

ACTIVE LEARNING AND INTERACTIVE LECTURES

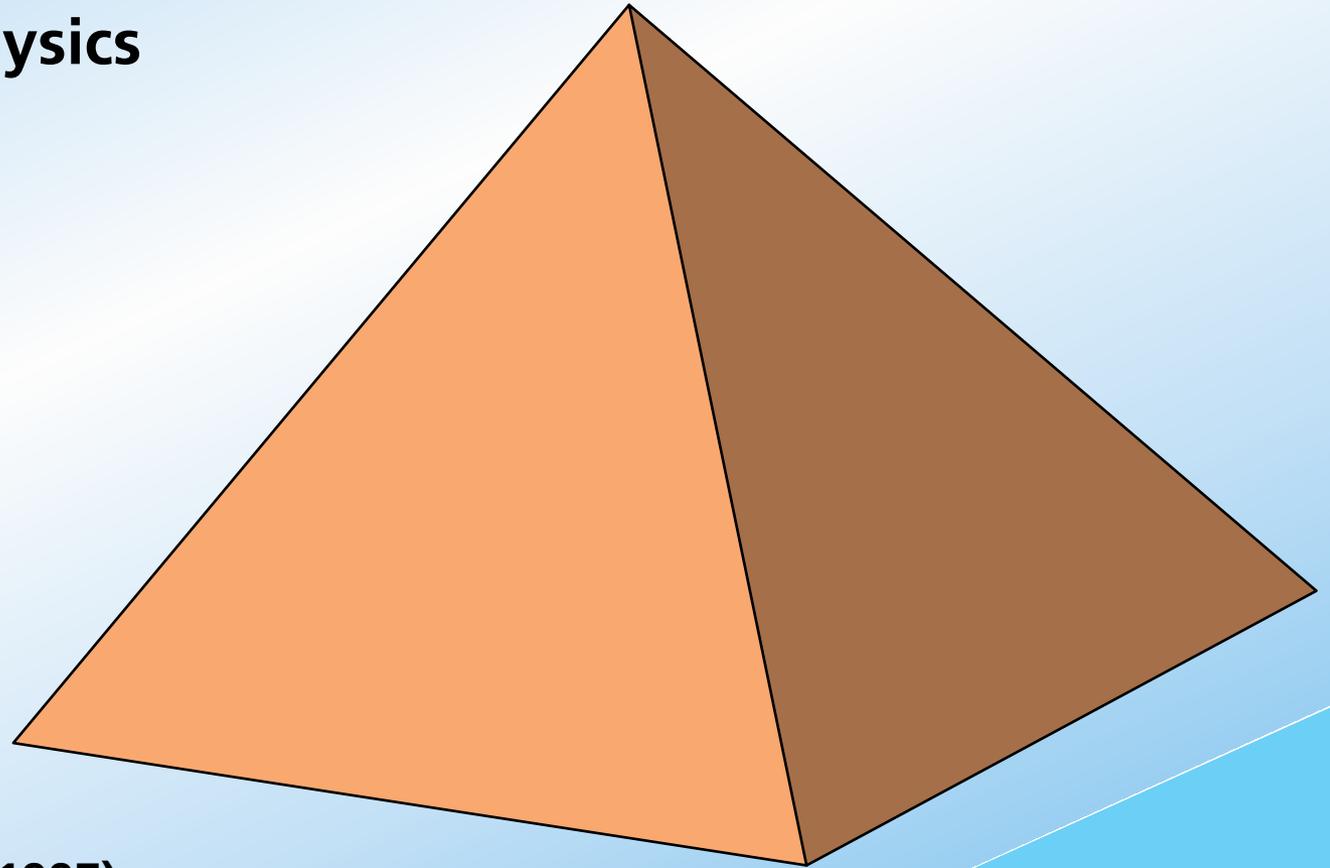
**Eric Mazur
Harvard University**

**AAPT New Faculty Workshop
College Park, MD, 7 November 2003**



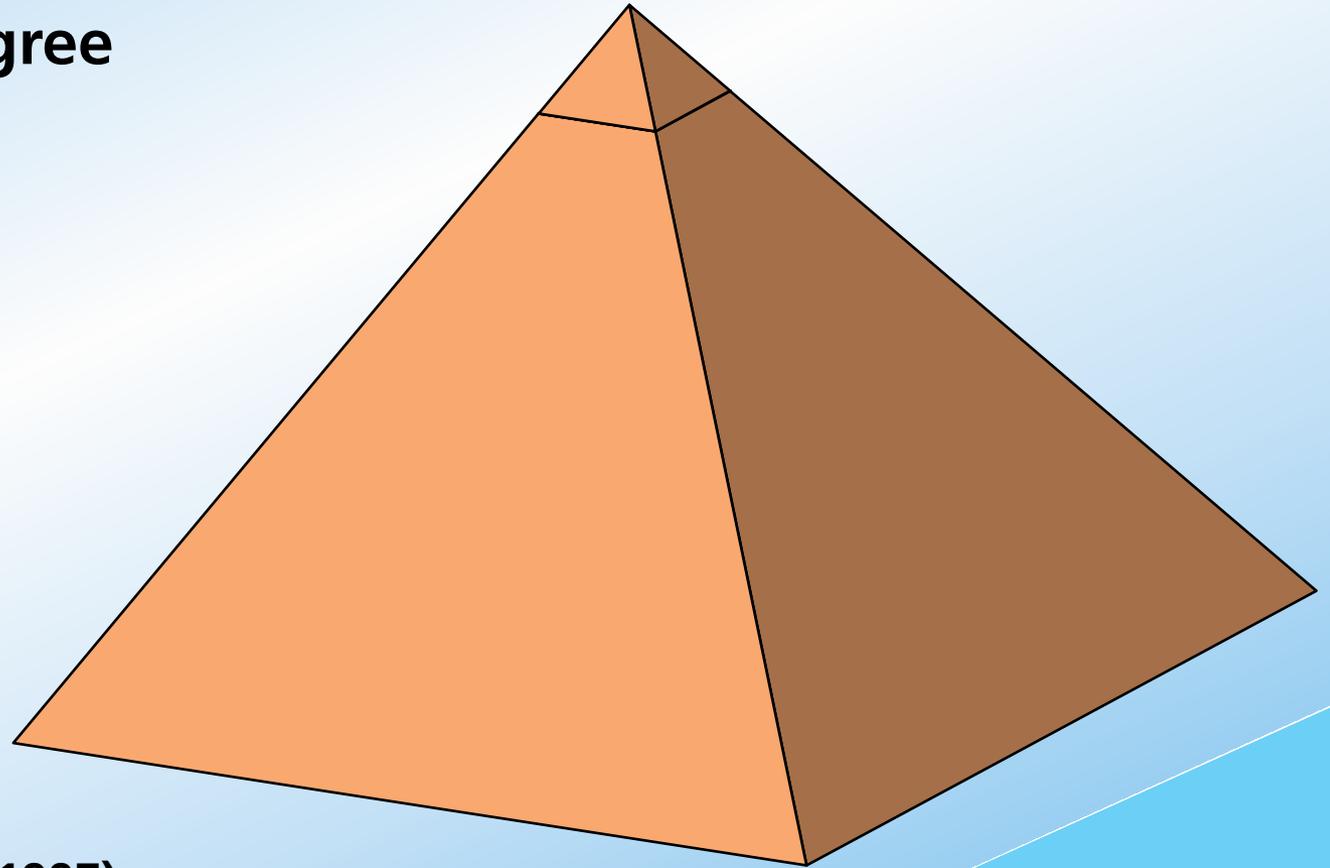
We have a problem

**380,000 students take
introductory physics
each year...**



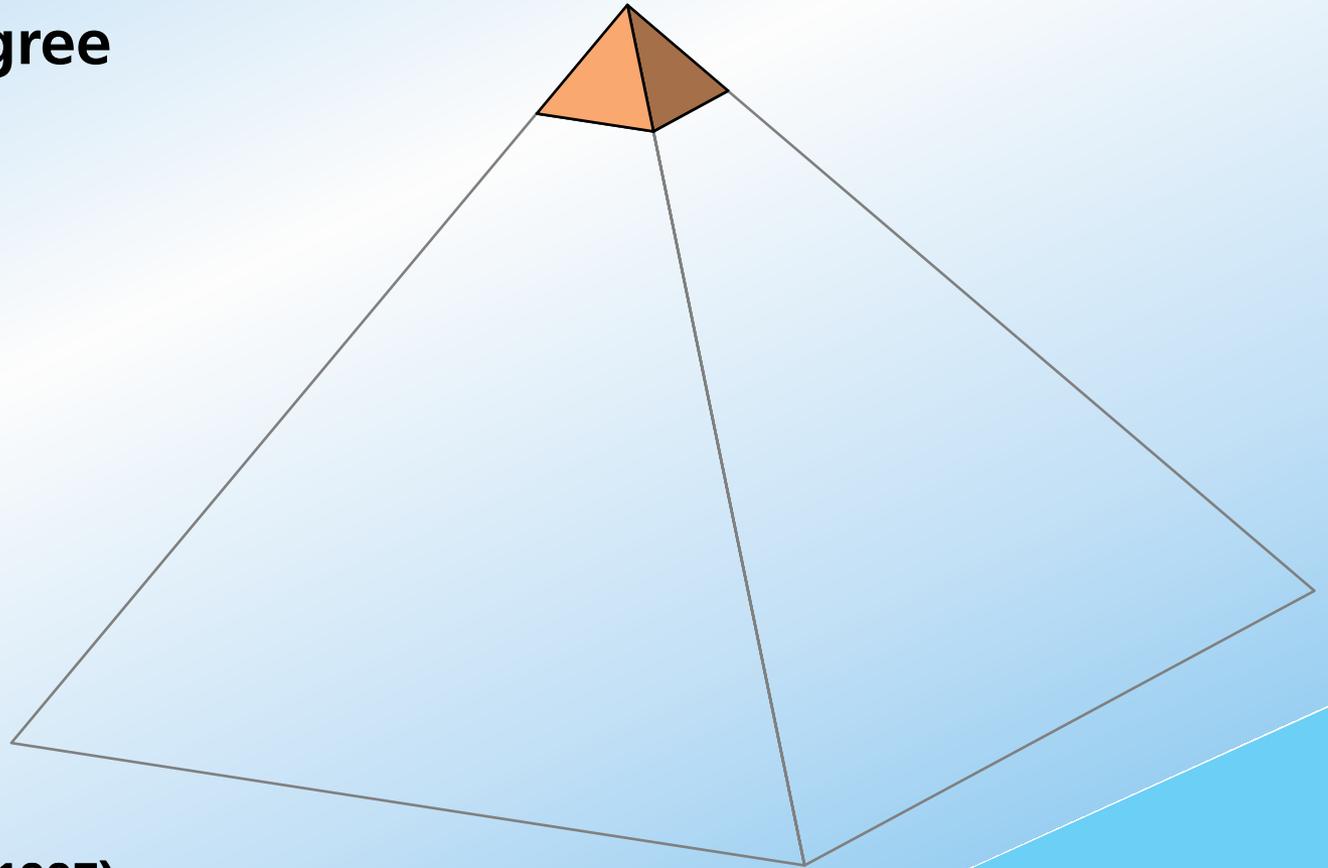
We have a problem

**about 1% of these get
a bachelor's degree
in physics**



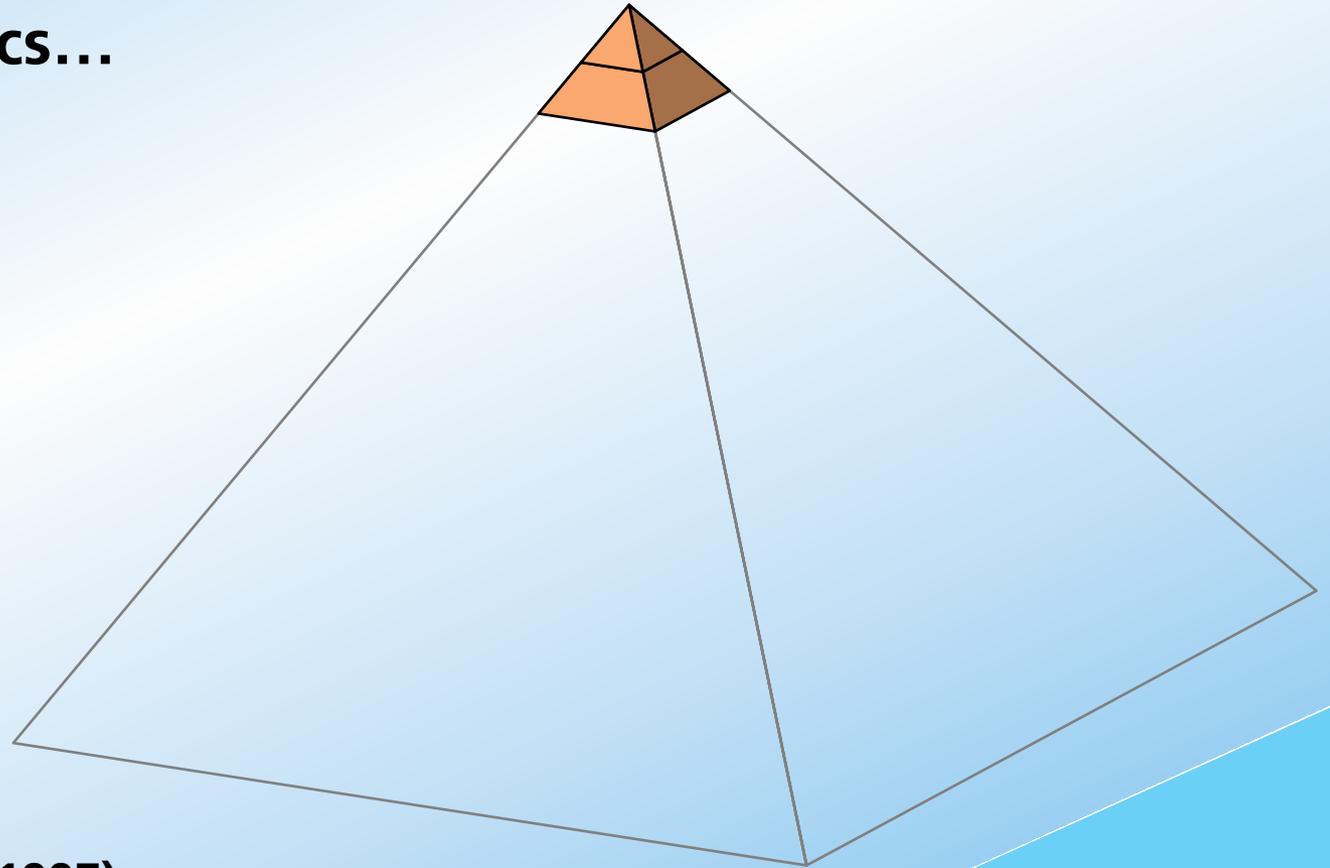
We have a problem

**Of the 4,300 students with
a bachelor's degree
in physics...**



We have a problem

**about 35% go on to get a graduate
degree in physics...**



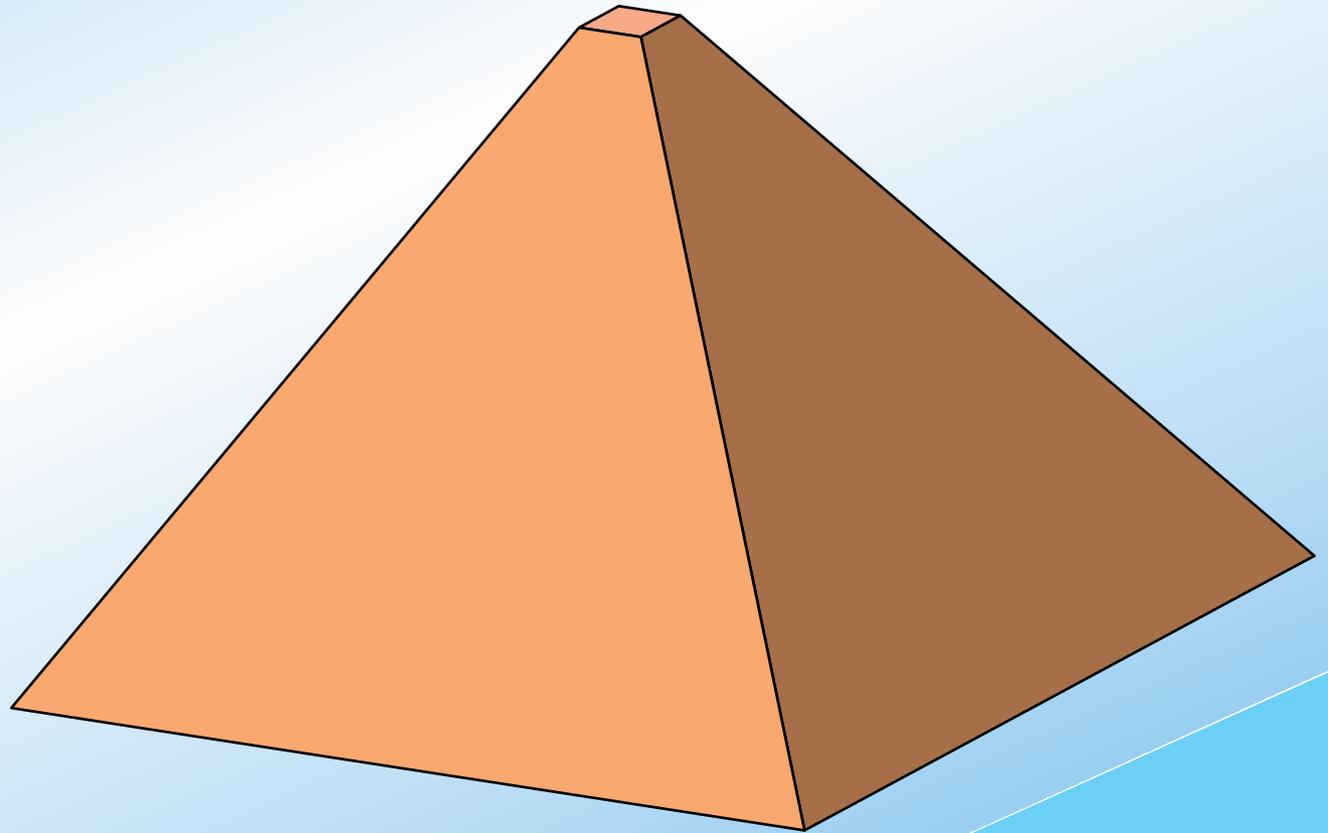
We have a problem

**That's one out of every
260 students in our
introductory
courses!**



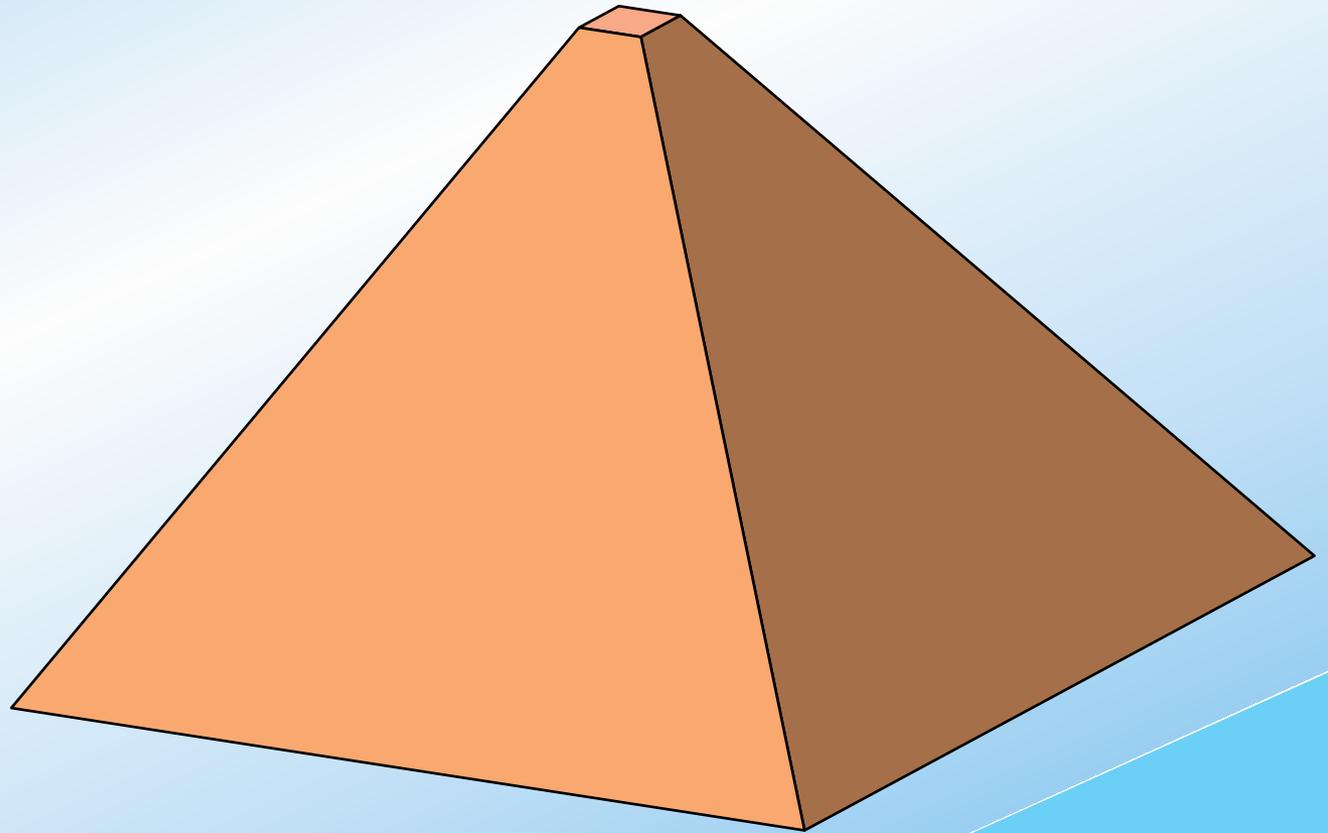
We have a problem

**What about the
other 259...?**



We have a problem

**What do we know
about these
students?**



We have a problem

Some disturbing symptoms:

- ▶ **frustration**
- ▶ **lack of understanding**
- ▶ **lack of basic knowledge**

We have a problem

Should we worry?

We have a problem

We'd better!

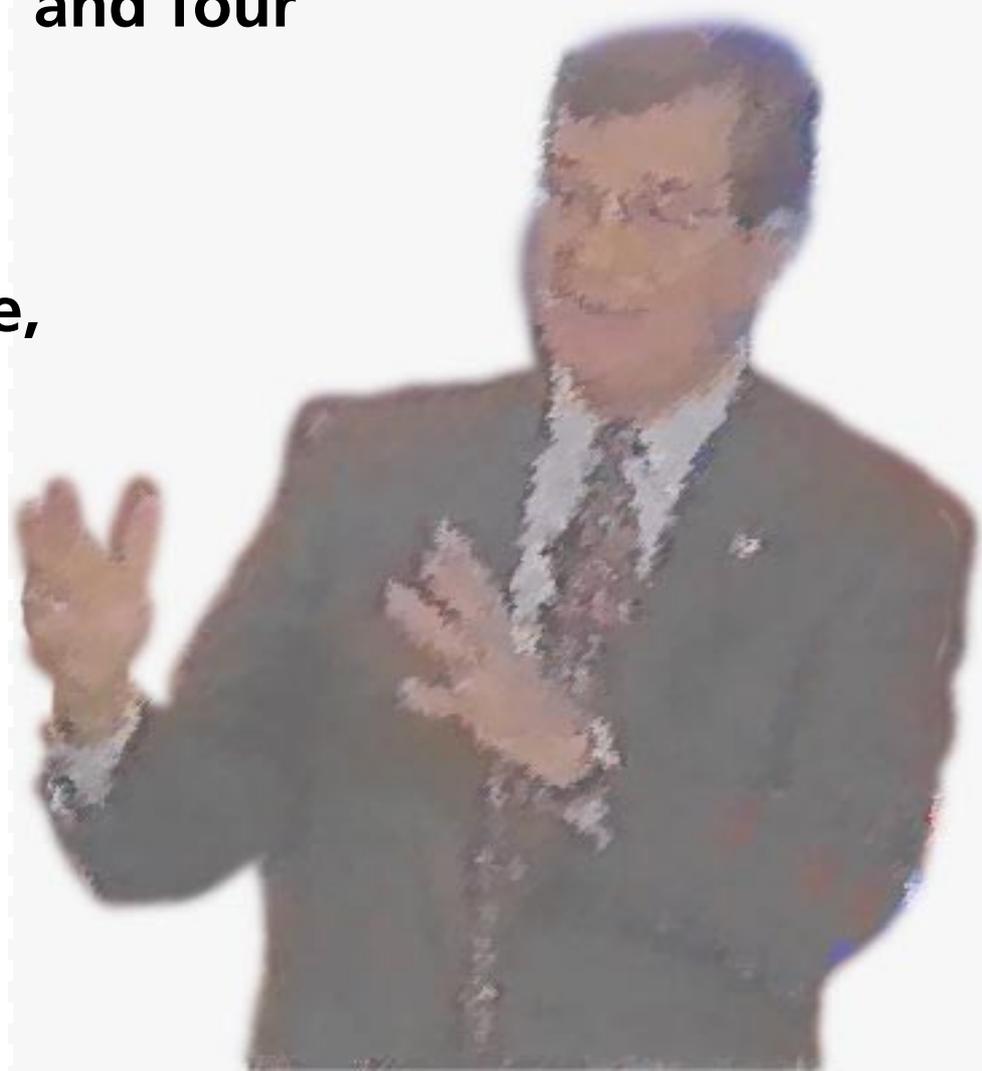
We have a problem

"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?*"



A close-up photograph of a diverse group of young people, likely students, smiling and looking towards the left. The image has a soft, slightly blurred quality. The text "Why do we have this problem?" is overlaid in the center in a bold, black, sans-serif font.

Why do we have this problem?

Why do we have this problem?

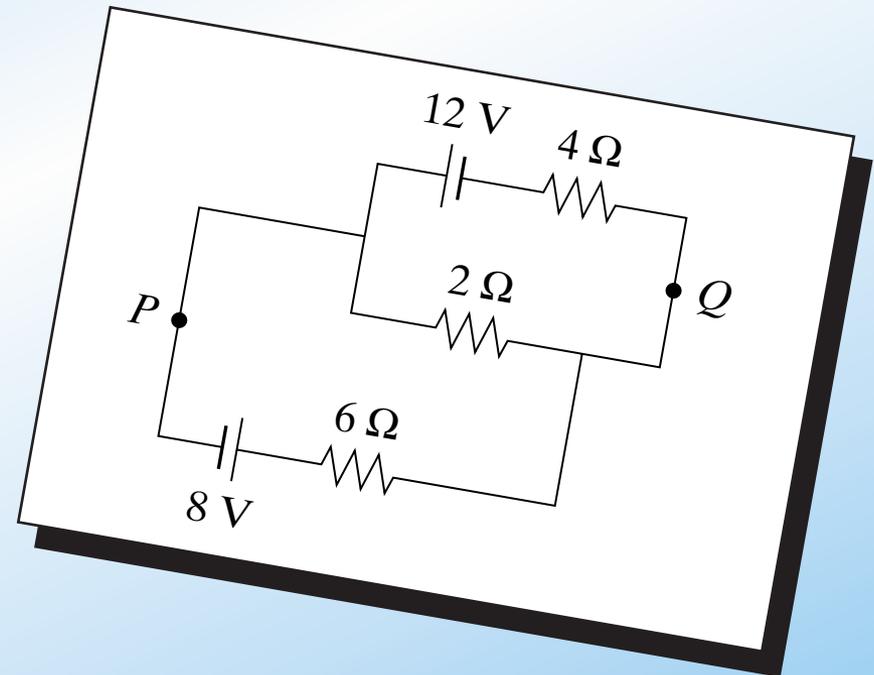
Lectures focus on transfer of information...

Why do we have this problem?

Conventional problems reinforce bad study habits

Why do we have this problem?

Conventional problems reinforce bad study habits

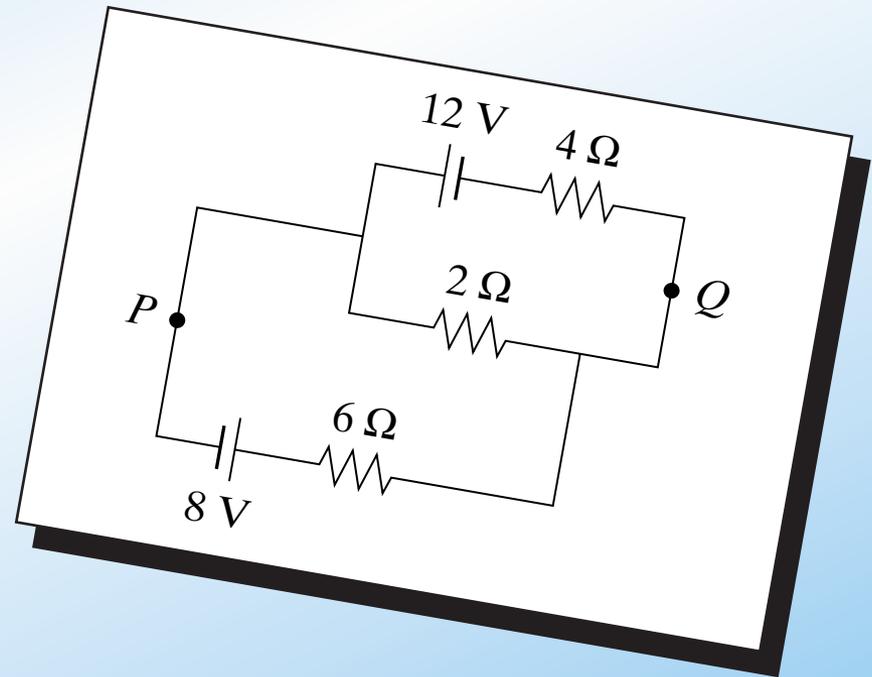


Why do we have this problem?

Conventional problems reinforce bad study habits

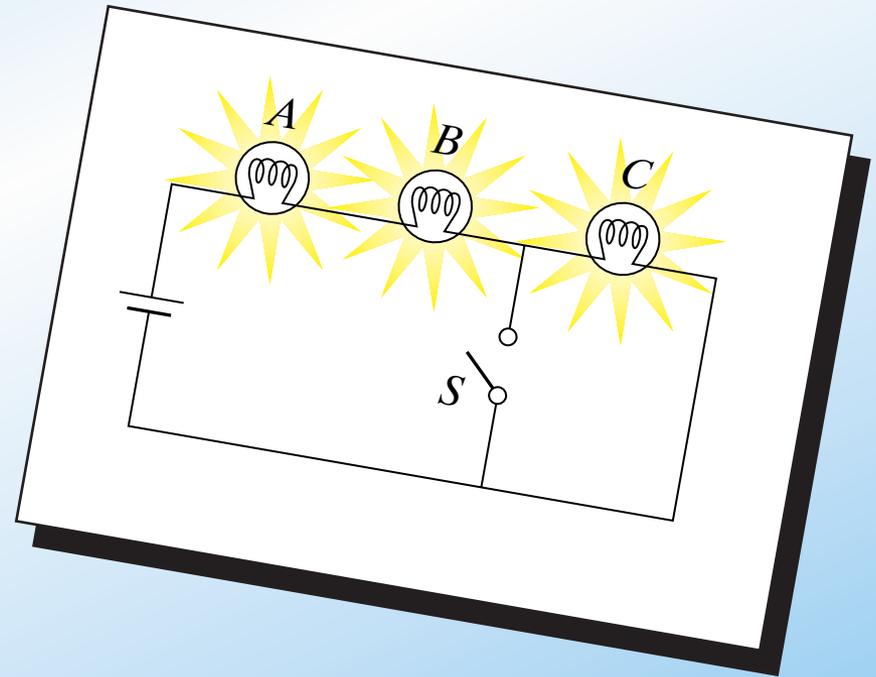
Calculate:

- (a) the current in the $2\text{-}\Omega$ resistor, and
- (b) the potential difference between points P and Q



Why do we have this problem?

Are basic principles understood?

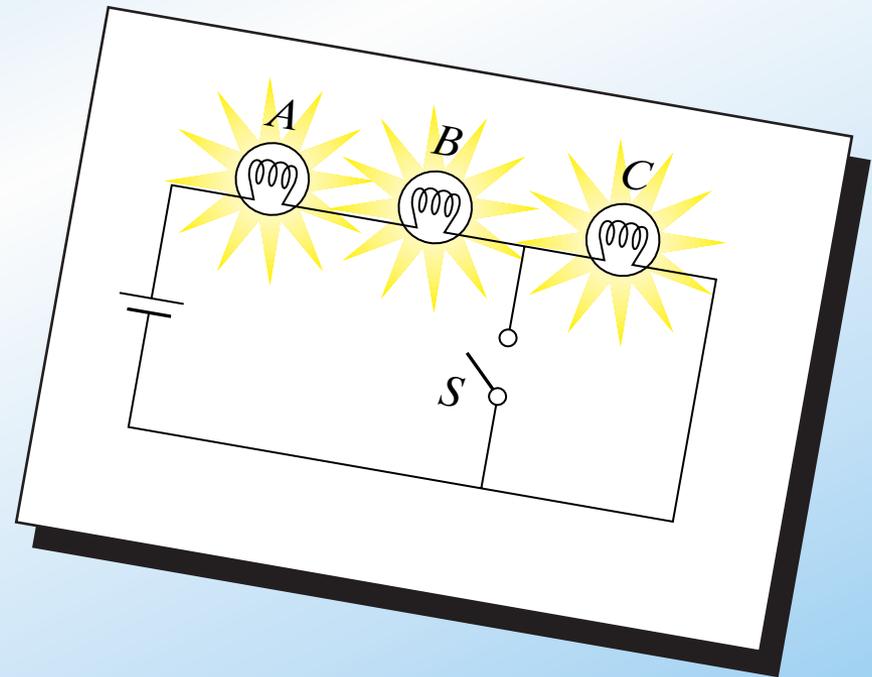


Why do we have this problem?

Are basic principles understood?

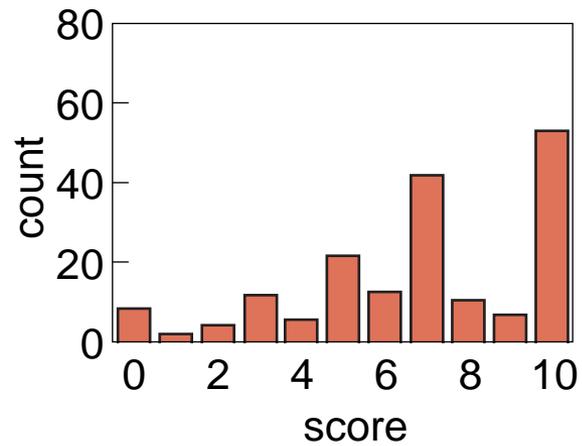
When S is closed, what happens to the:

- (a) intensities of A and B ?
- (b) intensity of C ?
- (c) current through battery?
- (d) voltage drop across A , B , and C ?
- (e) total power dissipated?

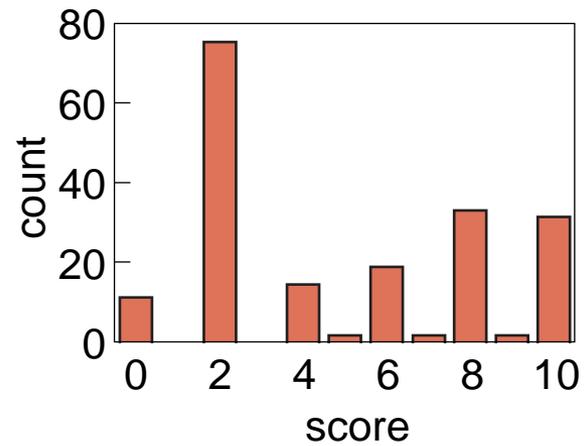


Why do we have this problem?

conventional

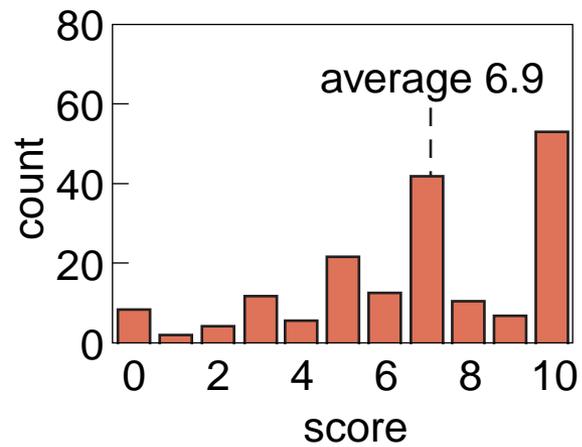


conceptual

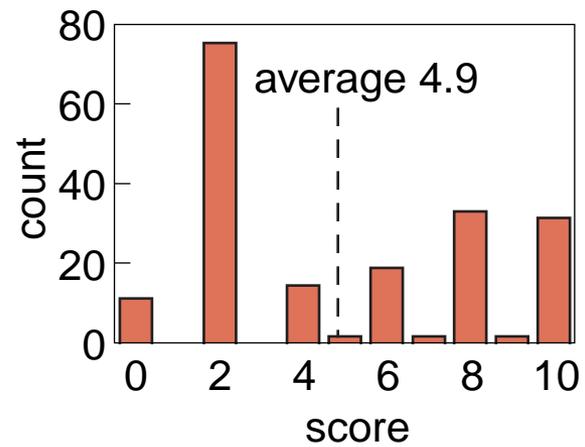


Why do we have this problem?

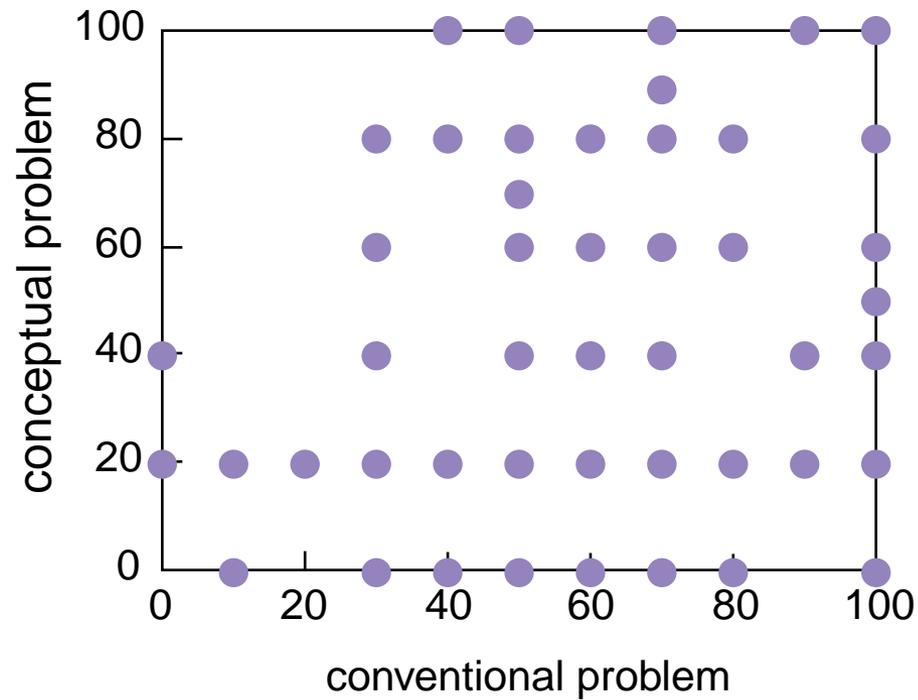
conventional



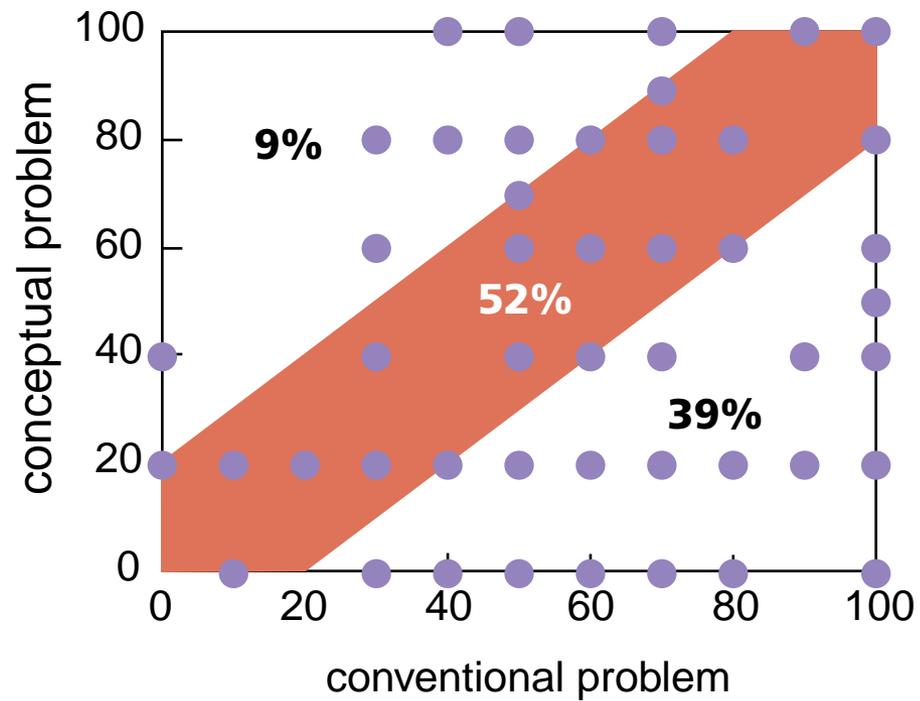
conceptual



Why do we have this problem?



Why do we have this problem?



A wide-angle photograph of a large lecture hall. The room is filled with students seated at desks, facing a stage. On the stage, a lecturer is standing at a podium, and a large projection screen displays text. The text on the screen is partially legible and includes the words "So what should we do?". The room has a curved wall and a high ceiling. The lighting is focused on the stage area.

So what should we do?

Peer Instruction

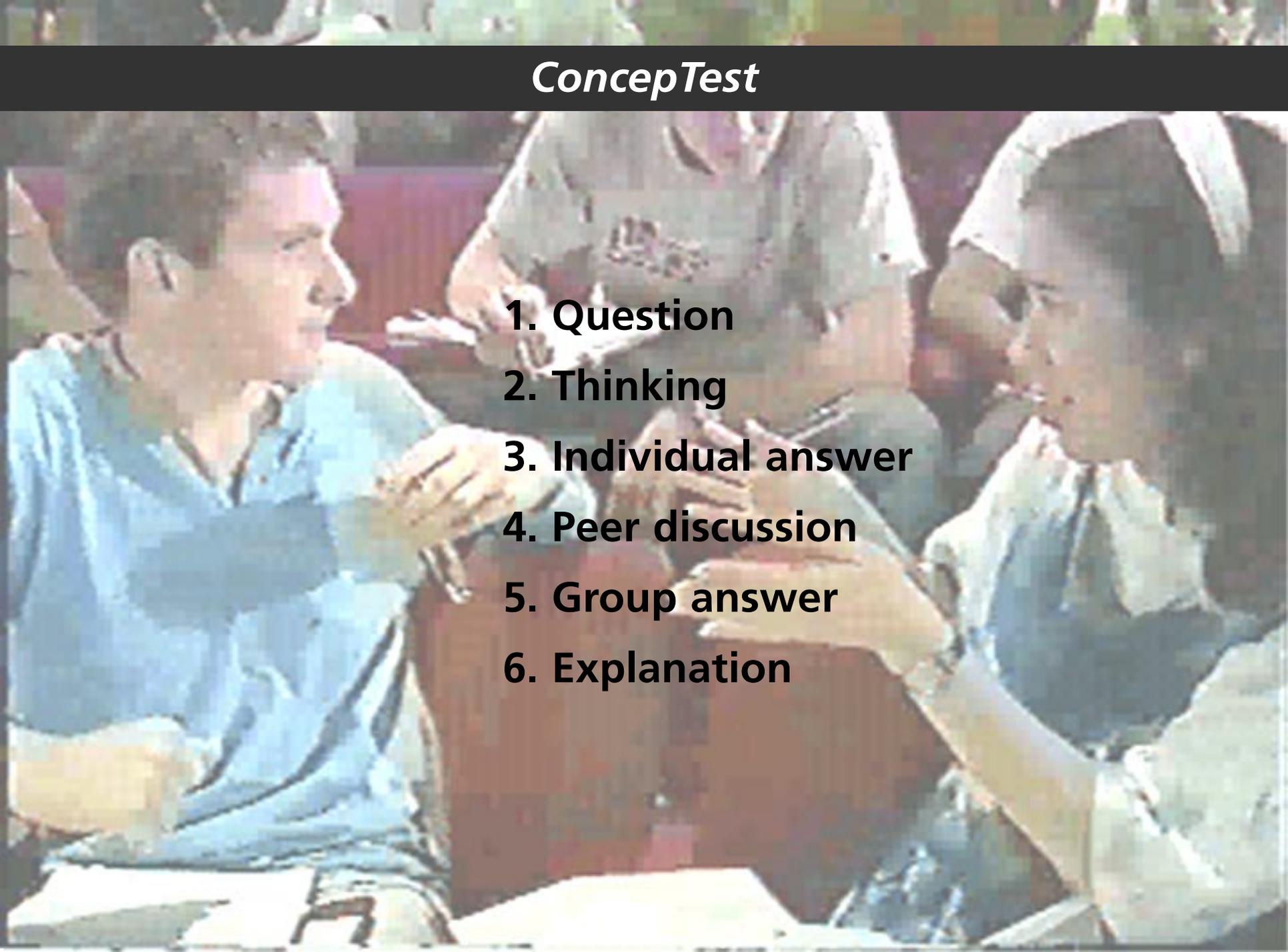
Help students take more responsibility for learning!

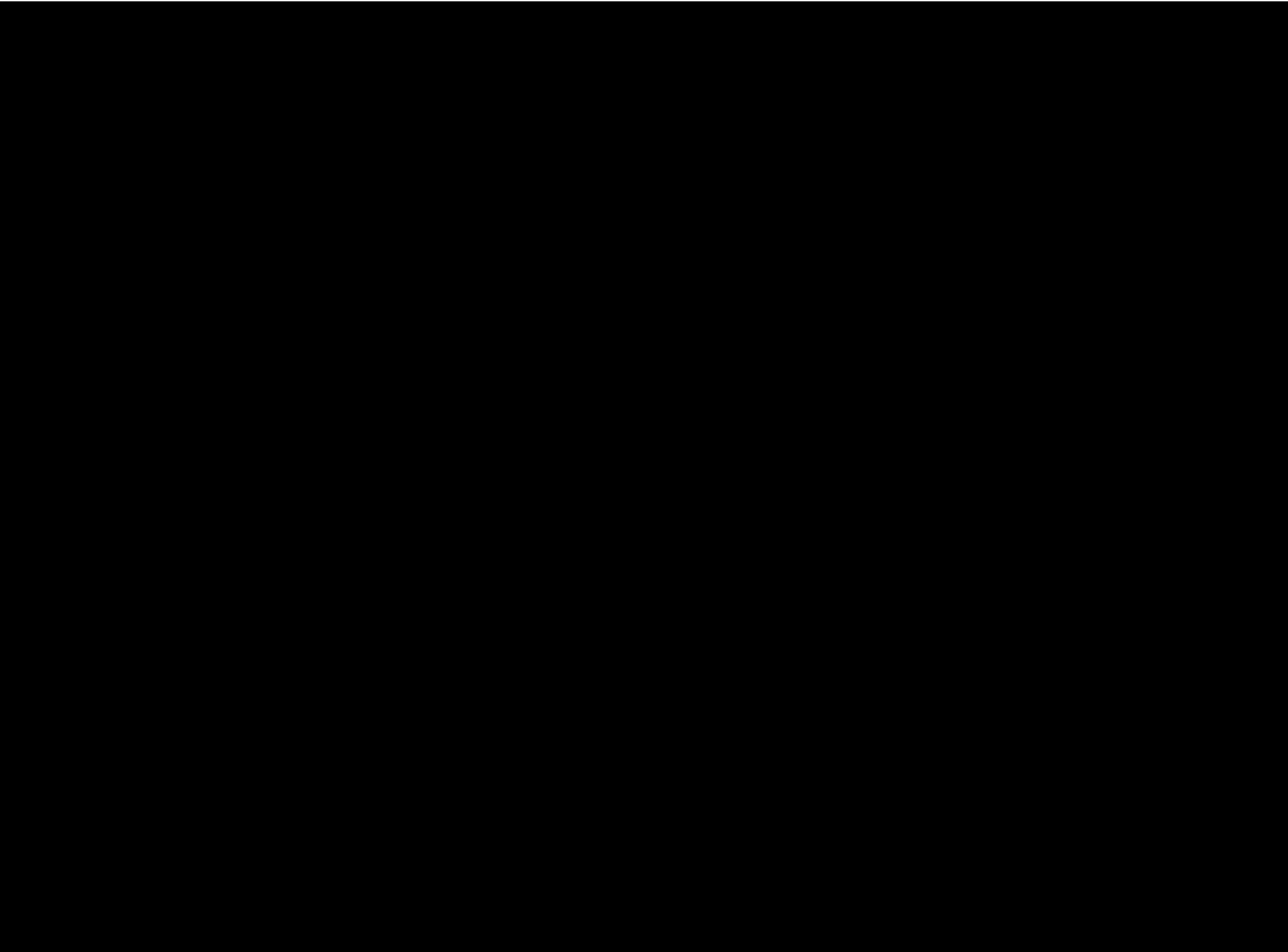
Peer Instruction

Main features:

- ▶ **Pre-class reading**
- ▶ **In class: depth, not coverage**
- ▶ **ConcepTests**

ConcepTest

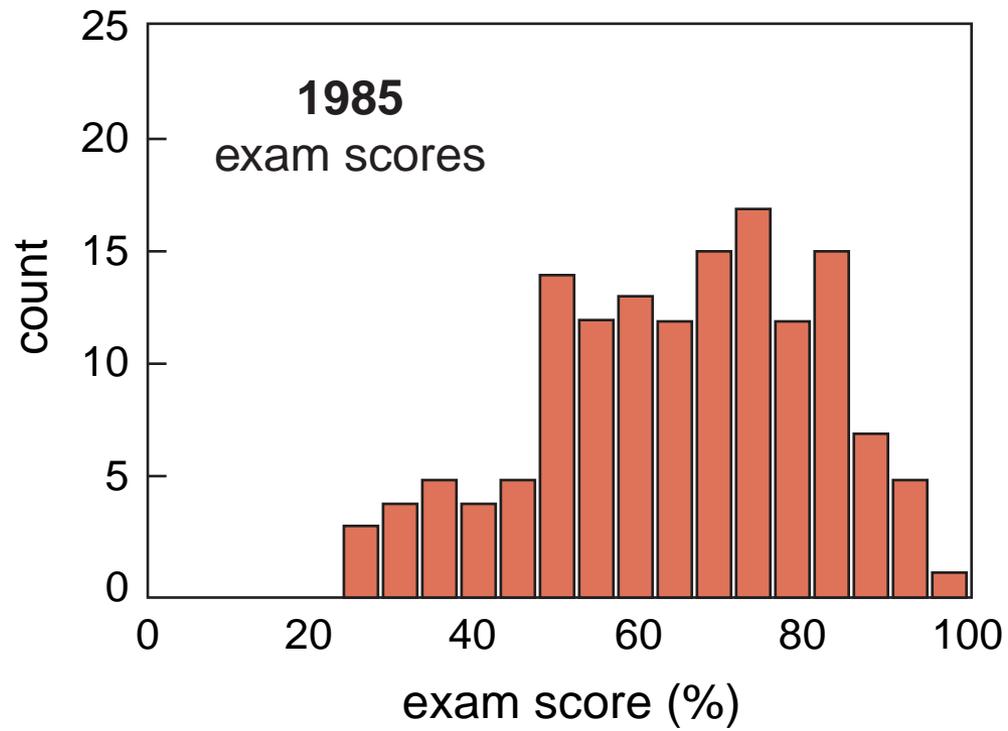
1. Question
 2. Thinking
 3. Individual answer
 4. Peer discussion
 5. Group answer
 6. Explanation
- 
- A photograph of three students in a classroom setting. A male student on the left, wearing a blue shirt, is gesturing with his hands while speaking. A female student on the right, wearing a white headscarf and a blue patterned top, is listening intently. A third student is partially visible in the background. They appear to be engaged in a group discussion or peer review activity.



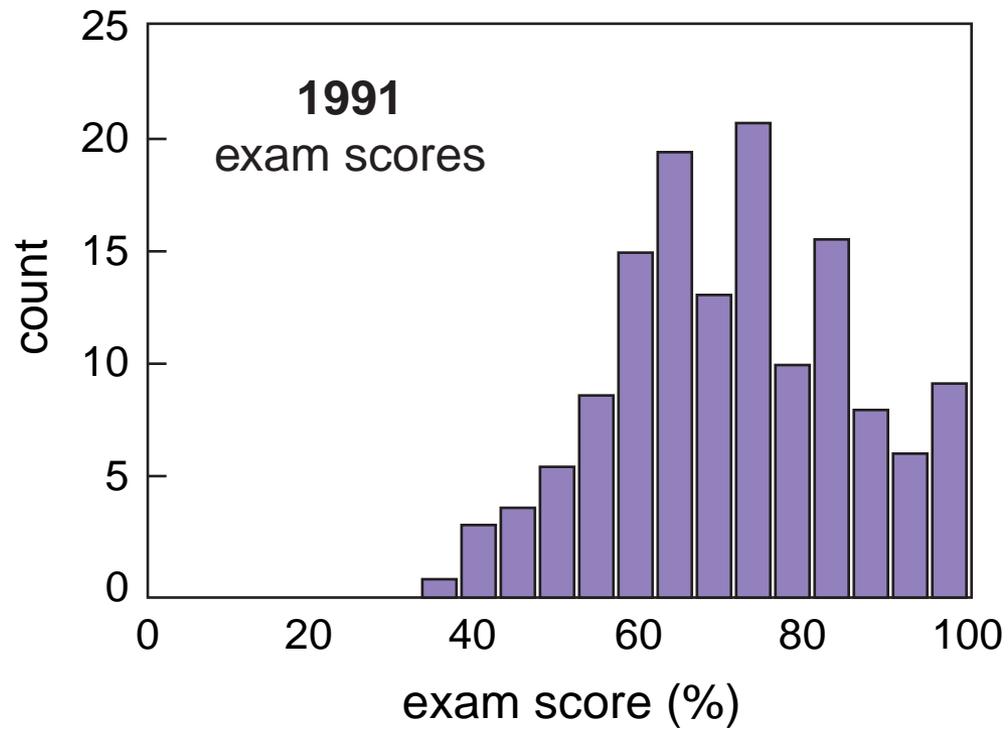
Results

What about problem solving...?

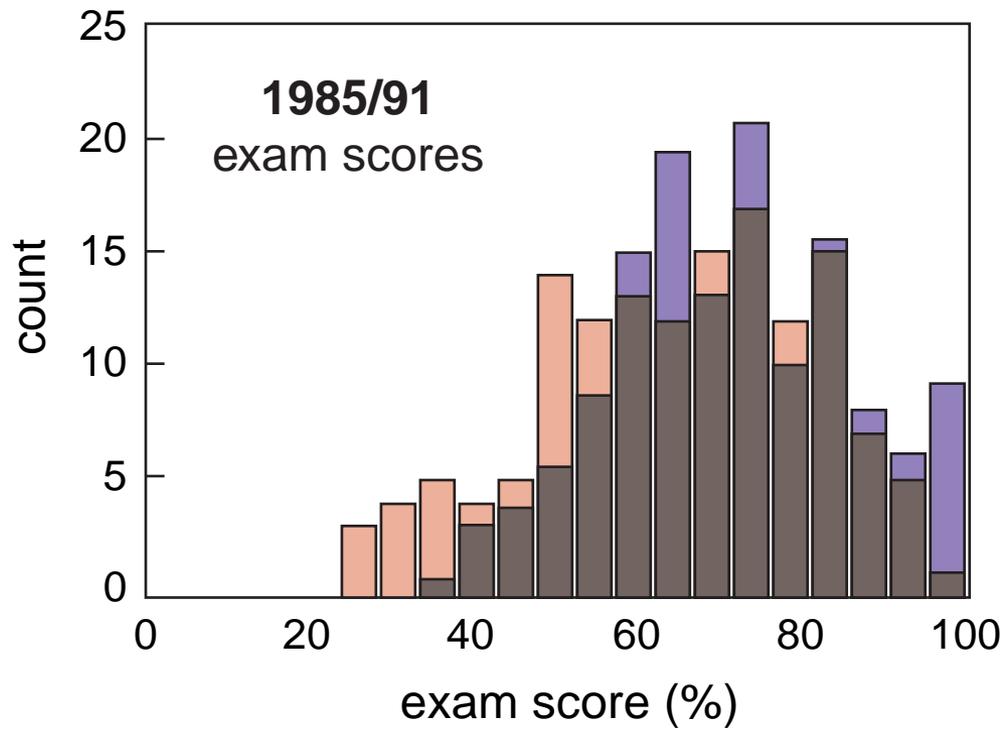
Results



Results



Results



Results

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

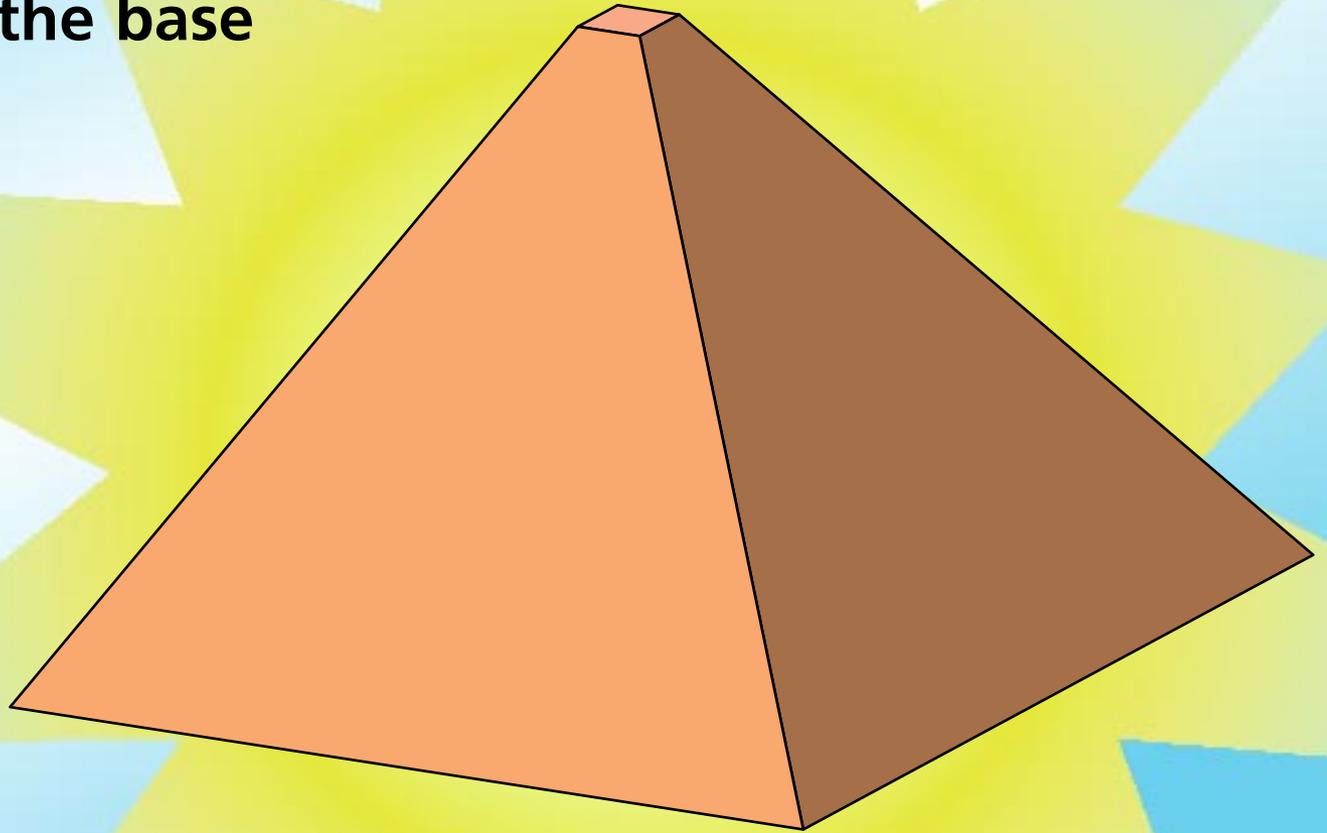
Results

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

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

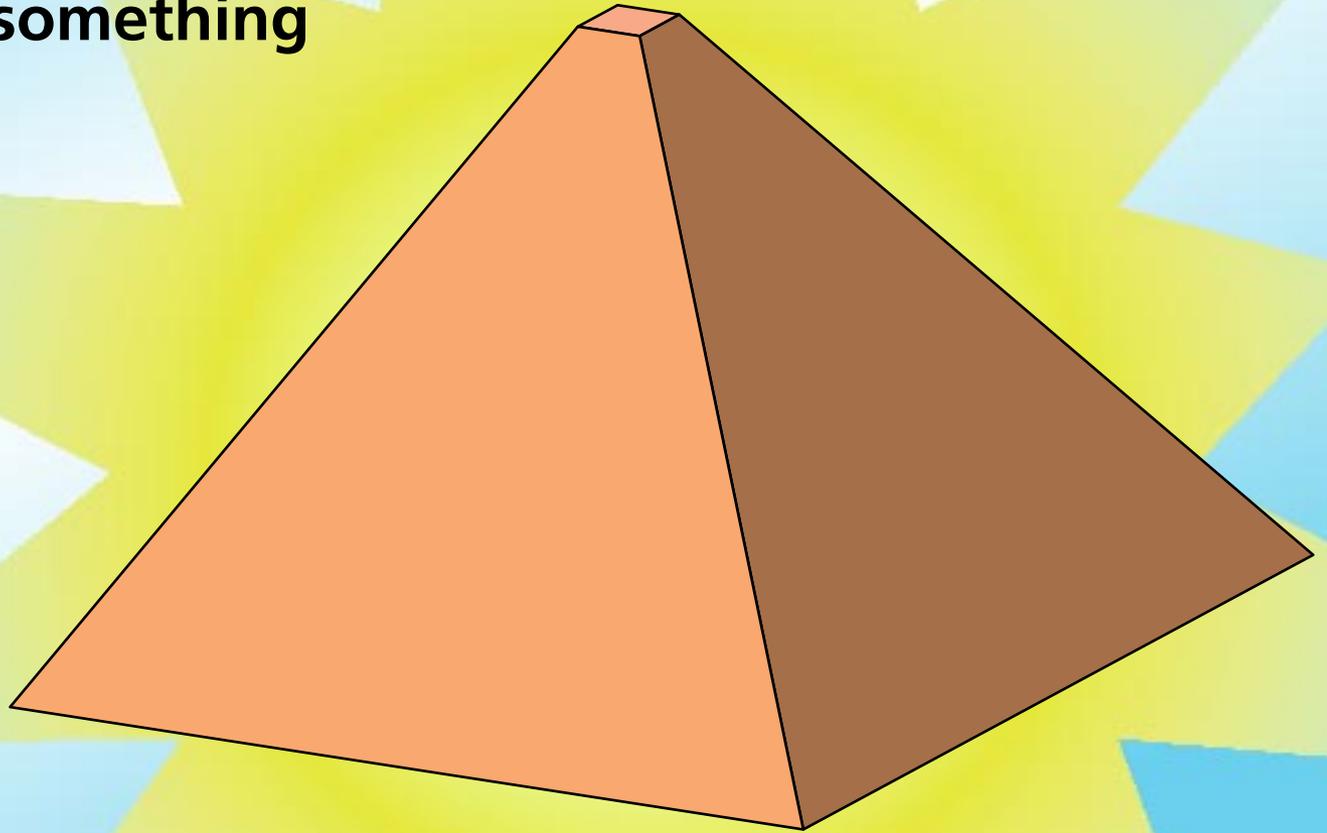
Conclusion

**Let's not forget the base
of the pyramid!**



Conclusion

**Let's give them something
of value!**



Funding

National Science Foundation

**For a copy of this talk and
additional information:**

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