

PEER INSTRUCTION: TURNING A LECTURE INTO A SEMINAR

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Outline

- ▶ **Why change lectures?**

Outline

- ▶ **Why change lectures?**
- ▶ **How should we change?**

Outline

- ▶ **Why change lectures?**
- ▶ **How should we change?**
- ▶ **What are the benefits?**

Why change?

Common student experiences:

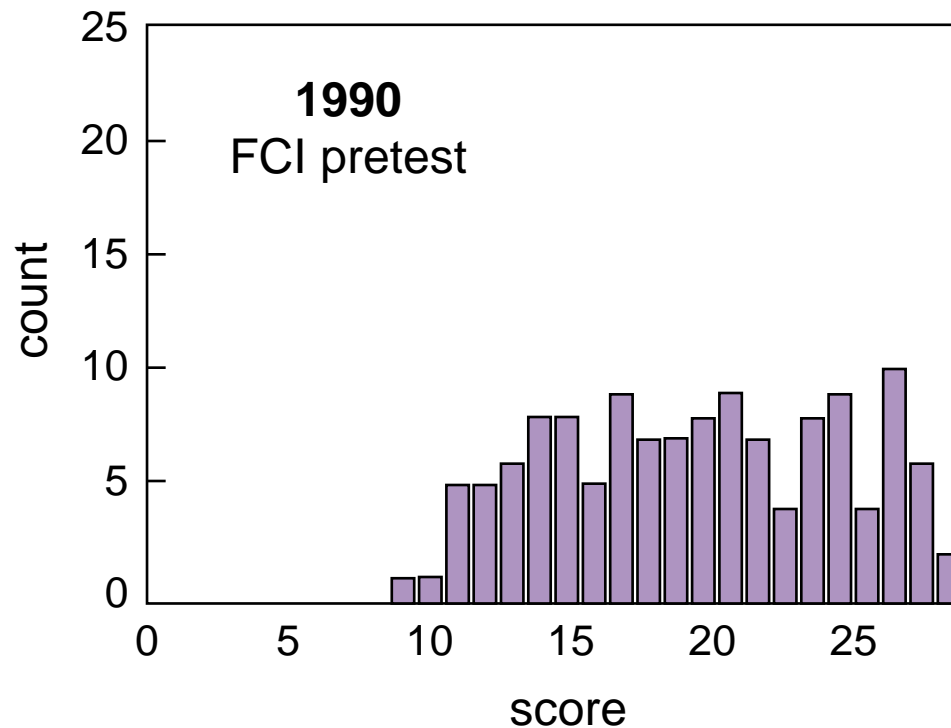
- ▶ **frustration**
- ▶ **lack of understanding**
- ▶ **lack of basic knowledge**

Why change?

Lectures focus on transfer of information...

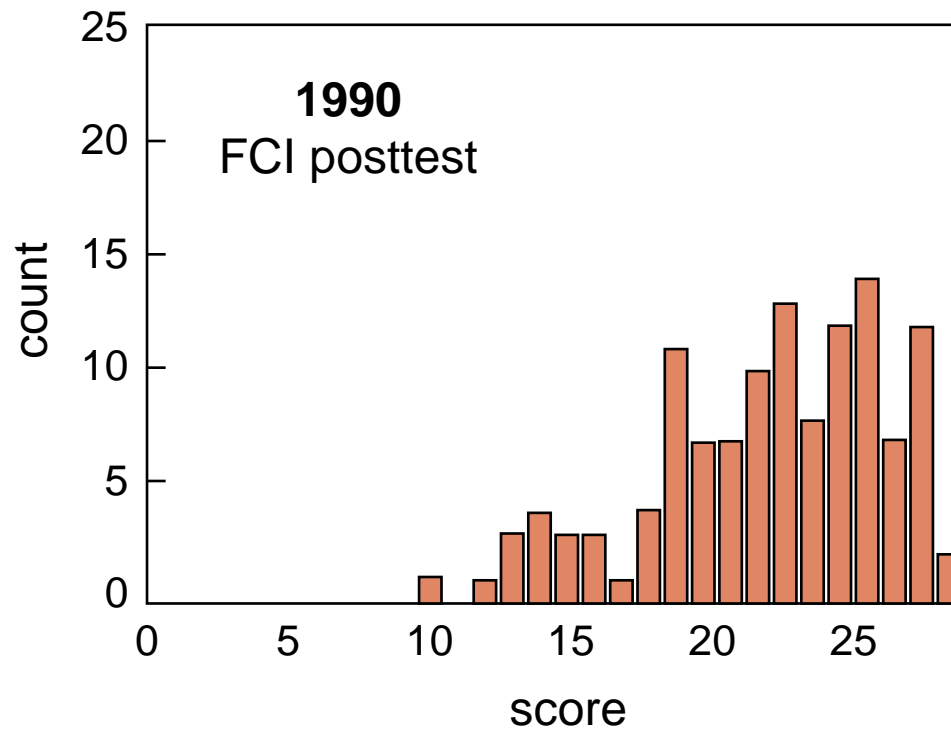
Why change?

...but science is not just information!



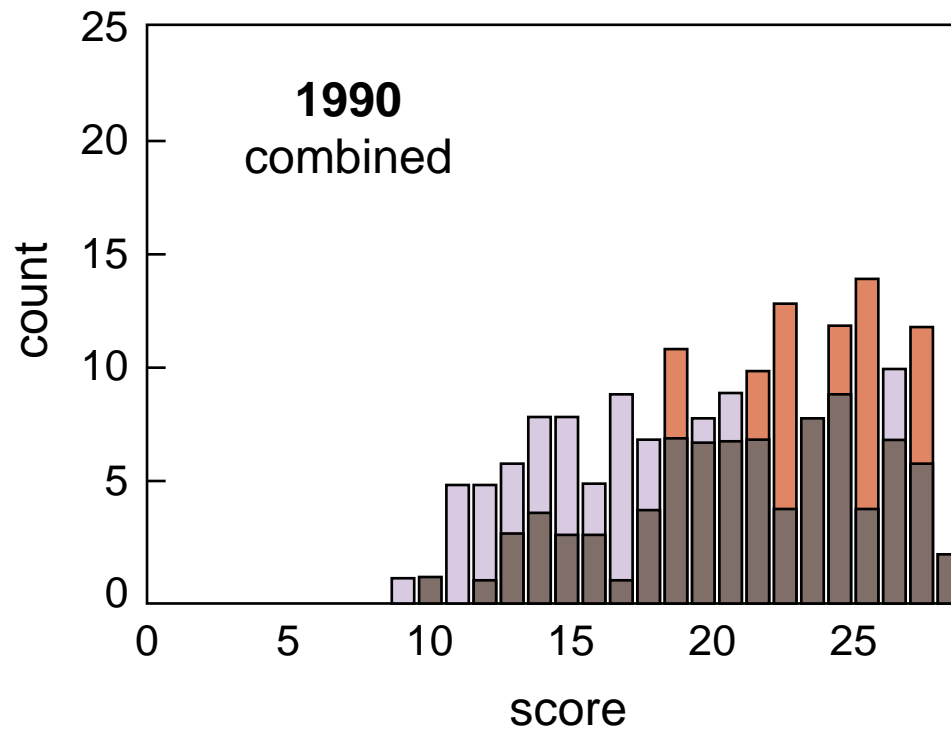
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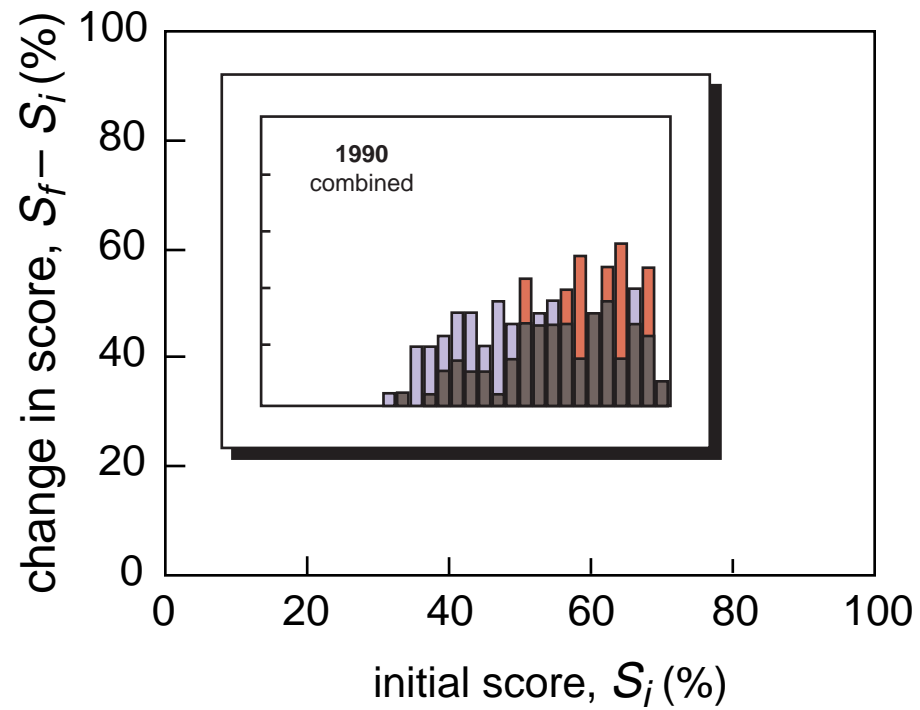


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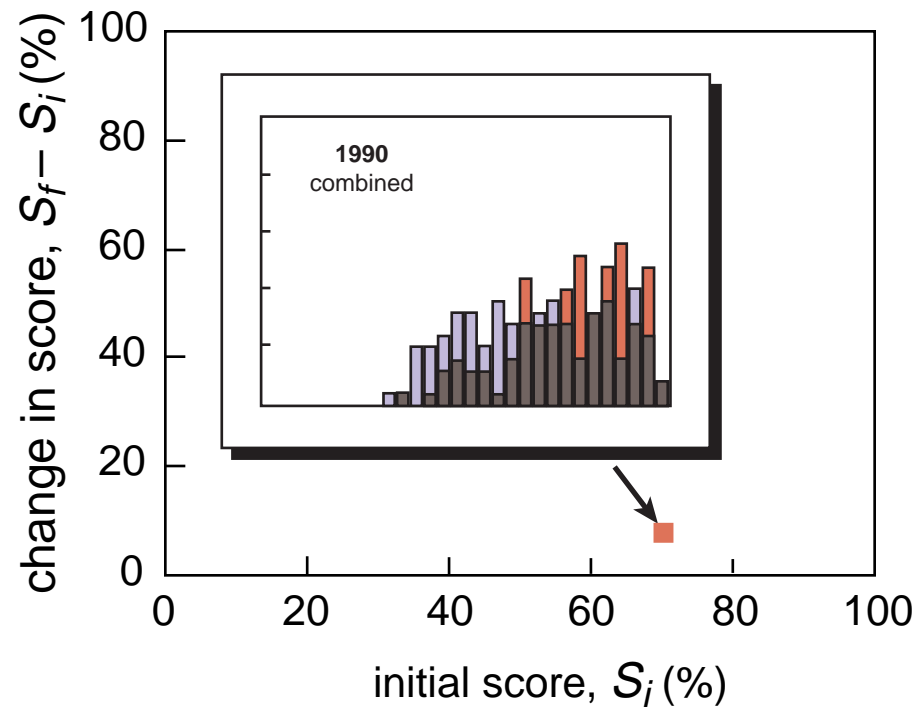
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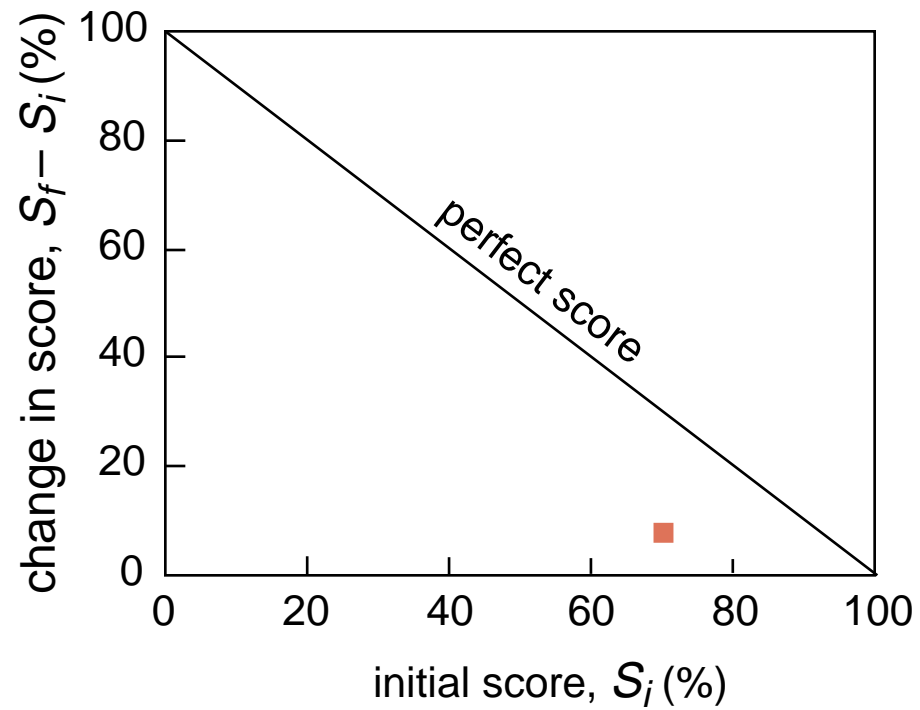
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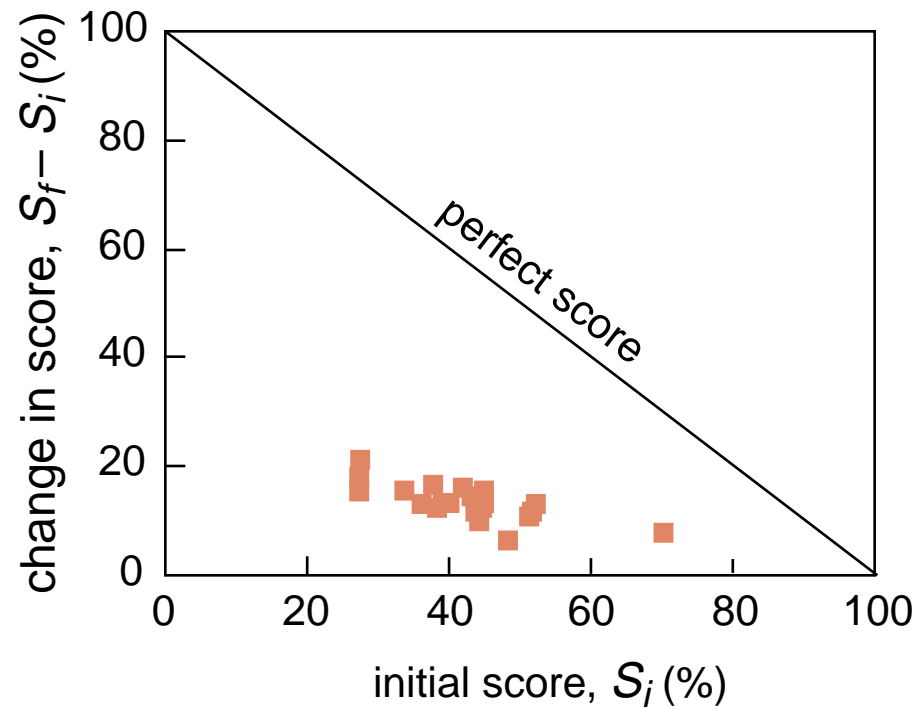
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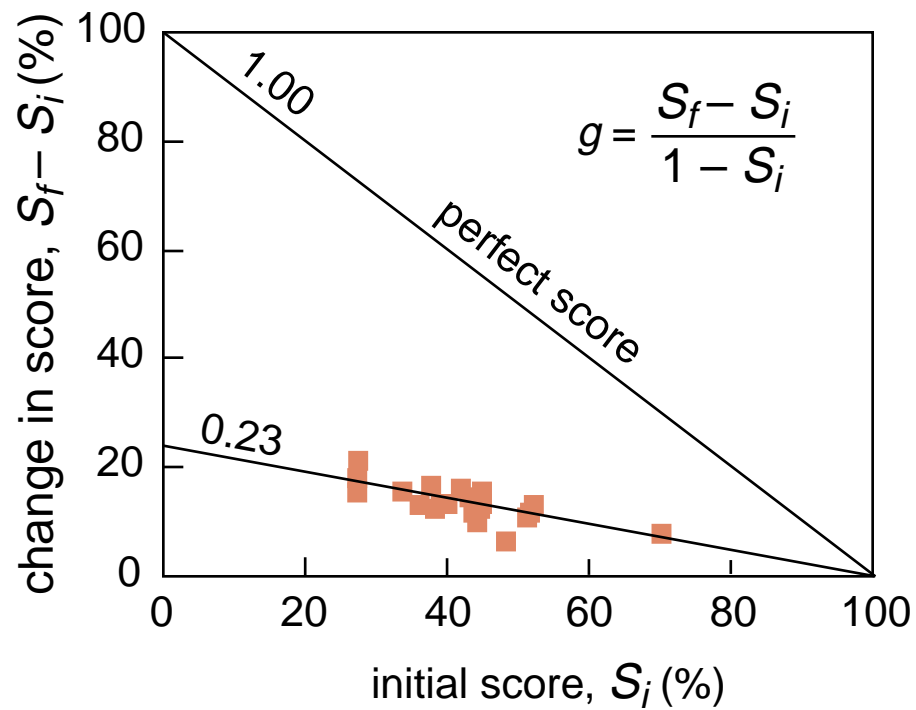
Why change?



Why change?



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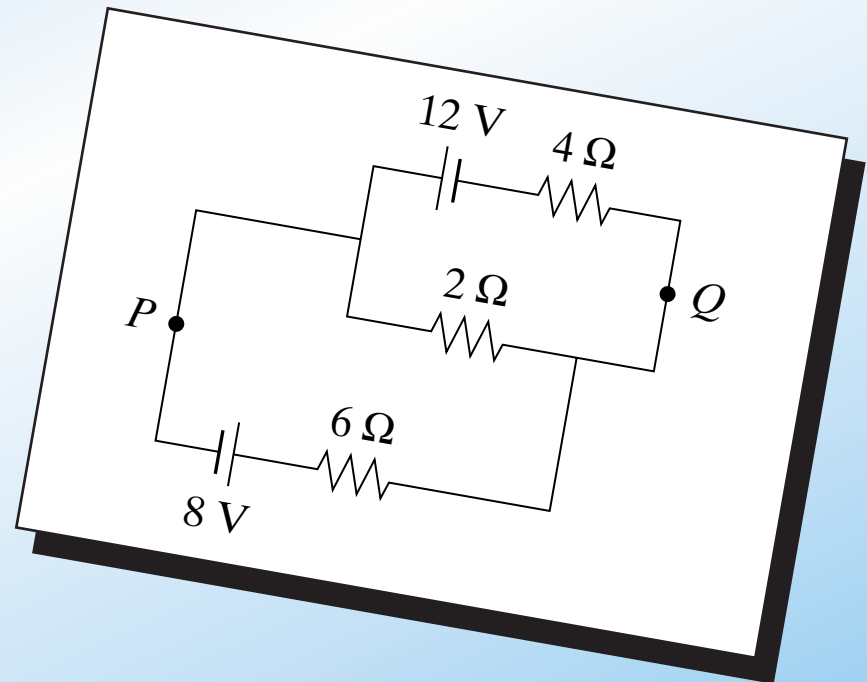


Why change?

Conventional problems reinforce bad study habits

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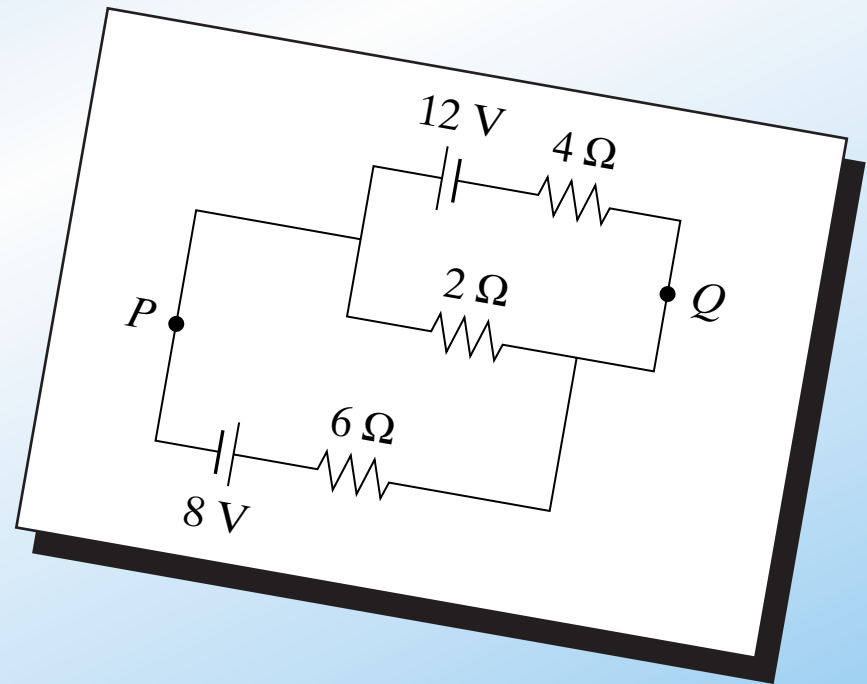


Why change?

Conventional problems reinforce bad study habits

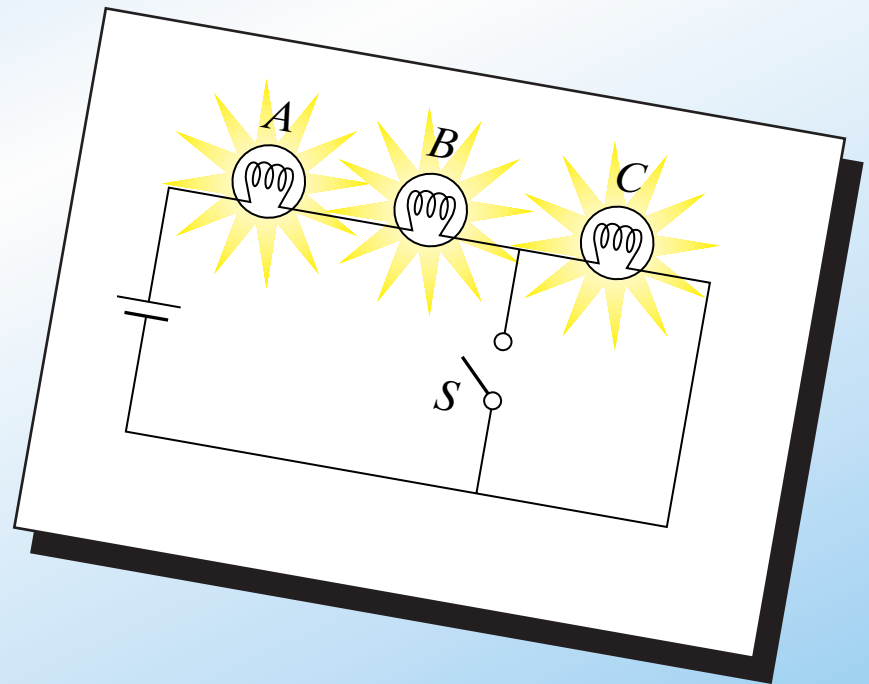
Calculate:

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



Why change?

Are basic principles understood?

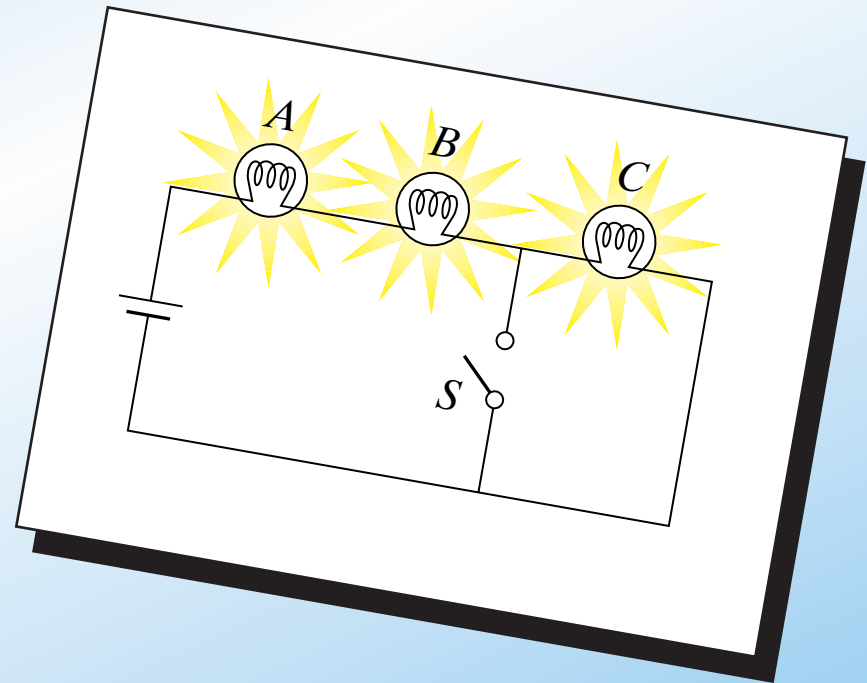


Why change?

Are basic principles understood?

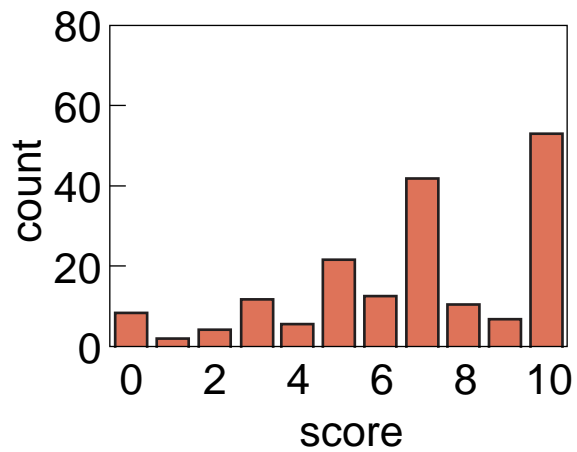
When S is closed, what happens to the:

- (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?

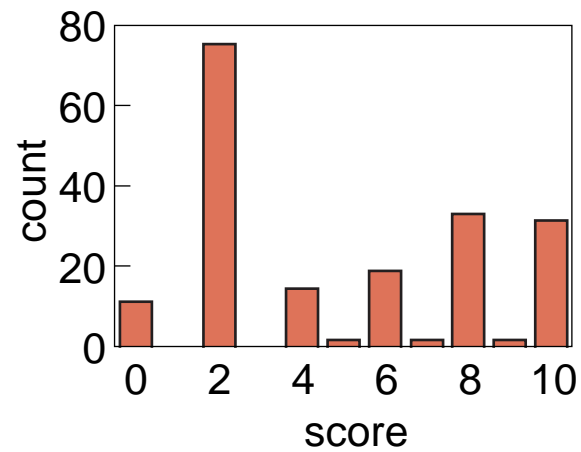


Why change?

conventional

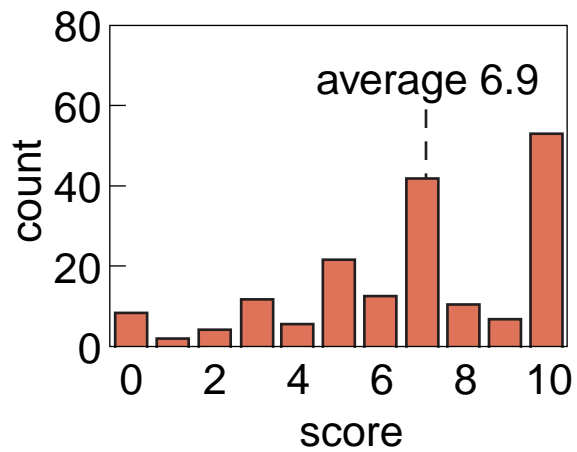


conceptual

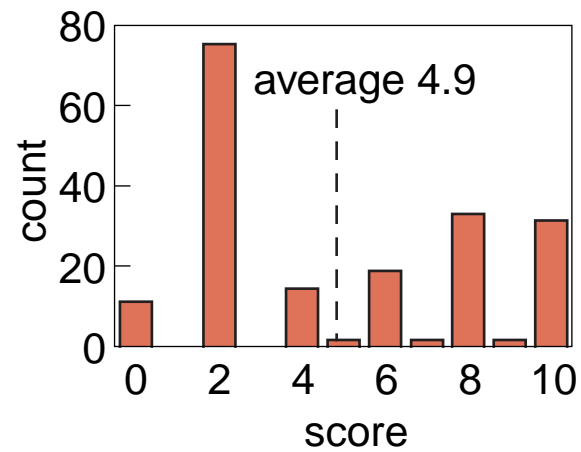


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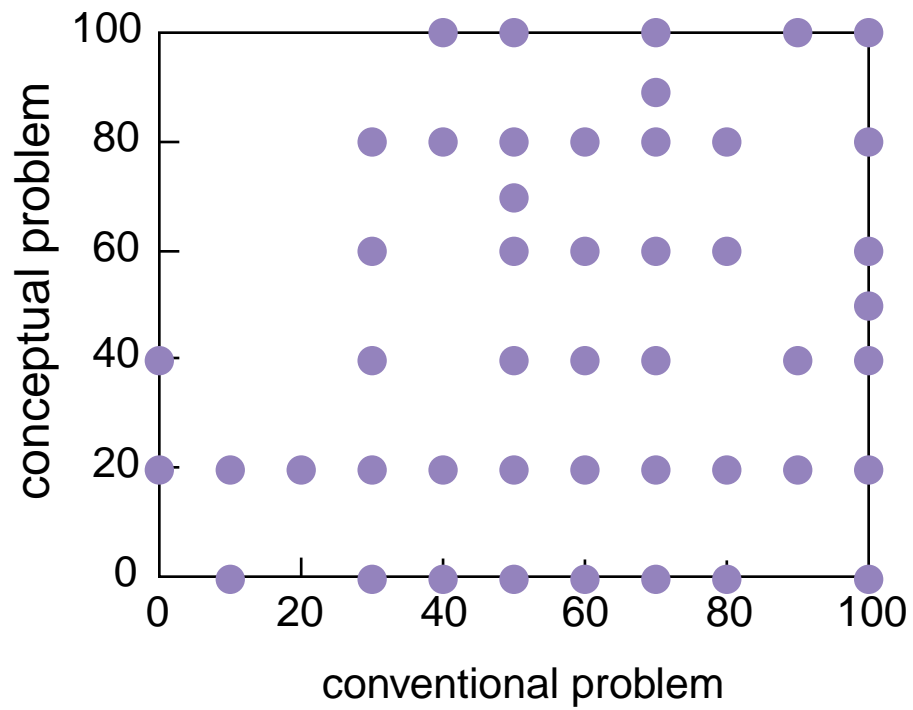
conventional



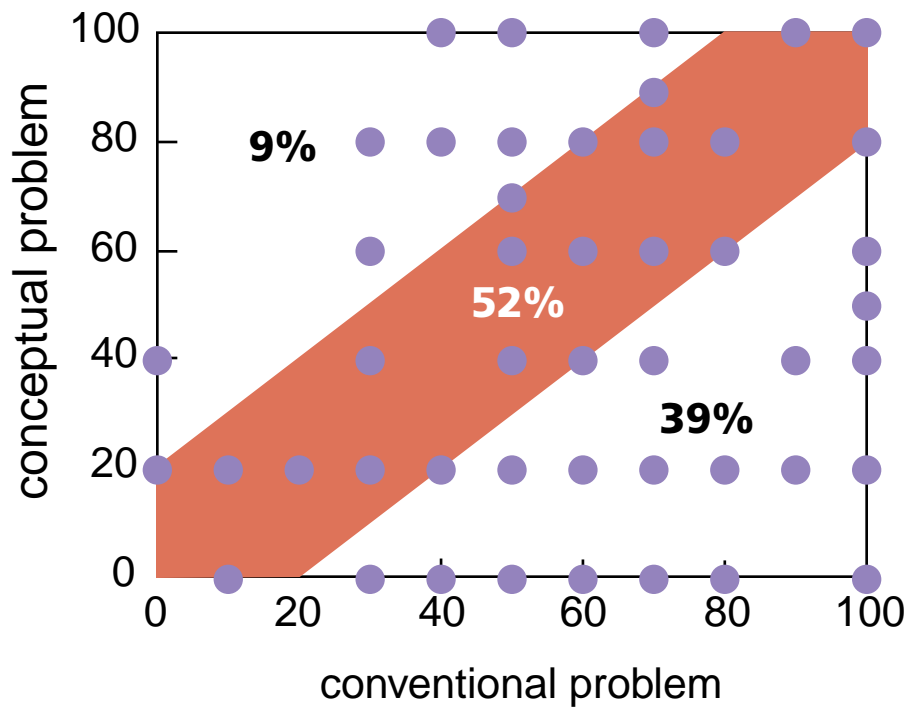
conceptual



Why change?



Why change?



A wide-angle photograph of a large lecture hall. In the foreground, rows of students are seated at blue-topped desks, viewed from behind. They are looking towards the front of the room. At the front, a lecturer stands behind a long desk, facing the audience. Behind the lecturer is a large, curved wall with several blackboards. Above the blackboards, a large projection screen displays text and a diagram. To the right of the main screen, a smaller screen shows a list of items. The room is dimly lit, with the primary light source being the projection screens. The text "So what should we do?" is overlaid in white on the blackboard area.

So what should we do?

Peer Instruction

Help students take more responsibility for learning!

Peer Instruction

- ▶ **Move first exposure to the material out of the classroom...**

Peer Instruction

- ▶ **Move first exposure to the material out of the classroom: *assign reading!***

Peer Instruction

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- ▶ Use class to deepen and broaden understanding
- ▶ by identifying **key ideas**

Peer Instruction

- ▶ Move first exposure to the material out of the classroom: **assign reading!**
- ▶ Use class to deepen and broaden understanding
- ▶ by identifying **key ideas**
- ▶ and giving students opportunities to **think**

Peer Instruction

Main features:

- ▶ **Pre-class reading**

Peer Instruction

Main features:

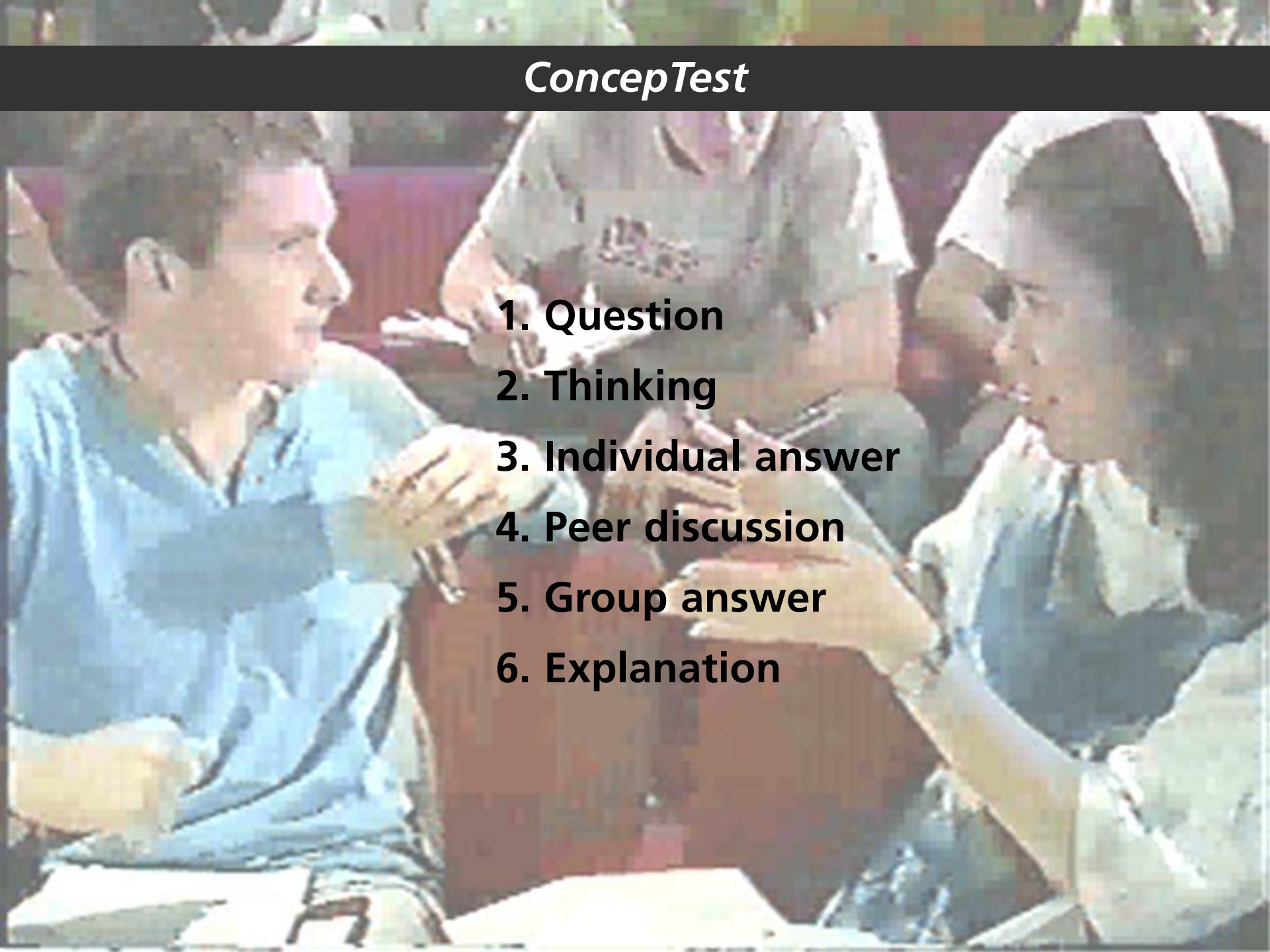
- ▶ **Pre-class reading**
- ▶ **In class: depth, not coverage**

Peer Instruction

Main features:

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

ConcepTest

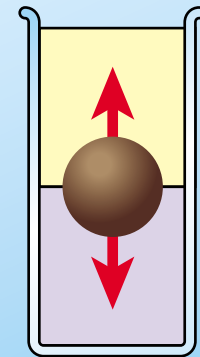
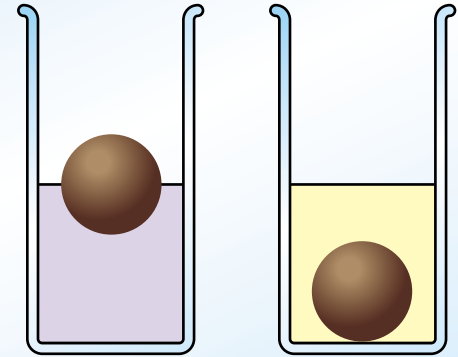
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- A photograph of three students in a classroom. On the left, a male student in a blue shirt is looking towards the center. In the middle, a female student in a grey shirt is looking down at a book or paper. On the right, a female student in a blue shirt is looking towards the center. They appear to be engaged in a discussion or activity.
- 1. Question**
 - 2. Thinking**
 - 3. Individual answer**
 - 4. Peer discussion**
 - 5. Group answer**
 - 6. Explanation**

Sample ConceptTest

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 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.



Reading

- ▶ **Web-based assignment due before class**

Reading

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- ▶ **Three questions (content and feedback)**

Reading

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- ▶ **Graded on effort**

Reading

- ▶ Web-based assignment due before class
- ▶ Three questions (content and feedback)
- ▶ Graded on effort
- ▶ 5% of final grade

Motivating students

► Suitable ConceptTests

Motivating students

- ▶ **Suitable ConcepTests**
- ▶ **Rewards for participation**

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- ▶ **Noncompetitive grading**

Motivating students

- ▶ **Suitable ConcepTests**
- ▶ **Rewards for participation**
- ▶ **Noncompetitive grading**
- ▶ **Conceptual exam questions**

Is it any good?

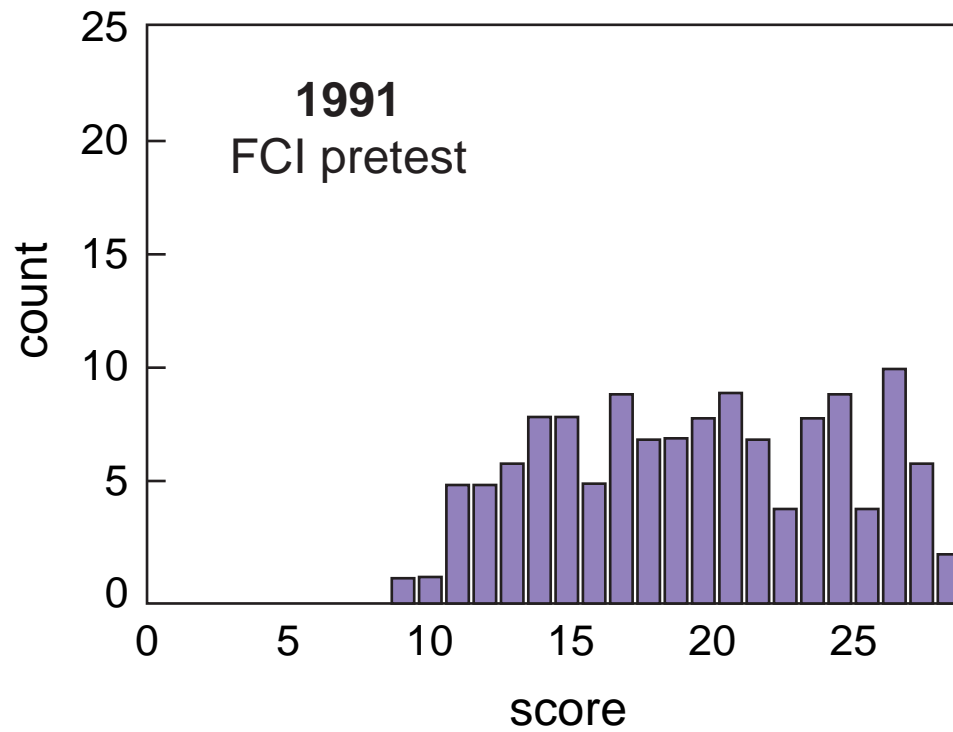
Is it any good?

► **Results**

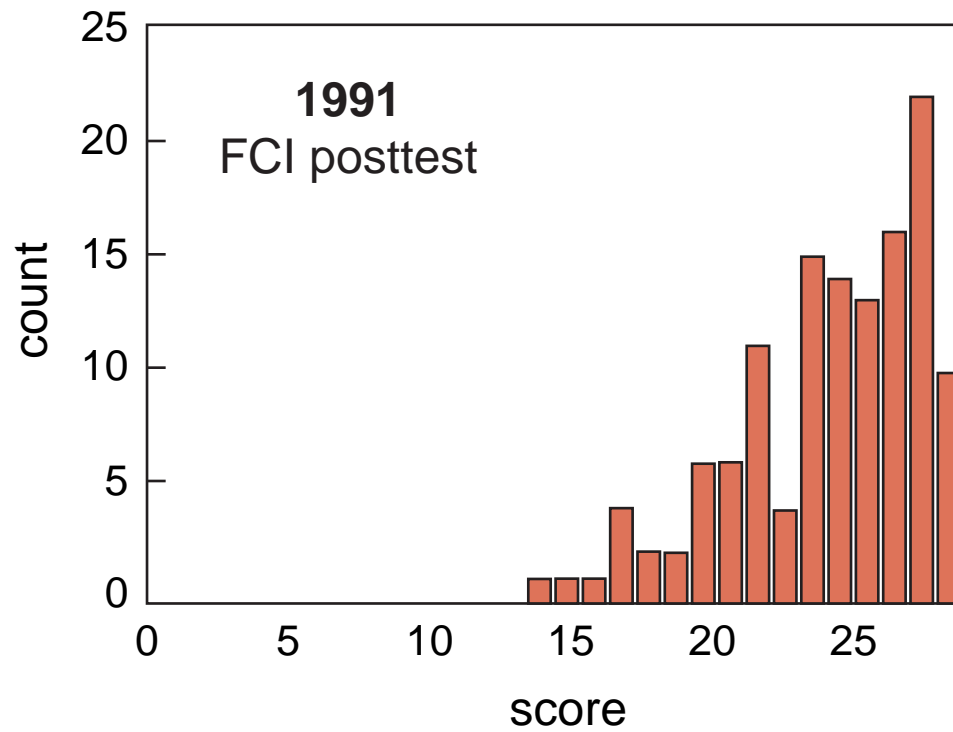
Is it any good?

- ▶ **Results**
- ▶ **Student Reactions**

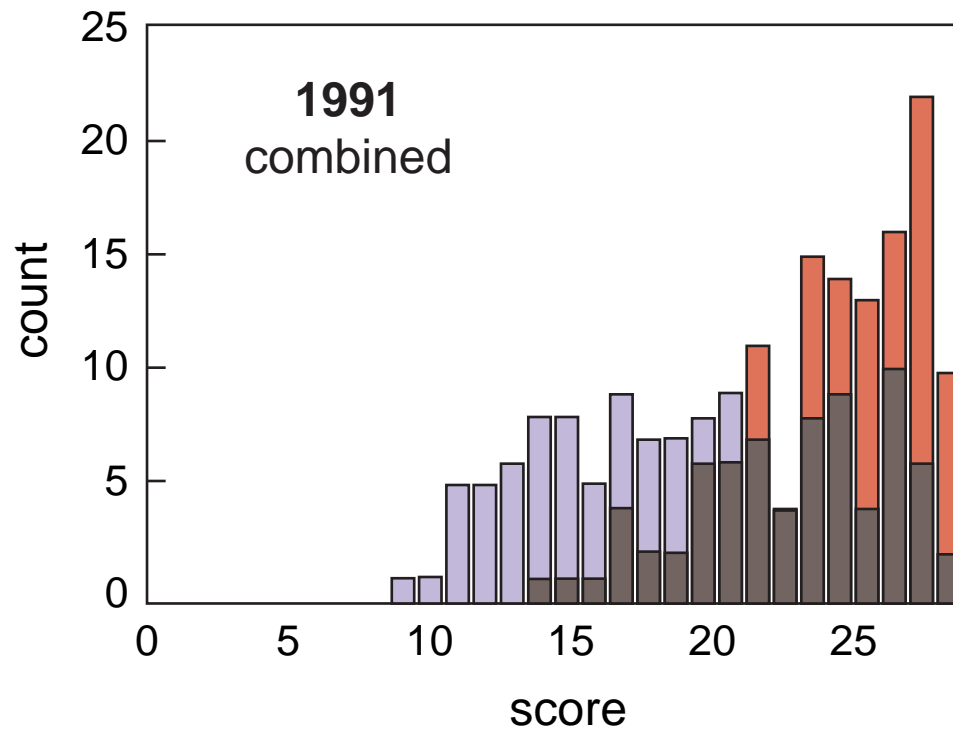
Results



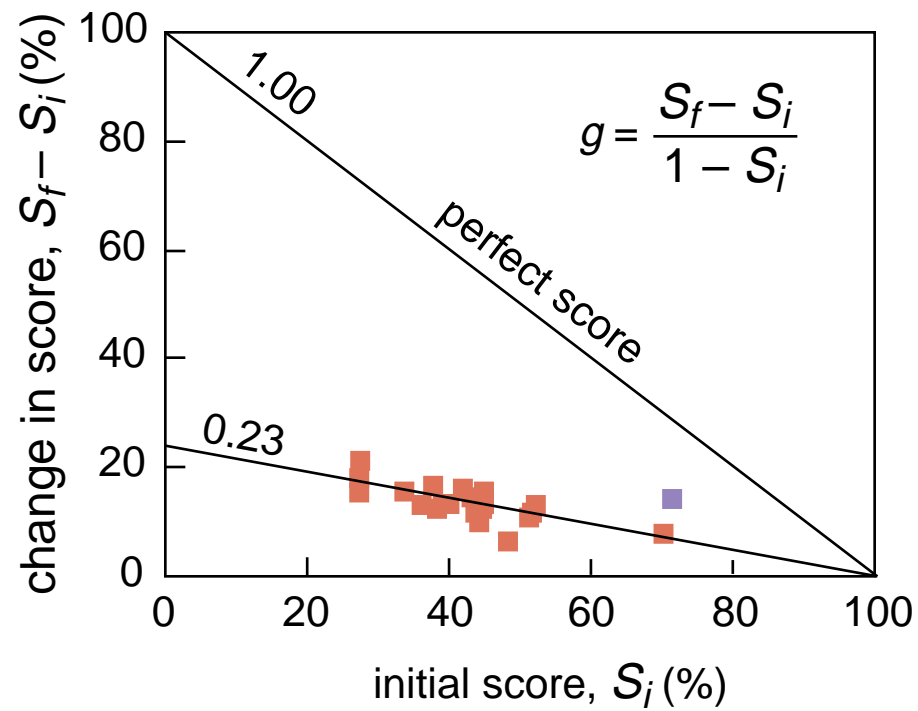
Results



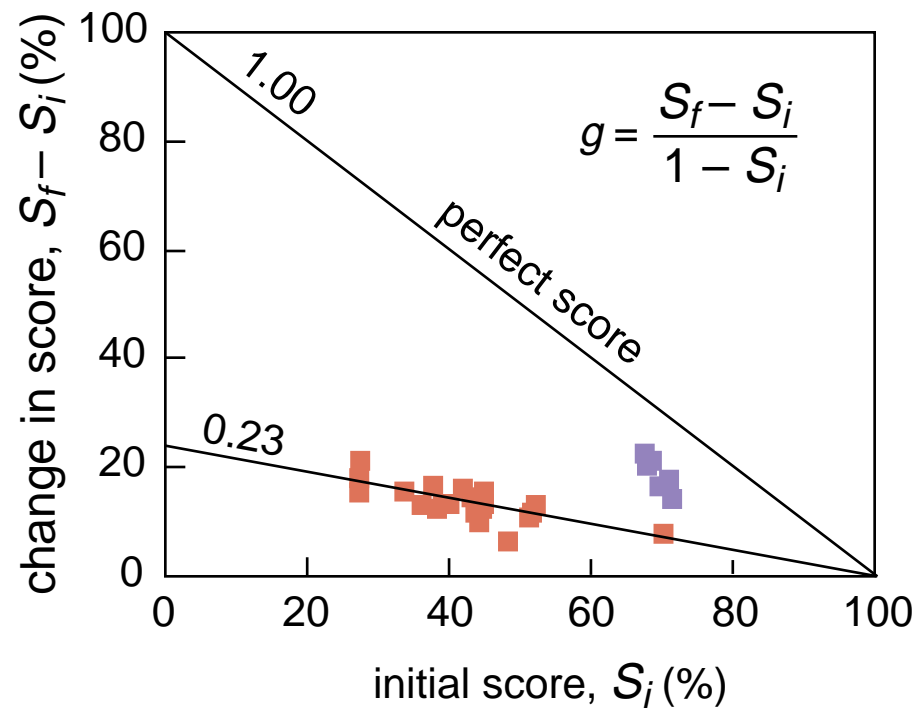
Results



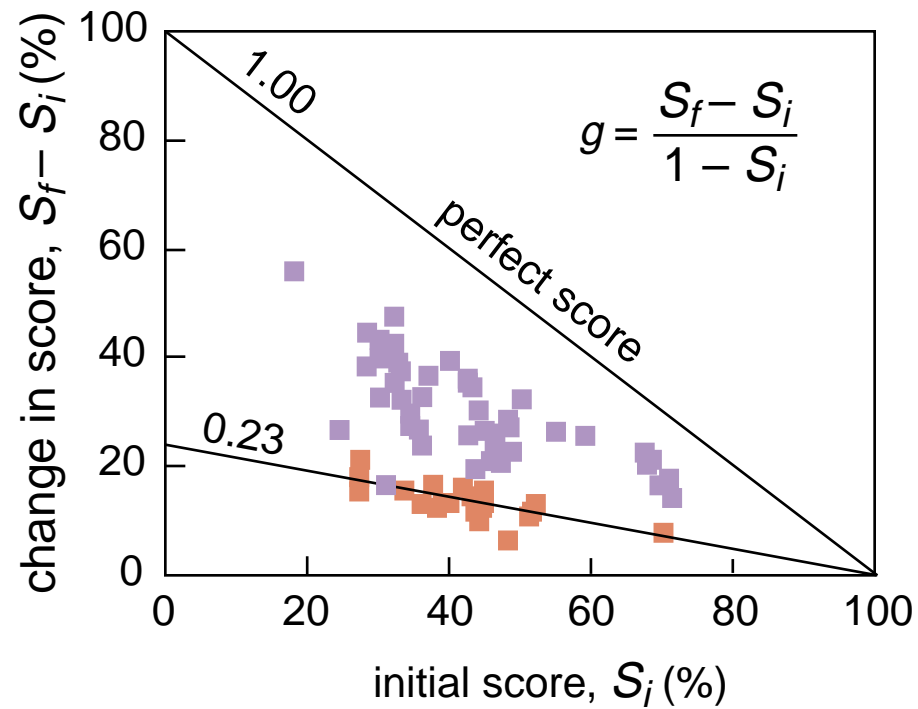
Results



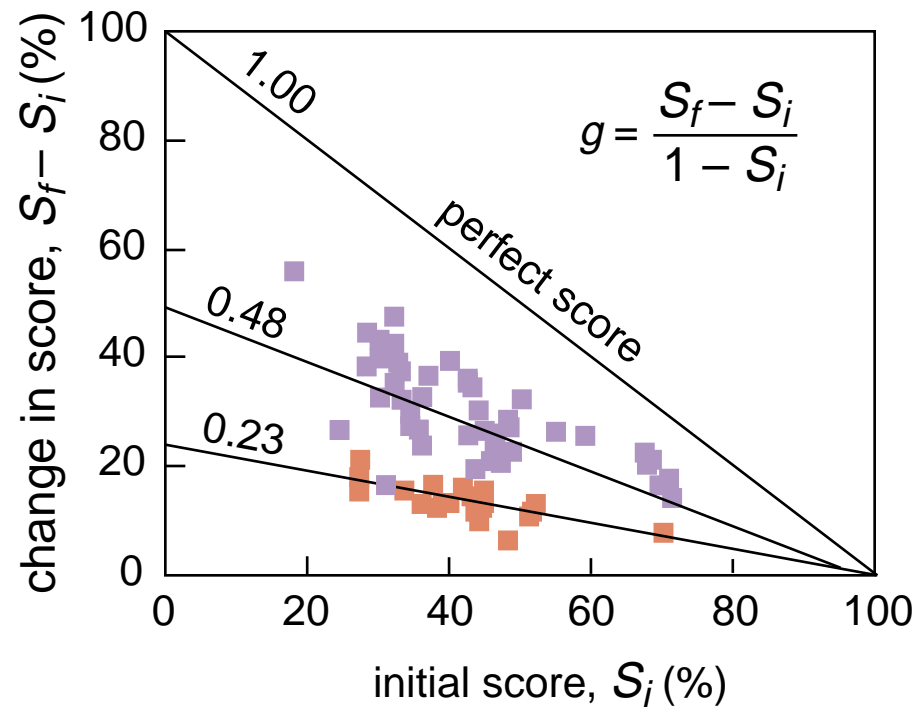
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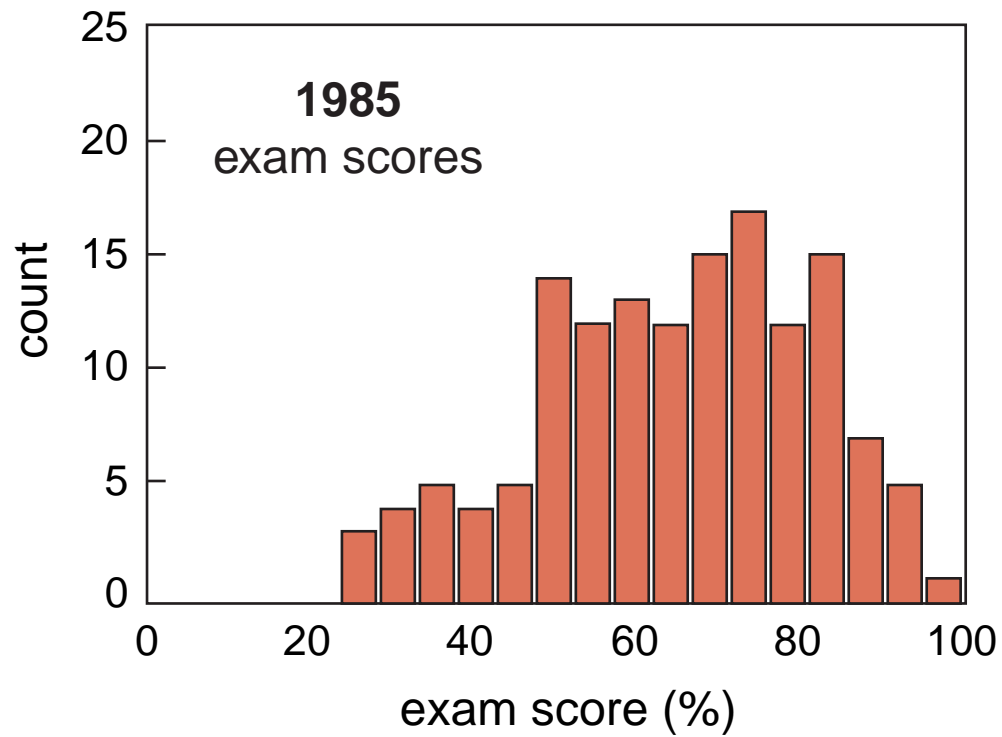
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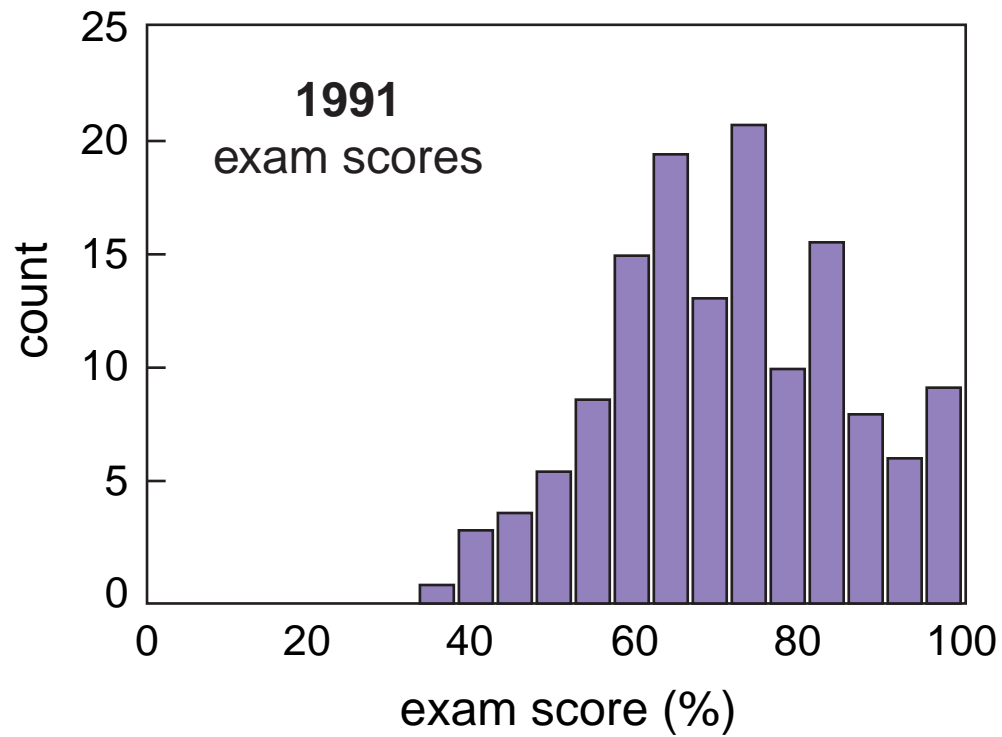
Results

What about problem solving...?

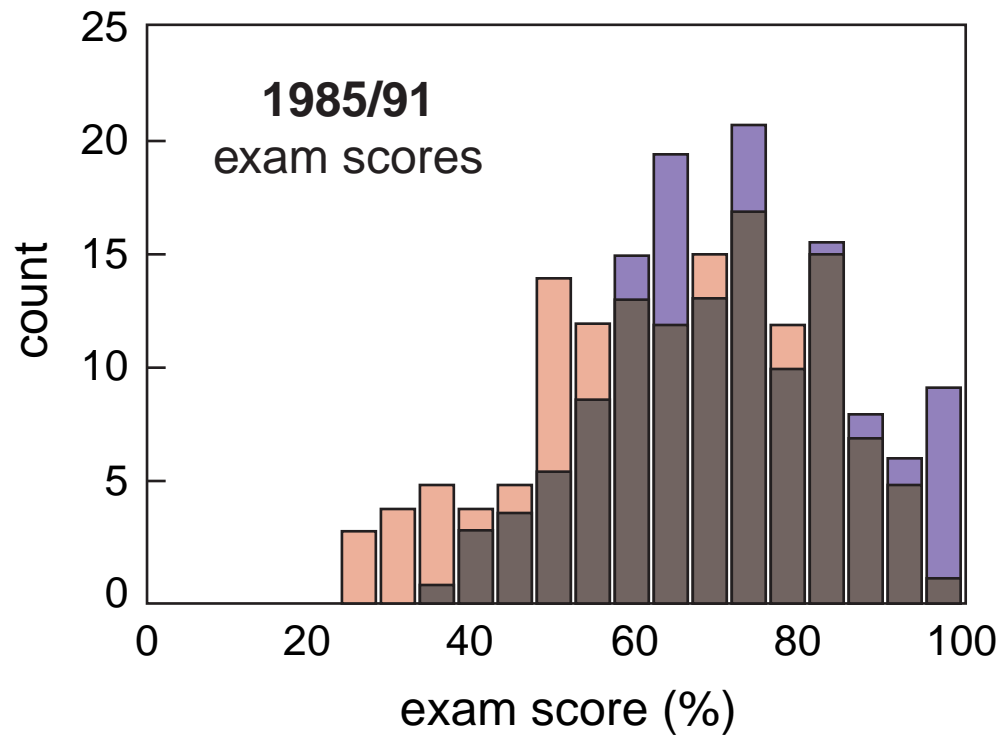
Results



Results



Results



Why it works for students

- ▶ focuses students on understanding

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- ▶ focuses students on understanding
- ▶ gets students thinking

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- ▶ gets students thinking
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- ▶ focuses students on understanding
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- ▶ uncovers misunderstandings
- ▶ builds confidence

Why it works for instructors

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Why it works for instructors

- ▶ **modification, not drastic change**

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Why it works for instructors

- ▶ **modification, not drastic change**
- ▶ **adaptable**

Why it works for instructors

- ▶ **modification, not drastic change**
- ▶ **adaptable**
- ▶ **resources (<http://galileo.harvard.edu>)**

Results

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

Results

So better understanding leads to better problem solving!

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

Conclusion

Challenges:

- ▶ **skepticism**
- ▶ **growing pains**

Conclusion

Rewards:

- ▶ engagement
- ▶ improved understanding
- ▶ class is fun!

Funding

National Science Foundation

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

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