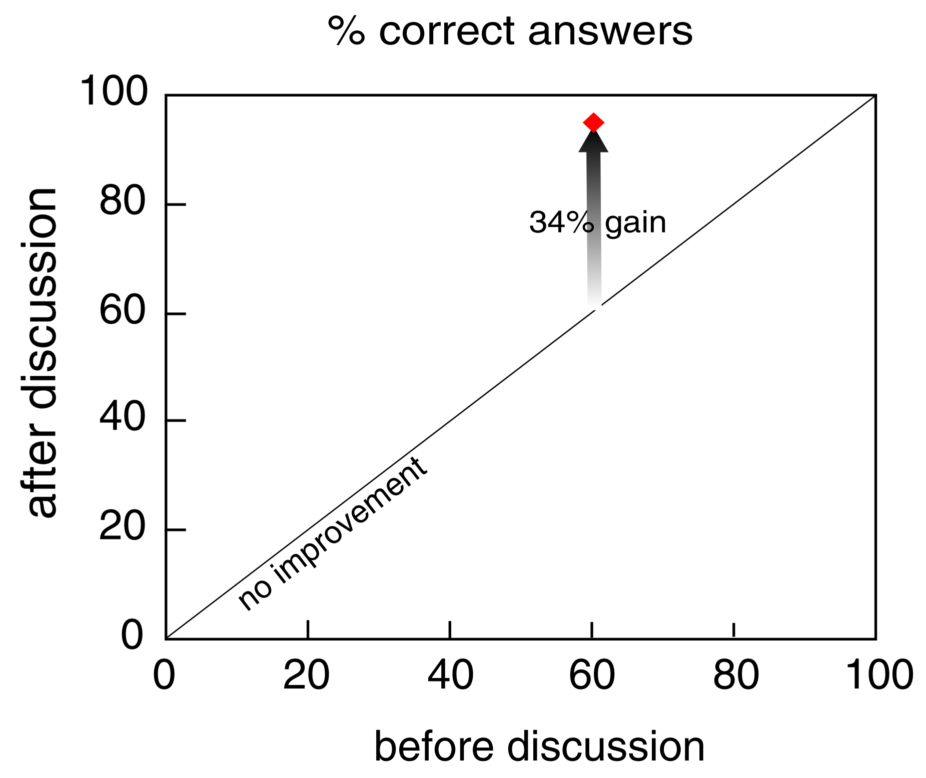

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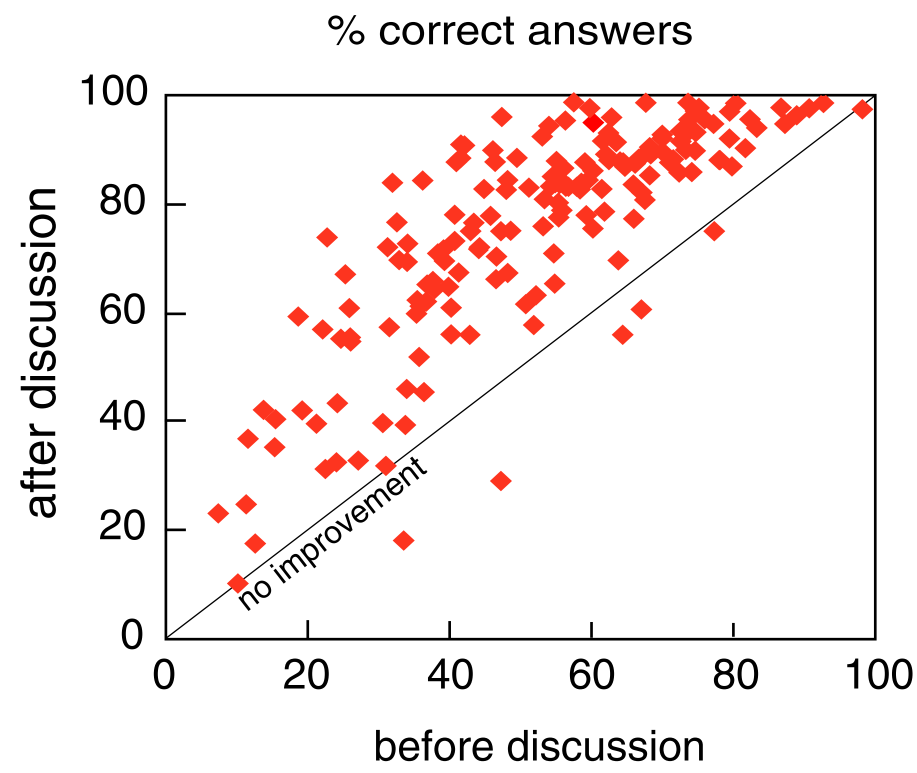

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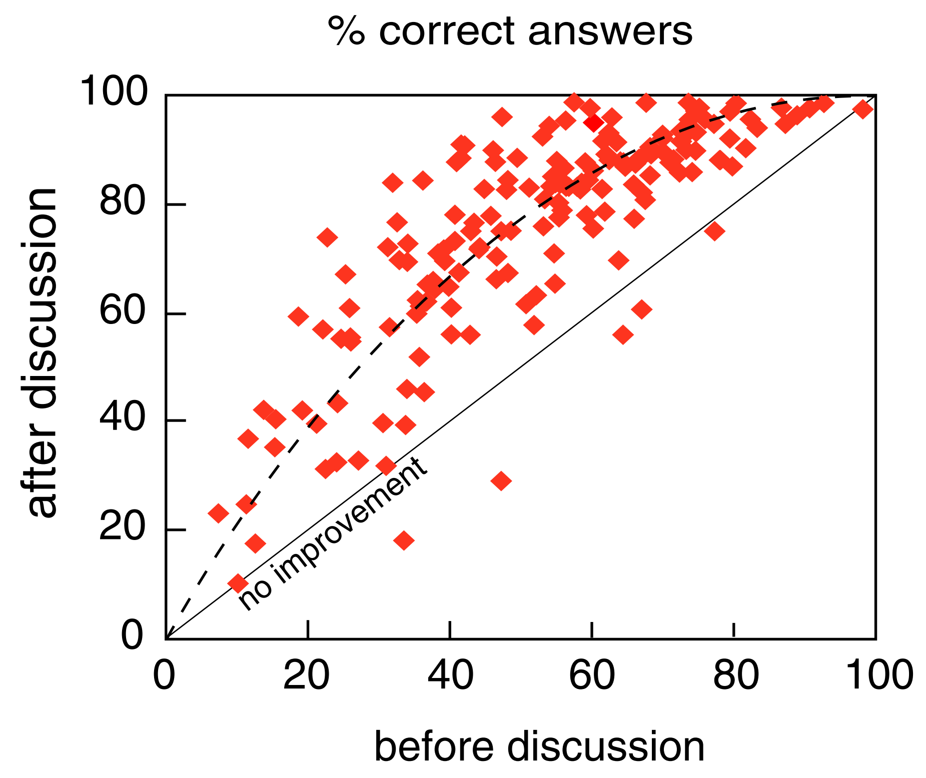

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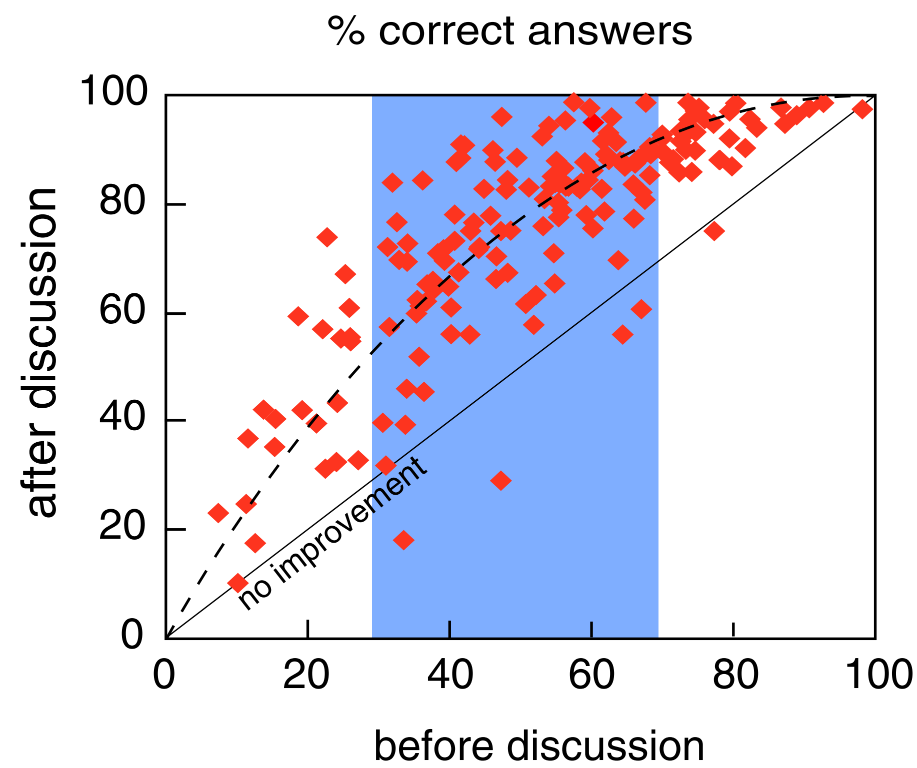
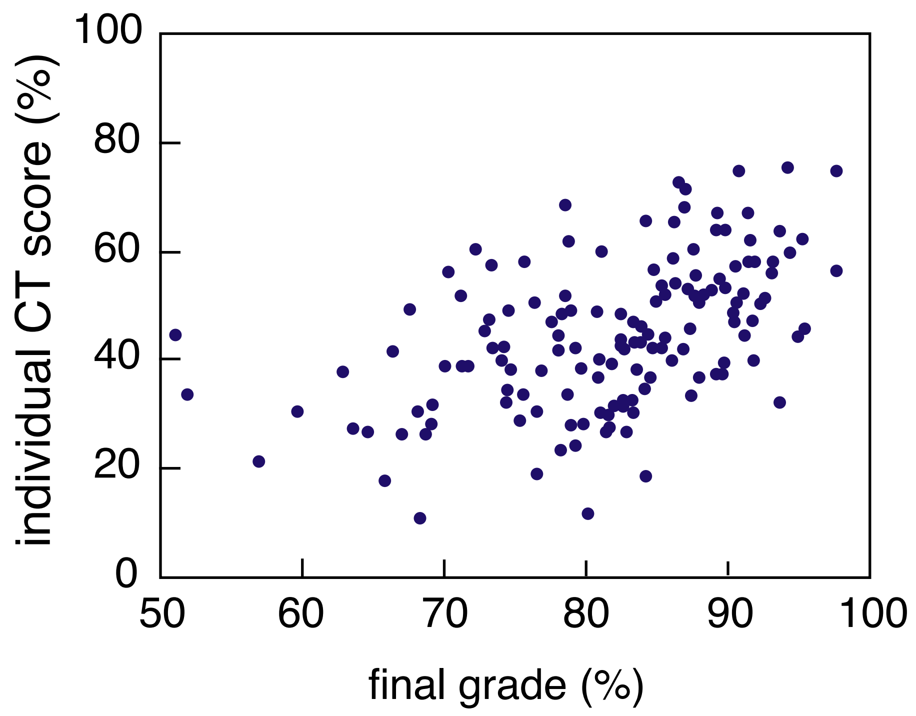


Research: providing the basis for change

who benefits from the ConcepTests?



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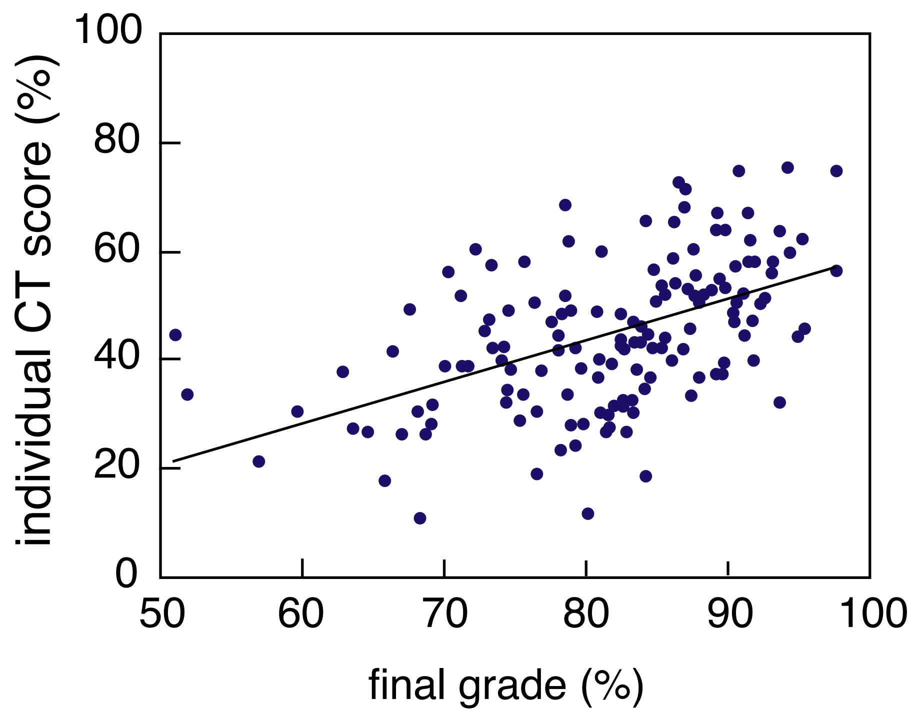
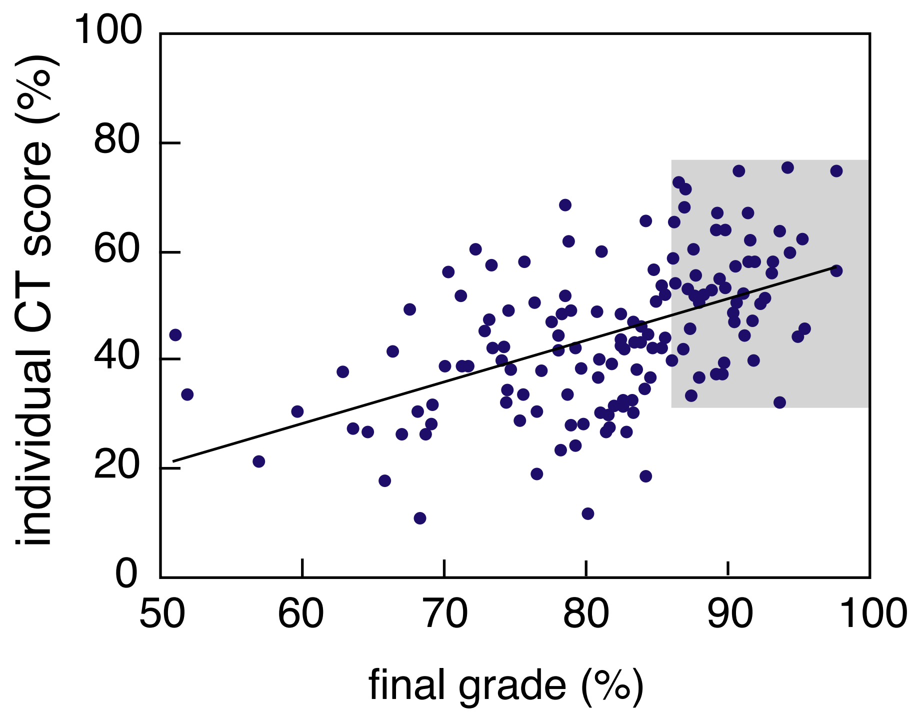


Research: providing the basis for change

even the best students are challenged



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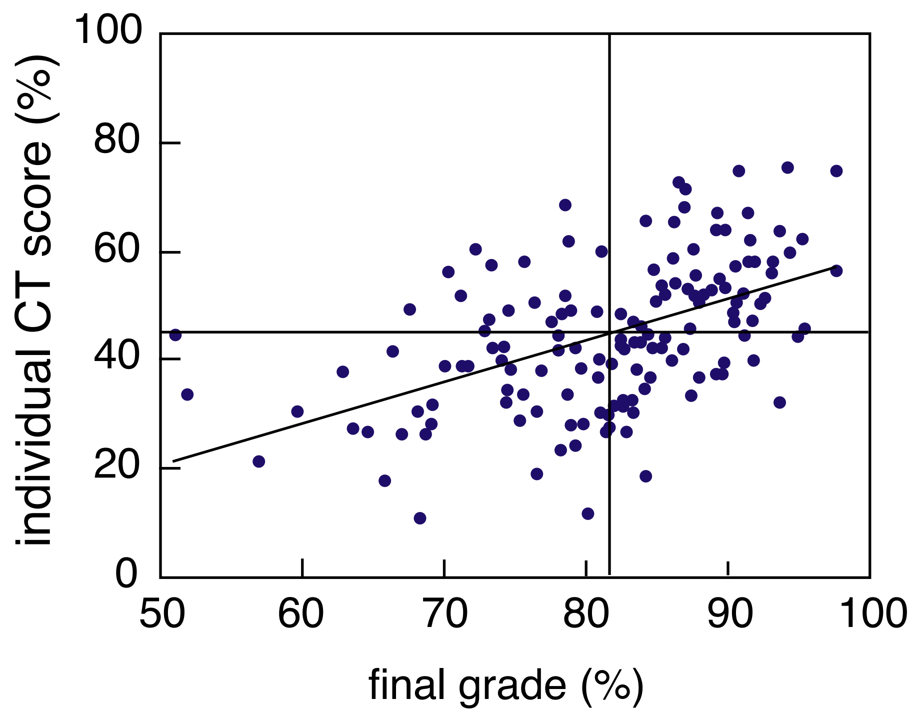

Problems with problems

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

Problems with problems

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area, where people are know to shop, on average, for 2 hours. 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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How long do you have to wait before someone frees up a space?

Requires:

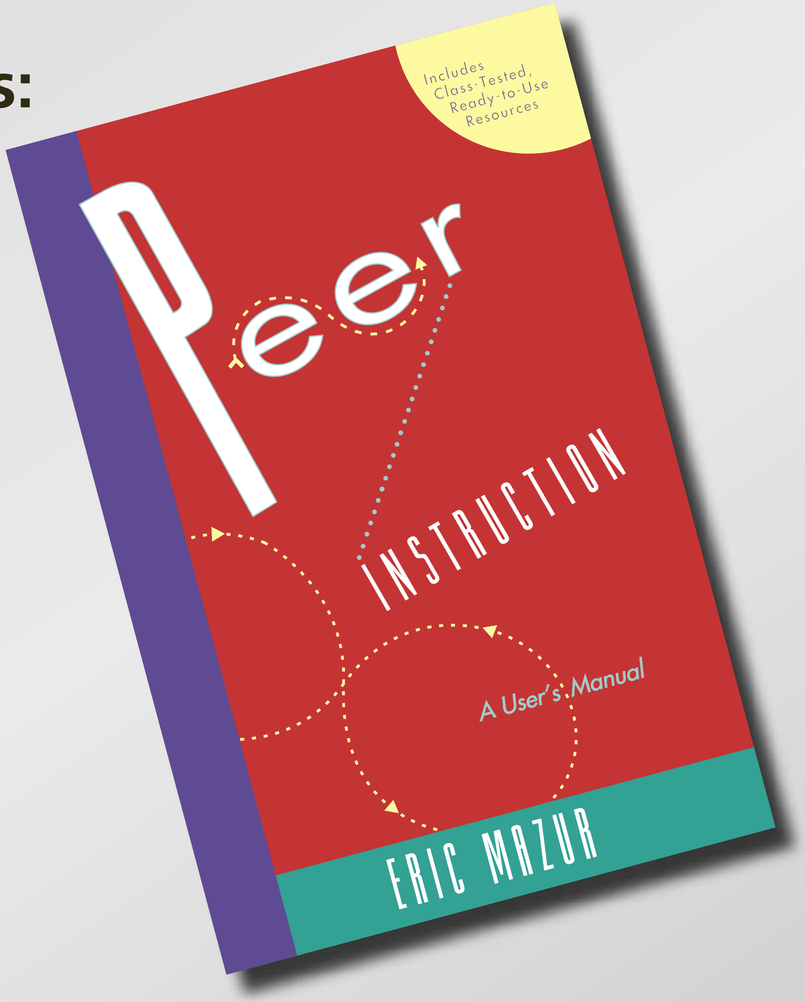
Using a calculator

$$t_{wait} = \frac{T_{shop}}{N_{spaces}}$$

Resources

Books with ConcepTests:

- Physics (Prentice Hall)



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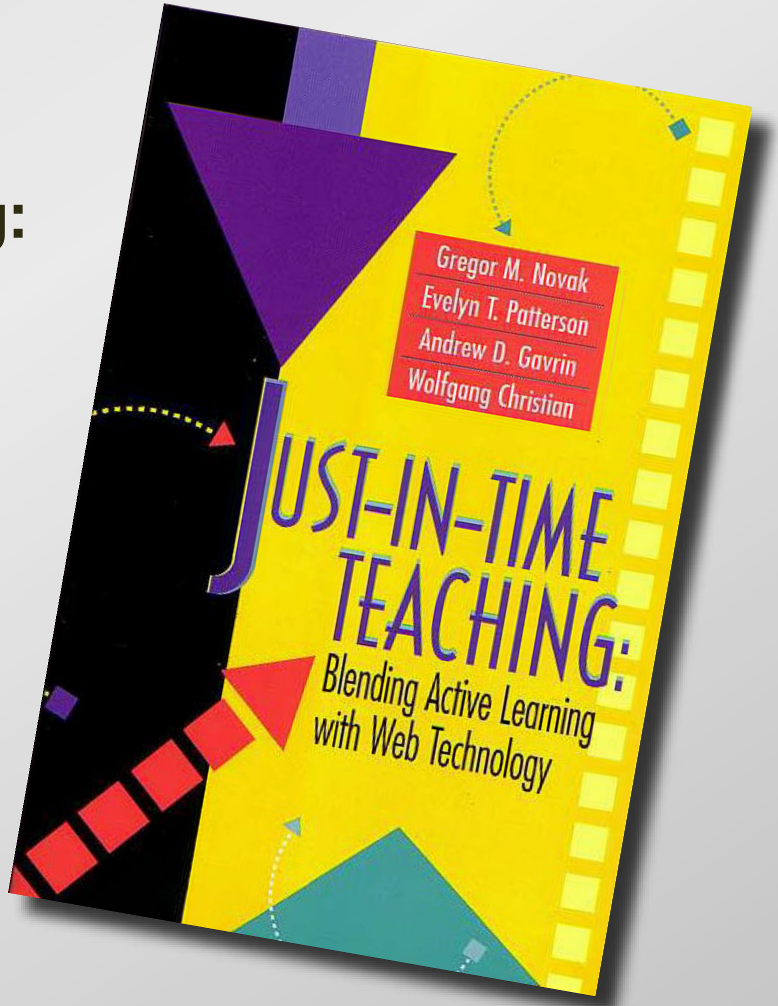
- Physics (Prentice Hall)
- Chemistry (Prentice Hall)
- Astronomy (Prentice Hall)
- Calculus (Wiley)

Resources

Information on Just-in-Time-Teaching:

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

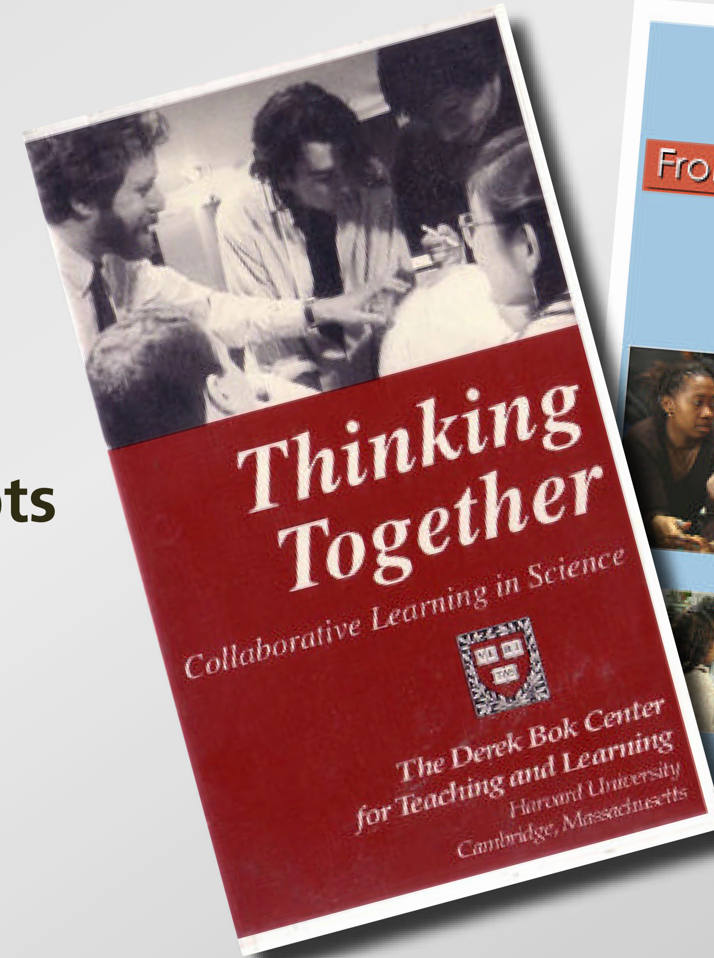


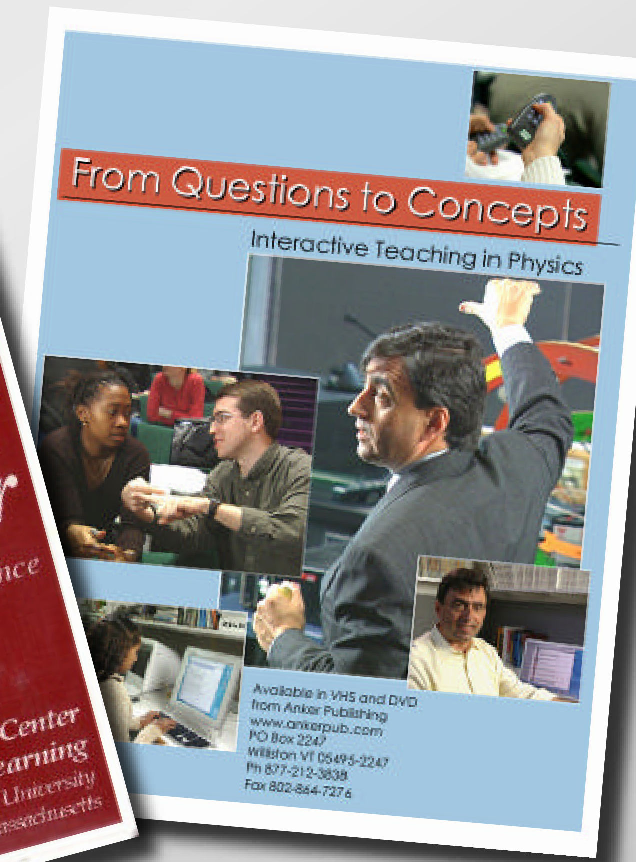
Resources

Videos:

- Thinking together
- From questions to concepts

http://www.ankerpub.com

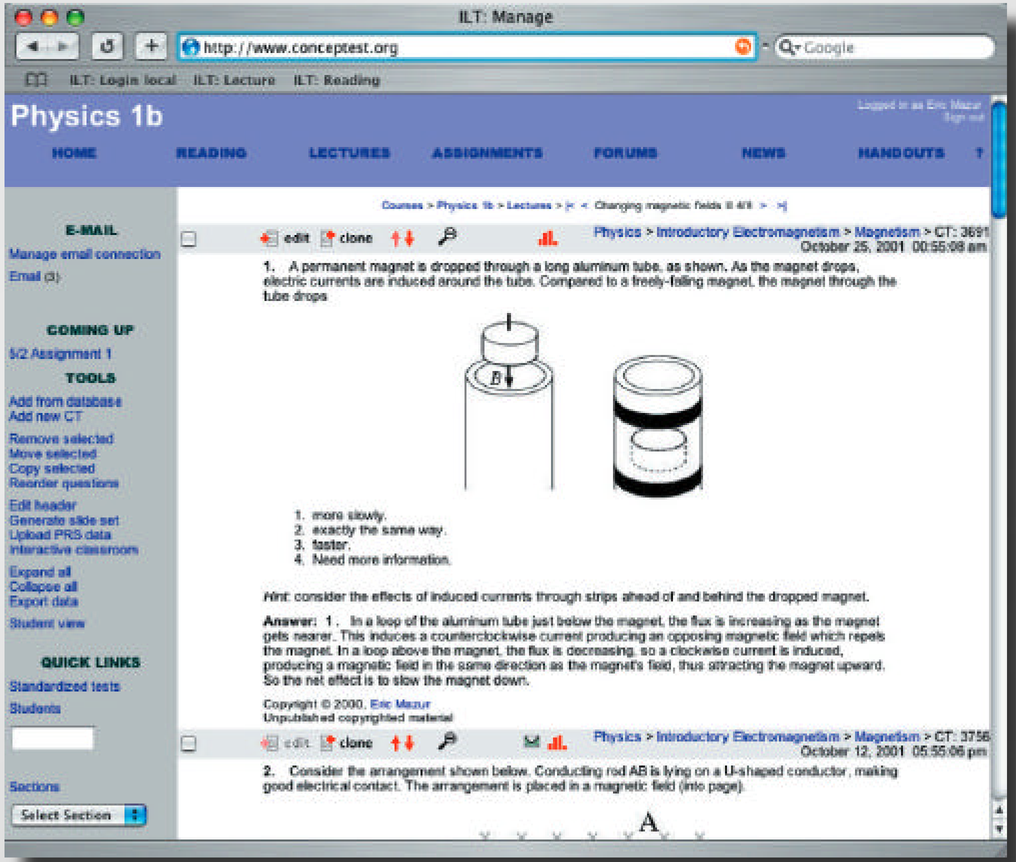




Resources

Course management:

http://deas.harvard.edu/ilt



Barriers to reform

Challenges:

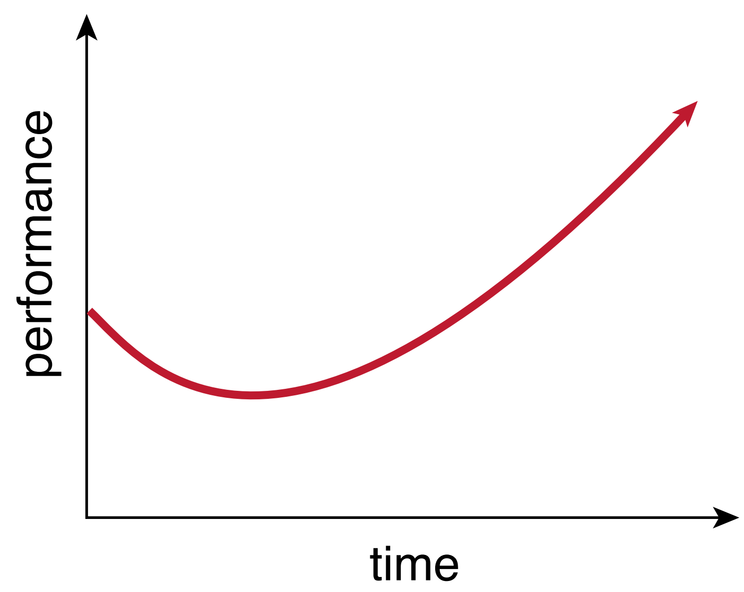
- skepticism
- growing pains
- limited circle of influence

Barriers to reform

Two things to watch out for

Barriers to reform

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



Barriers to reform

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

(must recognize confusion as step towards understanding)

Barriers to reform

Things to do:

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

Barriers to reform

	"lectures"	PI
coverage	complete	partial
preclass reading	none	cover everything
confusion	little none	substantial
evaluations	known	unknown

Barriers to reform

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learning	little	better	
retention	little	better	

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confusion	little none	substantial	problem
evaluations	known	unknown	important
learning	little	better	not measured
retention	little	better	not part of grade

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National Science Foundation

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