



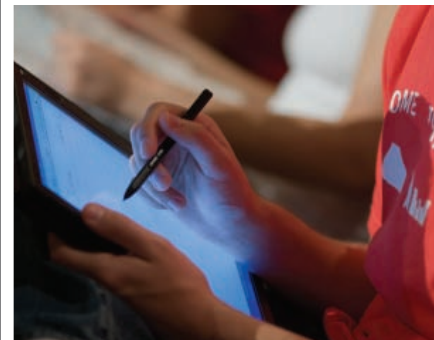
Committee on University Resources Annual Symposium

HARVARD UNIVERSITY

Memorization or Understanding: Are We Teaching the Right Thing?

Eric Mazur

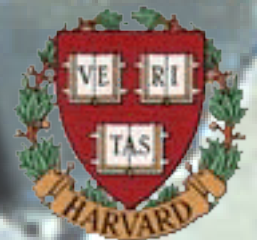
Gordon McKay Professor of Applied Physics and Professor of Physics,
Faculty of Arts and Sciences



Understanding or Memorization: Are we teaching the right thing?

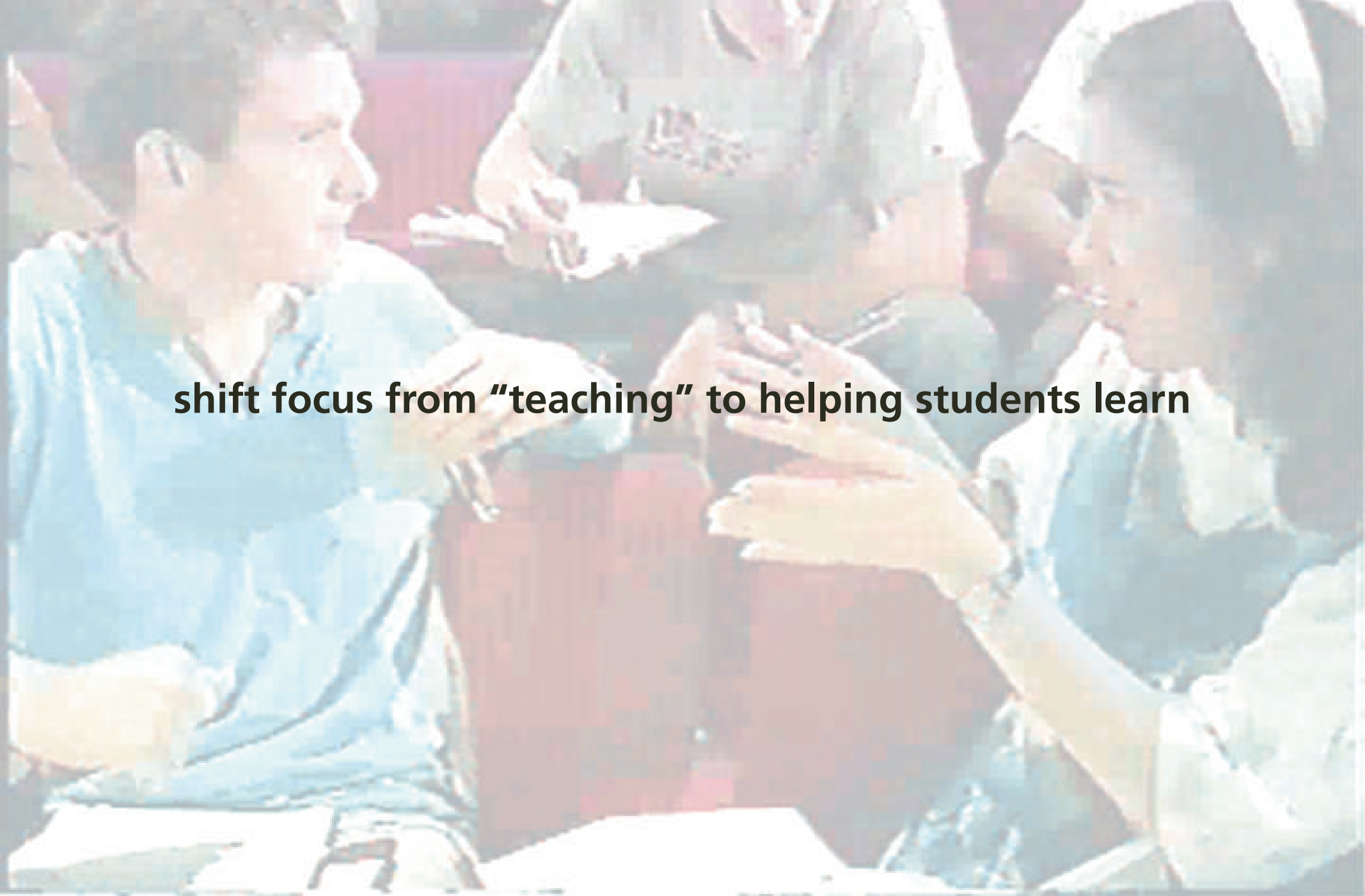


Committee on University Resources Annual Symposium
Harvard University
Cambridge, MA, 17 March 2007



My message

shift focus from “teaching” to helping students learn



Outline

- Education



Outline

- Education
- Peer Instruction



Outline

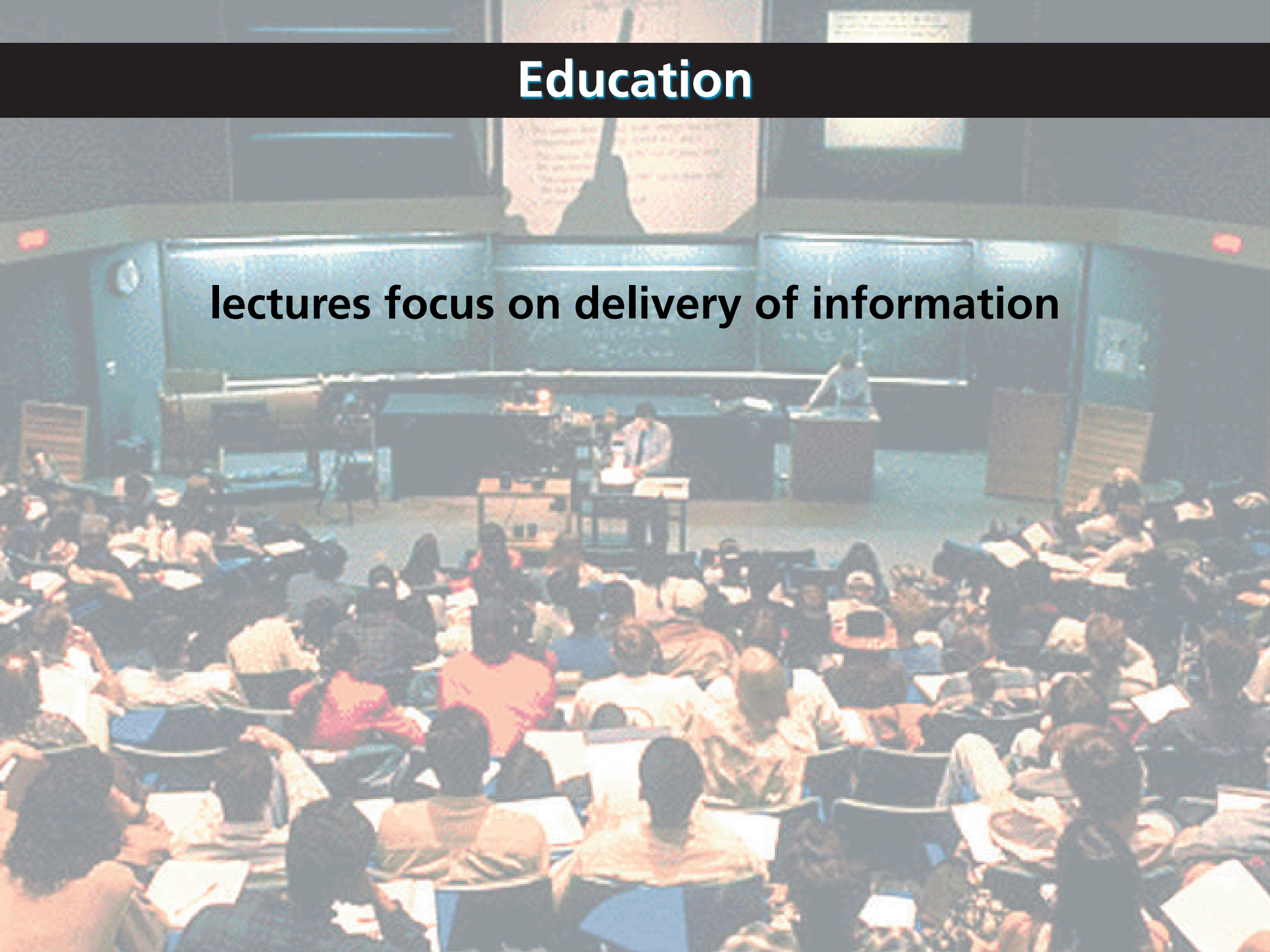
- Education
- Peer Instruction
- Results

Education



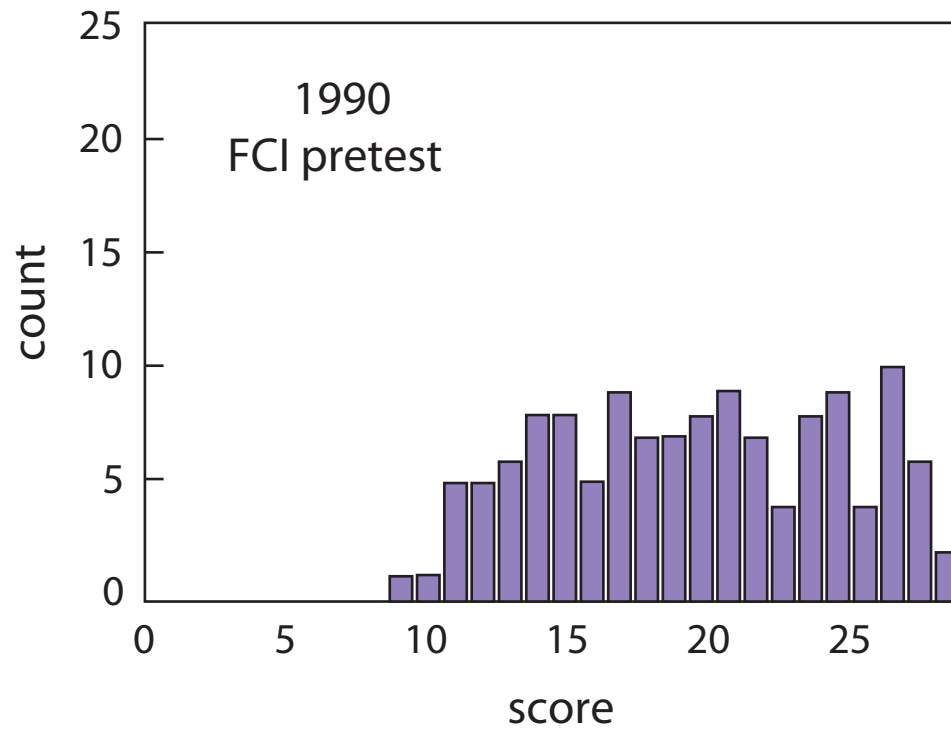
Education

lectures focus on delivery of information



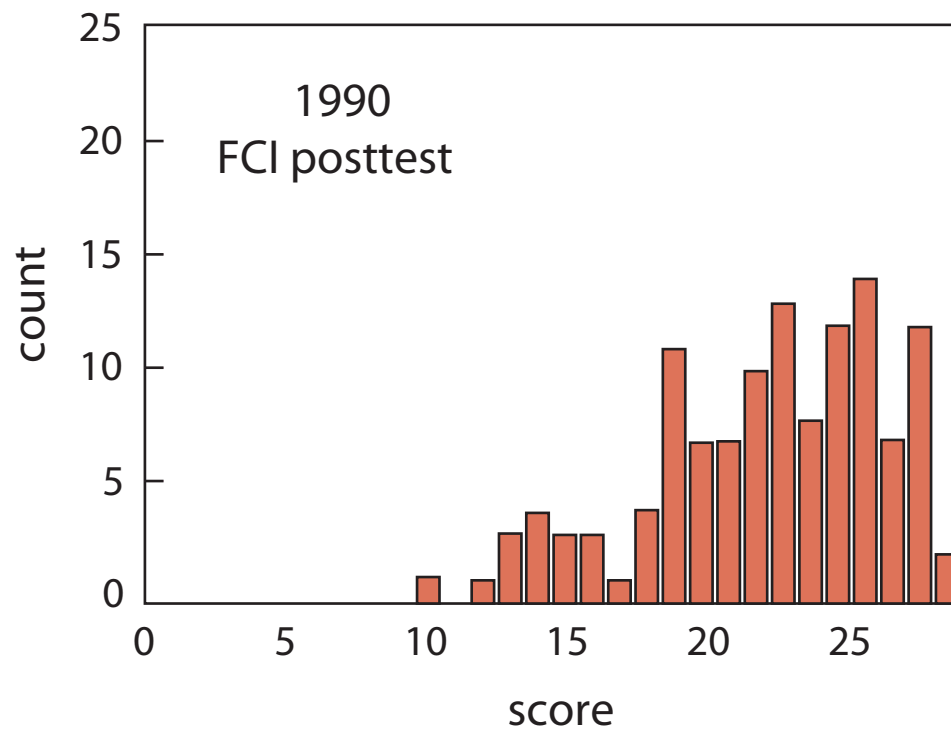
Education

education is not just information transfer



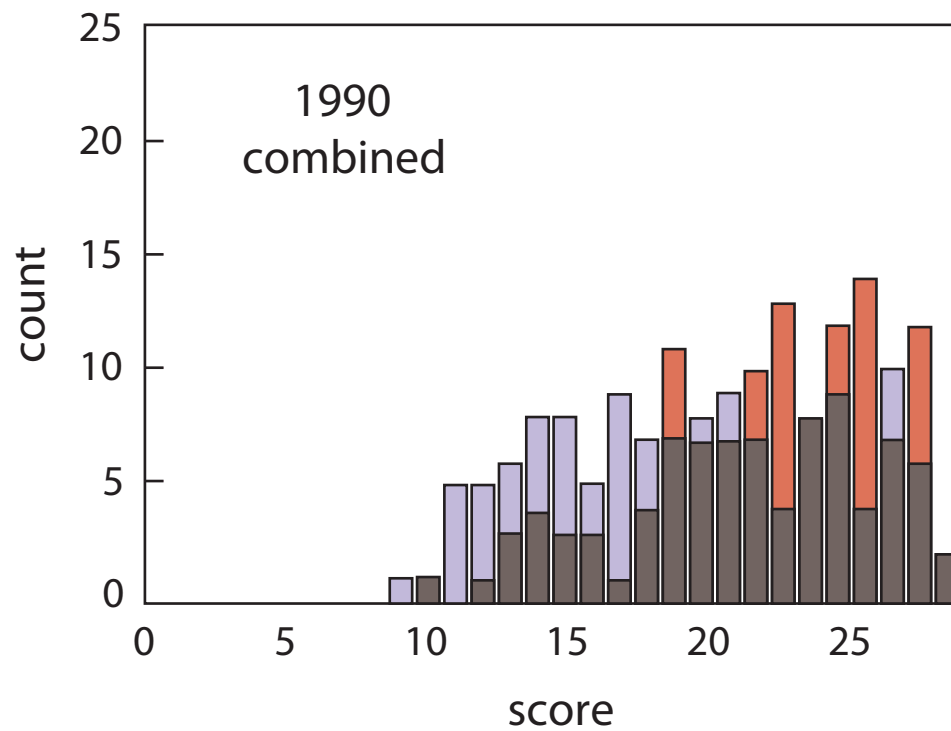
Education

education is not just information transfer

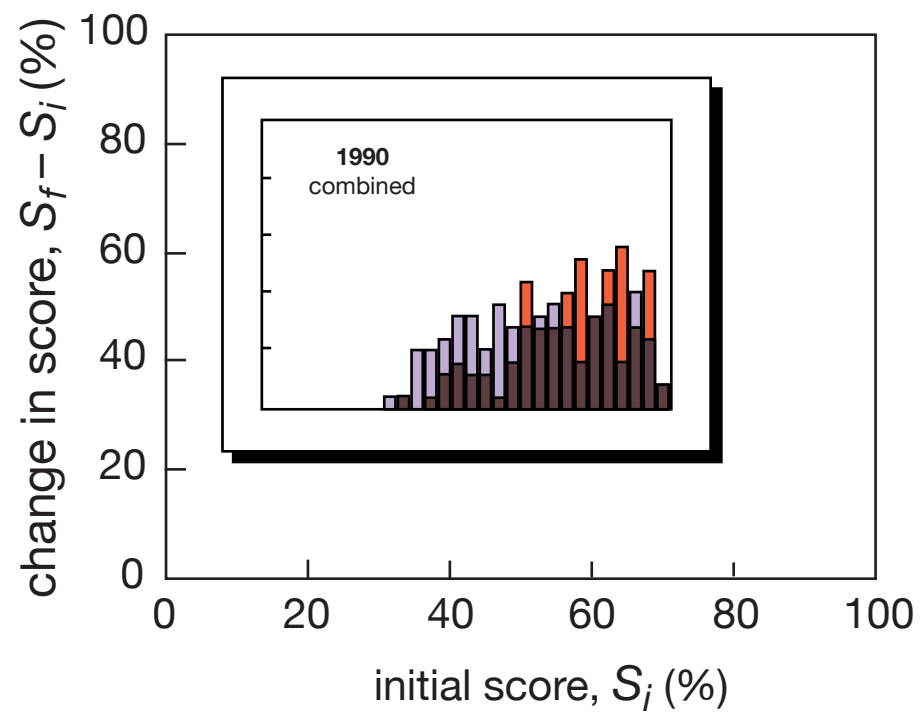


Education

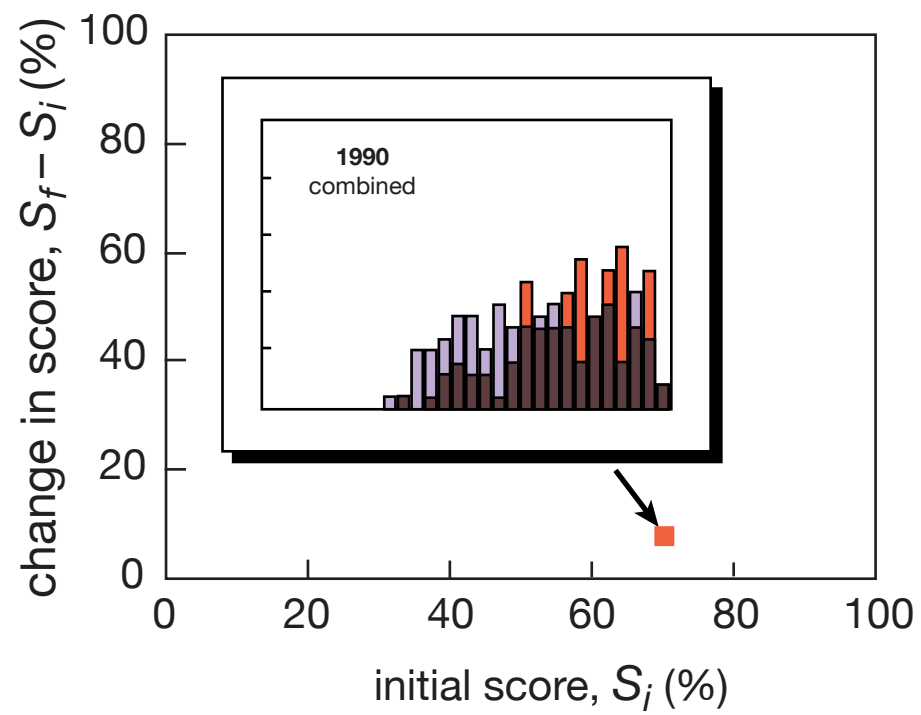
education is not just information transfer



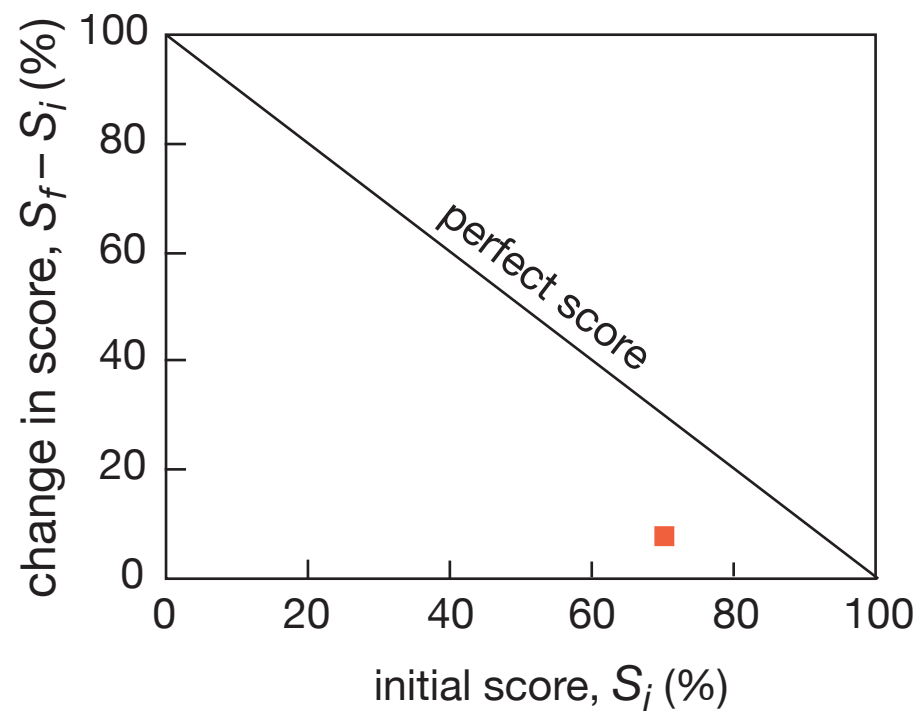
Education



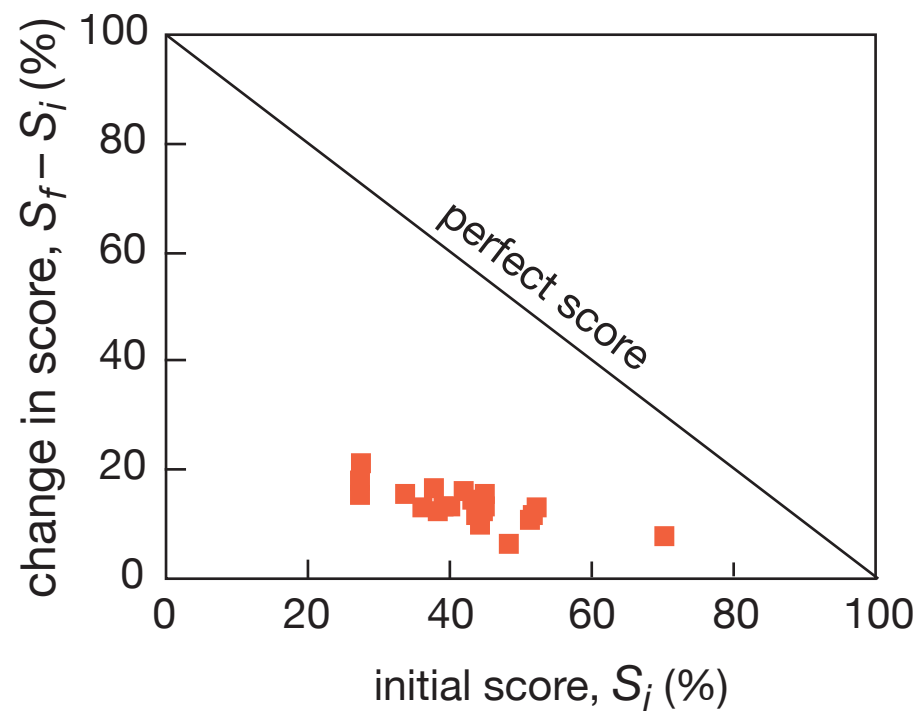
Education



Education



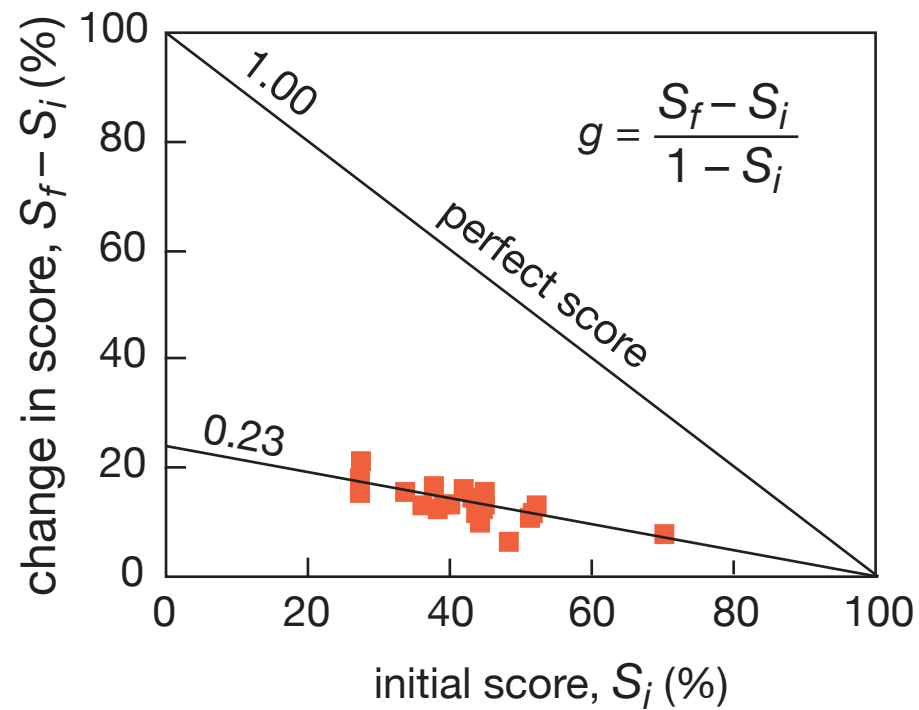
Education



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

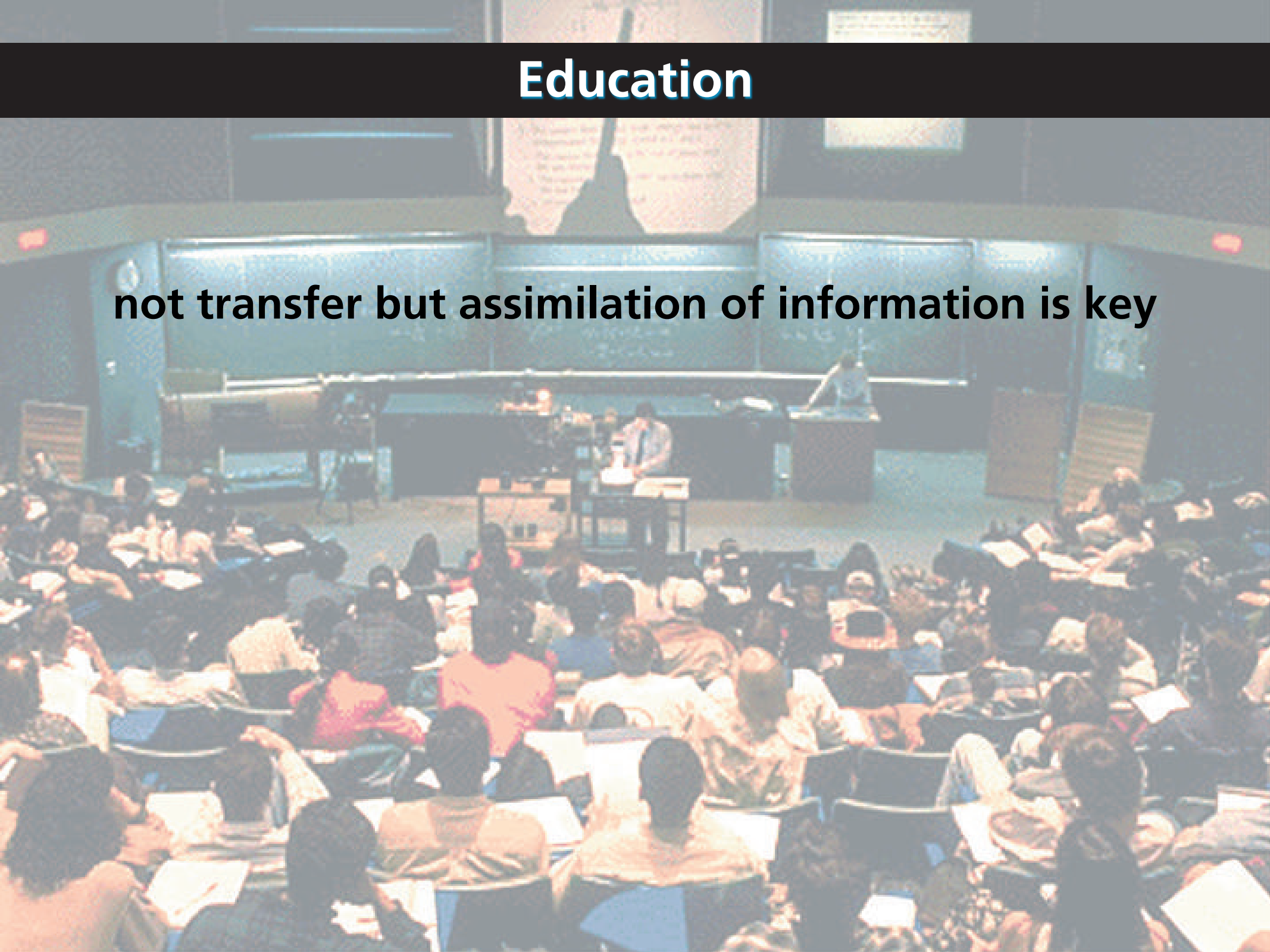
Education

only one quarter of maximum gain realized



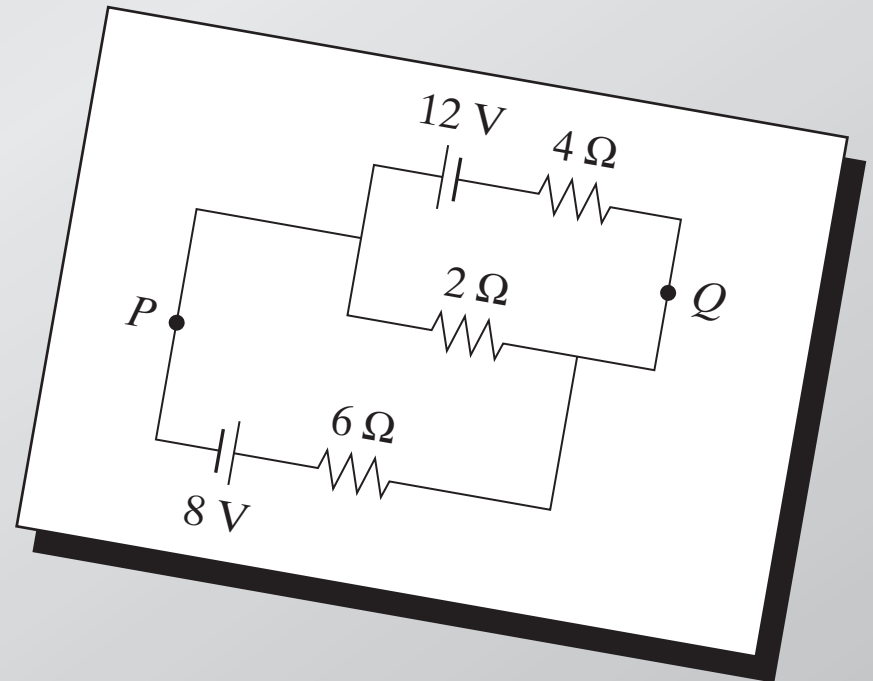
Education

not transfer but assimilation of information is key



Education

conventional problems misleading



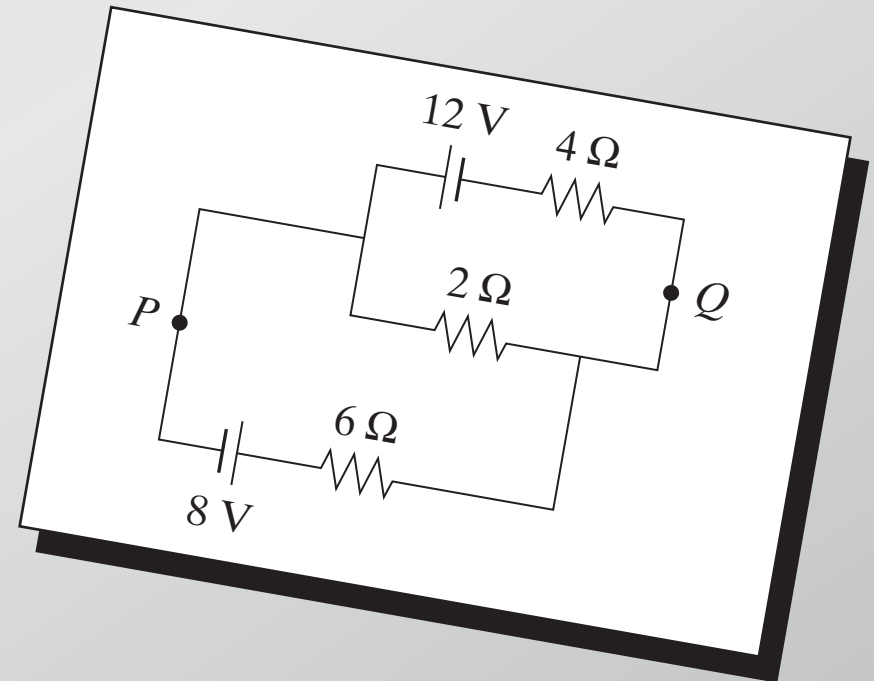
Education

conventional problems misleading

Calculate:

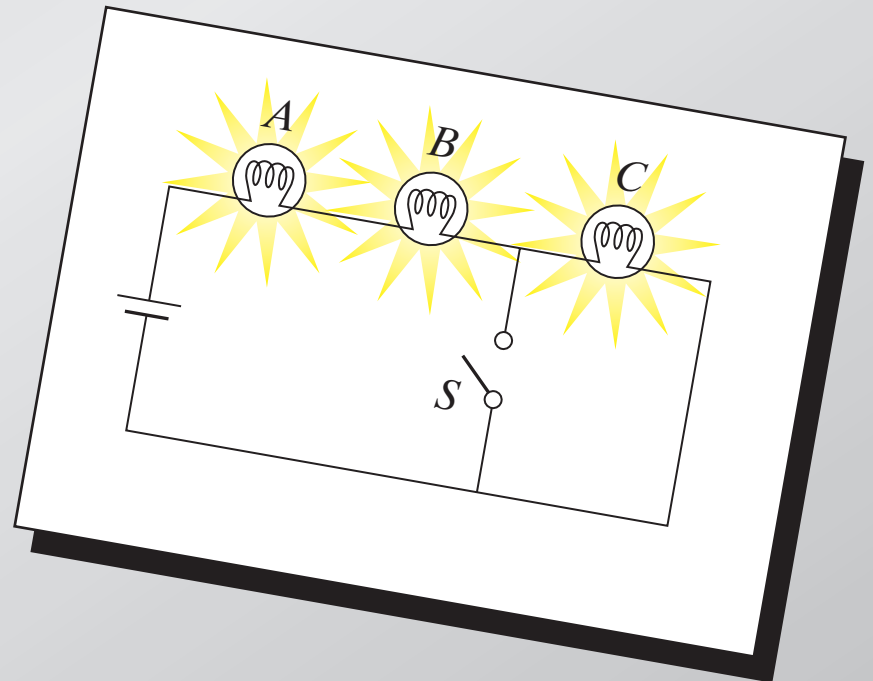
(a) current in 2- Ω resistor

(b) potential difference
between P and Q



Education

are the basic principles understood?

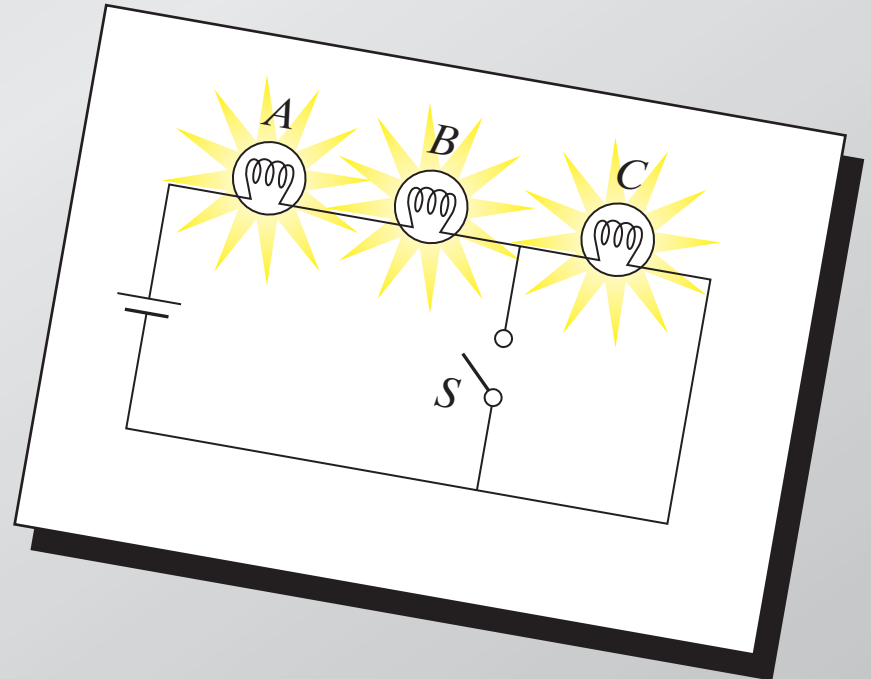


Education

are the basic principles understood?

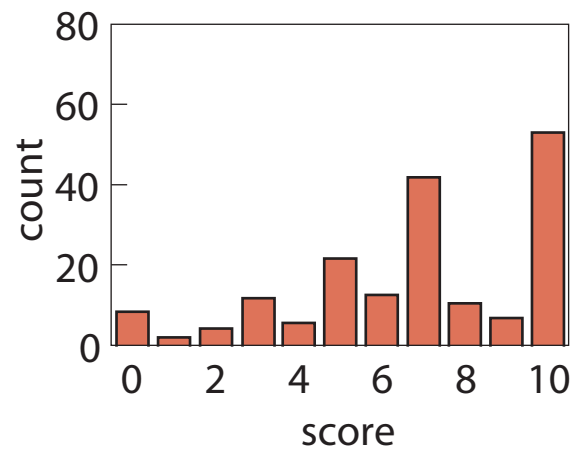
When S is closed, what happens to:

- (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?

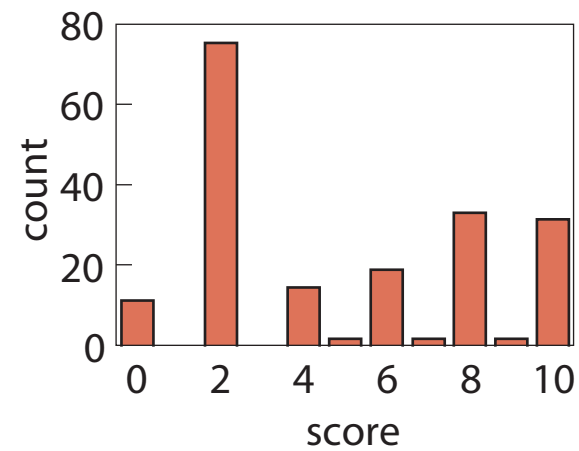


Education

conventional

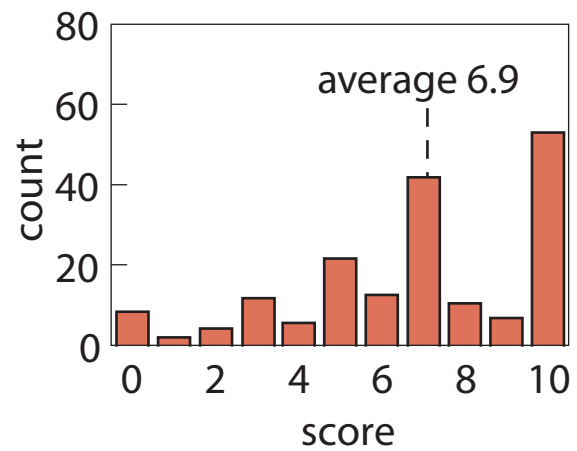


conceptual

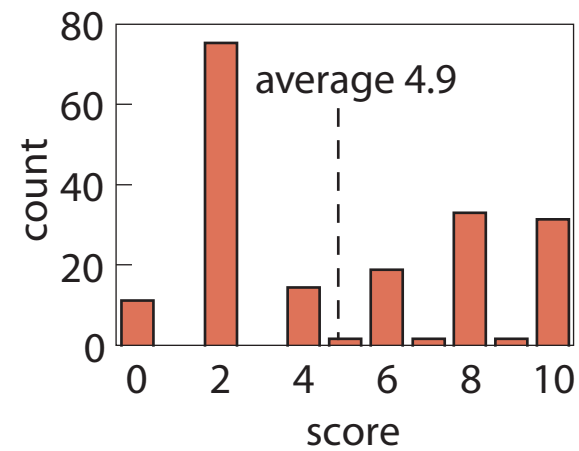


Education

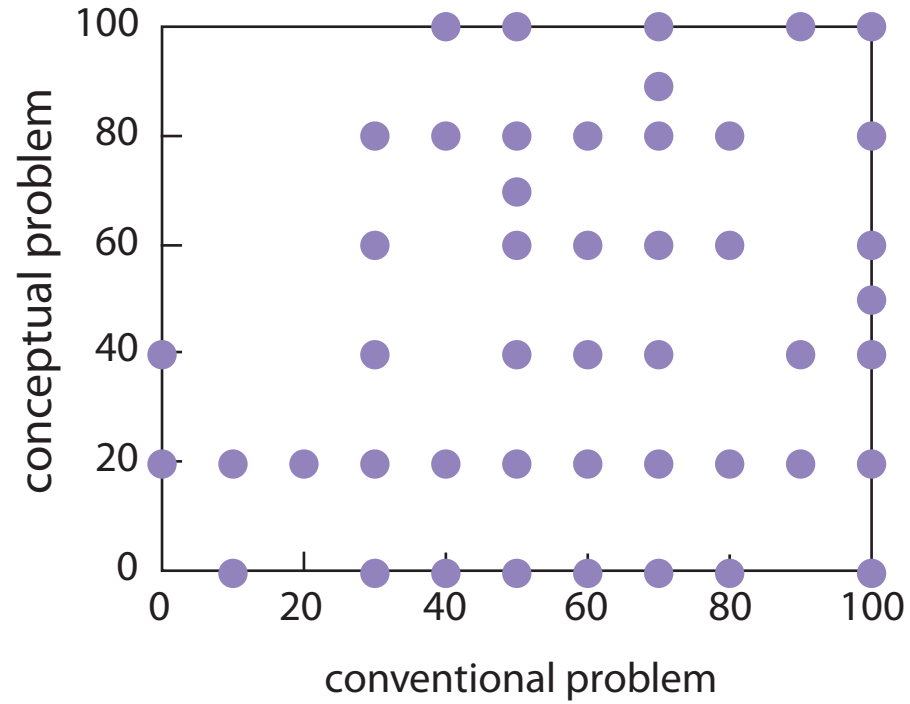
conventional



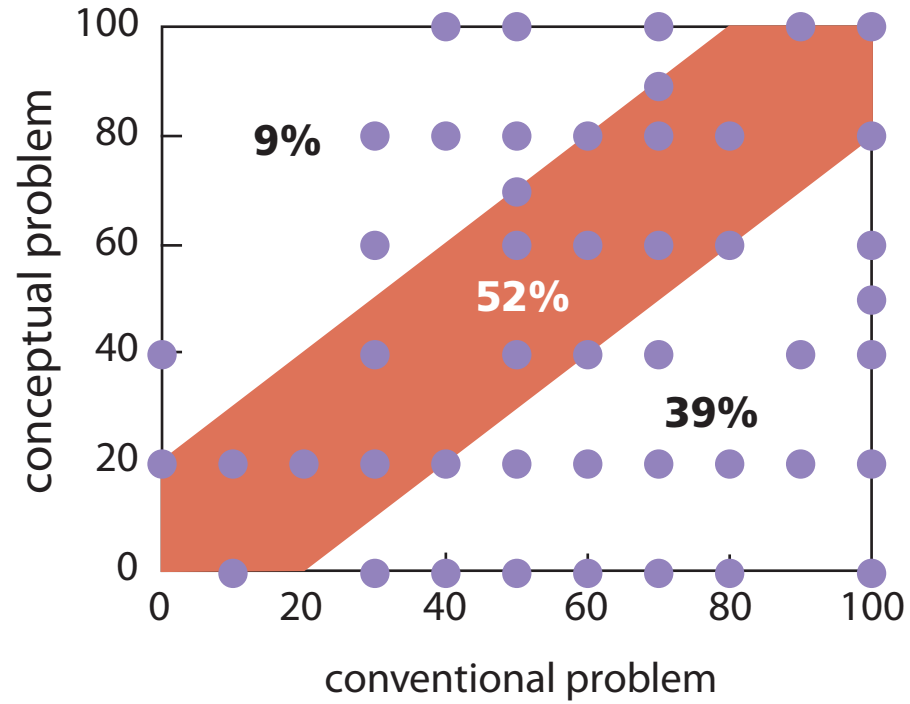
conceptual



Education



Education



So what should we do?



Peer Instruction

Give students more responsibility for gathering information...

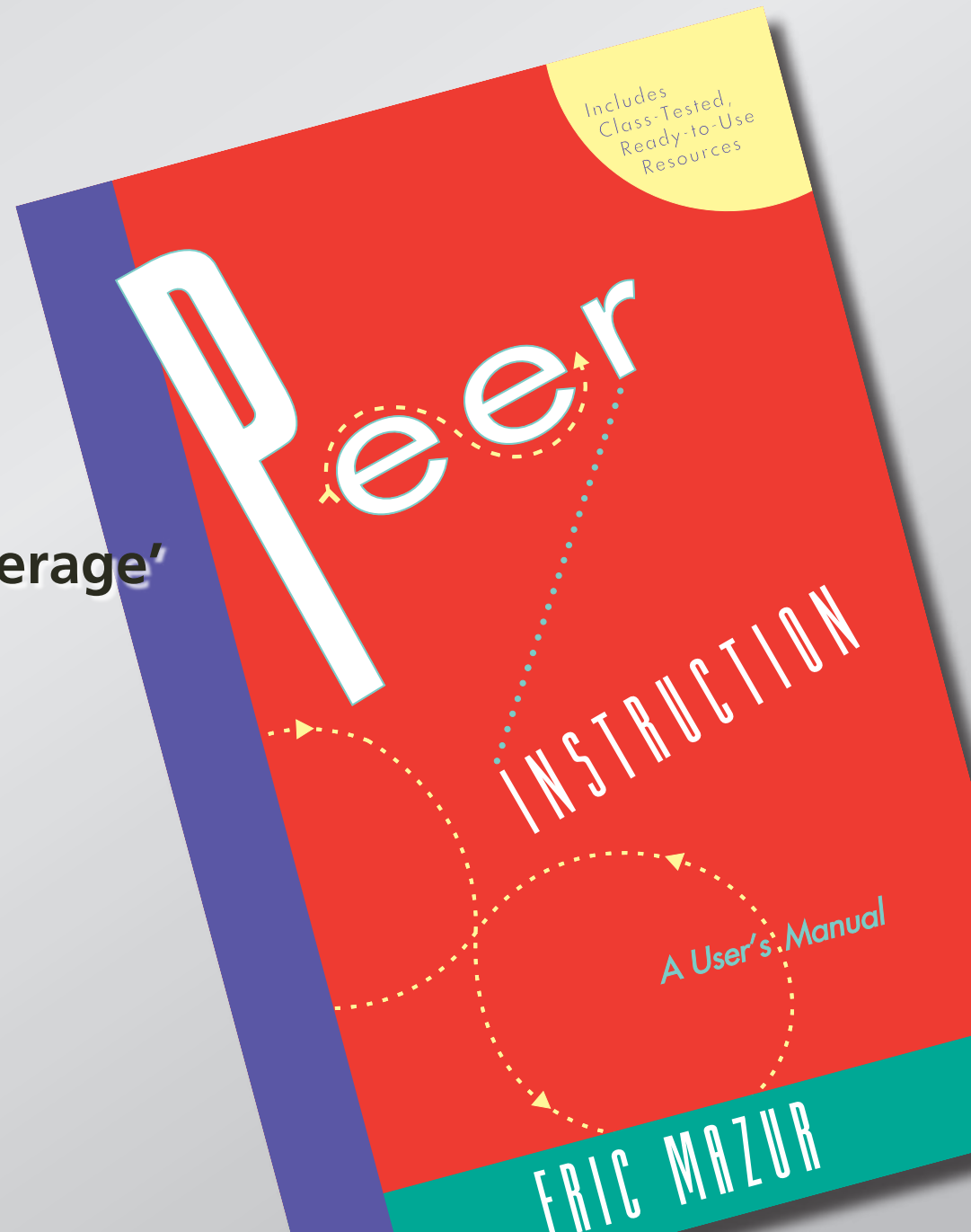
Peer Instruction

**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:

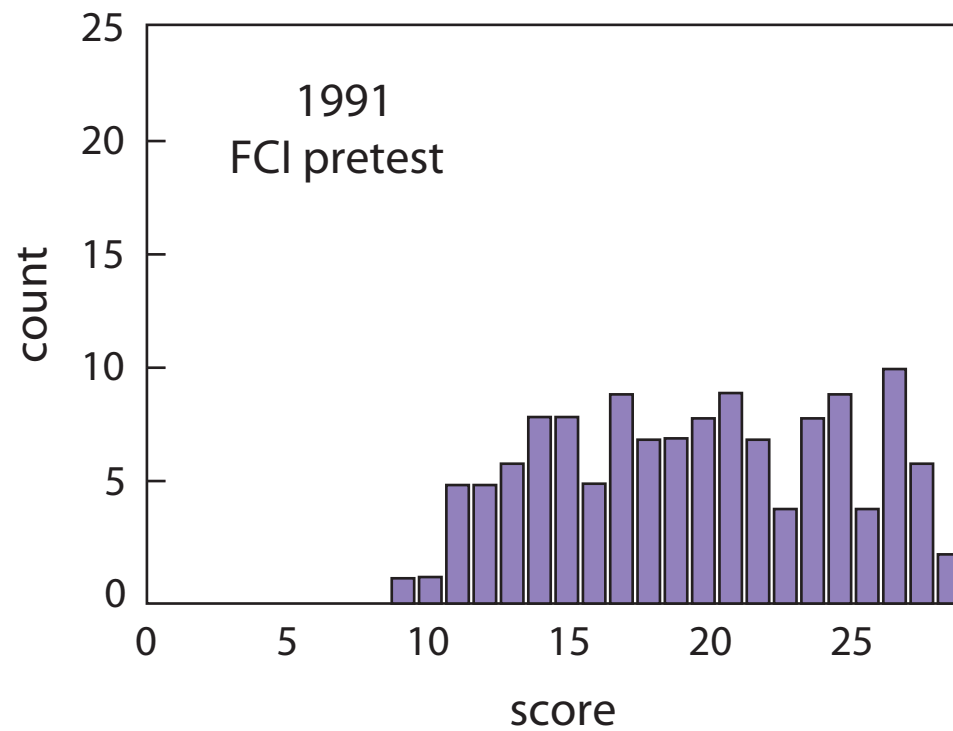
- 1. Question**
- 2. Thinking**
- 3. Individual answer**
- 4. Peer discussion**
- 5. Revised/Group answer**
- 6. Explanation**

Results

is it any good?

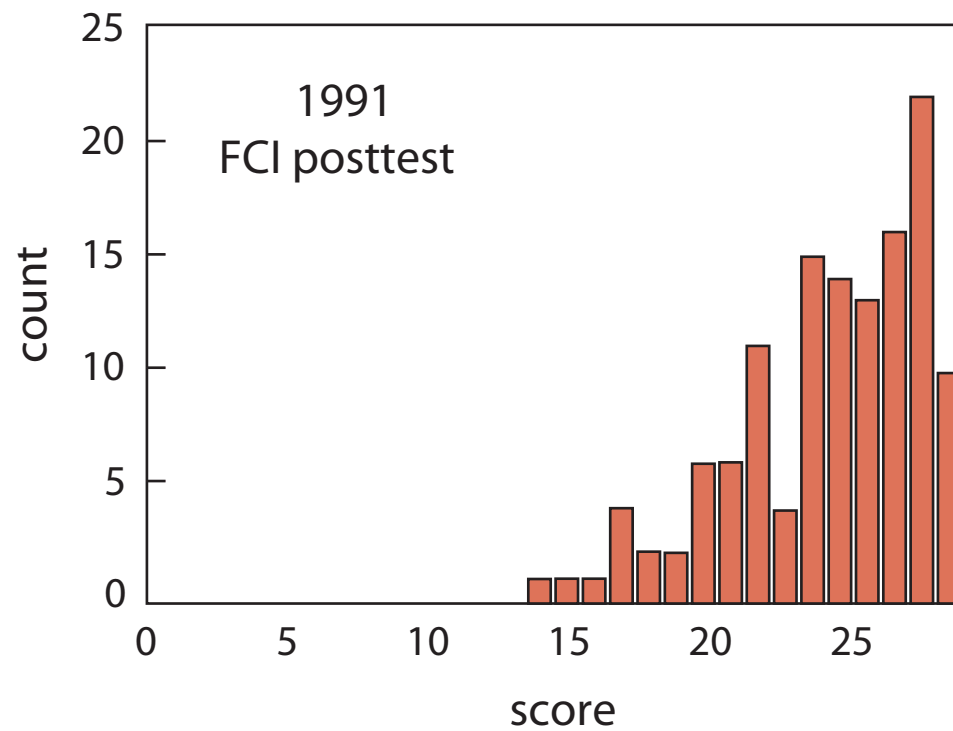
Results

first year of implementing PI



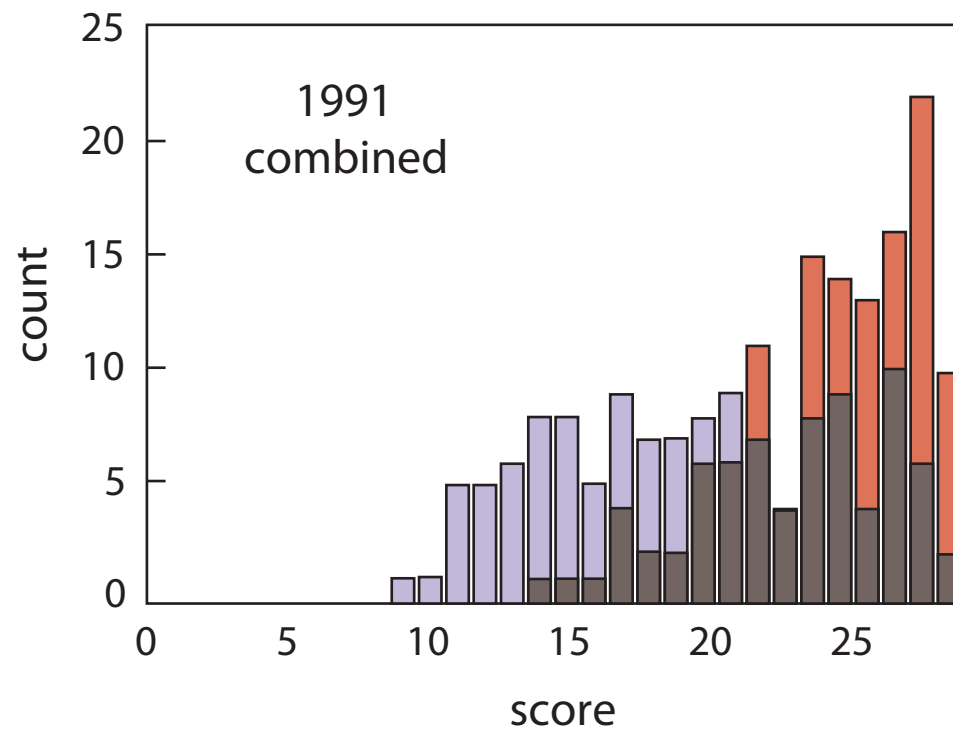
Results

first year of implementing PI

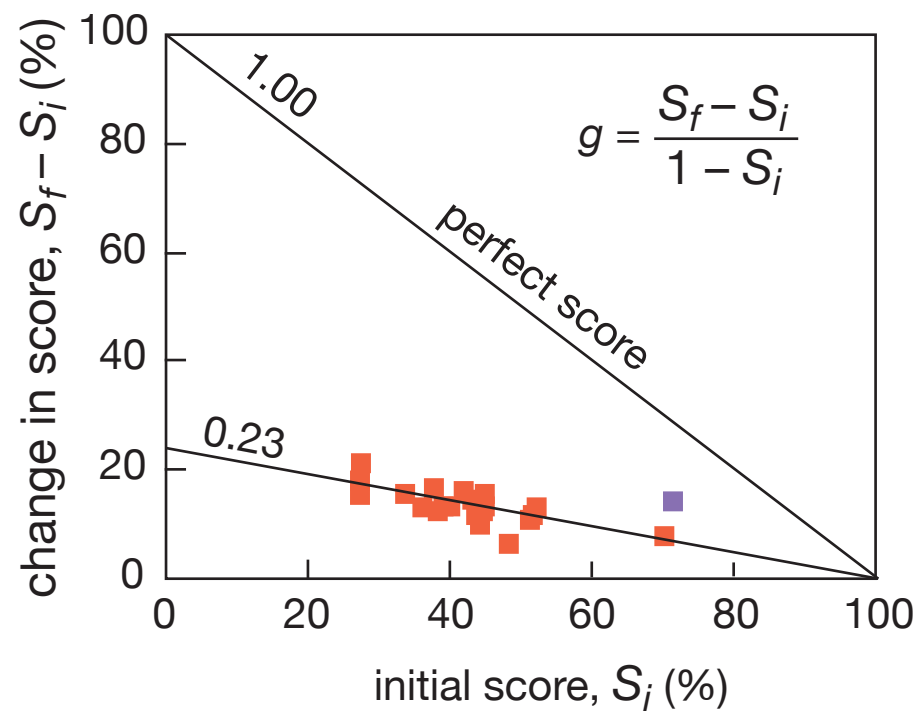


Results

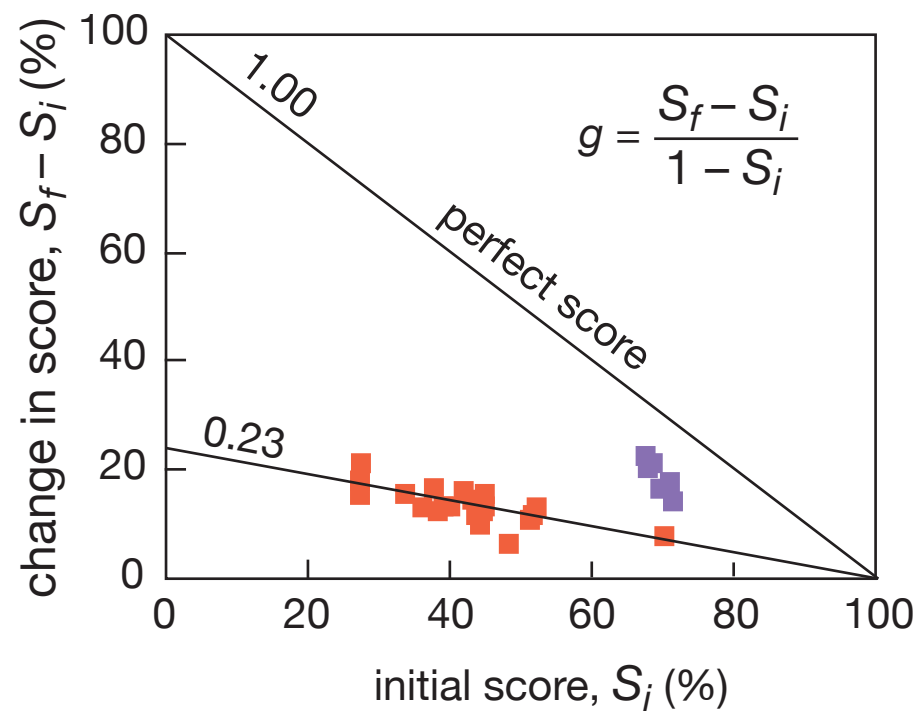
first year of implementing PI



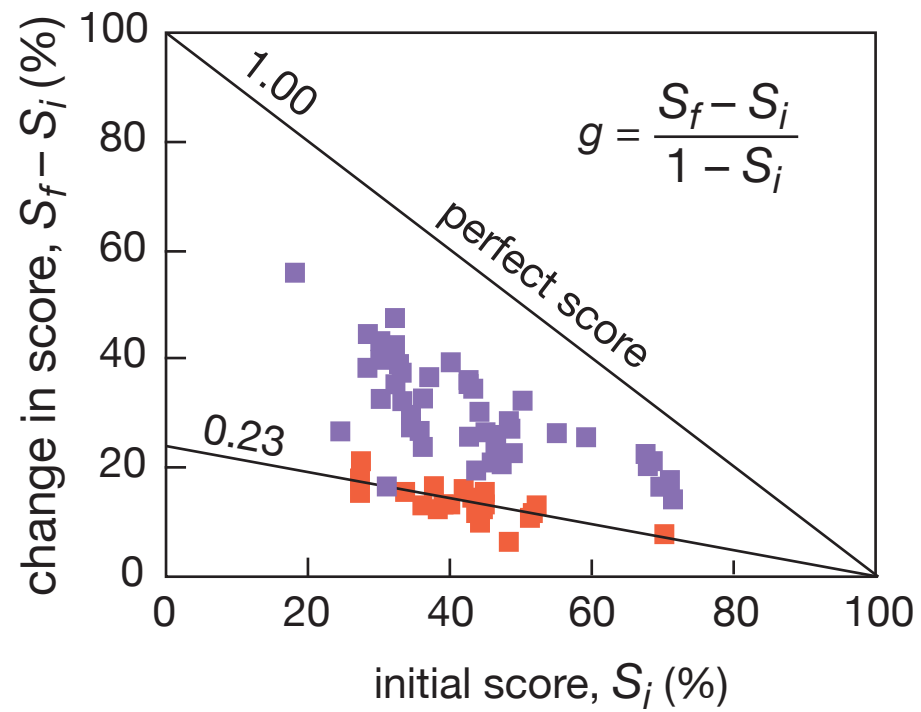
Results



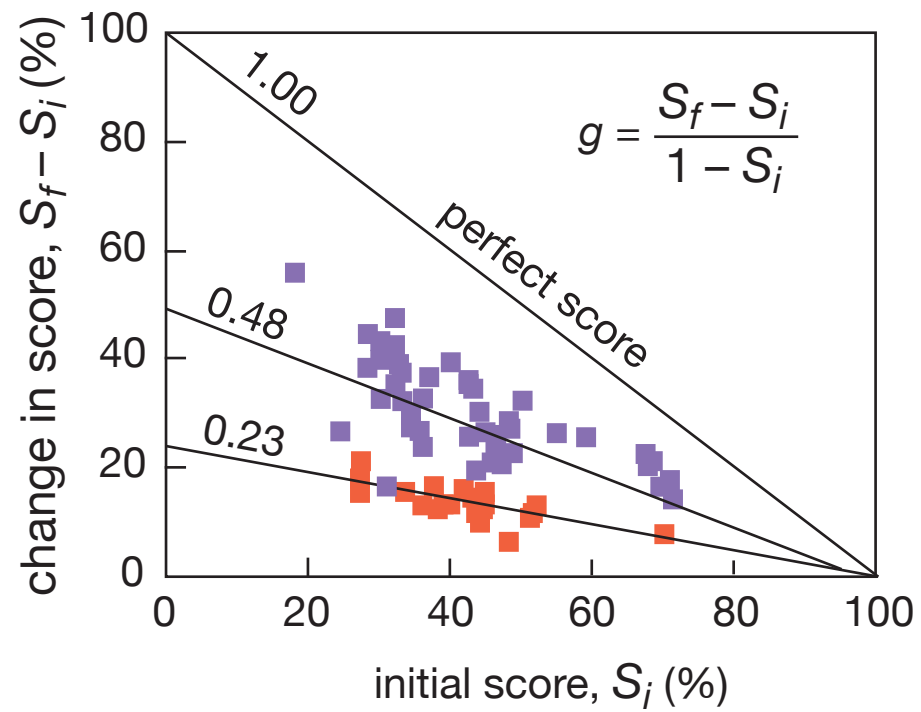
Results



Results



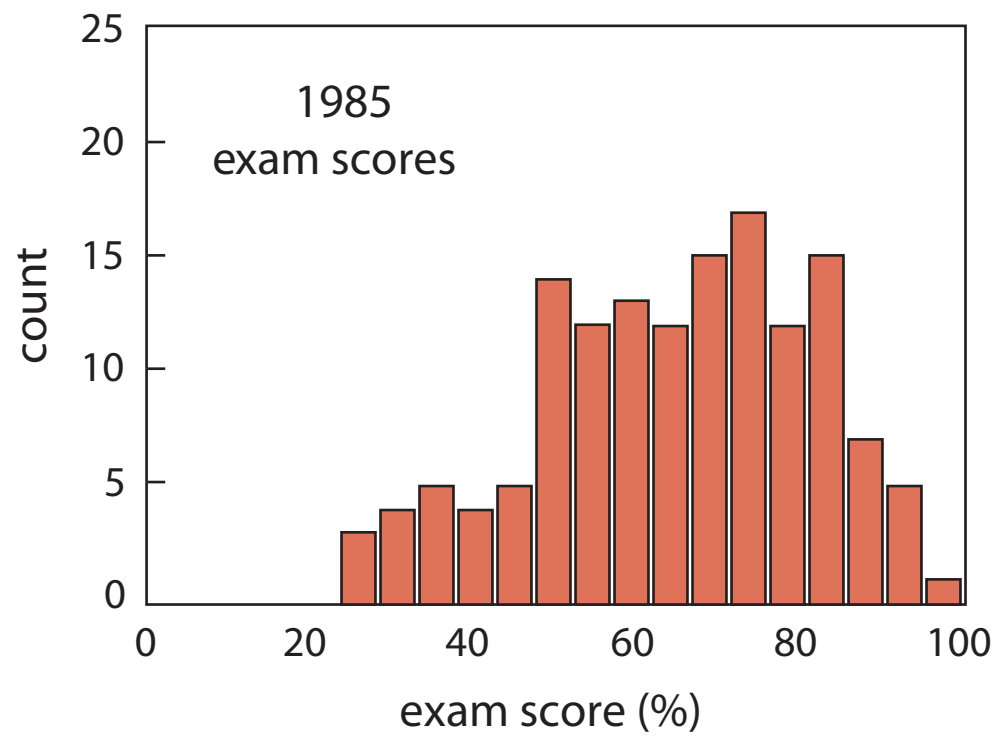
Results



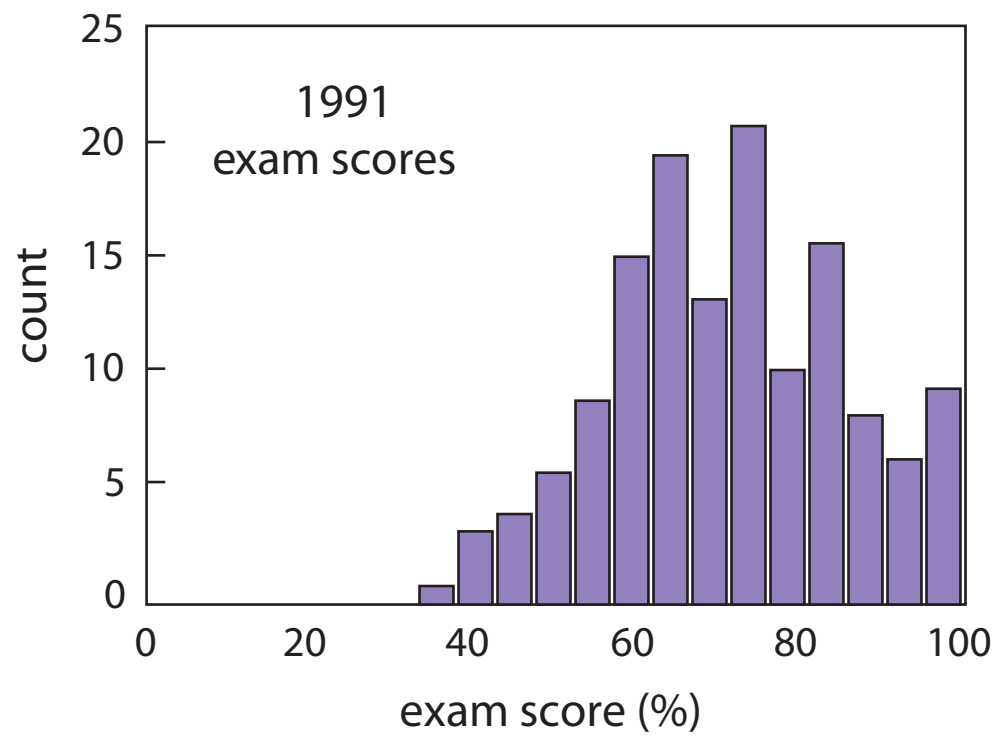
Results

what about problem solving?

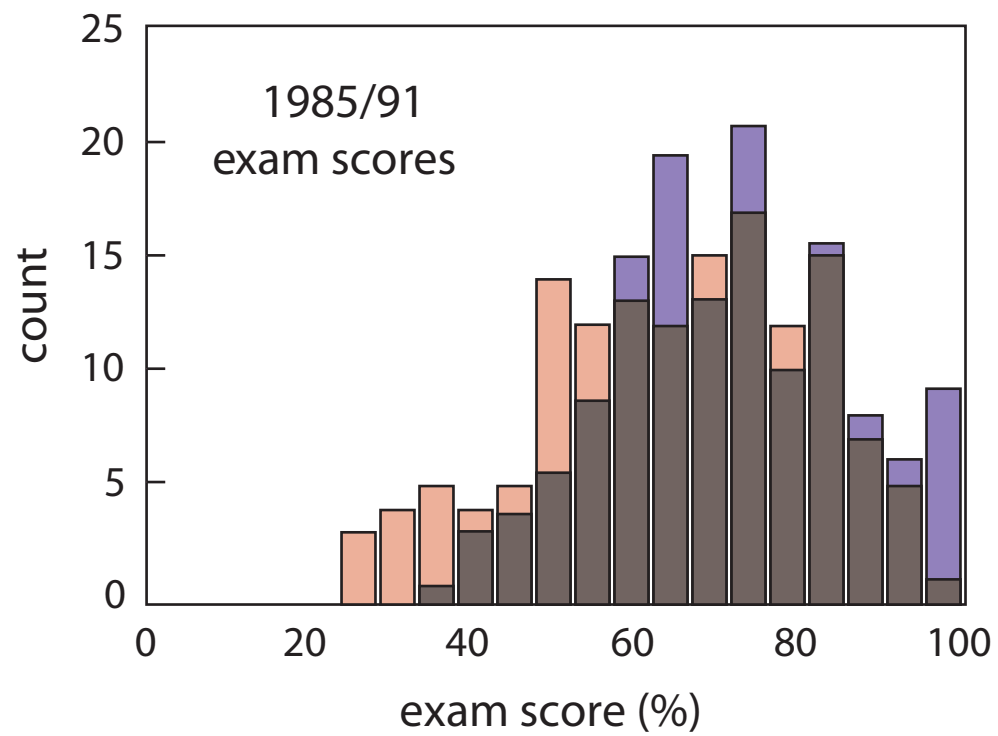
Results



Results



Results



Summary

**So better understanding leads to better
problem solving!**

Summary

So better understanding leads to better problem solving!

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

Funding:

National Science Foundation

for a copy of this presentation:

<http://mazur-www.harvard.edu>