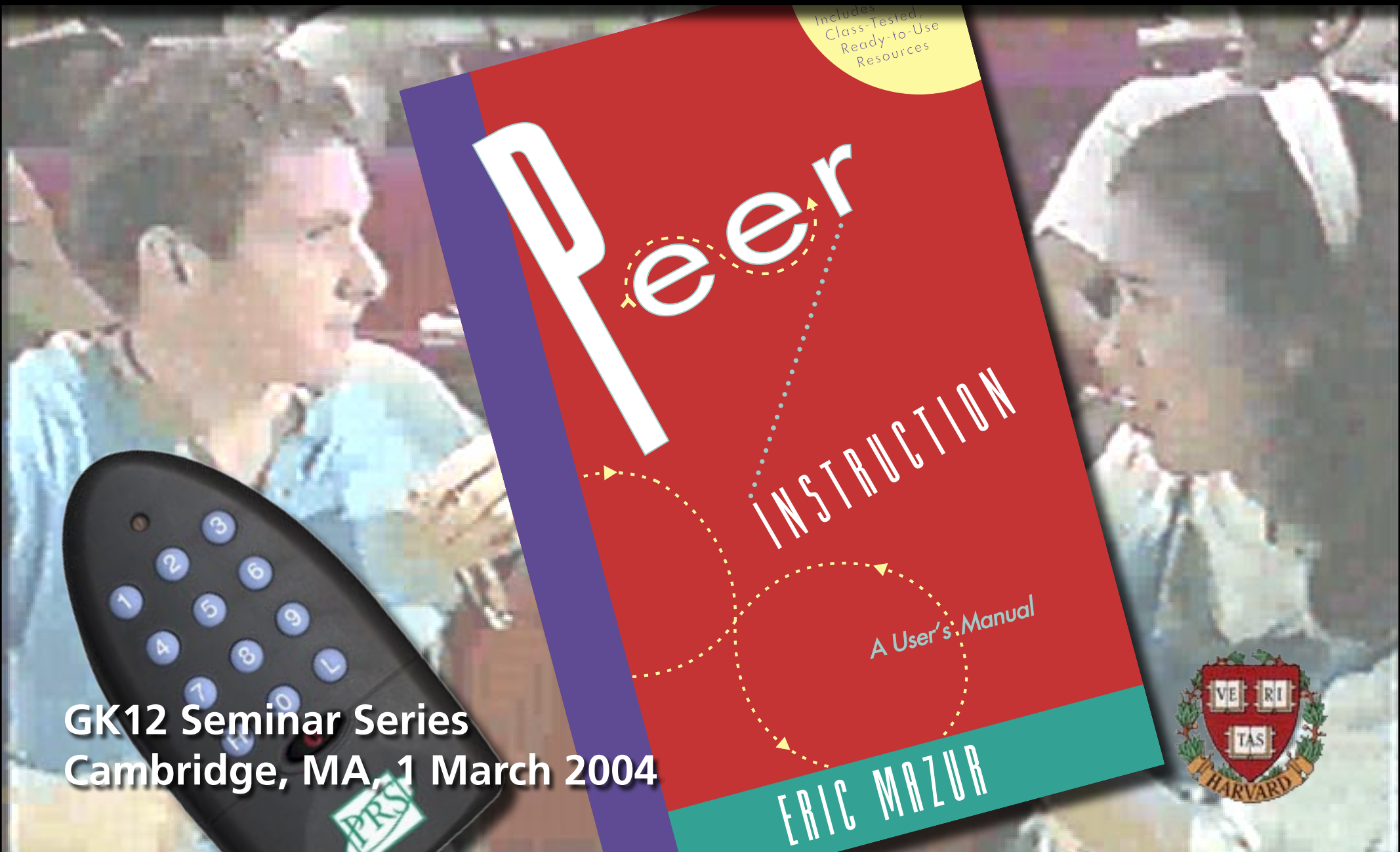
Workshop on Peer Instruction



GK12 Seminar Series
Cambridge, MA, 1 March 2004

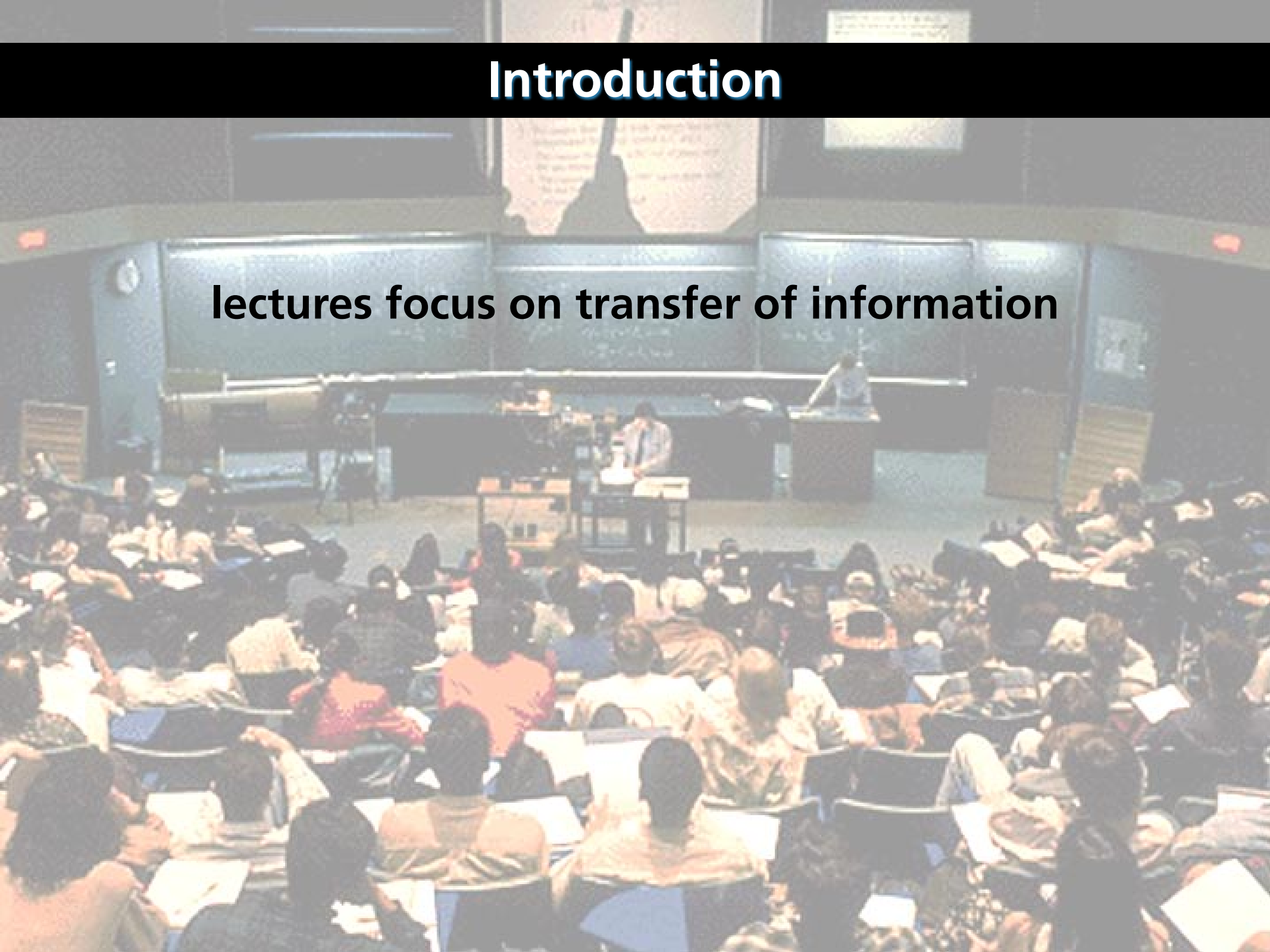
Eric Mazur

Kristy Beauvais

Meghan Walbran

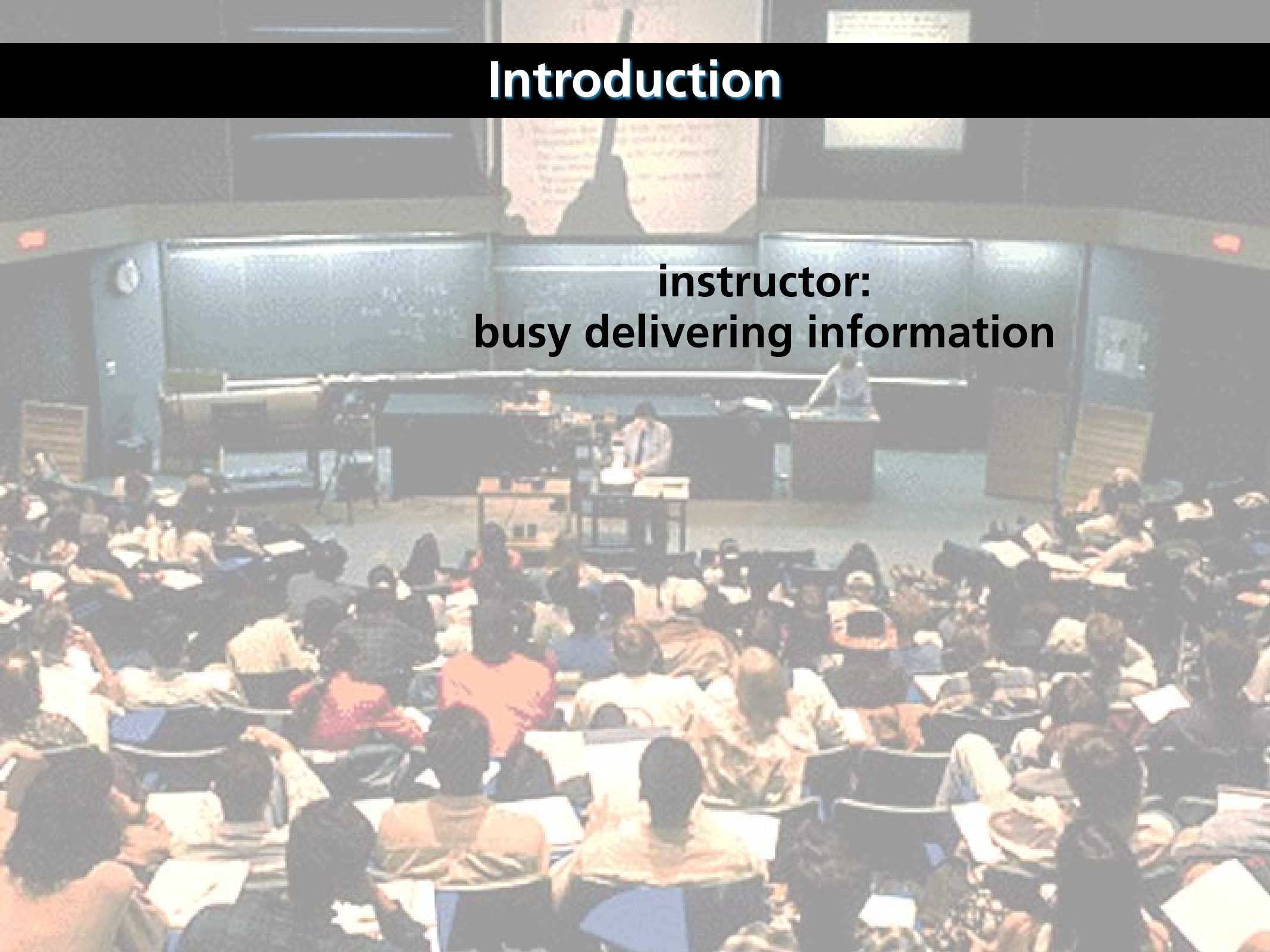
Introduction

Introduction



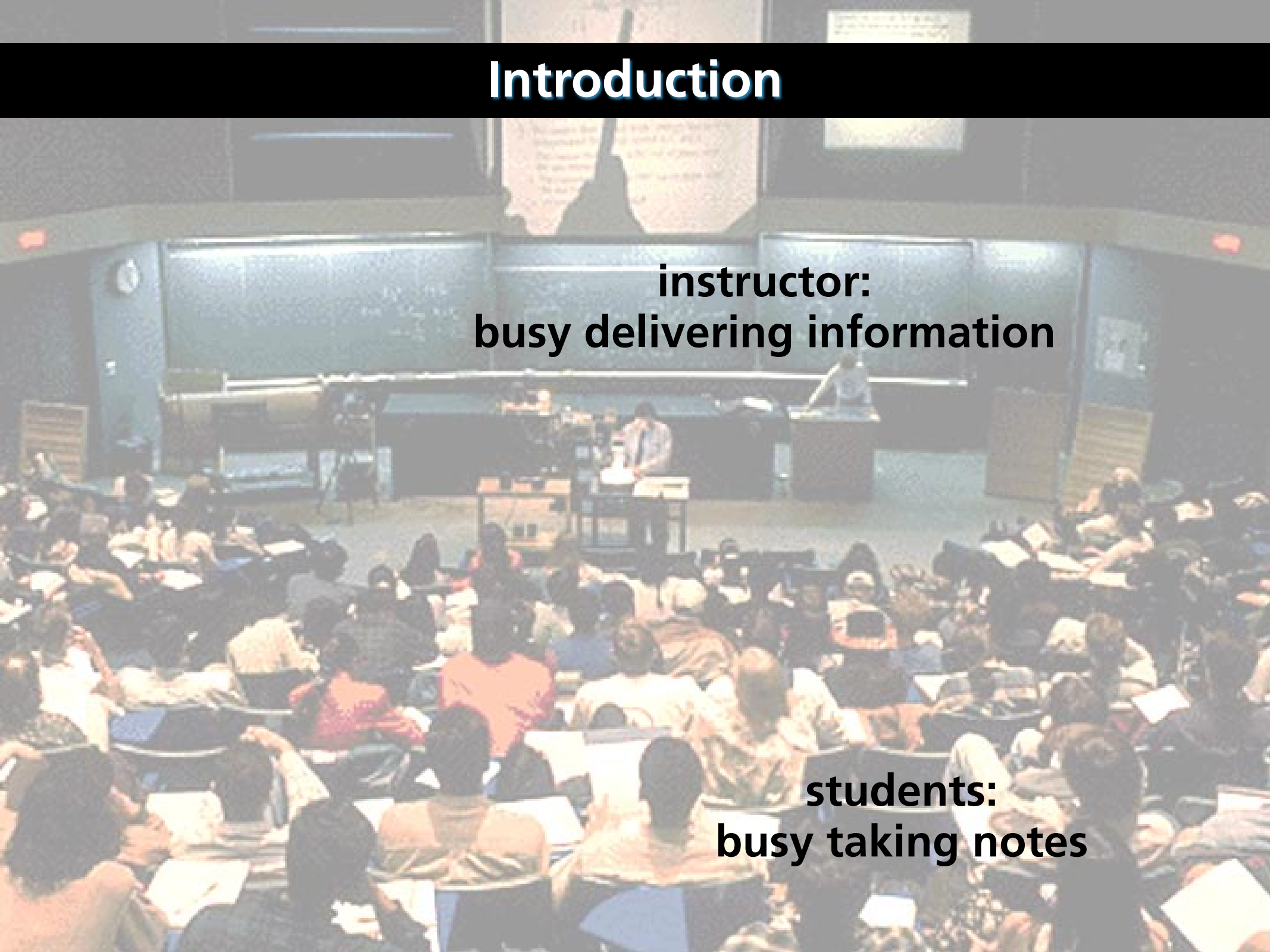
lectures focus on transfer of information

Introduction



instructor:
busy delivering information

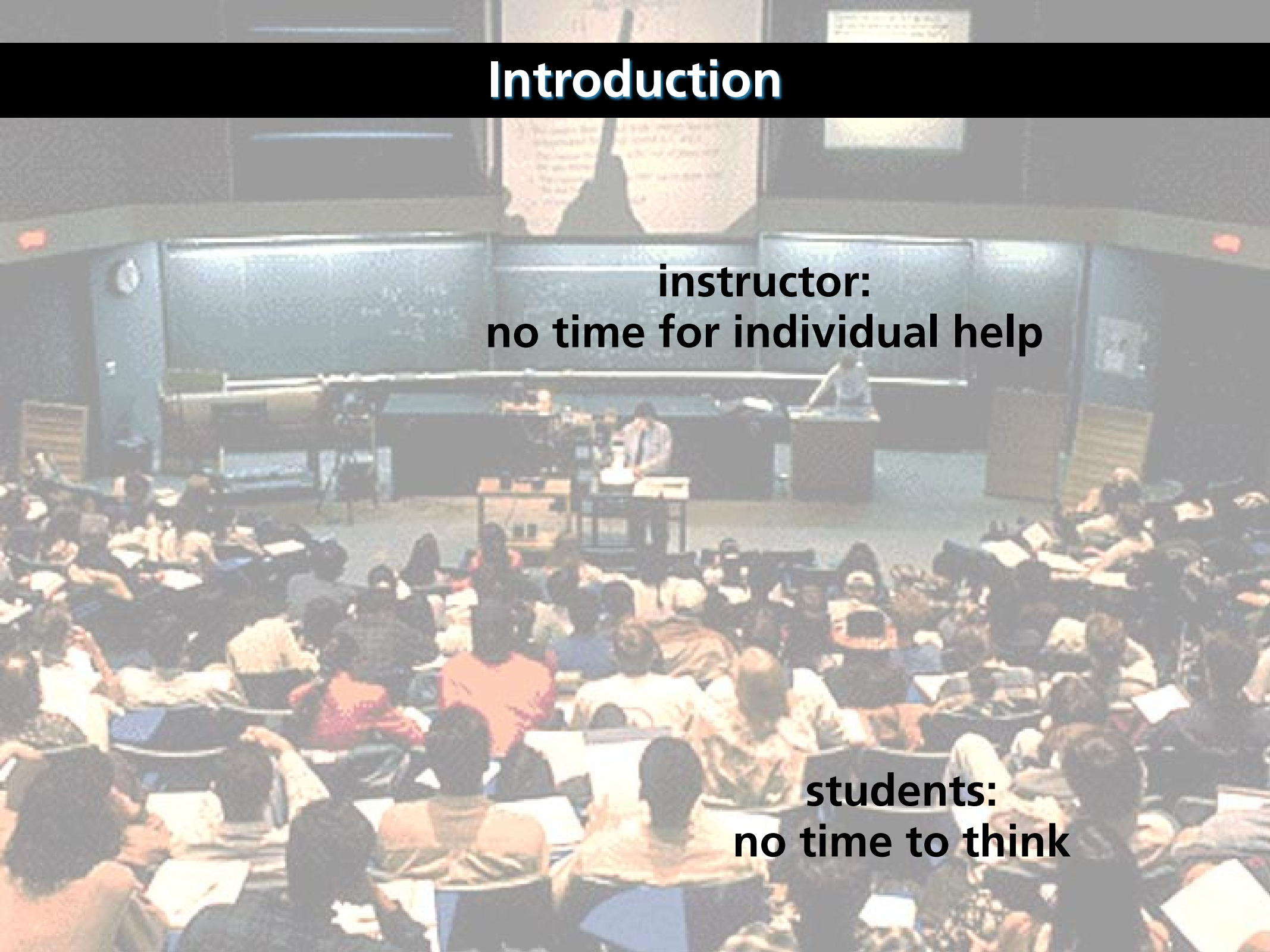
Introduction



instructor:
busy delivering information

students:
busy taking notes

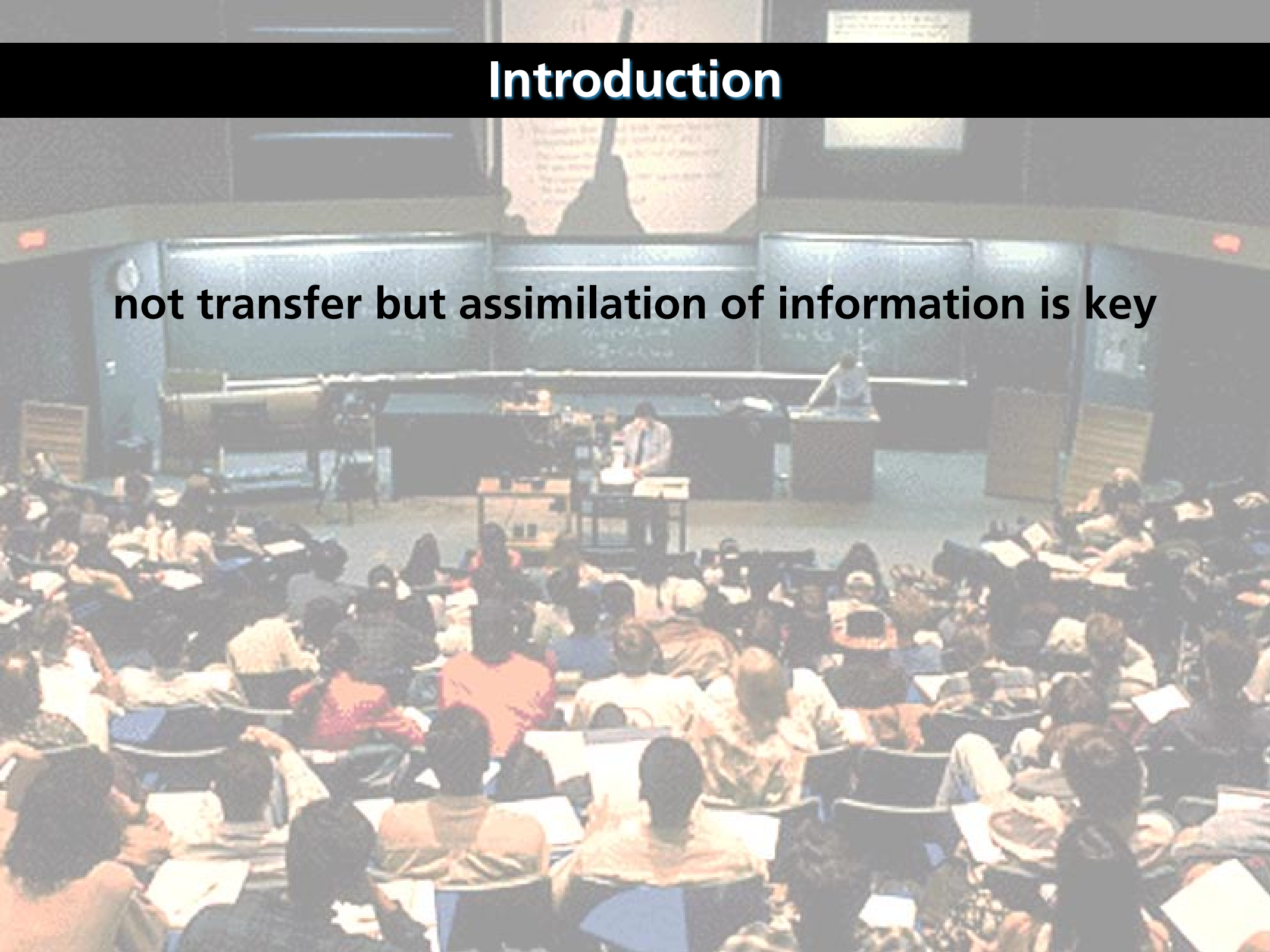
Introduction



instructor:
no time for individual help

students:
no time to think

Introduction



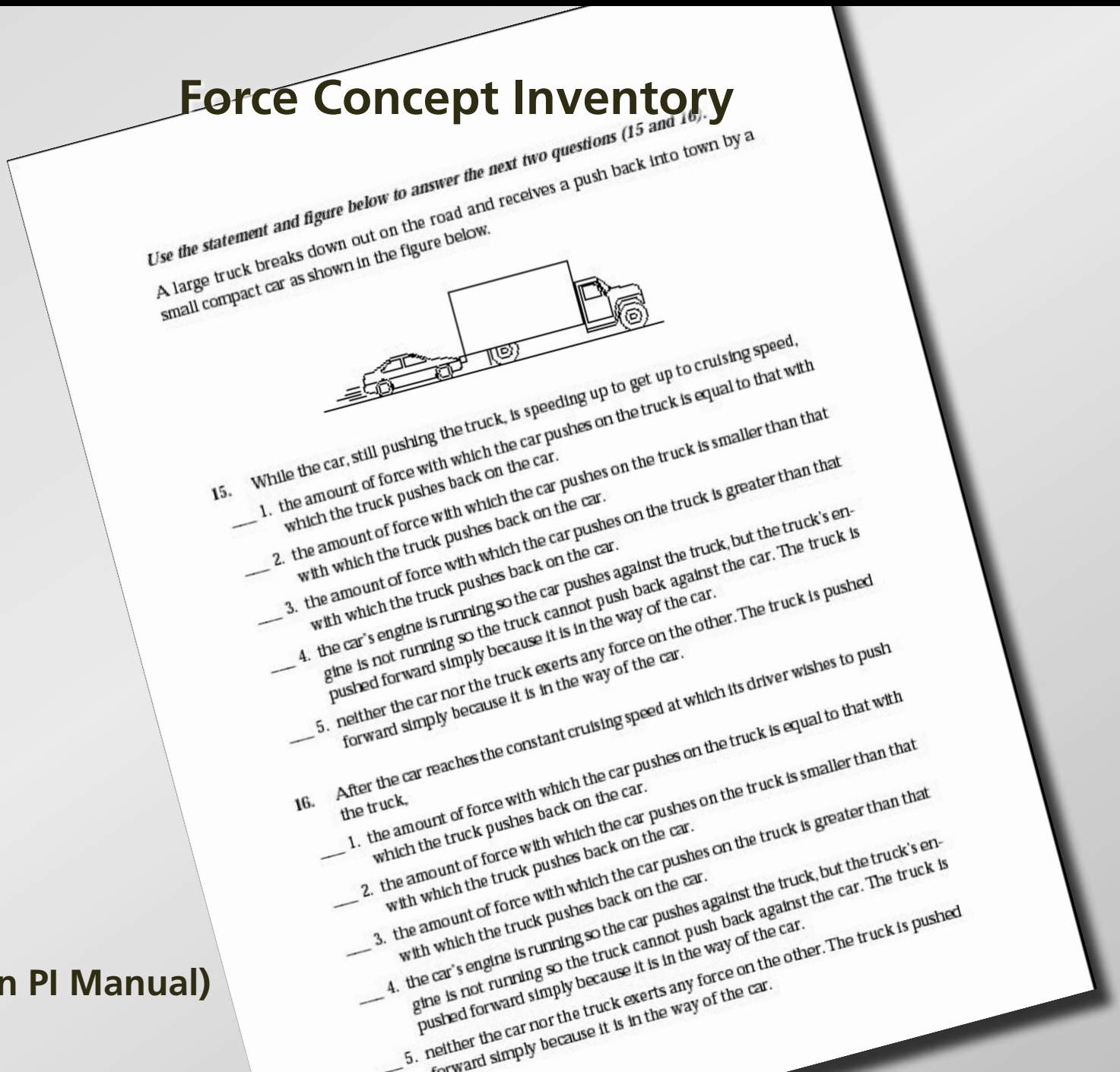
not transfer but assimilation of information is key

Outline

- Peer Instruction
- PI at Concord-Carlisle High School
- PI at Marblehead High School

Peer Instruction

Force Concept Inventory



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.

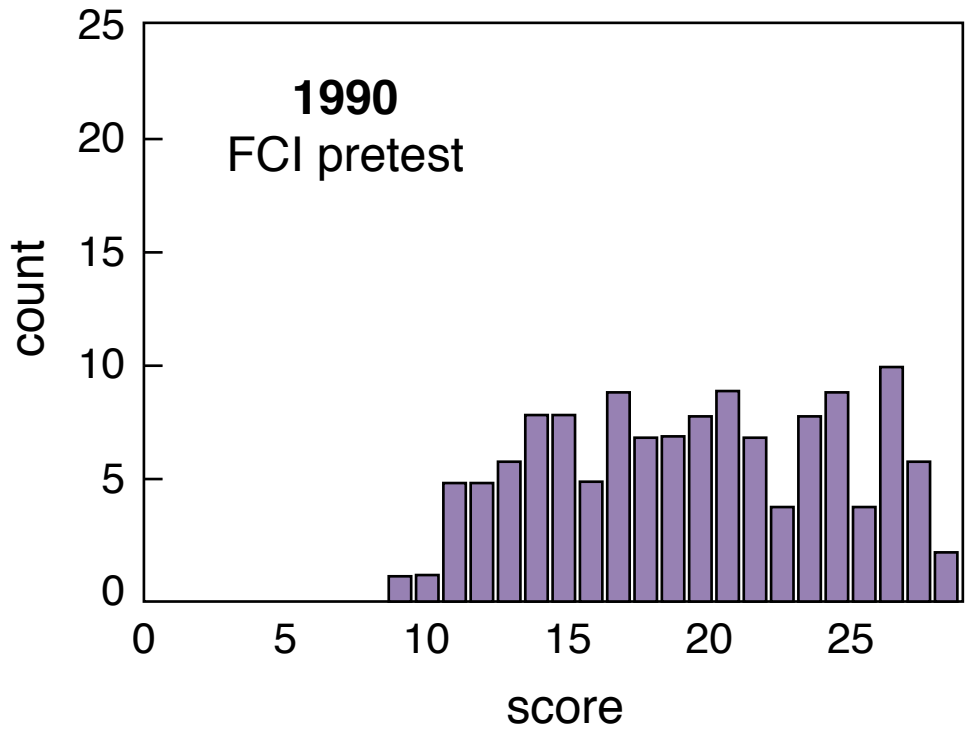
15. While the car, still pushing the truck, is speeding up to get up to cruising speed,
___ 1. the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car.
___ 2. the amount of force with which the car pushes on the truck is smaller than that 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.
___ 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.

(copy available in PI Manual)

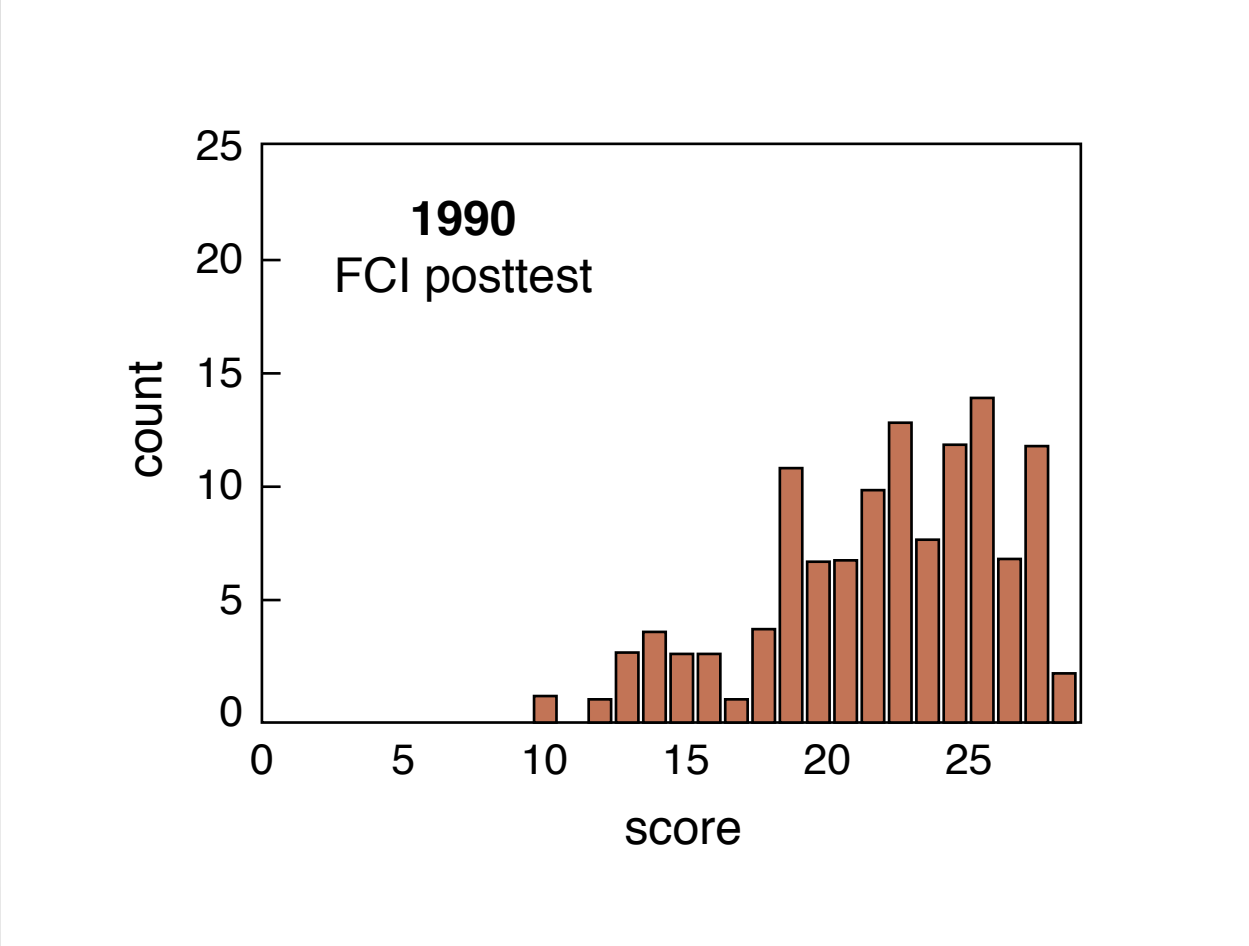
Peer Instruction

education is not just information transfer



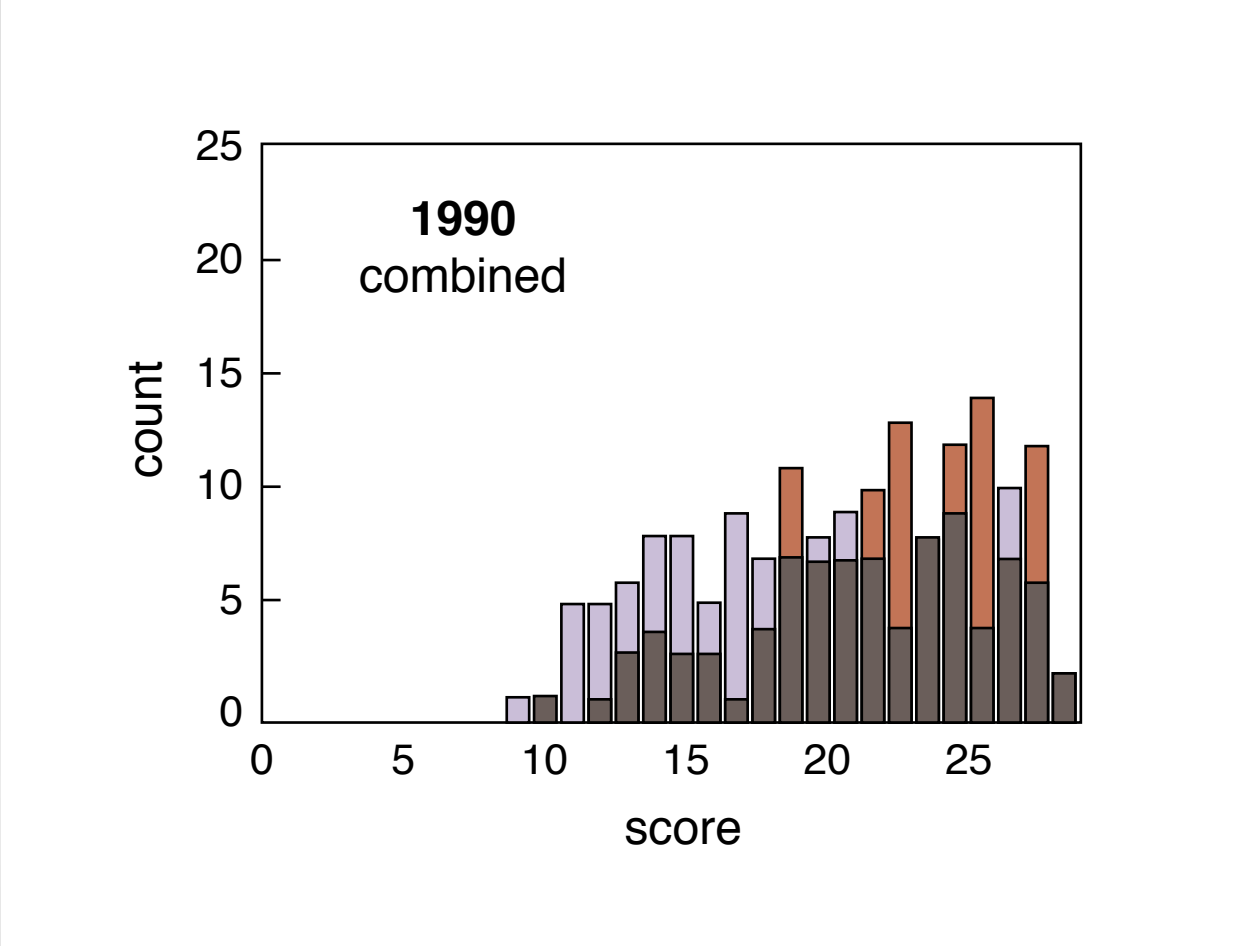
Peer Instruction

education is not just information transfer

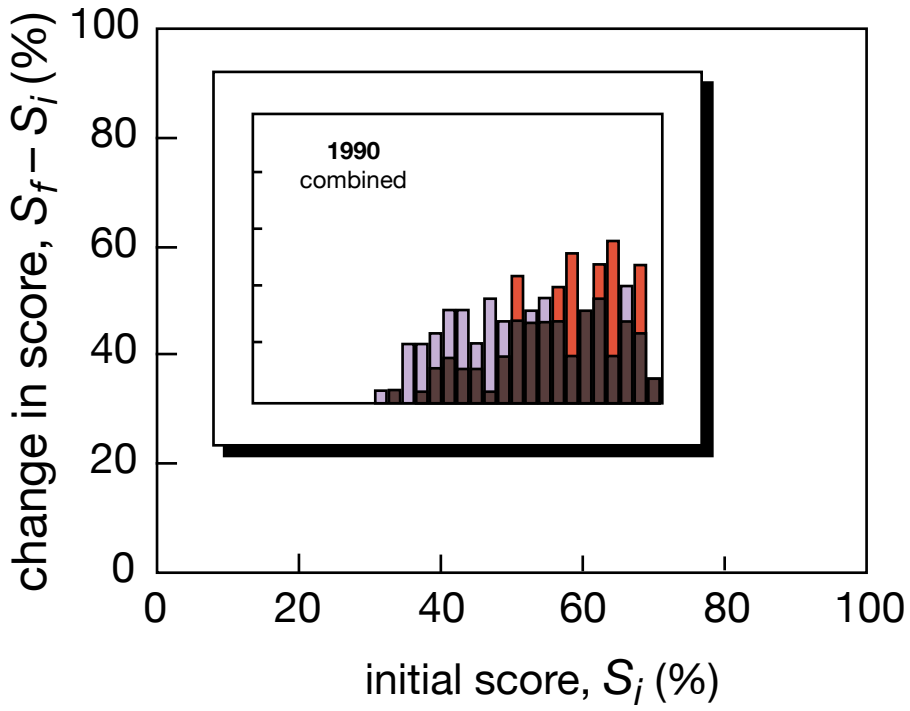


Peer Instruction

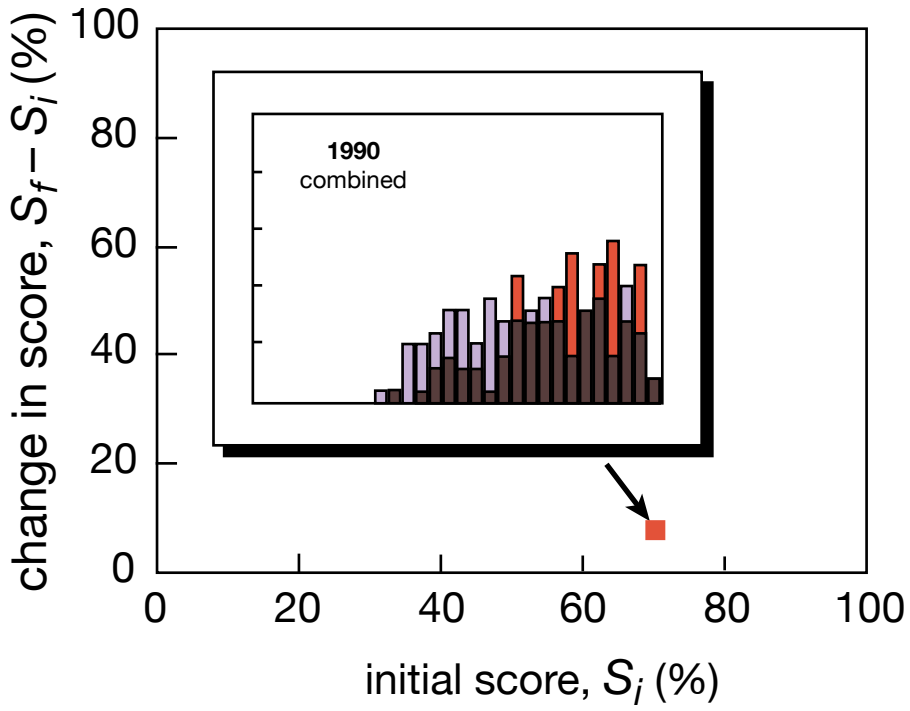
education is not just information transfer



Peer Instruction



Peer Instruction



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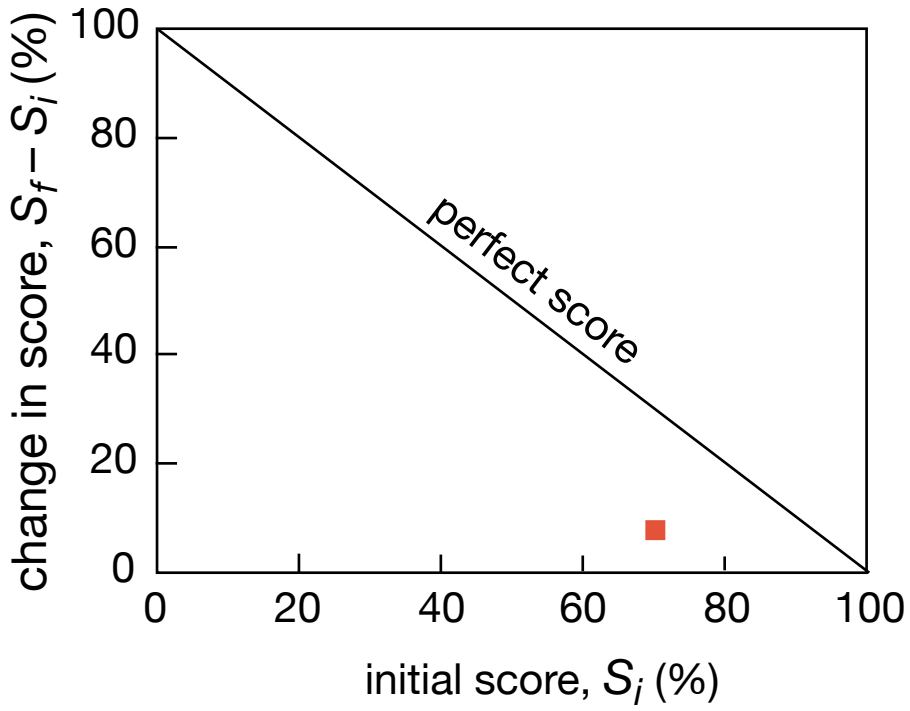
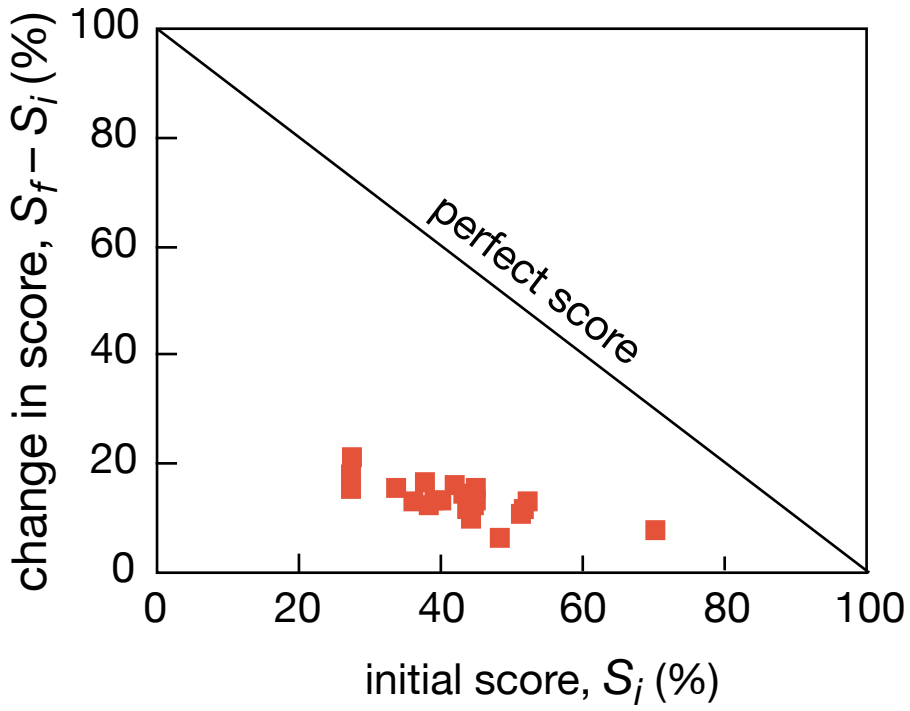


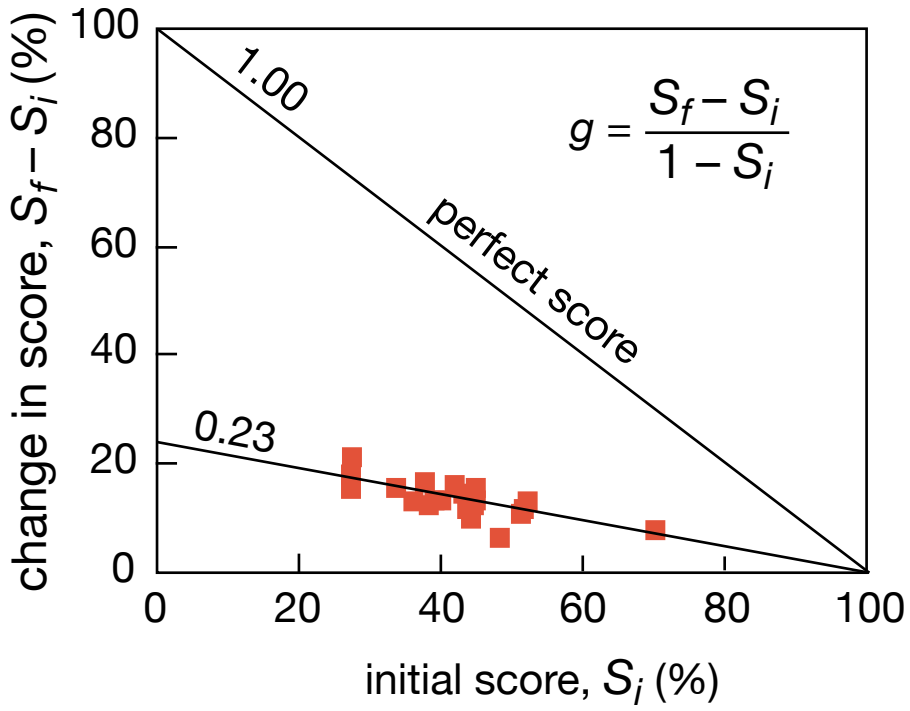
Peer Instruction



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

Peer Instruction

only one quarter of maximum gain realized



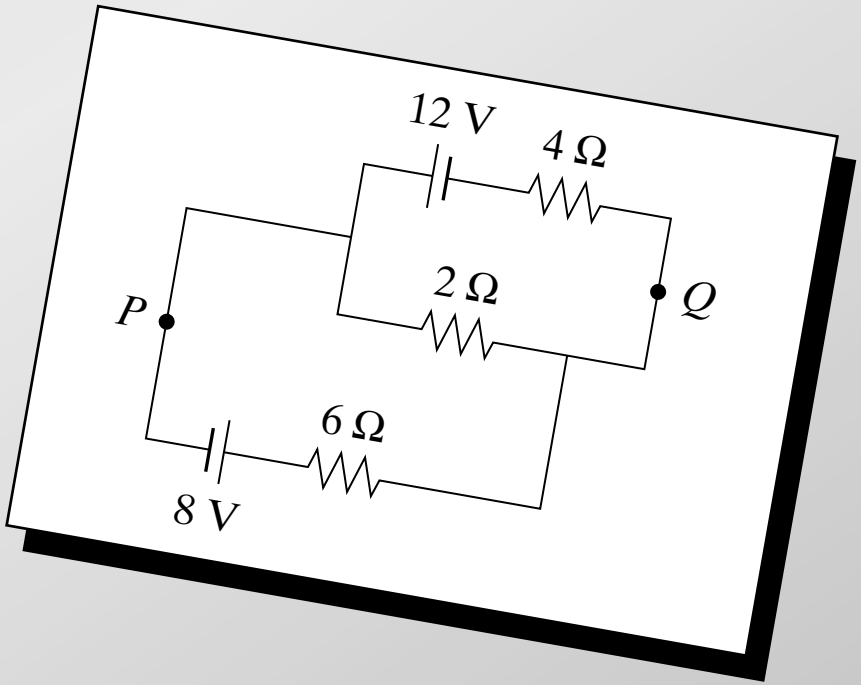
R.R. Hake, *Am. J. Phys.* 66, 64 (1998)

Peer Instruction

what causes this problem?

Peer Instruction

conventional problems reinforce bad study habits



Peer Instruction

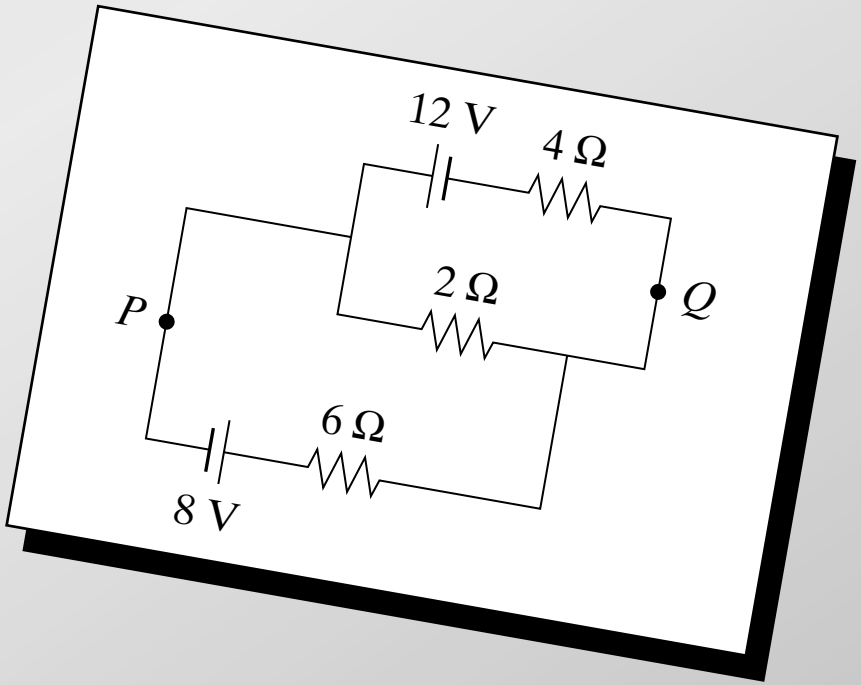
conventional problems reinforce bad study habits

Calculate:

(*a*) current in 2-Ω resistor

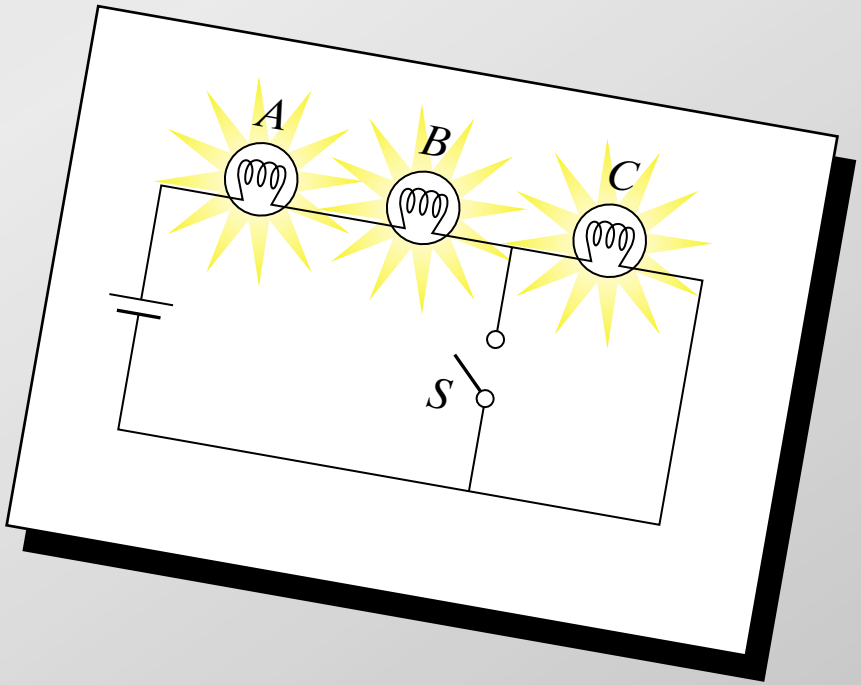
(*b*) potential difference

between *P* and *Q*



Peer Instruction

are the basic principles understood?



Peer Instruction

are the basic principles understood?

When *S* is closed, what happens to:

(*a*) intensities of A and B?

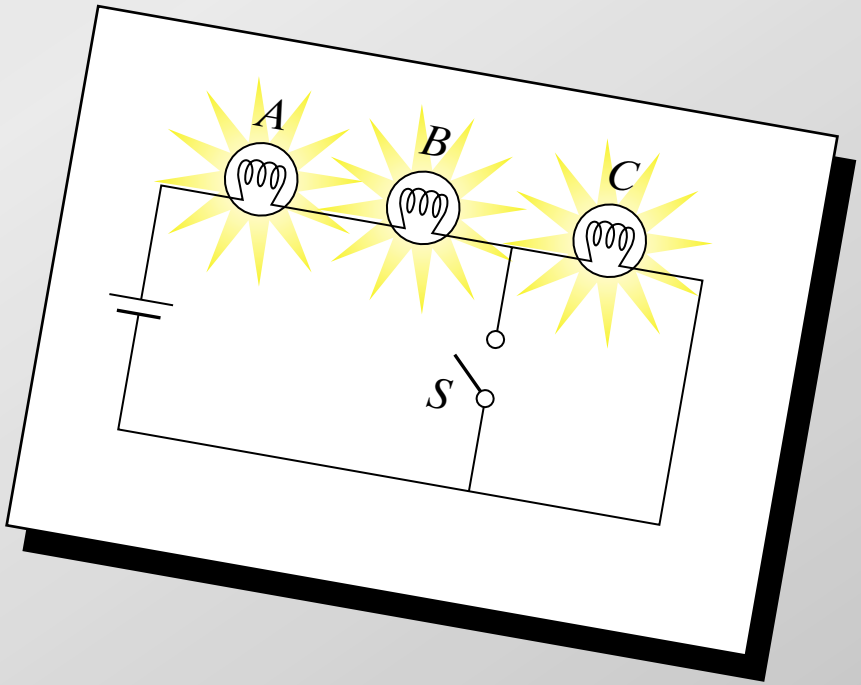
(*b*) intensity of C?

(*c*) current through battery?

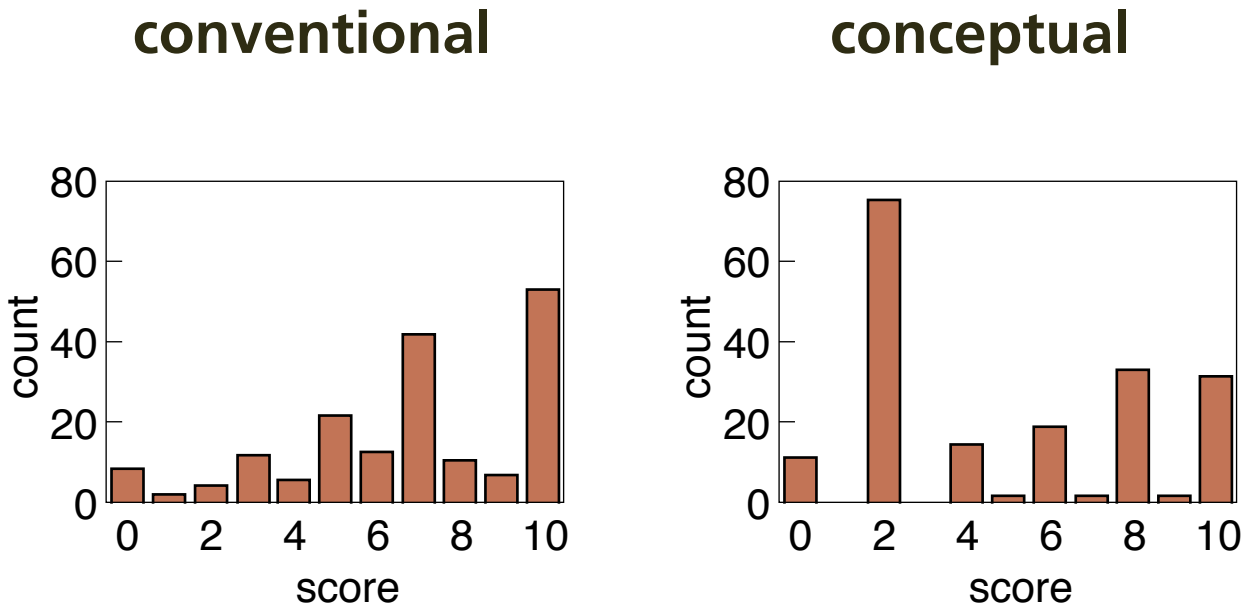
(*d*) potential difference across

A, *B*, and *C*?

(*e*) the total power dissipated?



Peer Instruction



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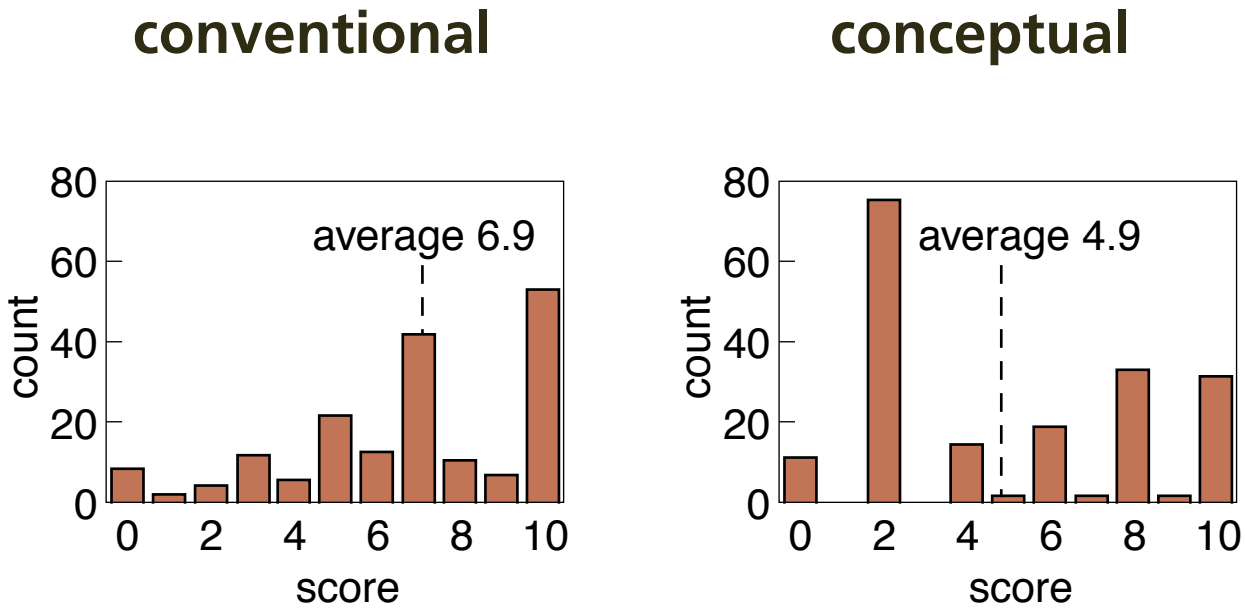

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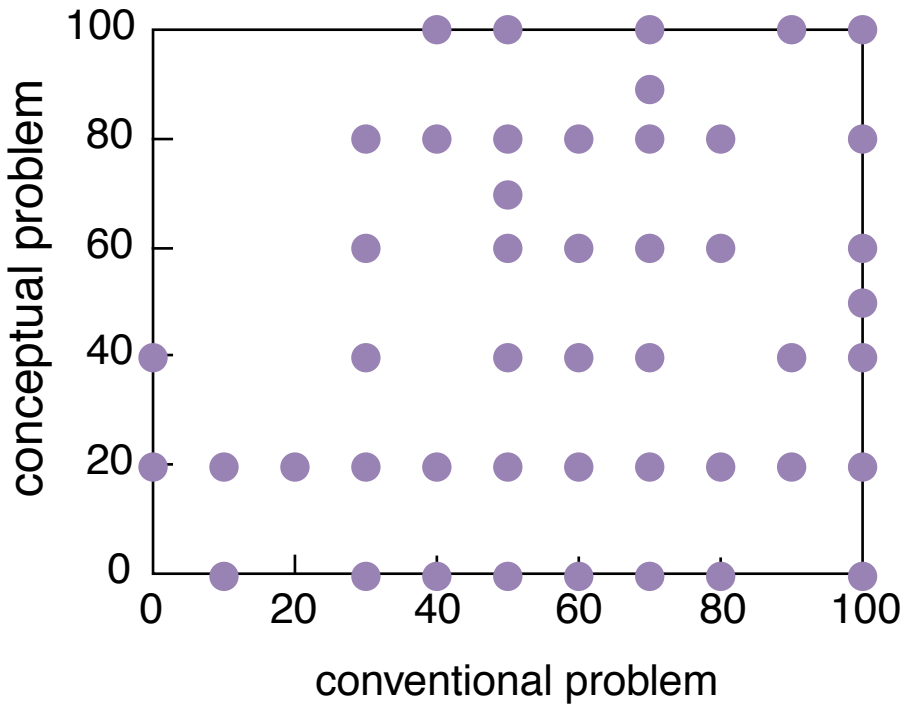

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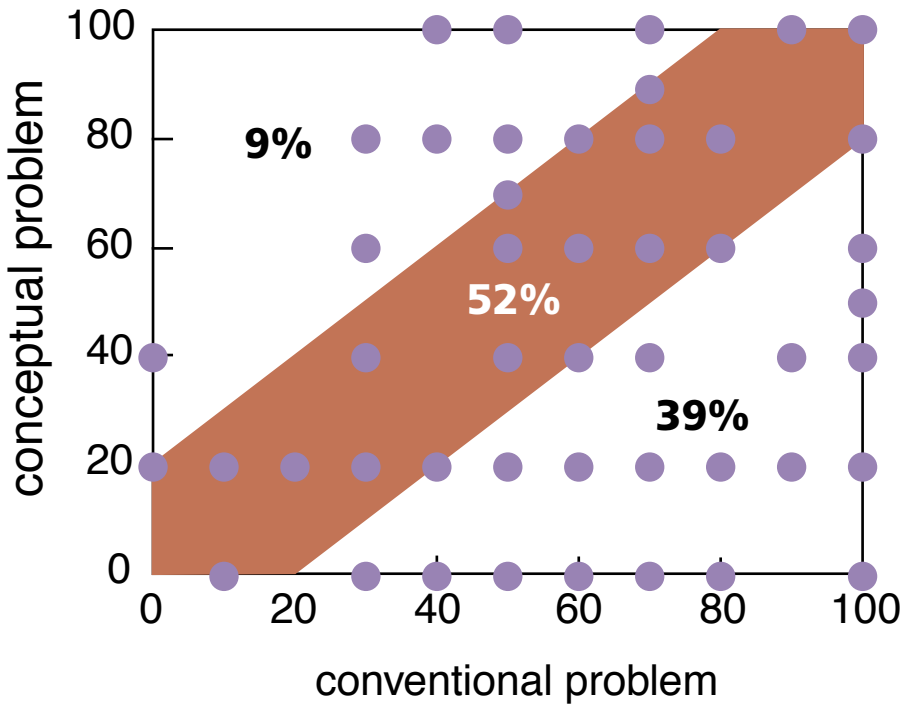


Peer Instruction

so what should we do?

Peer Instruction

Give students more responsibility for gathering information…

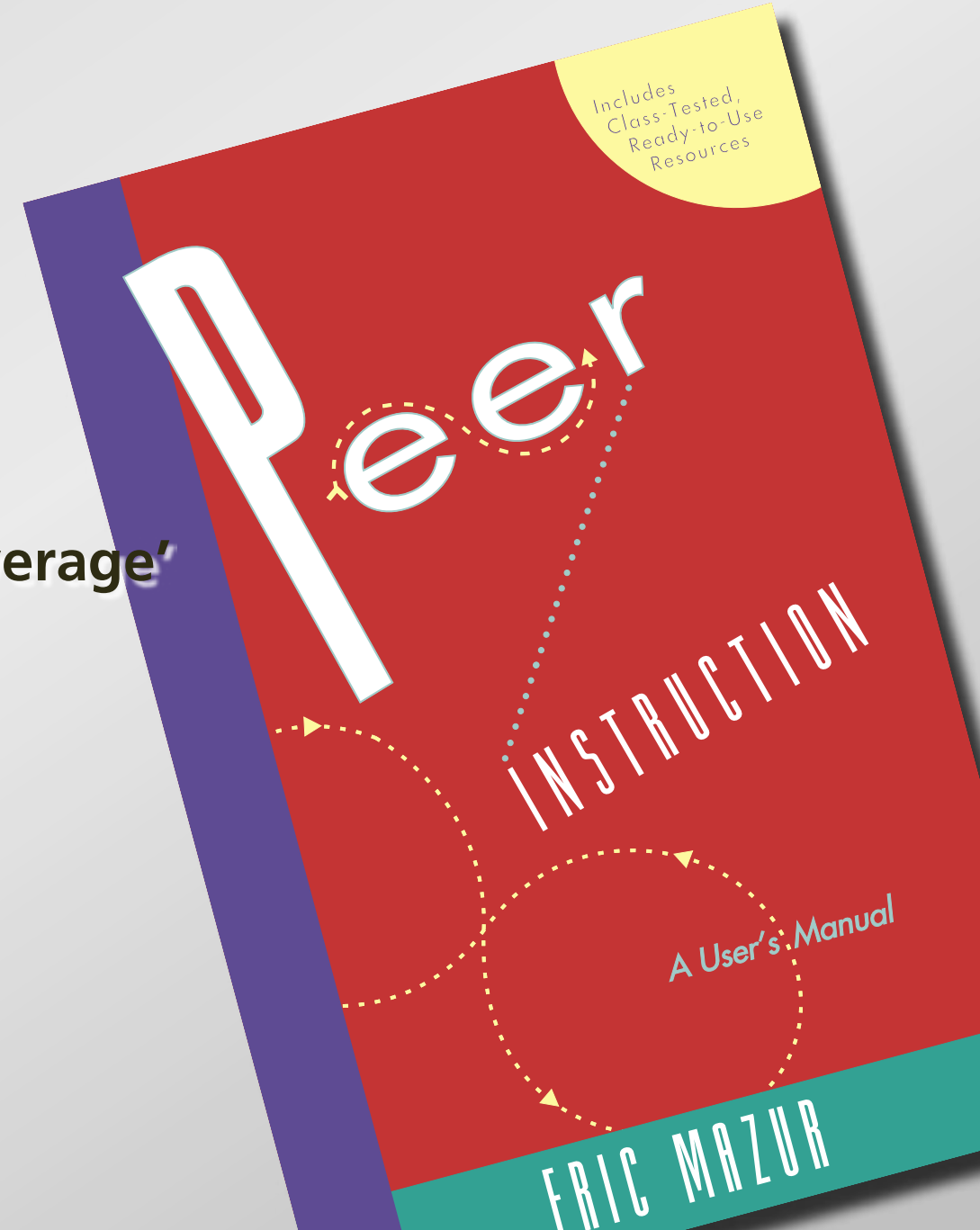
Peer Instruction

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

Peer Instruction

Main features:

- pre-class reading
- in-class: depth, not ‘coverage’
- ConcepTests



Peer Instruction

ConcepTest:

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

Peer Instruction

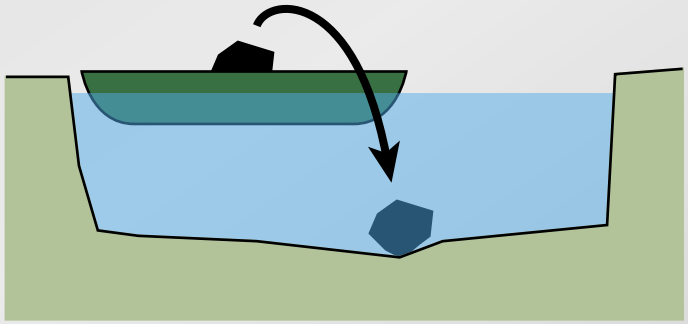
is it any good?

Peer Instruction

let's try it!

Peer Instruction

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.



Peer Instruction

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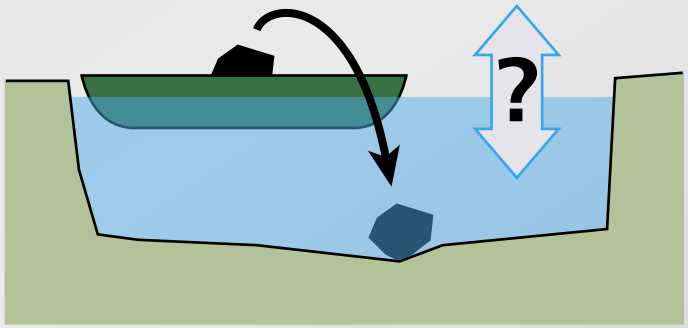


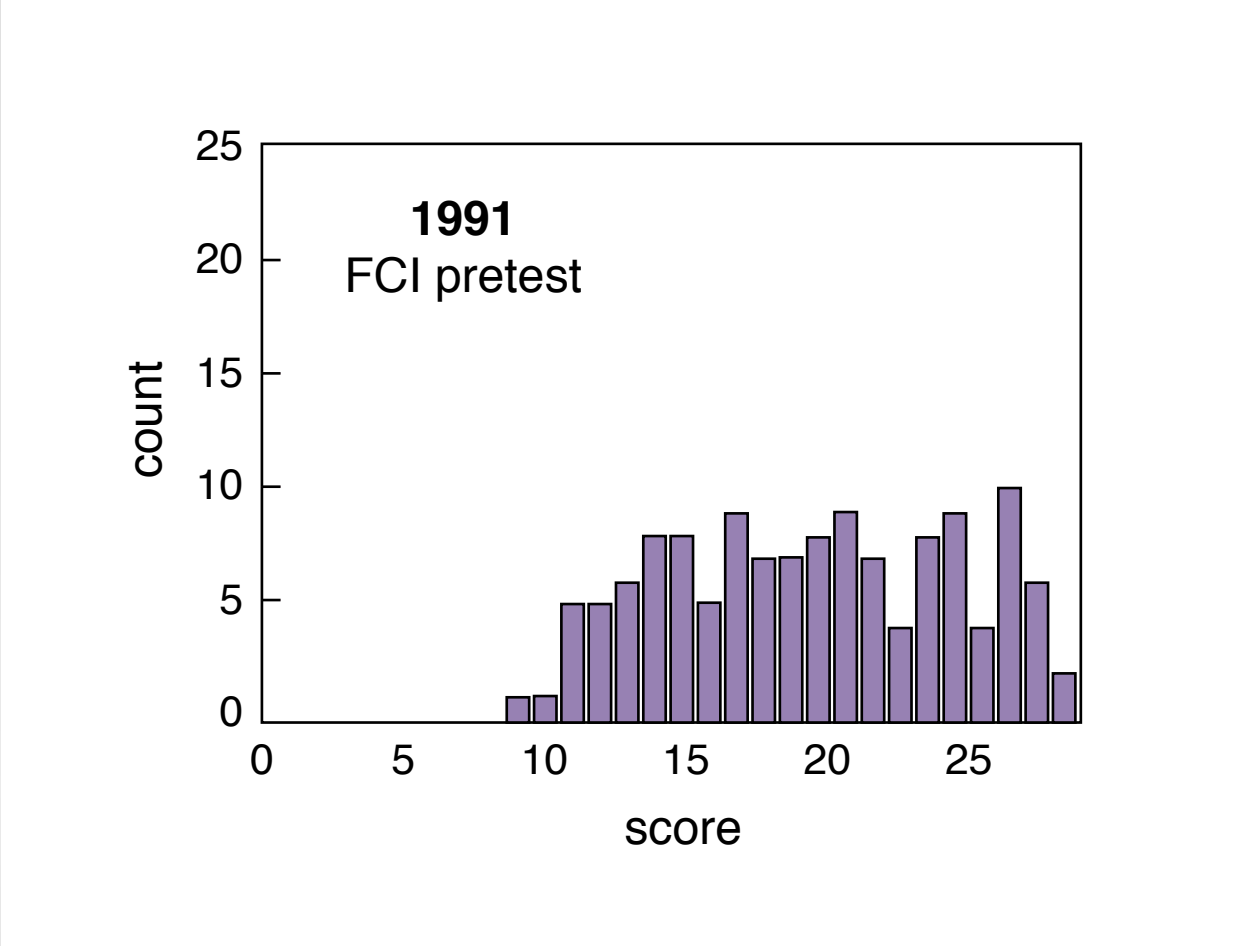
After the boulder sinks to the bottom of the pond, the level of the water in the pond is

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

it was when the boulder was in the boat.

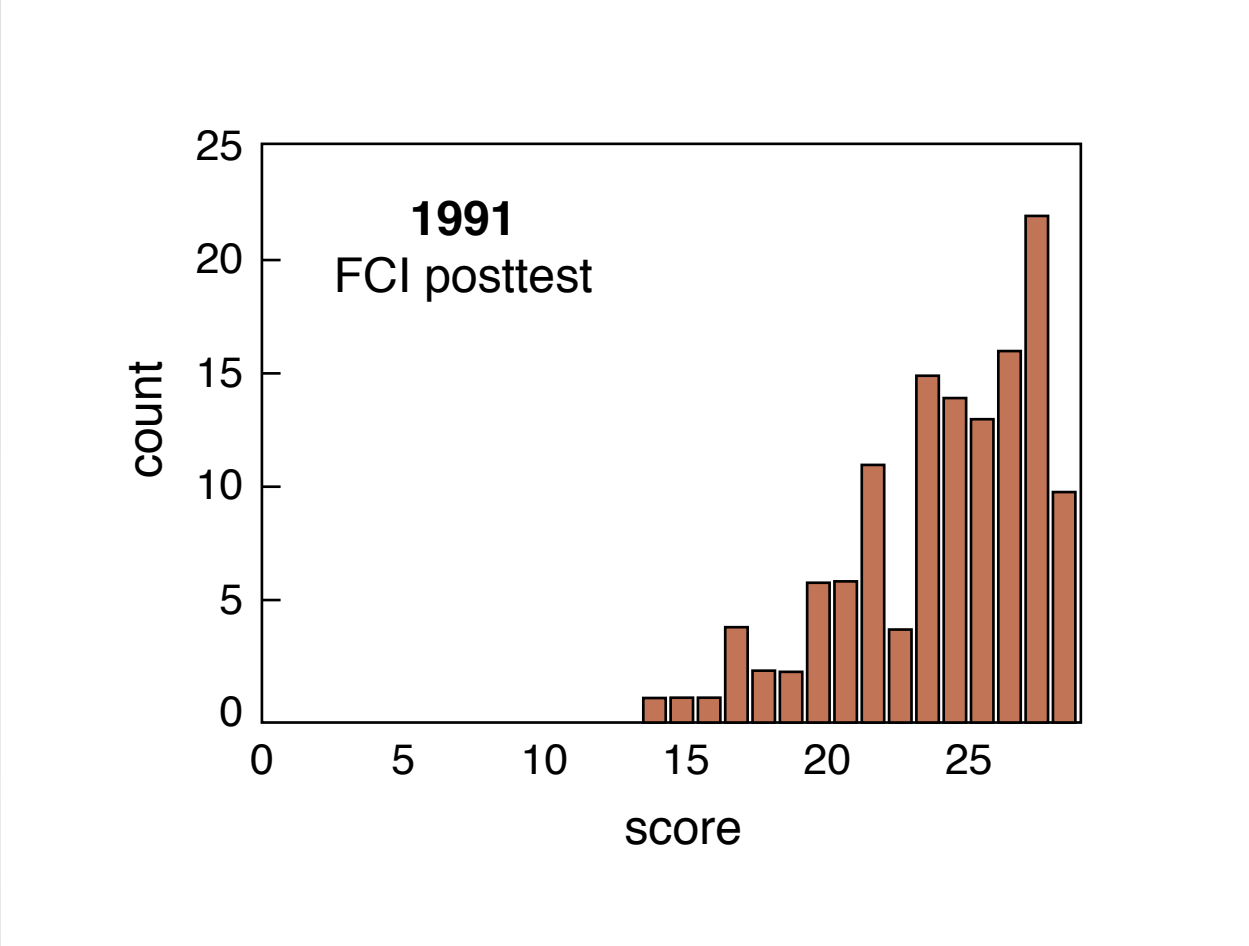
Peer Instruction

first year of implementing PI



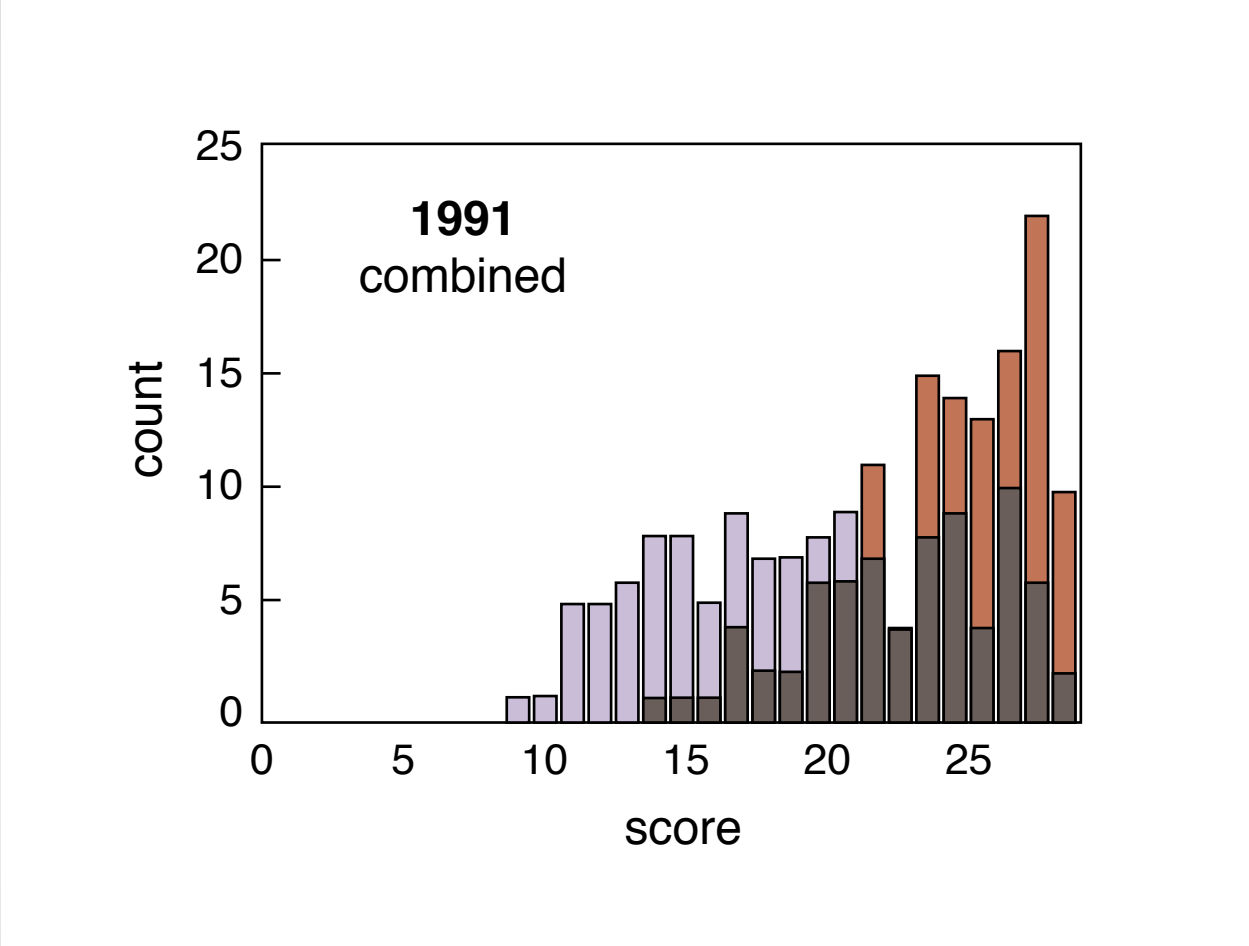
Peer Instruction

first year of implementing PI

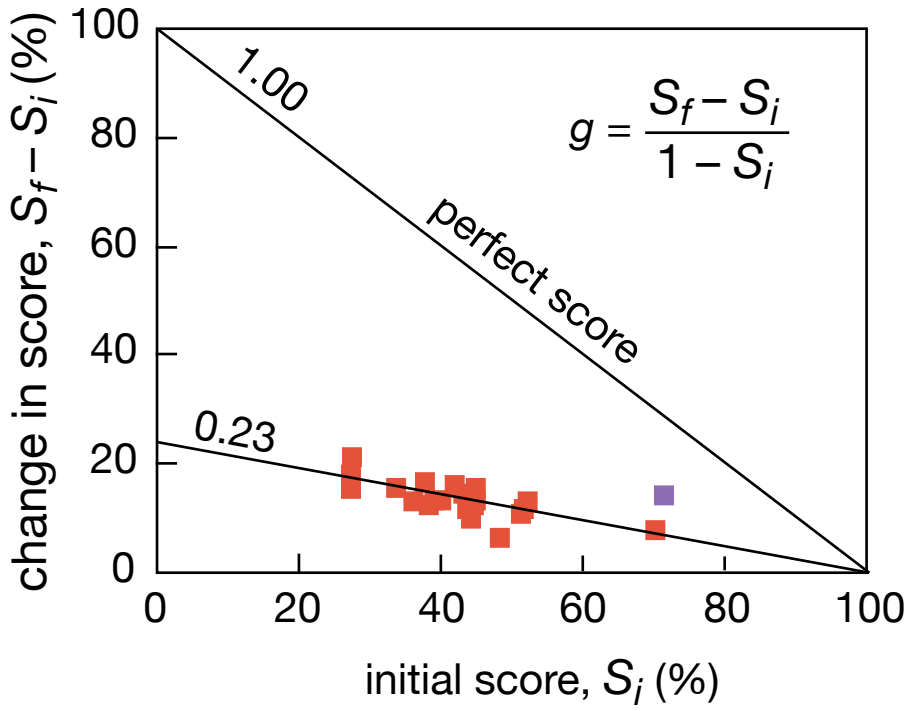


Peer Instruction

first year of implementing PI



Peer Instruction



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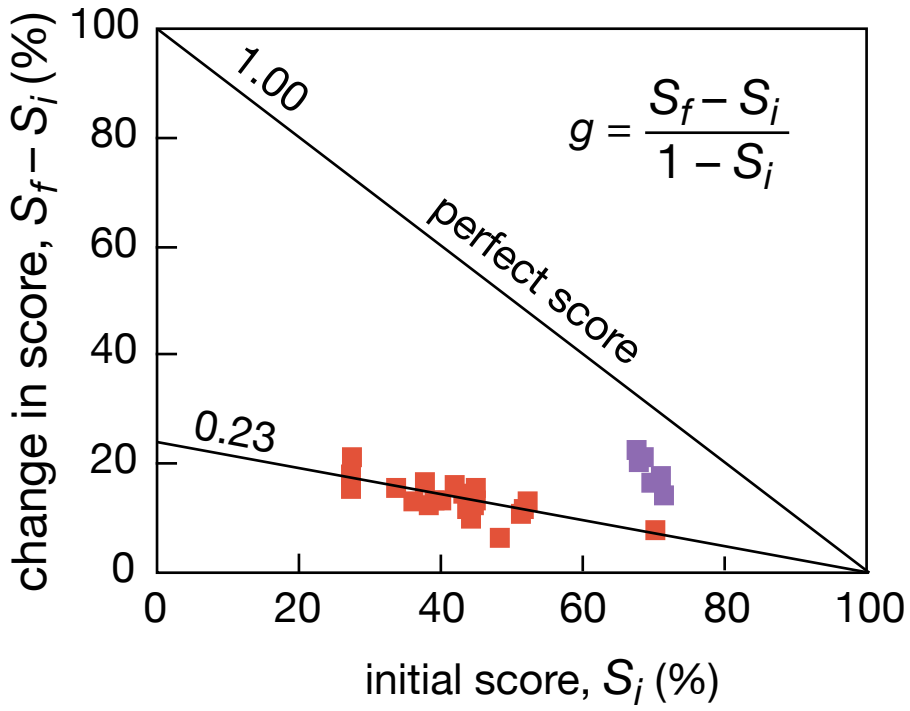

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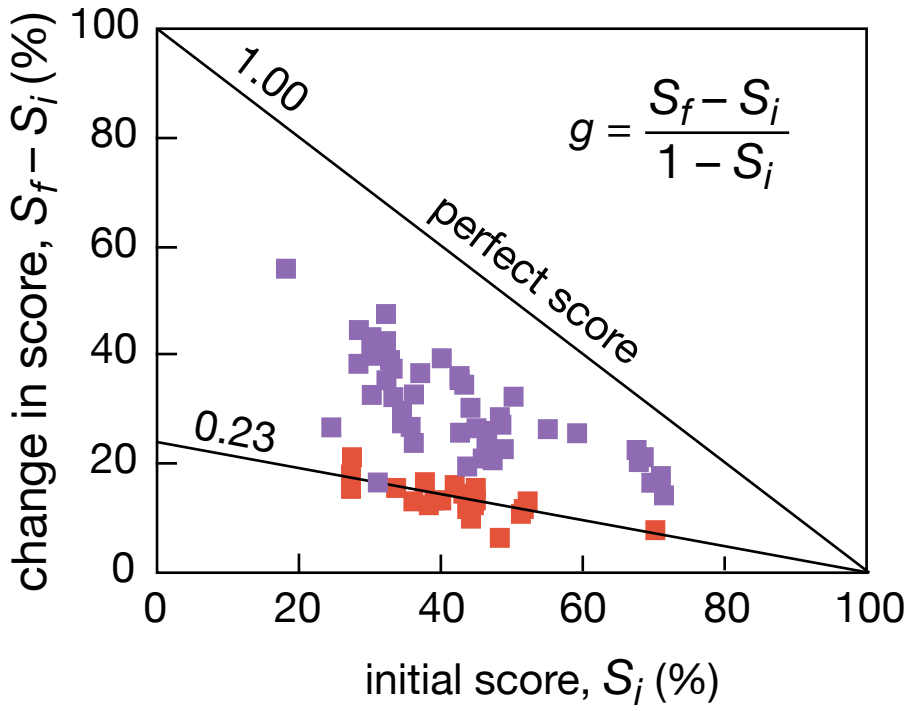
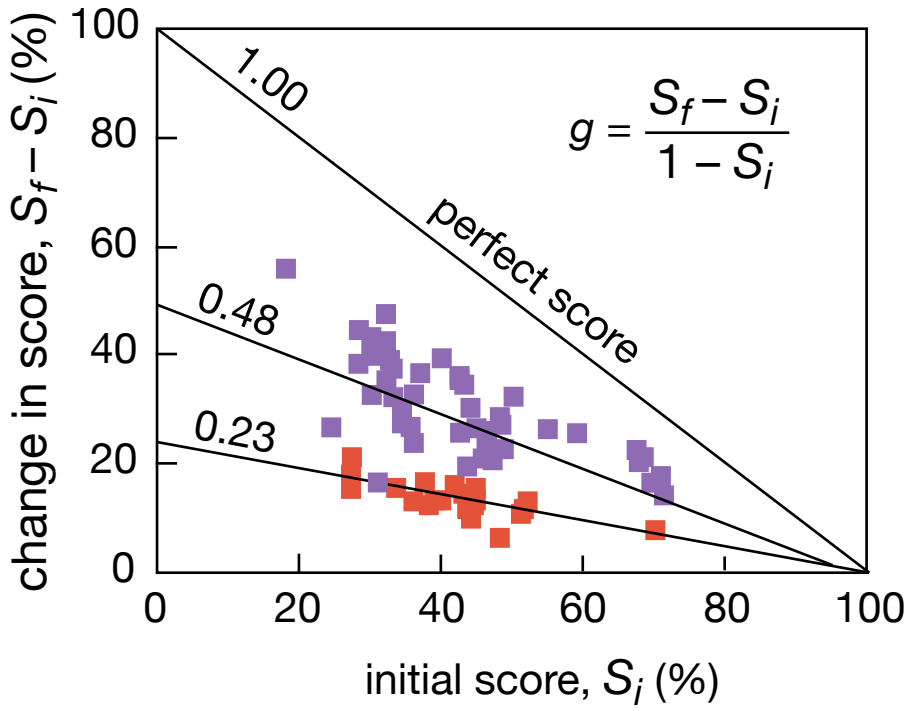


R.R. Hake, *Am. J. Phys.* 66, 64 (1998)

Peer Instruction

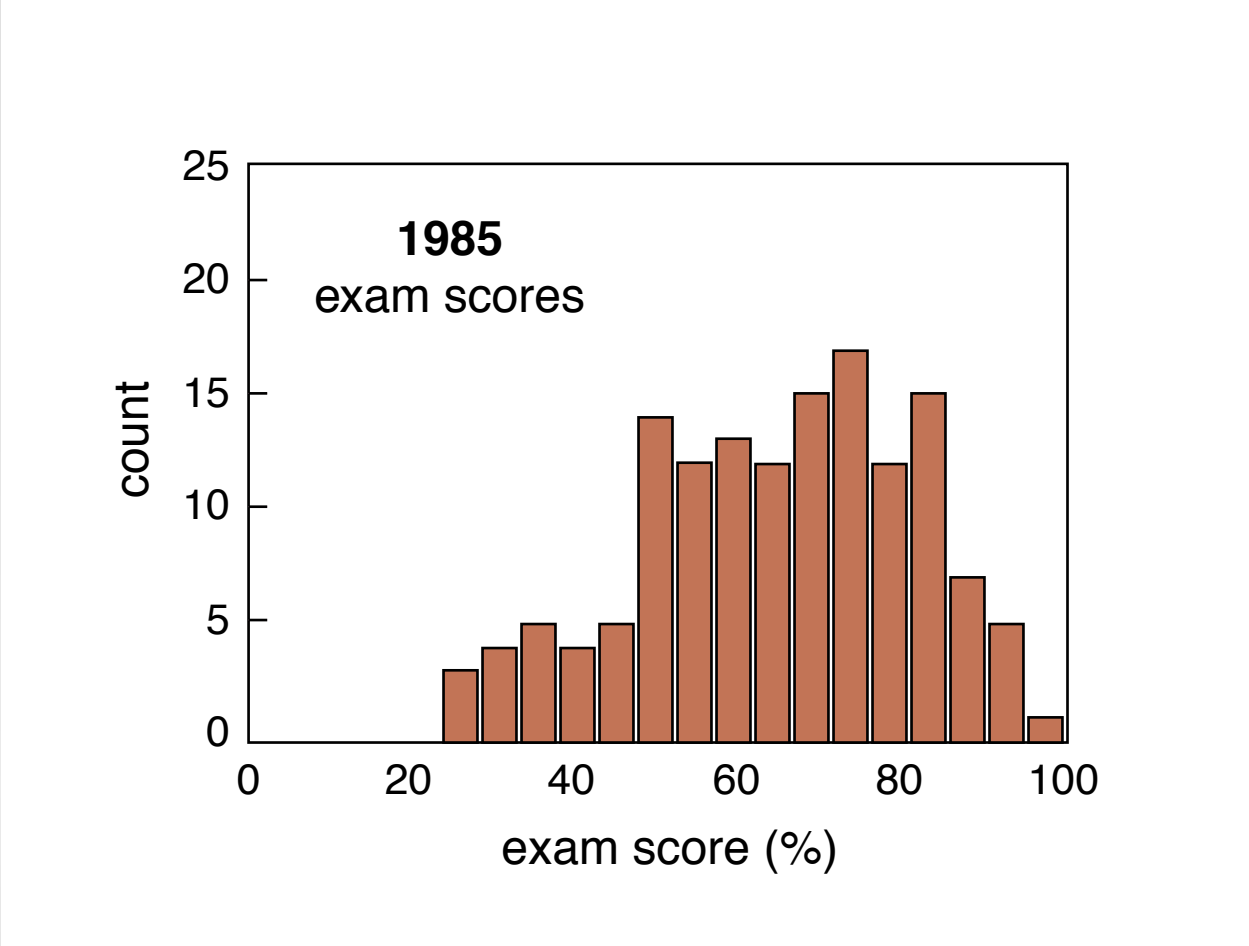


R.R. Hake, *Am. J. Phys.* 66, 64 (1998)

Peer Instruction

what about problem solving?

Peer Instruction



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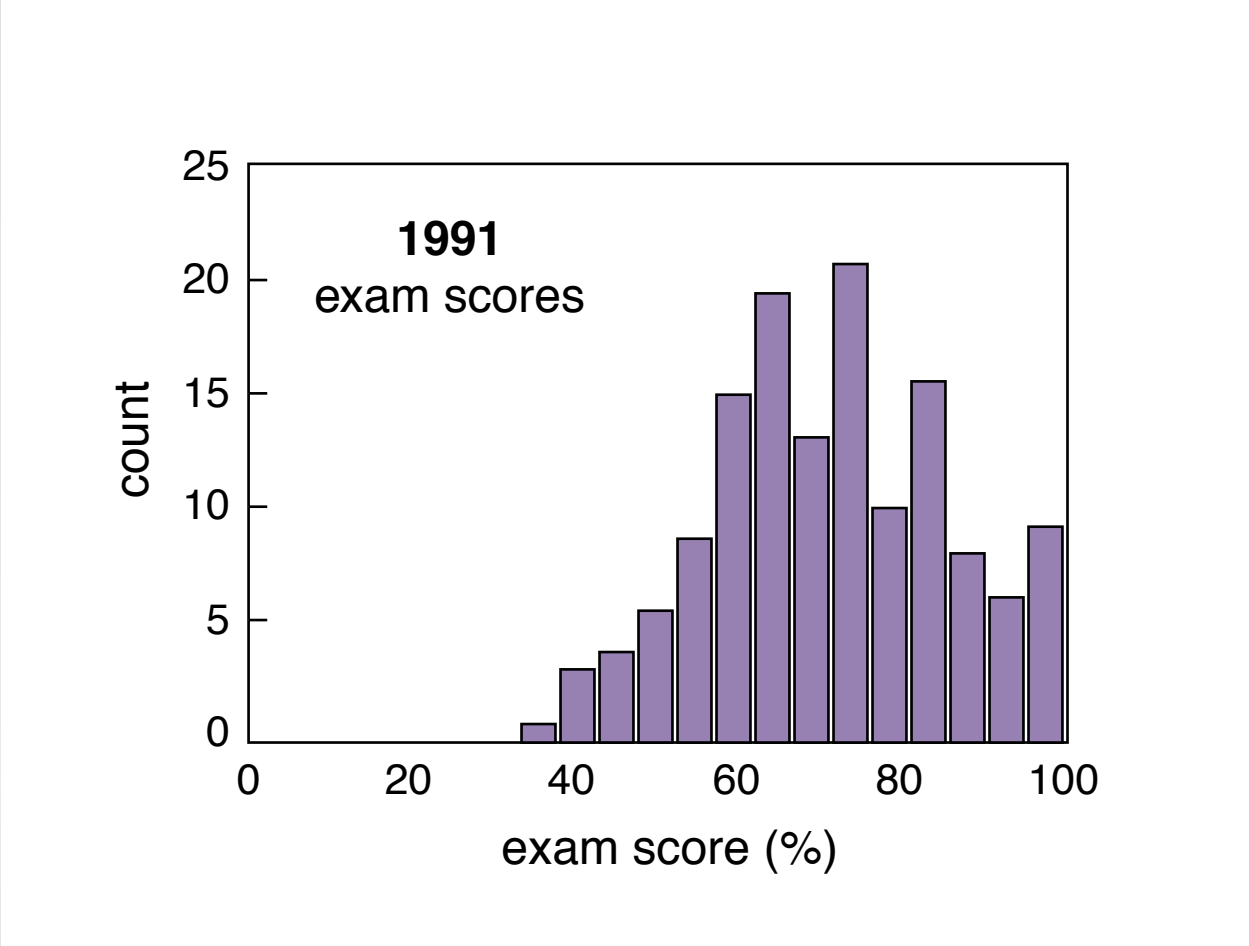

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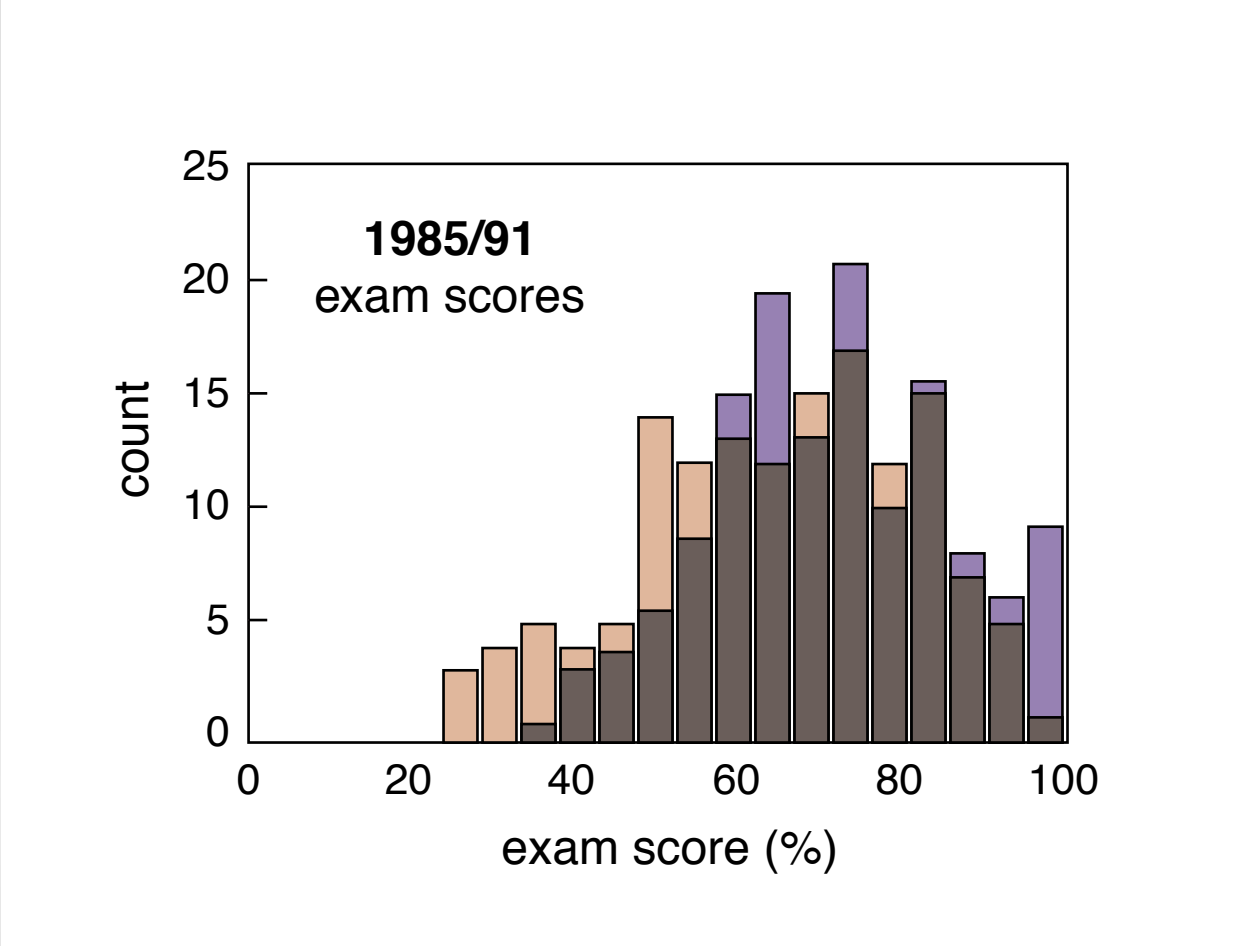


Peer Instruction

So better understanding leads to better problem solving!

Peer Instruction

So better understanding leads to better problem solving!

(but “good” problem solving doesn’t always indicate understanding!)

Outline

- Peer Instruction
- PI at Concord-Carlisle High School
- PI at Marblehead High School

PI at Concord-Carlisle HS

What you need to know up front:

PI at Concord-Carlisle HS

What you need to know up front:

- the kids love it!

PI at Concord-Carlisle HS

What you need to know up front:

- the kids love it!
- it's easy to use

PI at Concord-Carlisle HS

What you need to know up front:

- the kids love it!
- it’s easy to use
- it really works

PI at Concord-Carlisle HS

But…

PI at Concord-Carlisle HS

But…

- it takes time

PI at Concord-Carlisle HS

But…

- it takes time
- it might not work every time

PI at Concord-Carlisle HS

But…

- it takes time
- it might not work every time
- it requires assessment

PI at Concord-Carlisle HS

Methods of implementation:

- heads down, hands up
- index cards
- Personal Response System

PI at Concord-Carlisle HS

PI at Concord-Carlisle HS

Strategies for success:

- explain pedagogy

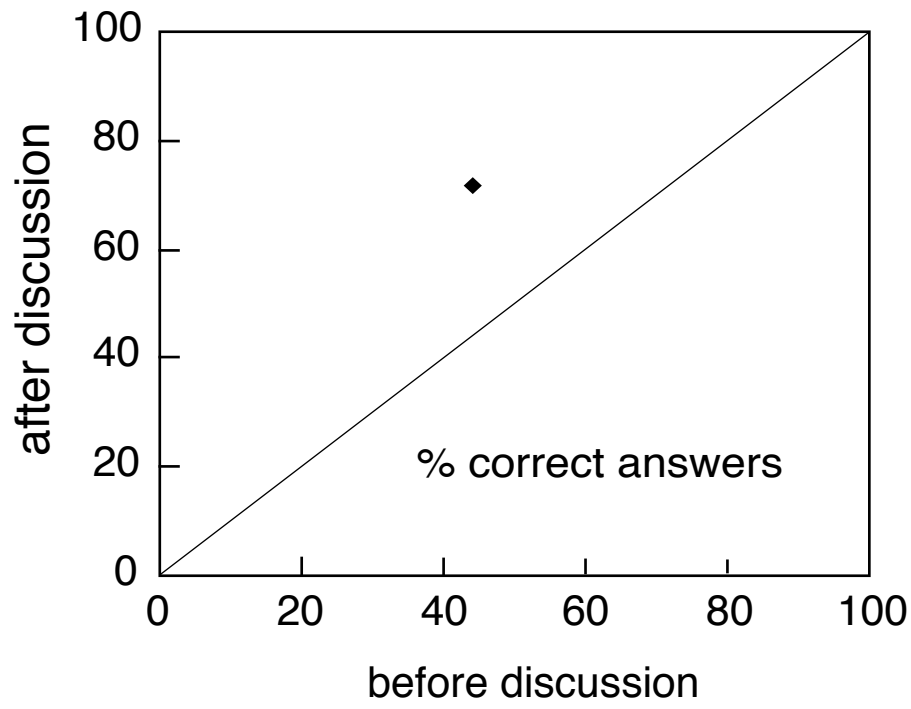
PI at Concord-Carlisle HS

Strategies for success:

- explain pedagogy
- maximize opportunities for success

PI at Concord-Carlisle HS

make sure enough are initially correct!



PI at Concord-Carlisle HS

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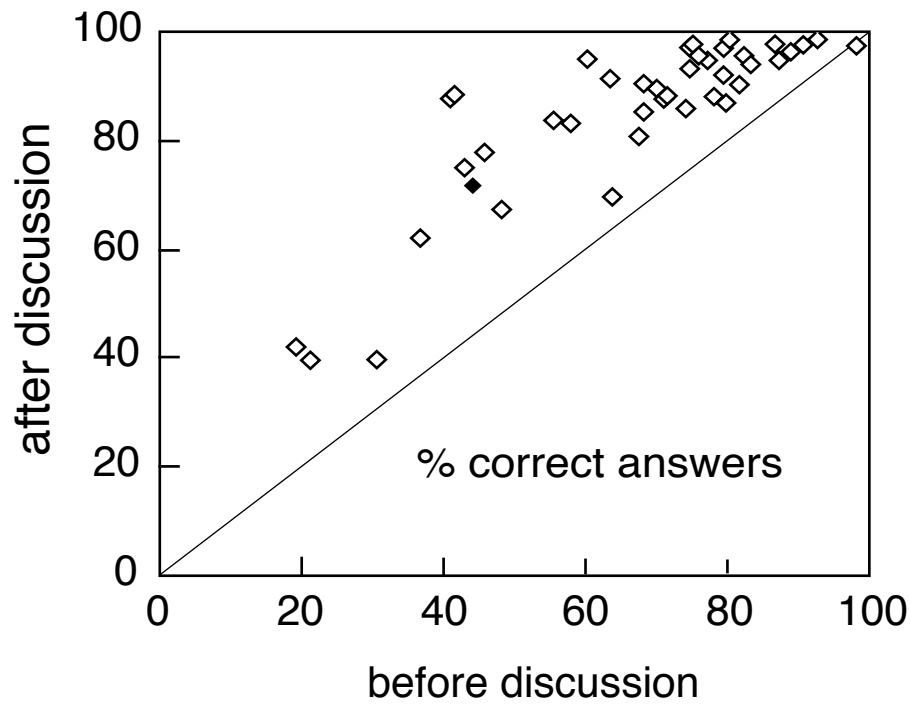

PI at Concord-Carlisle HS

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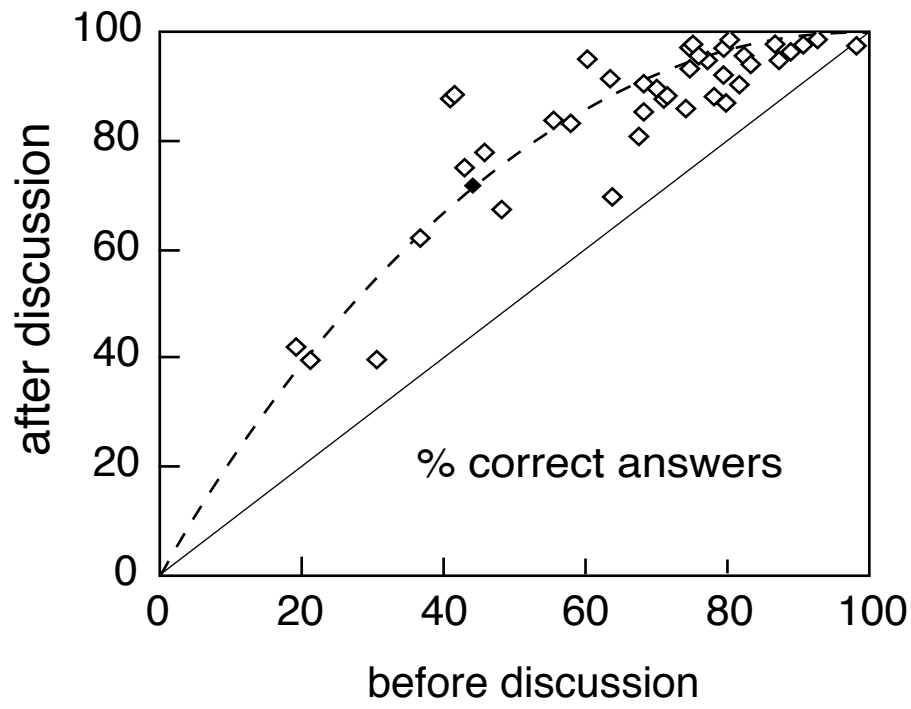
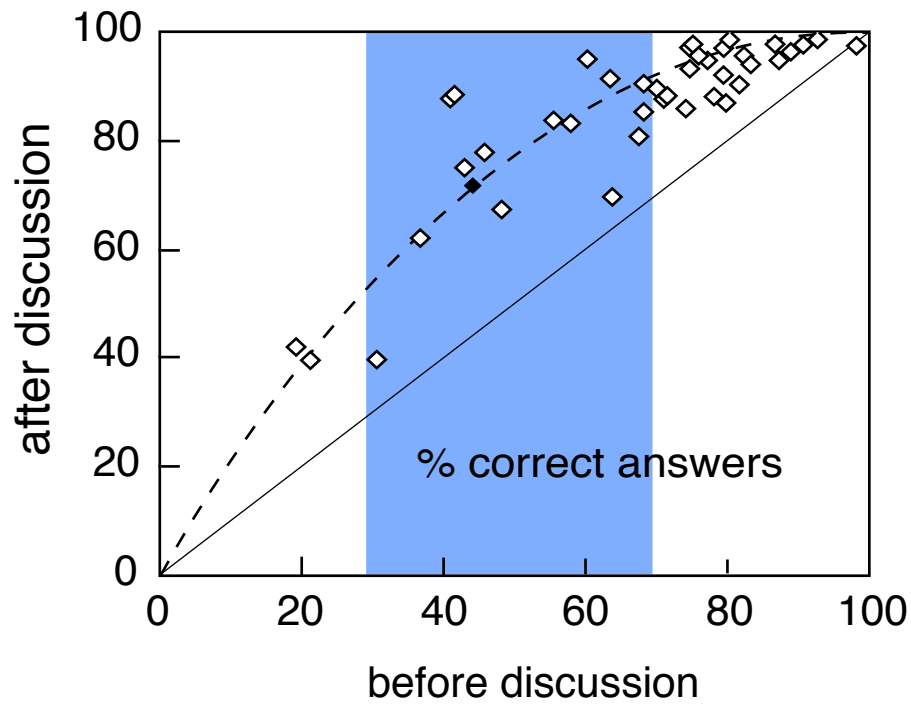


PI at Concord-Carlisle HS

optimum range: 35–70% correct initially



PI at Concord-Carlisle HS

Strategies for success:

- explain pedagogy
- maximize opportunities for success

PI at Concord-Carlisle HS

Strategies for success:

- explain pedagogy
- maximize opportunities for success
- explain results

PI at Concord-Carlisle HS

How to get started tomorrow:

- prepare 3–4 sentence handout
- find questions (online or in book)
- find 10–15 minutes
- try it!

Outline

- Peer Instruction
- PI at Concord-Carlisle High School
- PI at Marblehead High School

PI at Marblehead HS

PI used at three levels:

- Advanced Placement physics
- Honors Weighted physics
- College Preparatory I physics

PI at Marblehead HS

Results:

- improvement on FCI over first term of instruction
- students asking more and better questions

PI at Marblehead HS

Low-budget implementation:

- manila packing tags strung loosely in packs of 5
- tags numbered 1–5
- each number different color

PI at Marblehead HS

PI at Marblehead HS

Personal Response System:

- still in implementation phase
- students fascinated by receiver on the wall
- students excited about the “remote control thingies”
- creation of question and answer files easy

PI at Marblehead HS

Personal Response System:

- still in implementation phase
- students fascinated by receiver on the wall
- students excited about the “remote control thingies”
- creation of question and answer files easy

Finding time to implement… another story!

Conclusion

Some take-home points:

- it works at all levels
- it doesn’t require technology
- it doesn’t require much effort
- you can do it — tomorrow!

Funding:

National Science Foundation

for a copy of this presentation:

http://mazur-www.harvard.edu