

Turning lectures into learning



Turning Technologies User Conference
Leiden, Netherlands, 26 October 2016



Turning Technologies, LLC
turning ideas into solutions

Turning lectures into learning



@eric_mazur

Turning Technologies User Conference
Leiden, Netherlands, 26 October 2016



**Turning
Technologies, LLC**
turning ideas into solutions

Think of something you are good at — something that you know you do well.

Think of something you are good at — something that you know you do well.

How did you become good at this?

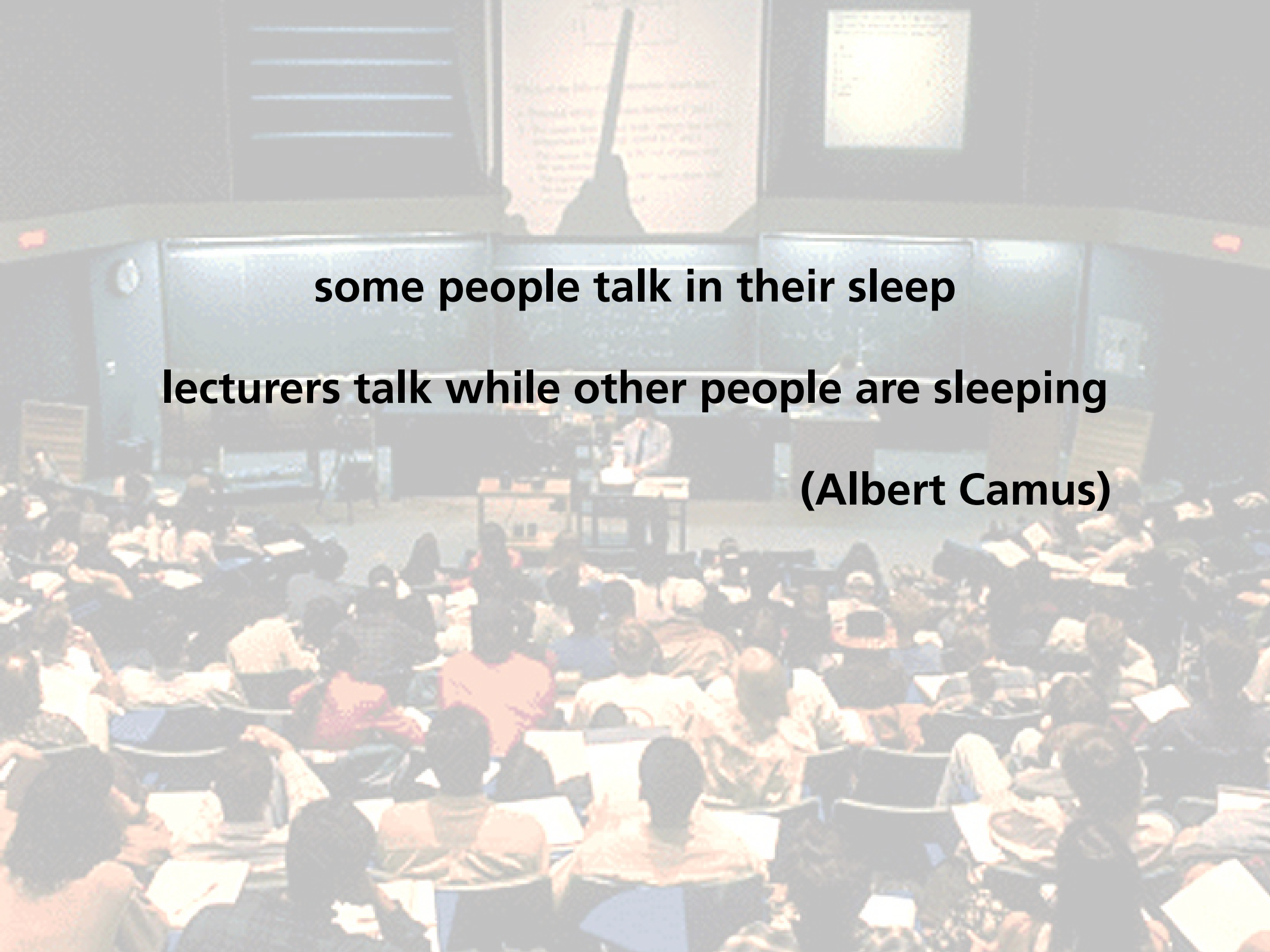
Became good at it by:

- 1. trial and error**
- 2. lectures**
- 3. practicing**
- 4. apprenticeship**
- 5. other**



A large lecture hall with a professor at a podium and students in the audience. The professor is standing at a podium on a stage, facing the audience. The audience is seated in rows of chairs, many with papers on their desks. The room has a curved wall and a large screen at the front. The text "some people talk in their sleep" is overlaid on the image.

some people talk in their sleep

A photograph of a large lecture hall. A lecturer is standing at a podium at the front of the room, facing a large audience of students seated at desks. The room is dimly lit, and the text is overlaid on the image.

some people talk in their sleep
lecturers talk while other people are sleeping
(Albert Camus)



What are the following...
1. Personal...
2. The...
3. The...
4. The...
5. The...

...
...
...
...
...

...
...
...
...
...

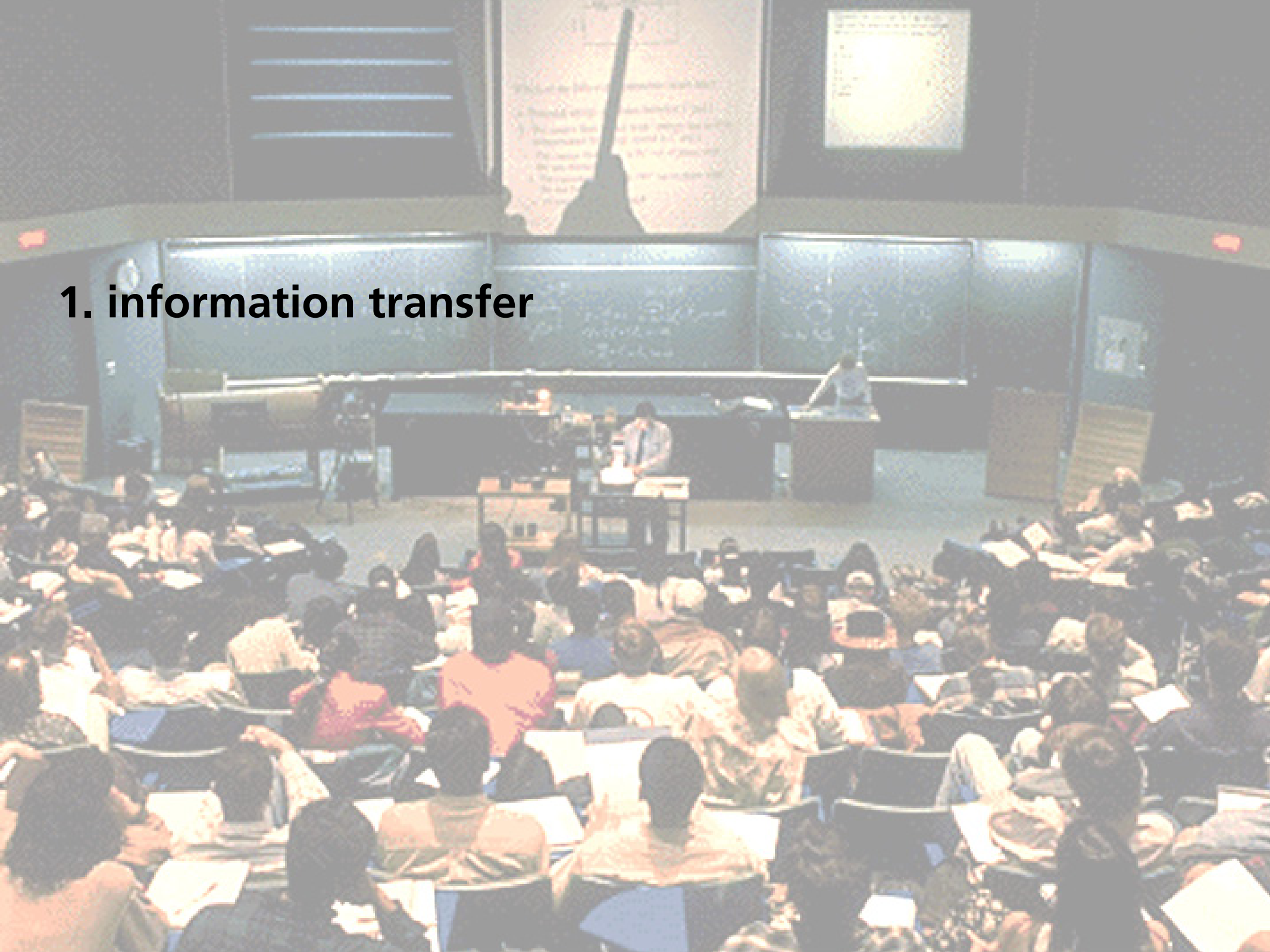
...
...
...
...
...

...
...
...
...
...

...
...
...
...
...

...
...
...
...
...

1. information transfer





1. information transfer

2. assimilation of information

A large lecture hall with a professor at a podium and students seated at desks. The room is filled with students, and the professor is standing at the front, addressing the class. The background features a large screen displaying text and a chalkboard with some writing.

1. information transfer (easy)

2. assimilation of information (hard and left to student)



1 Peer Instruction



1 Peer Instruction

2 let's try it!



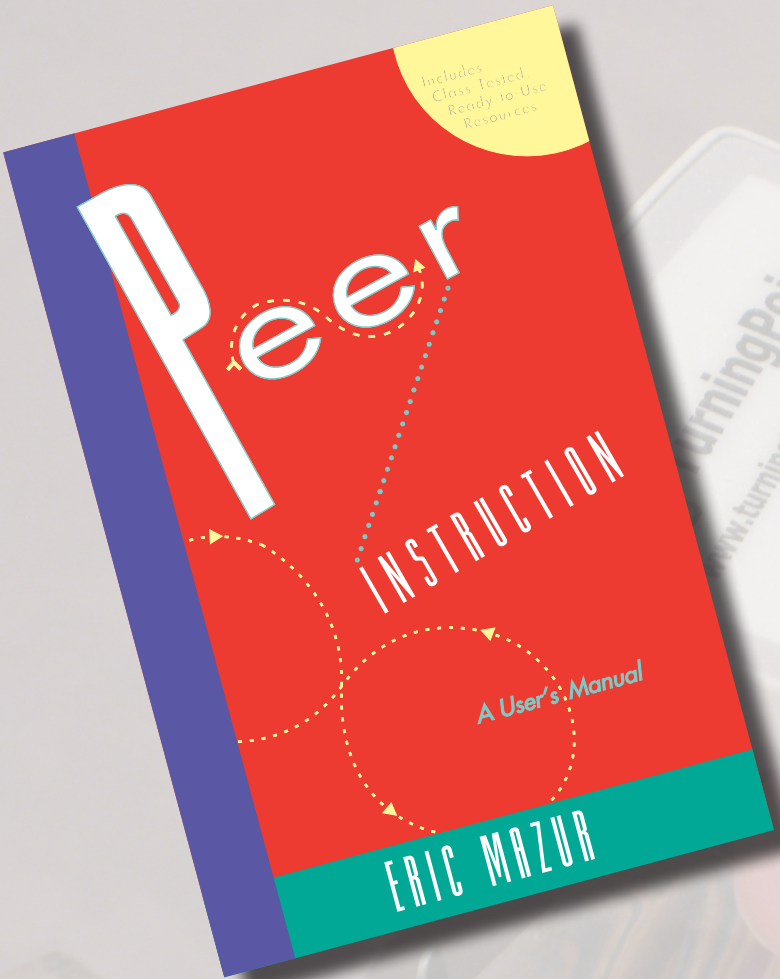
1 Peer Instruction

2 let's try it!

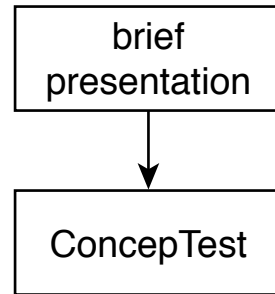
3 results

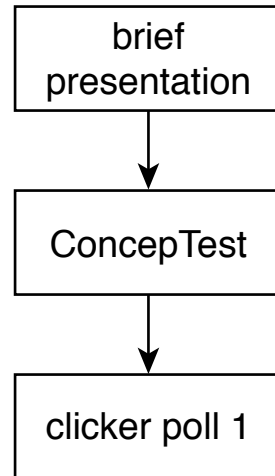
**move information transfer
out of classroom**

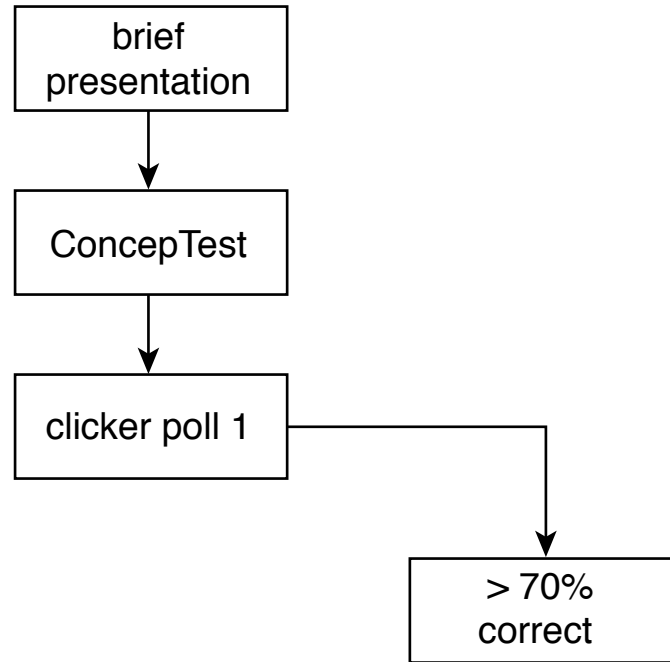
- **assign reading**
- **teach by questioning**

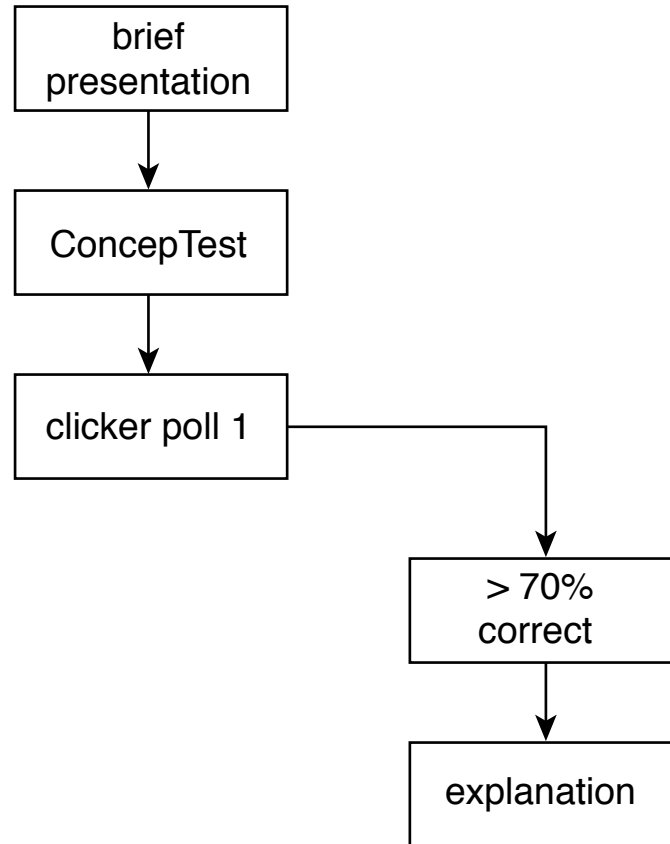


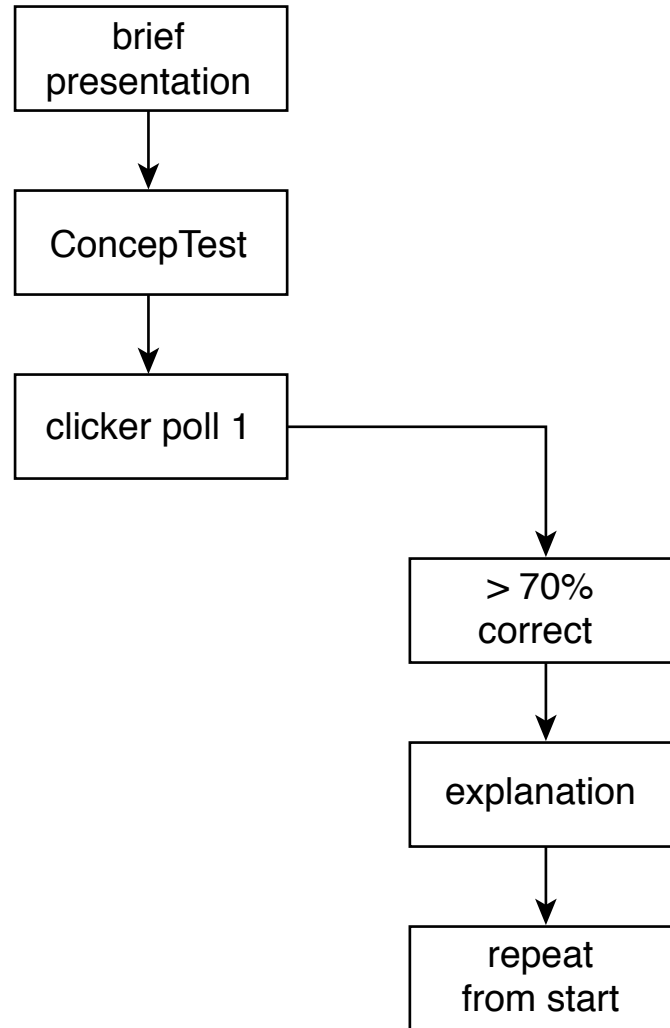
brief
presentation

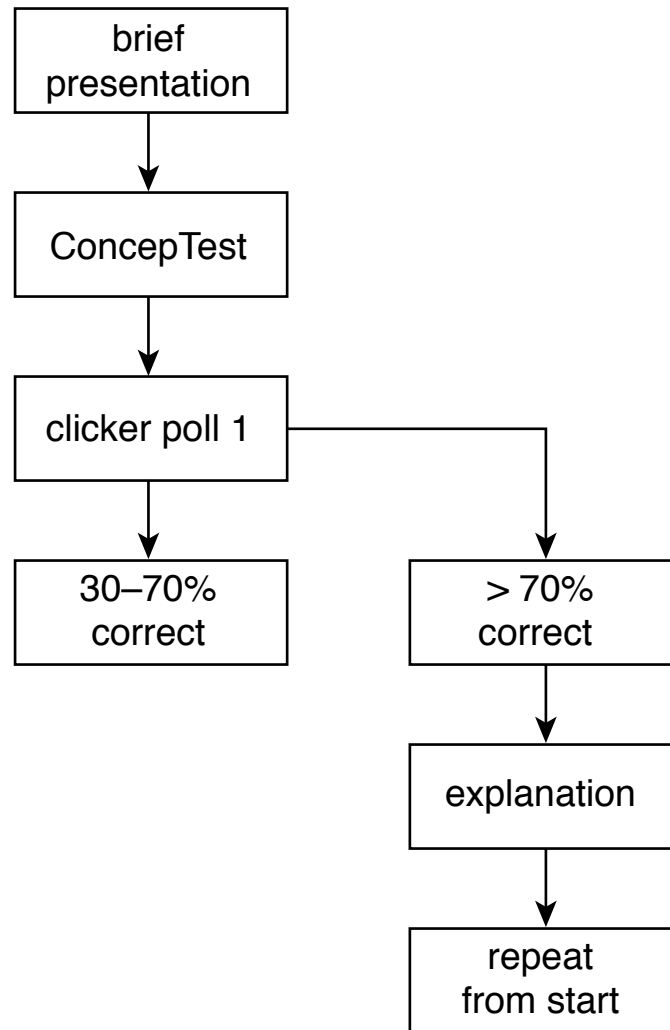


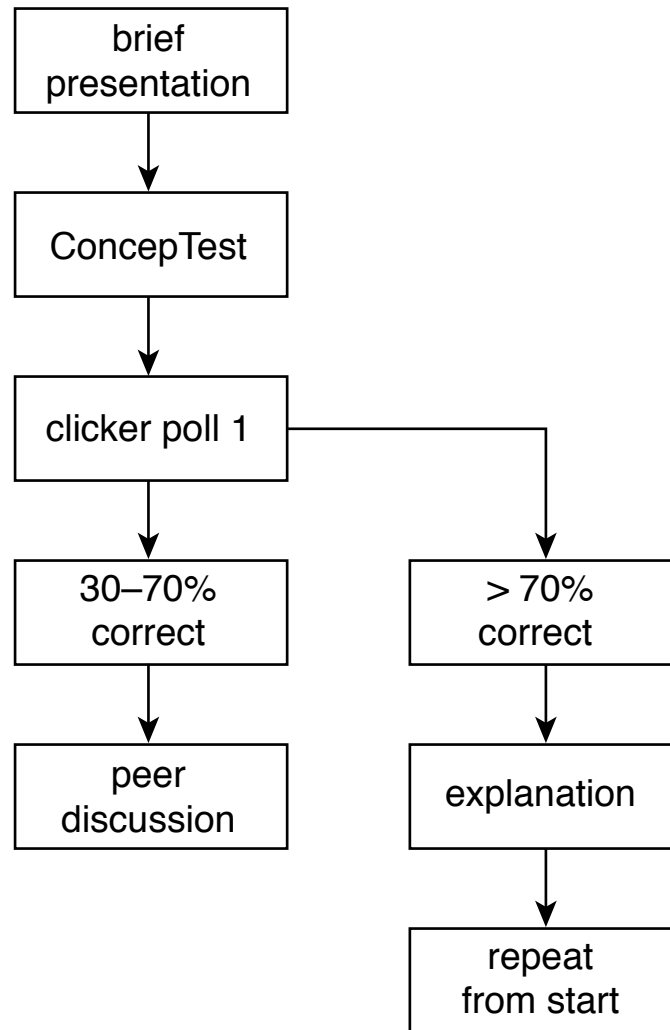


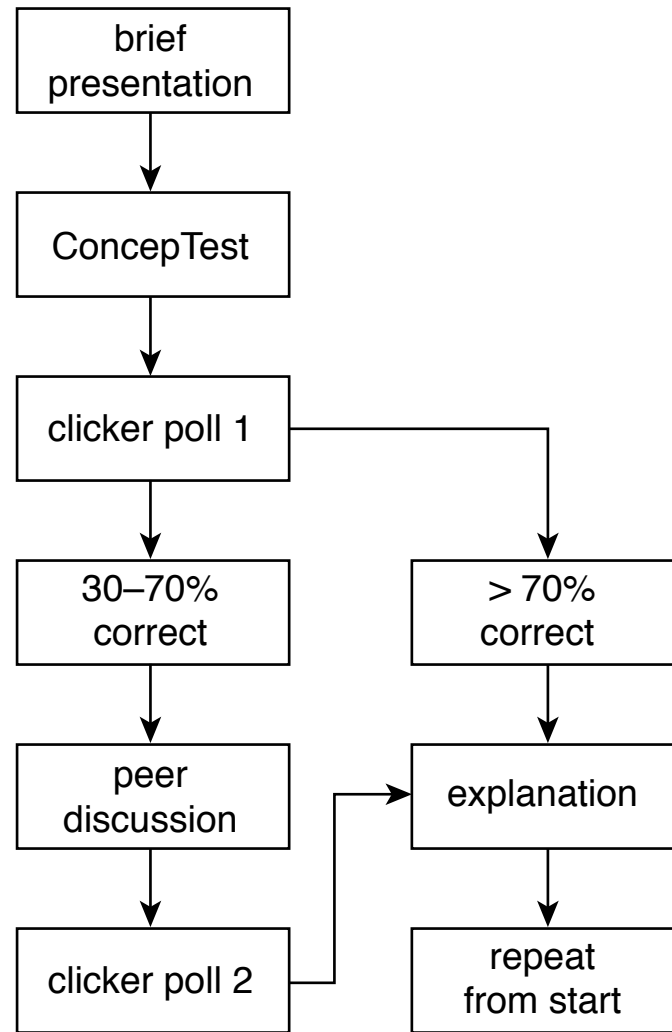


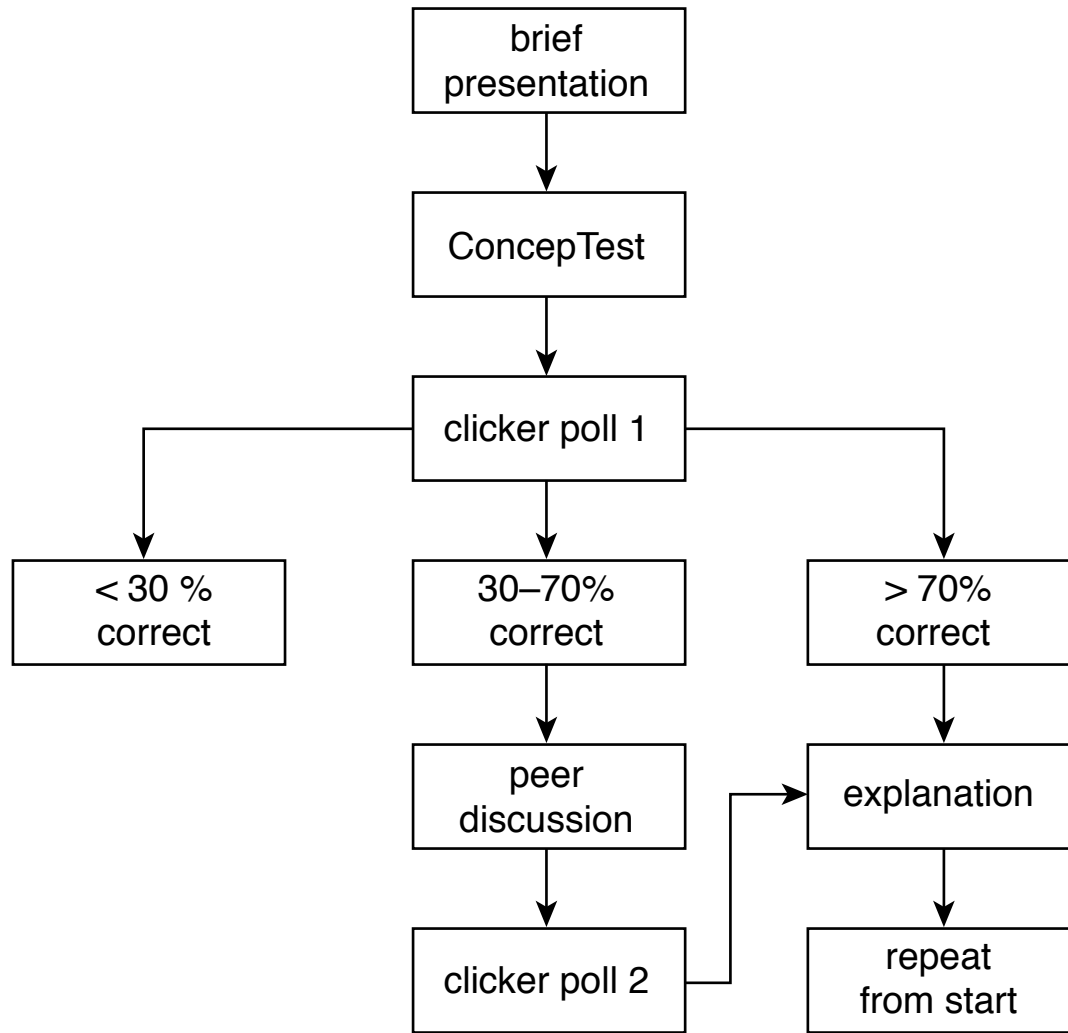


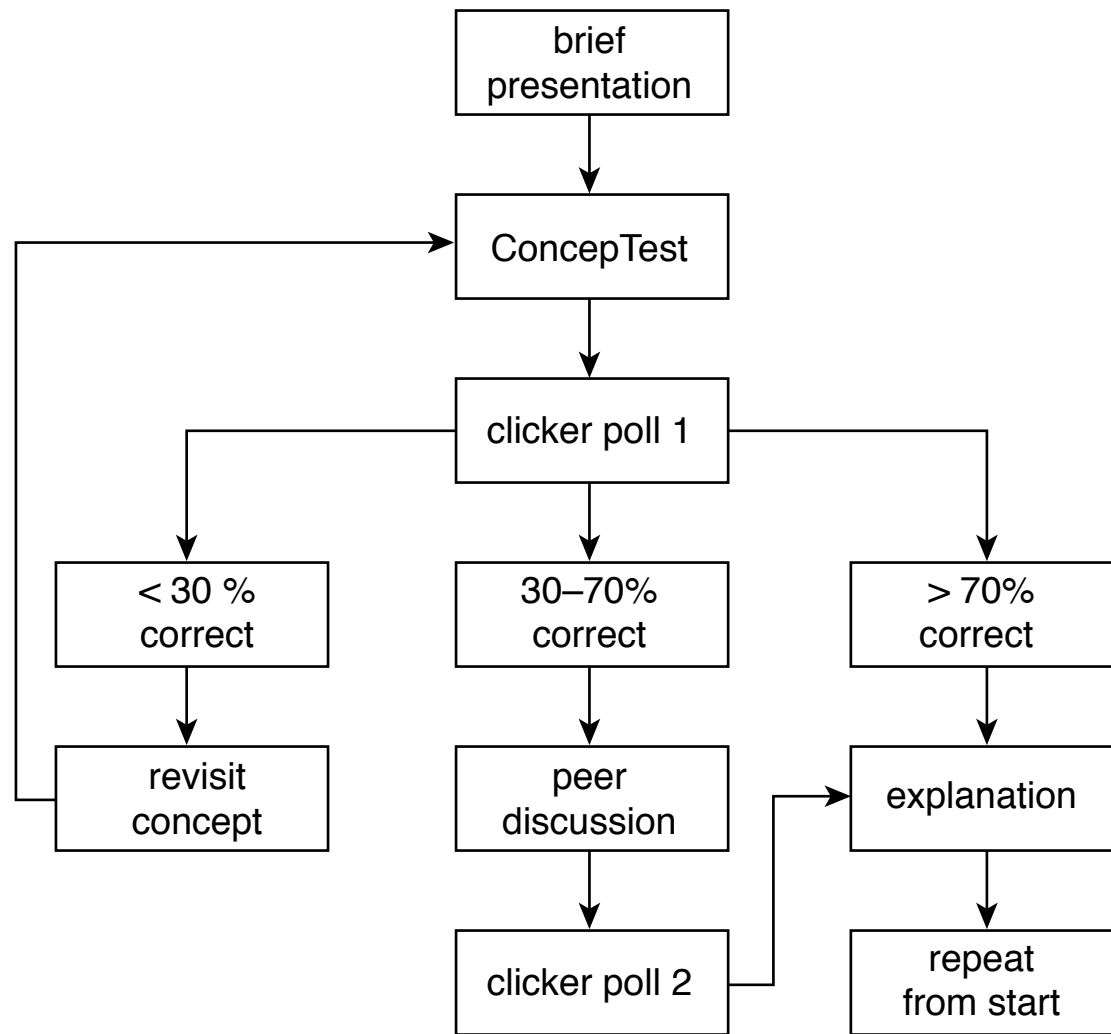


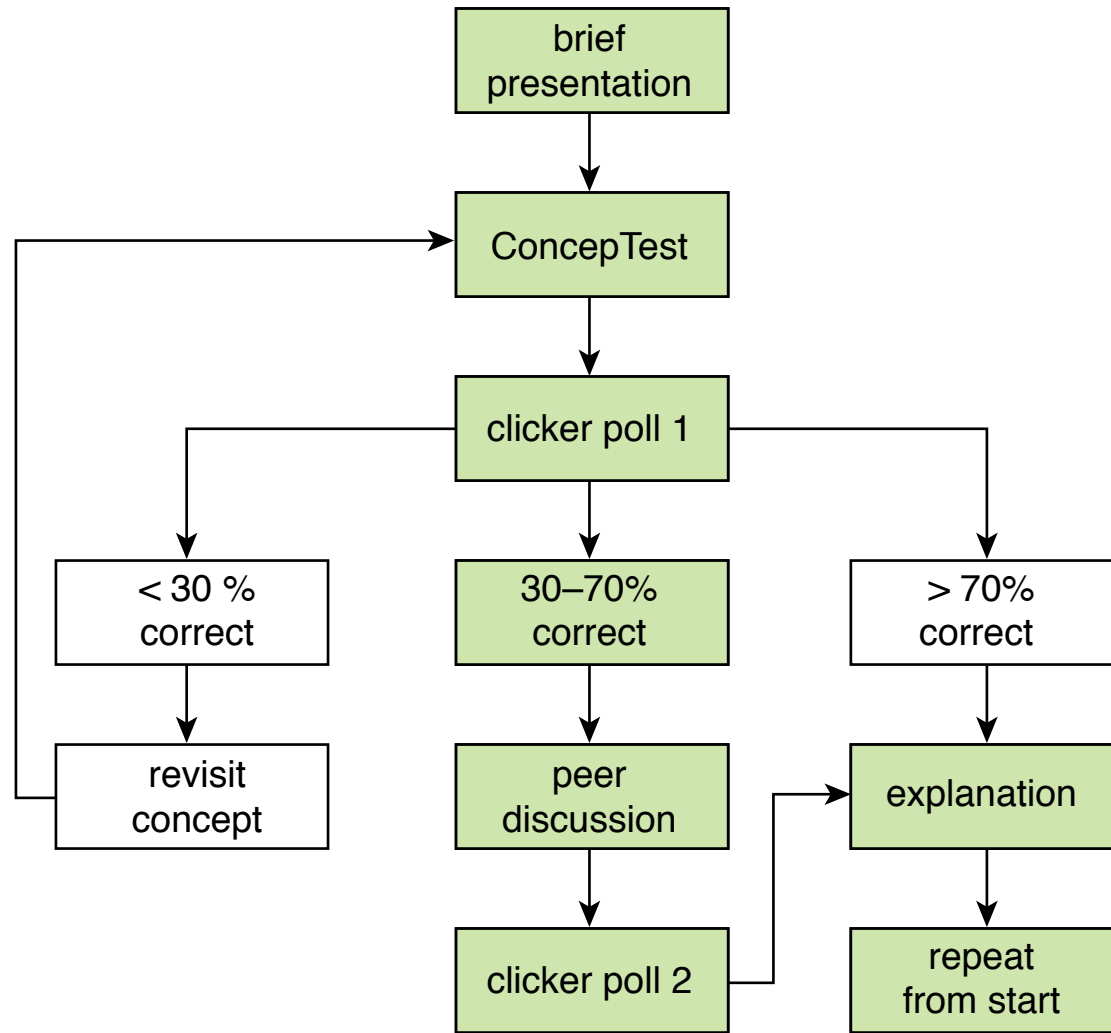












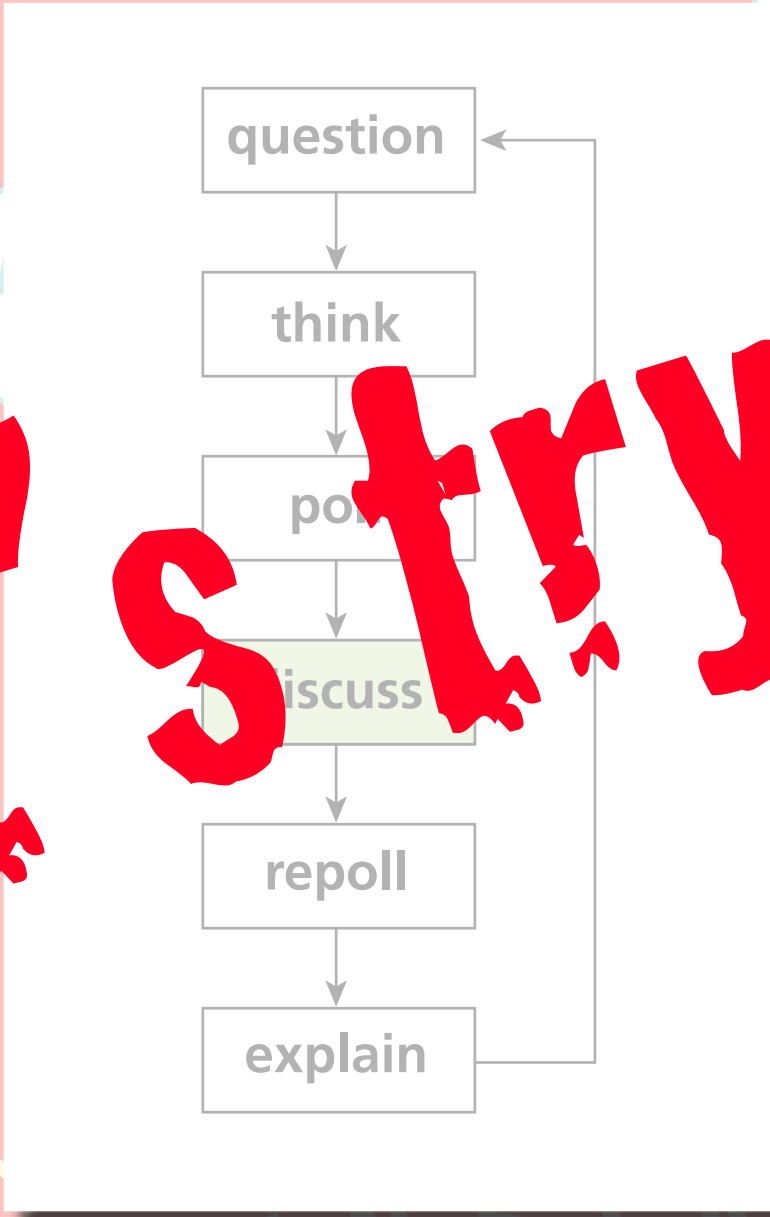


Let's try it!

QUESTION

Let's try it!

ACTION



1 Peer Instruction

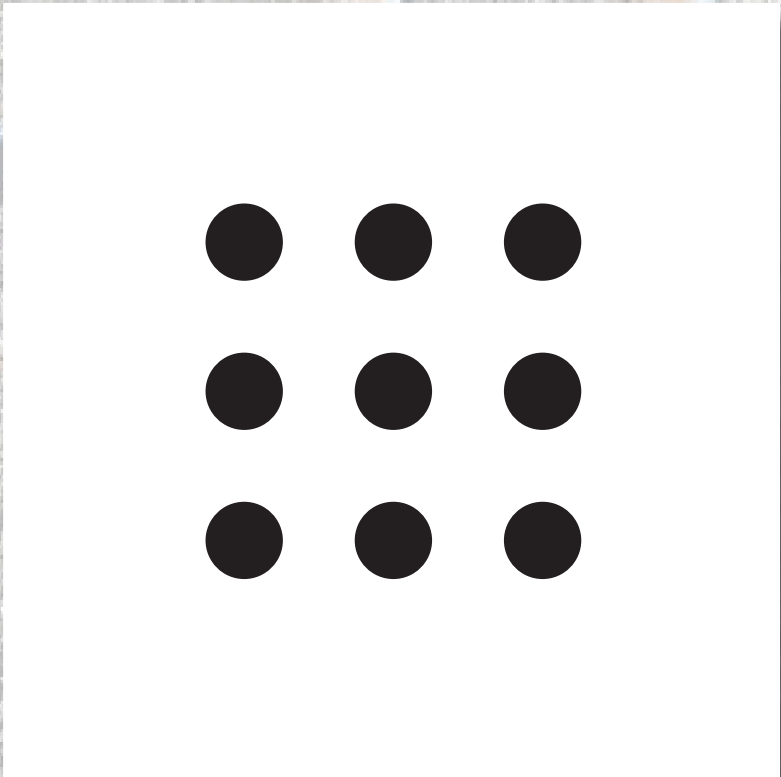
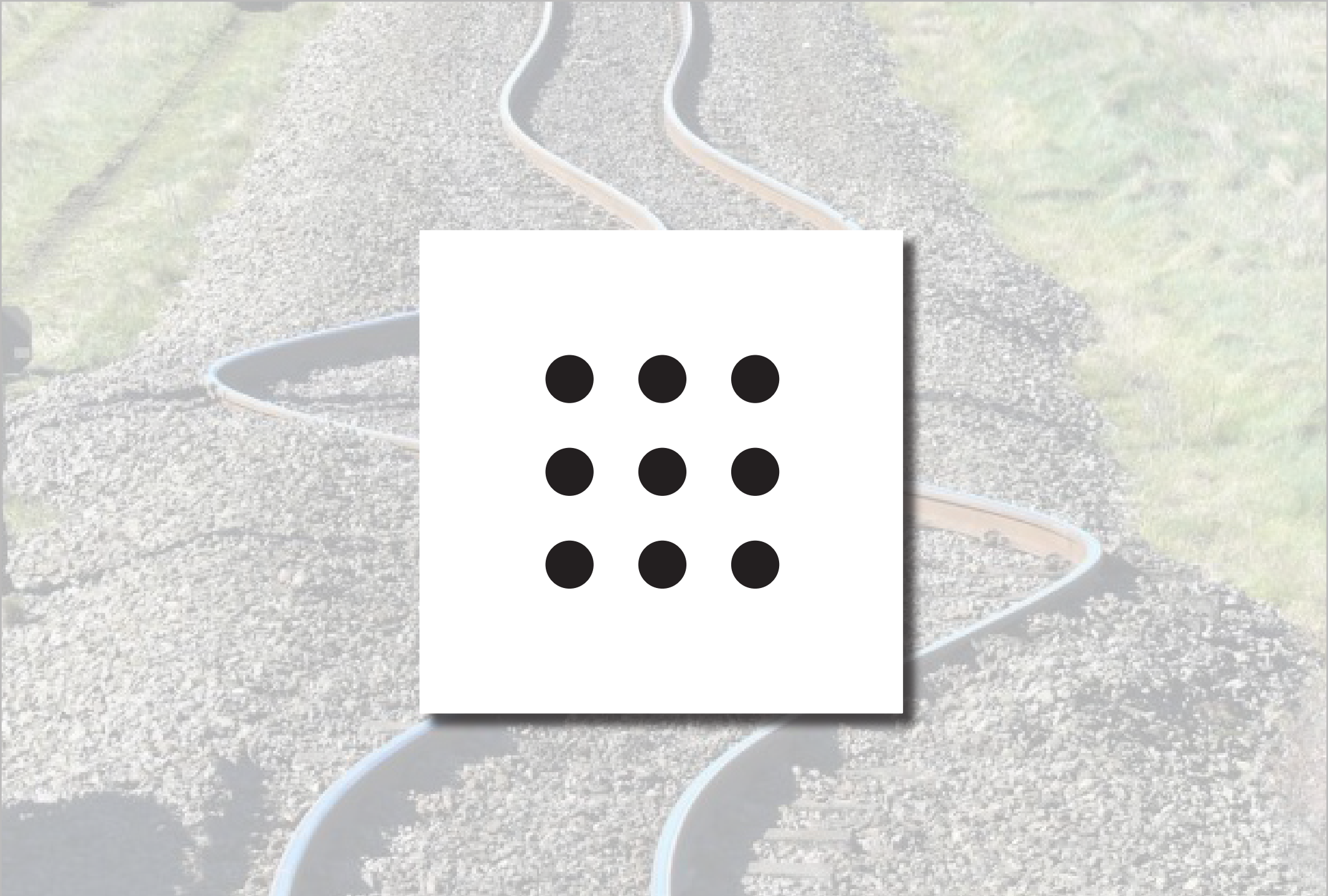
2 let's try it!

A photograph of a gravel path with a blue wavy line drawn on it, illustrating thermal expansion. The path is made of grey gravel and is flanked by green grass. The blue line is a continuous, wavy pattern that follows the path's length, demonstrating how a material expands when heated.

thermal expansion

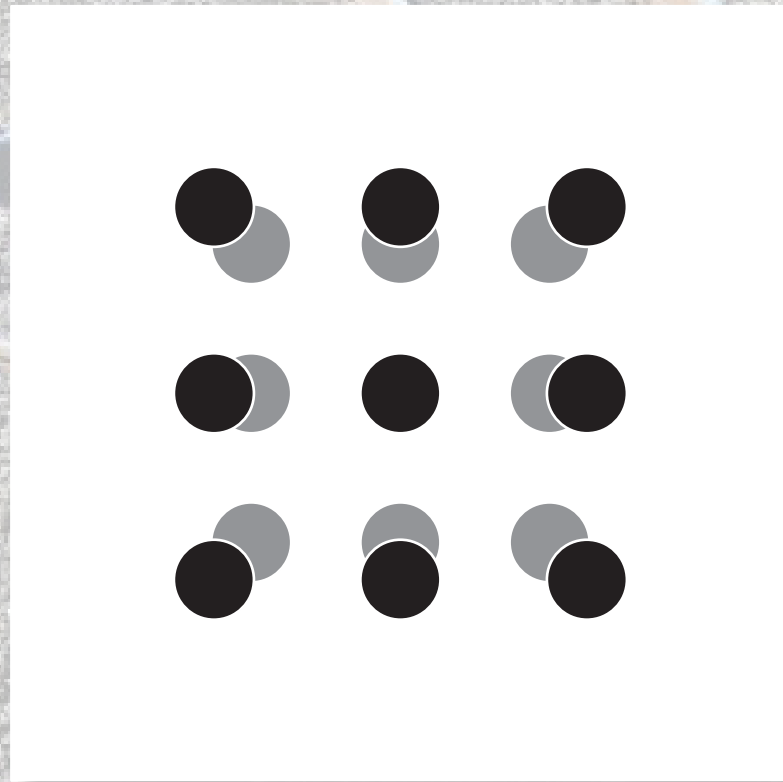
1 Peer Instruction

2 let's try it!



1 Peer Instruction

2 let's try it!



1 Peer Instruction

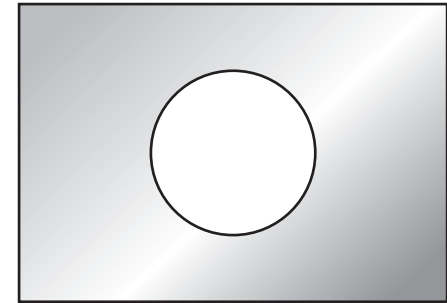
2 let's try it!

all of them!

1 Peer Instruction

2 let's try it!

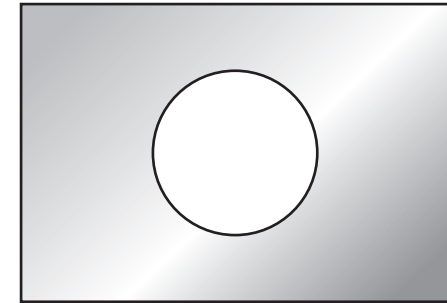
**Consider a rectangular metal plate
with a circular hole in it.**



1 Peer Instruction

2 let's try it!

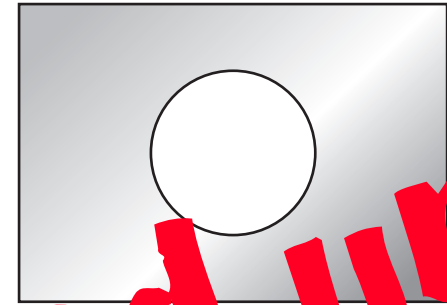
Consider a rectangular metal plate with a circular hole in it.



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

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

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

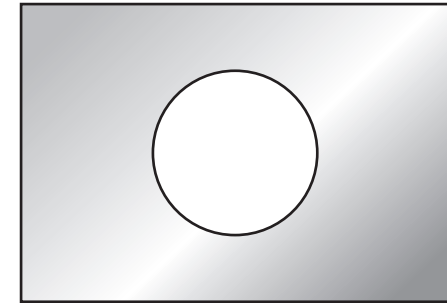


When the plate is uniformly heated, the diameter of the hole

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

you got all fired up!

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



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

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

Before I tell you the answer...

1 Peer Instruction

2 let's try it!

Before I tell you the answer, let's analyze what happened.

1 Peer Instruction

2 let's try it!

Before I tell you the answer, let's analyze what happened.

You...

Before I tell you the answer, let's analyze what happened.

You...

1. made a commitment

Before I tell you the answer, let's analyze what happened.

You...

- 1. made a commitment**
- 2. externalized your answer**

Before I tell you the answer, let's analyze what happened.

You...

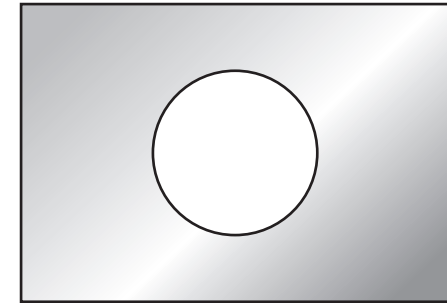
- 1. made a commitment**
- 2. externalized your answer**
- 3. moved from the answer/fact to reasoning**

Before I tell you the answer, let's analyze what happened.

You...

- 1. made a commitment**
- 2. externalized your answer**
- 3. moved from the answer/fact to reasoning**
- 4. became emotionally invested in the learning process**

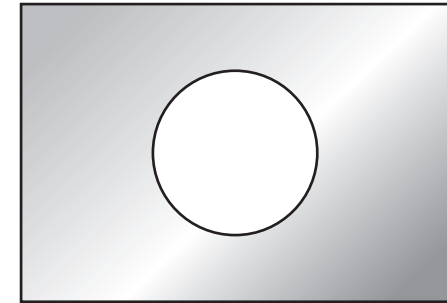
Consider a rectangular metal plate with a circular hole in it.



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

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

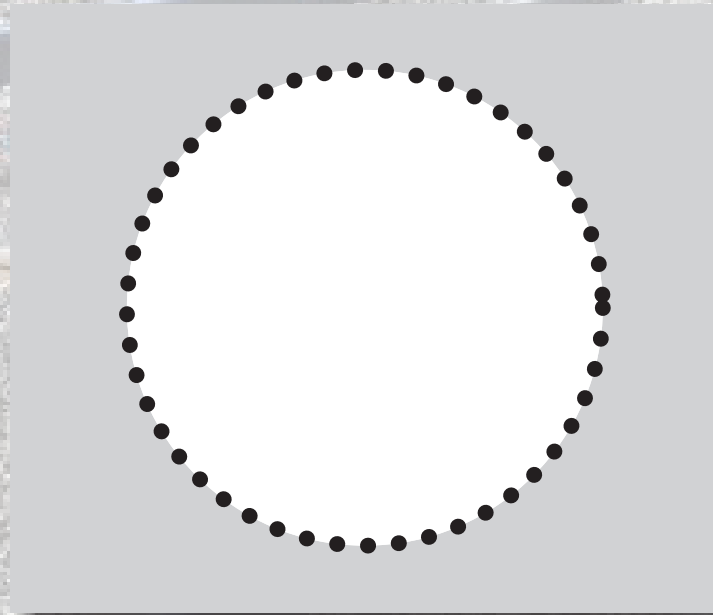
Consider a rectangular metal plate with a circular hole in it.



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

- 1. increases. ✓**
2. stays the same.
3. decreases.

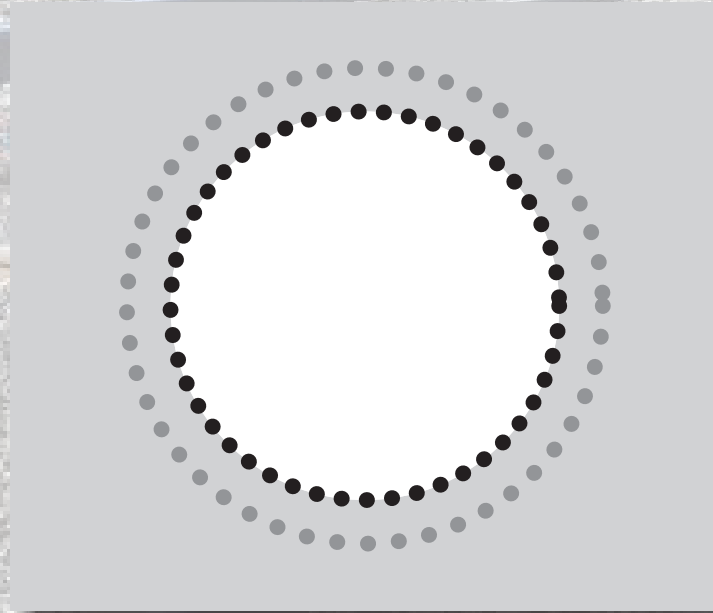
consider atoms at rim of hole



1 Peer Instruction

2 let's try it!

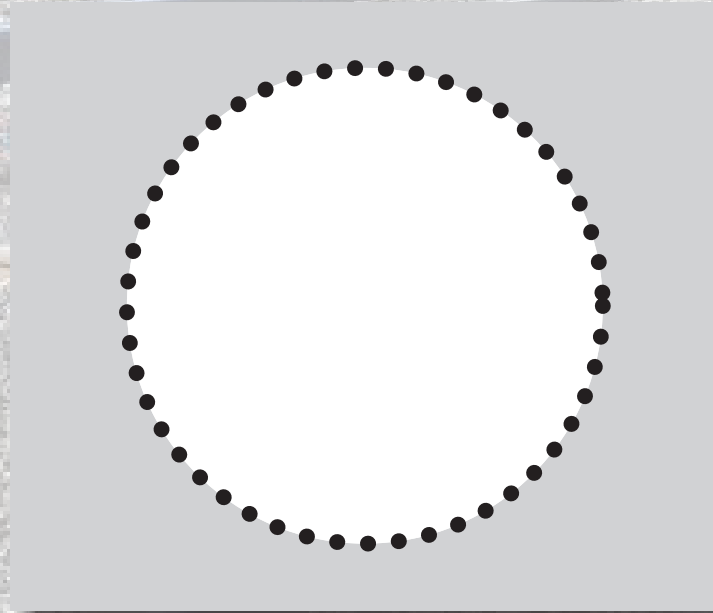
consider atoms at rim of hole



1 Peer Instruction

2 let's try it!

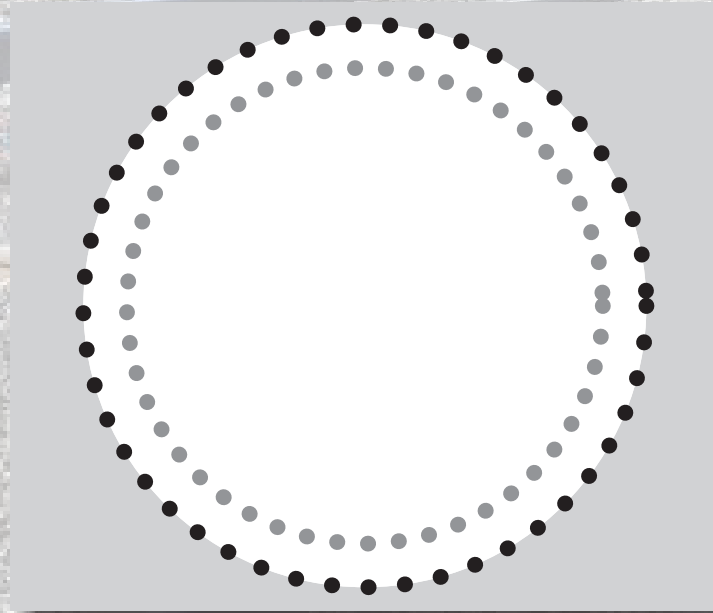
consider atoms at rim of hole



1 Peer Instruction

2 let's try it!

consider atoms at rim of hole



1 Peer Instruction

2 let's try it!

consider atoms at rim of hole

you won't forget this



1 Peer Instruction

2 let's try it!

Peer

back to pi

INSTRUCTION

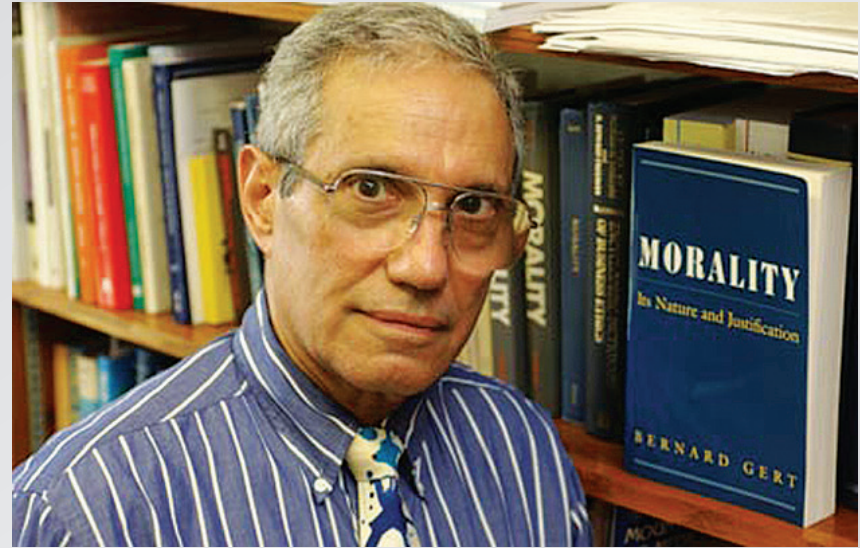
1 Peer Instruction

2 let's try it!

Bernard Gert (1934 – 2011)

Moral philosopher

Professor at Dartmouth

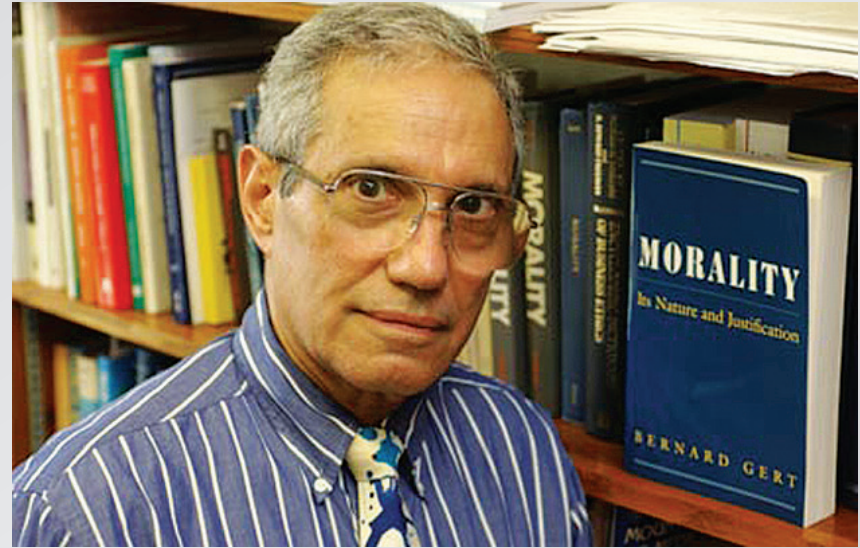


1 Peer Instruction

2 let's try it!

Bernard Gert (1934 – 2011)

**Moral philosopher
Professor at Dartmouth**



“Morality is an informal public system applying to all rational persons, governing behavior that affects others, and includes what are commonly known as the moral rules, ideals, and virtues and has the lessening of evil or harm as its goal.”

1 Peer Instruction

2 let's try it!

Bernard Gert's moral system created by 10 rules:

- 1. Do not kill**
- 2. Do not cause pain**
- 3. Do not disable**
- 4. Do not deprive of freedom**
- 5. Do not deprive of pleasure**
- 6. Do not deceive**
- 7. Keep your promises**
- 8. Do not cheat**
- 9. Obey the law**
- 10. Do your duty (as required by job, circumstances).**

Heinz's wife was near death, and her only hope was a drug that had been discovered by a pharmacist who was selling it for an exorbitant price. The drug cost \$20,000 to make, and the pharmacist was selling it for \$200,000. Heinz could only raise \$50,000 and insurance wouldn't make up the difference. He offered what he had to the pharmacist, and when his offer was rejected, Heinz said he would pay the rest later. Still the pharmacist refused. In desperation, Heinz broke into the store and stole the drug.

1 Peer Instruction

2 let's try it!

Heinz's wife was near death, and her only hope was a drug that had been discovered by a pharmacist who was selling it for an exorbitant price. The drug cost \$20,000 to make, and the pharmacist was selling it for \$200,000. Heinz could only raise \$50,000 and insurance wouldn't make up the difference. He offered what he had to the pharmacist, and when his offer was rejected, Heinz said he would pay the rest later. Still the pharmacist refused. In desperation, Heinz broke into the store and stole the drug.

Should Heinz have broken into the store to steal the drug for his wife?

1 Peer Instruction

2 let's try it!

Bernard Gert's moral system created by 10 rules:

- 1. Do not kill**
- 2. Do not cause pain**
- 3. Do not disable**
- 4. Do not deprive of freedom**
- 5. Do not deprive of pleasure**
- 6. Do not deceive**
- 7. Keep your promises**
- 8. Do not cheat**
- 9. Obey the law**
- 10. Do your duty (as required by job, circumstances).**

Bernard Gert's moral system created by 10 rules:

1. Do not kill
2. Do not cause pain
3. Do not disable
4. Do not deprive of freedom
5. Do not deprive of pleasure
6. Do not deceive
7. Keep your promises
8. Do not cheat
9. Obey the law
10. Do your duty (as required by job, circumstances).

Should Heinz have broken into the store to steal the drug for his wife?

- 1. Yes**
- 2. No**



1 Peer Instruction

2 let's try it!

Bernard Gert's moral system created by 10 rules:

1. Do not kill
2. Do not cause pain
3. Do not disable
4. Do not deprive of freedom
5. Do not deprive of pleasure
6. Do not deceive
7. Keep your promises
8. Do not cheat
9. Obey the law
10. Do your duty (as required by job, circumstances).

Should Heinz have broken into the store to steal the drug for his wife?

1. Yes
2. No

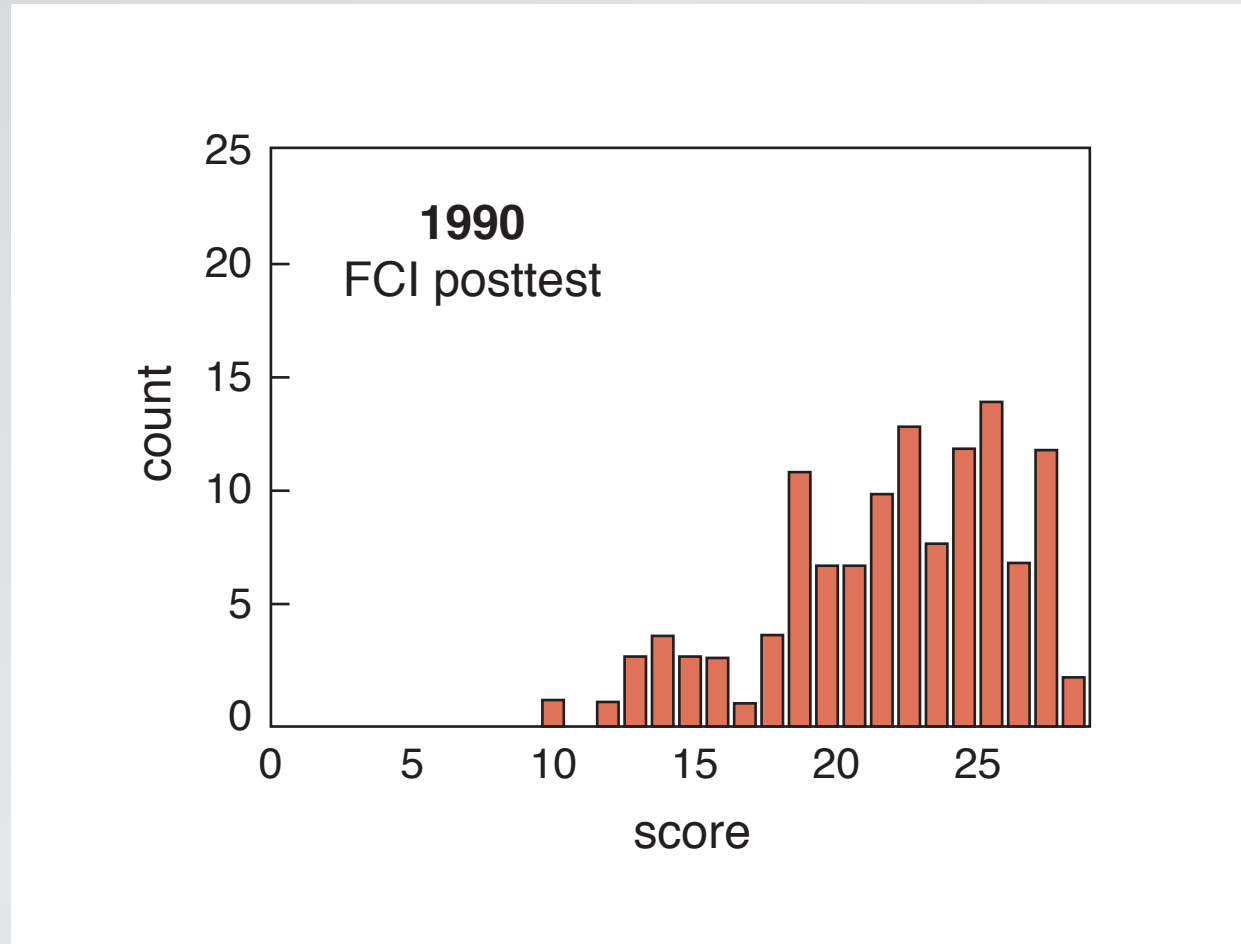
you got all engaged!



1 Peer Instruction

2 let's try it!

traditional instruction

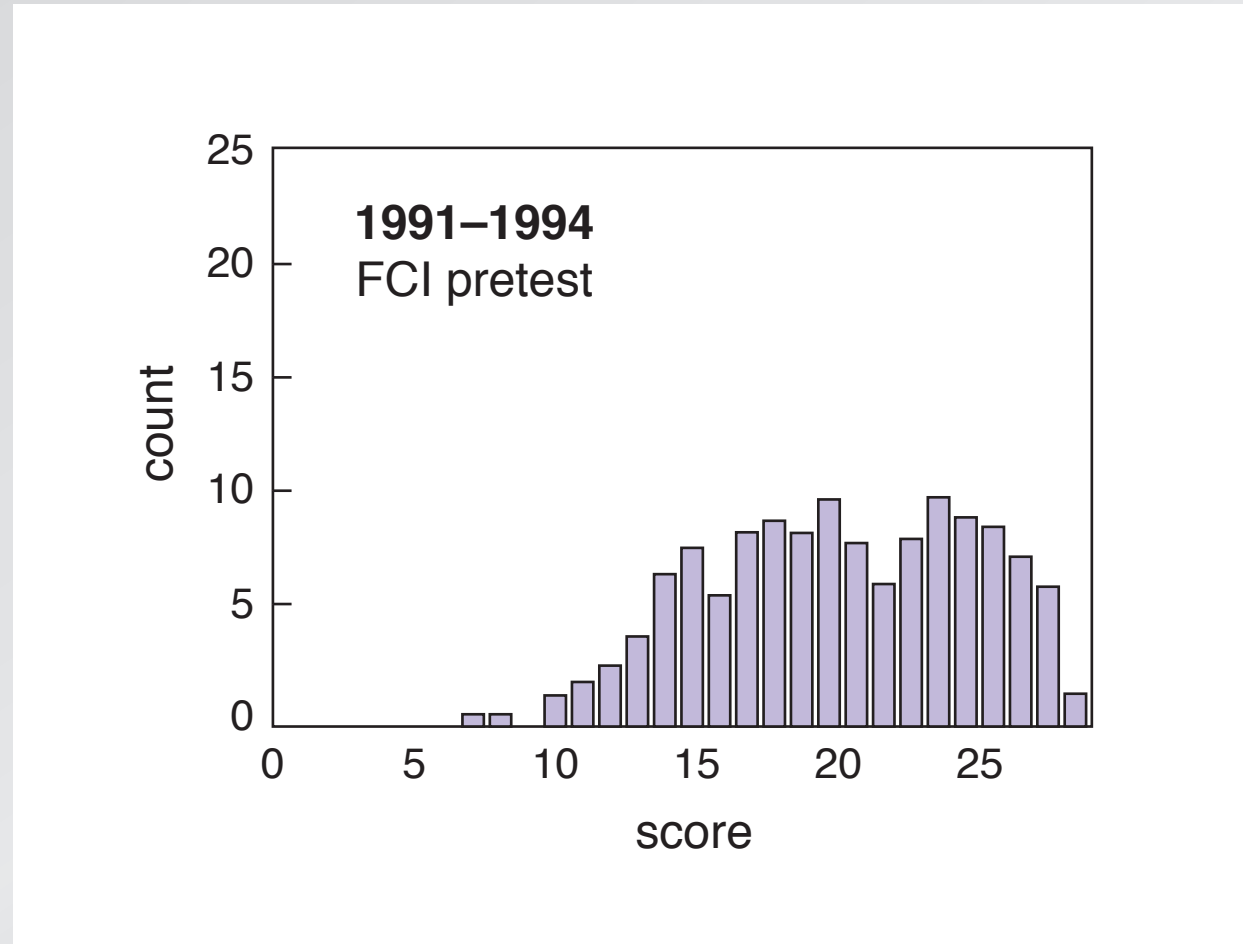


1 Peer Instruction

2 let's try it!

3 results

traditional instruction

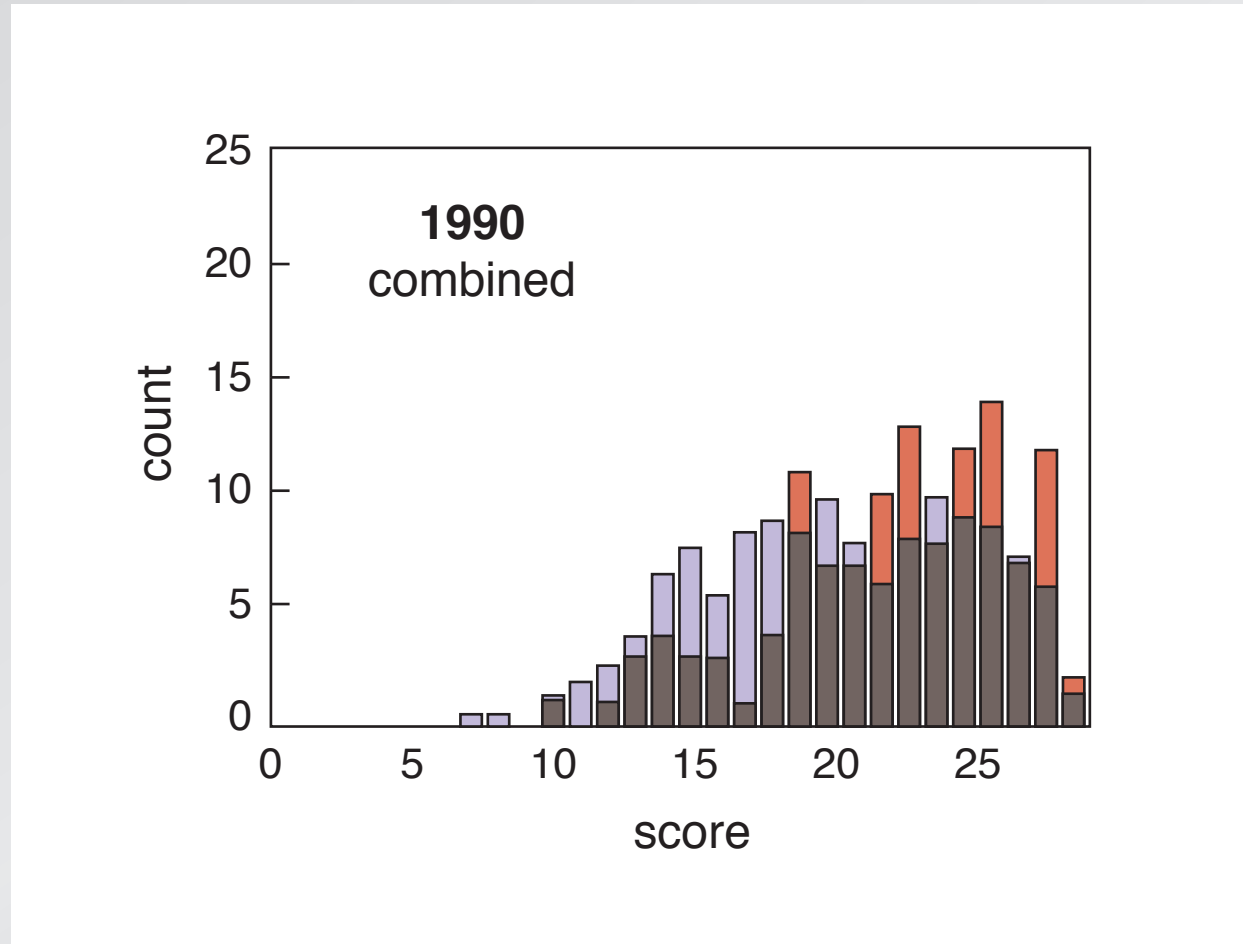


1 Peer Instruction

2 let's try it!

3 results

traditional instruction

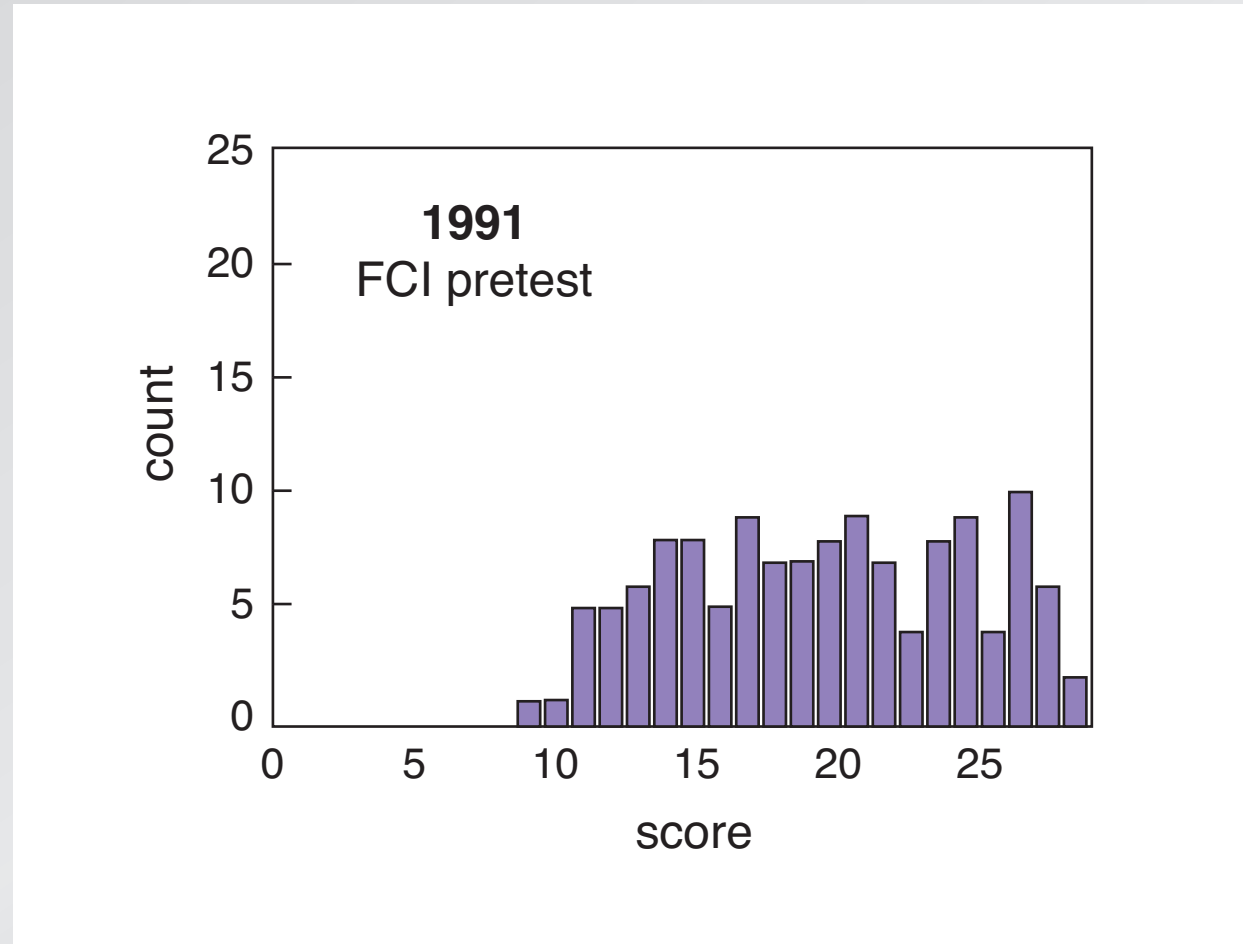


1 Peer Instruction

2 let's try it!

3 results

first year of implementing PI

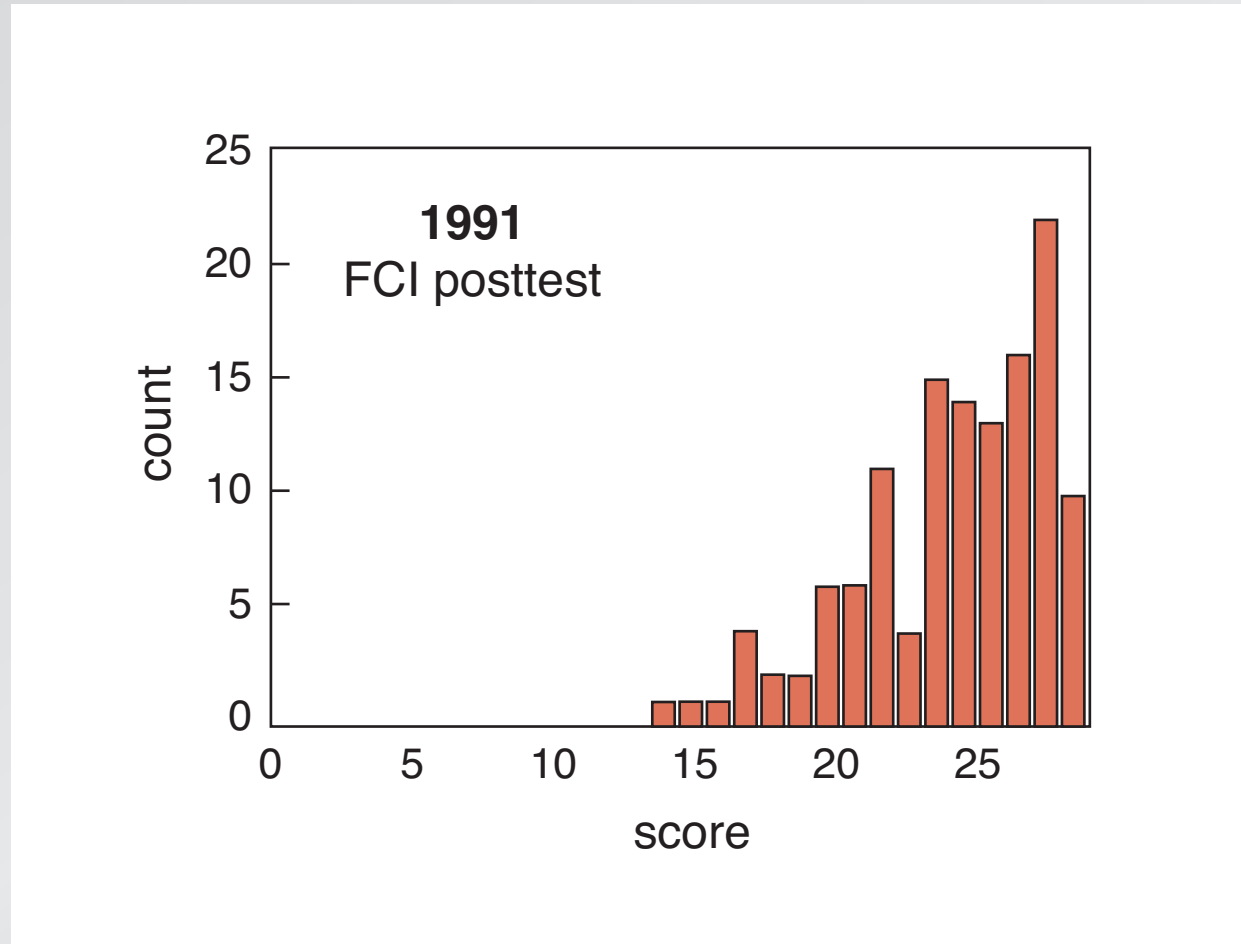


1 Peer Instruction

2 let's try it!

3 results

first year of implementing PI

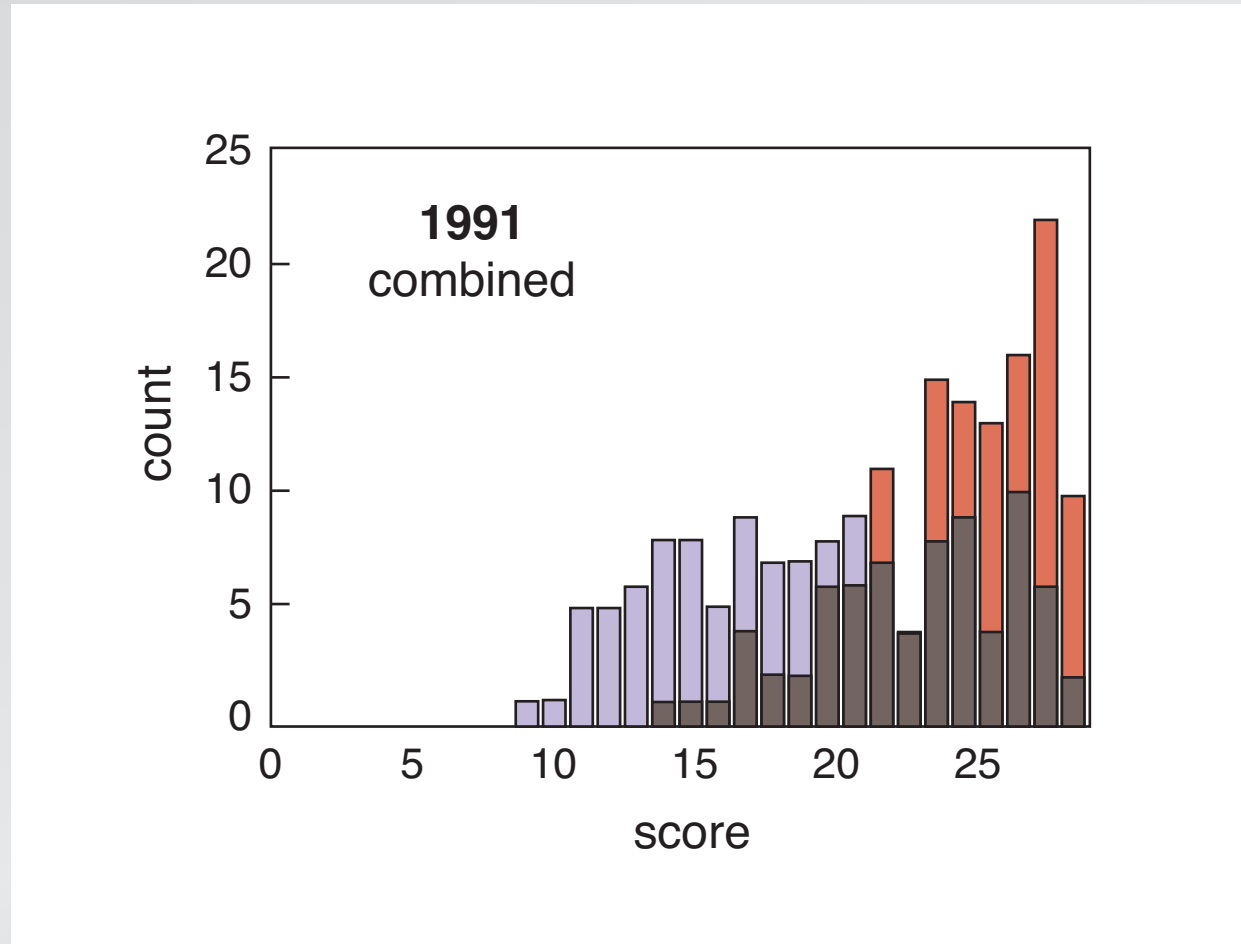


1 Peer Instruction

2 let's try it!

3 results

first year of implementing PI



1 Peer Instruction

2 let's try it!

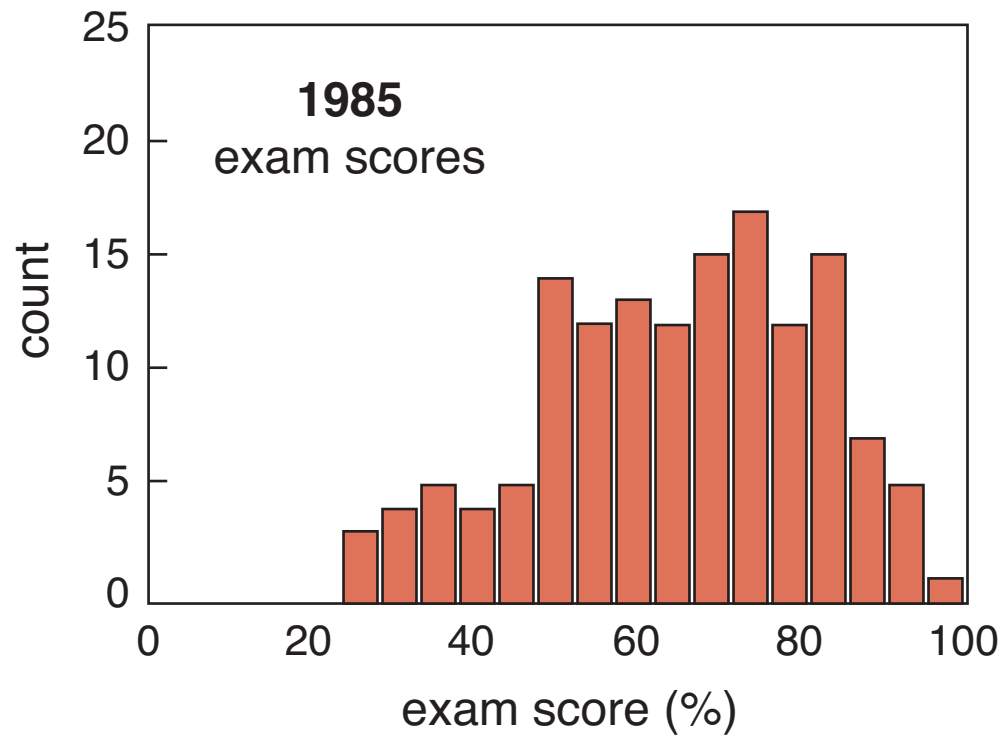
3 results

what about problem solving?

1 Peer Instruction

2 let's try it!

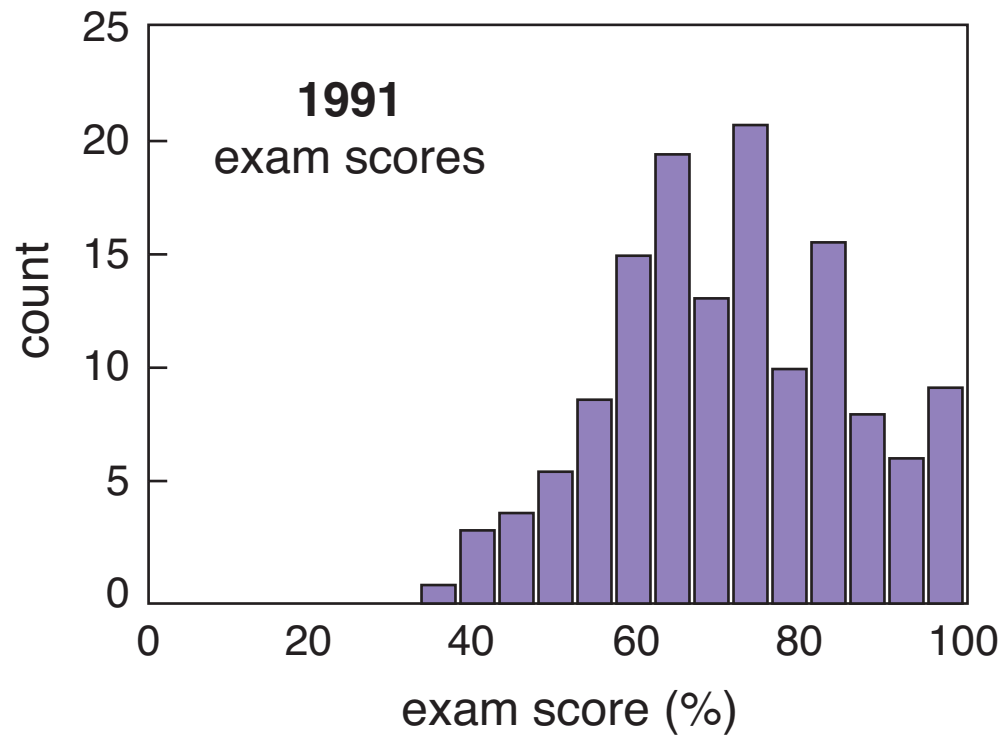
3 results



1 Peer Instruction

2 let's try it!

3 results

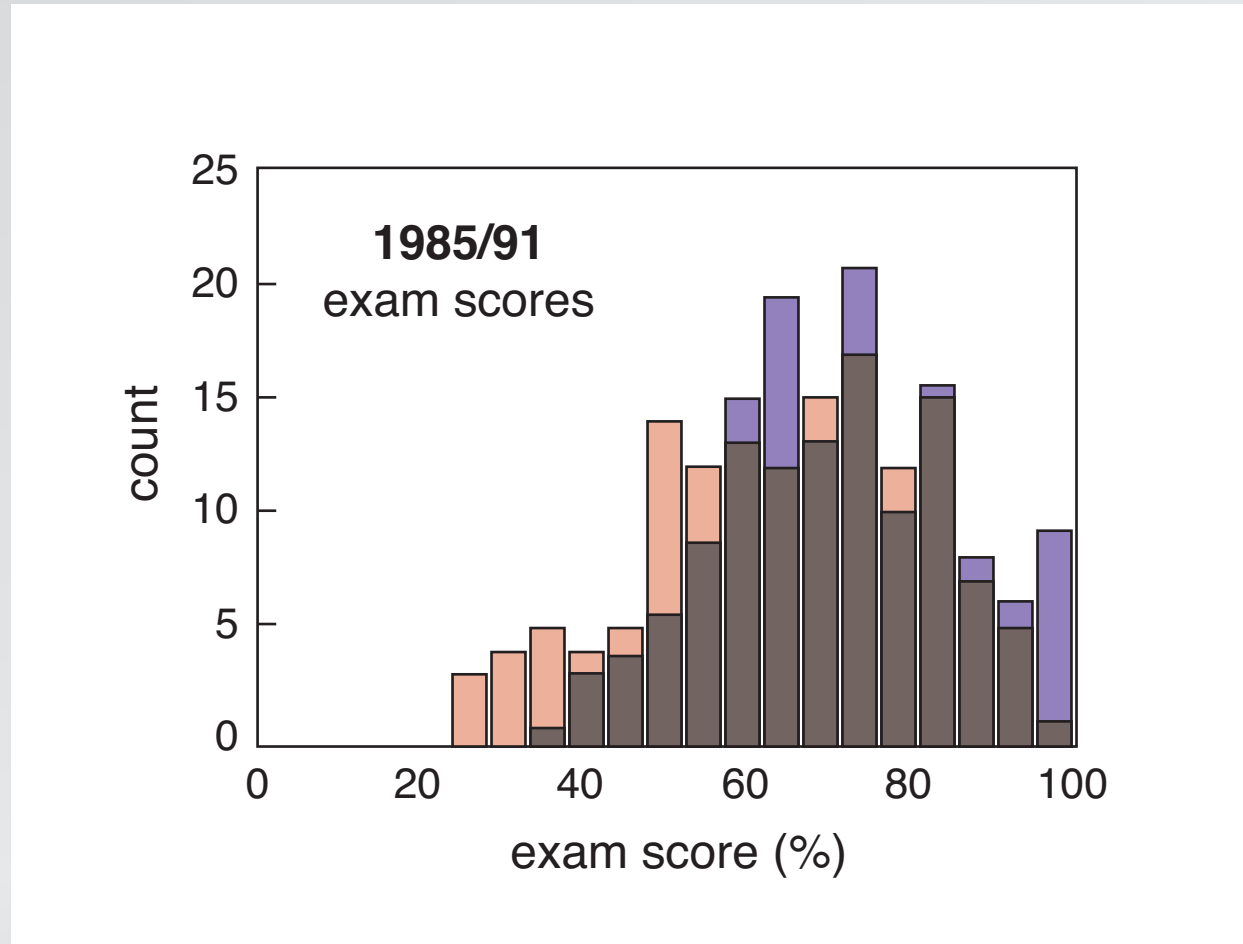


1 Peer Instruction

2 let's try it!

3 results

better understanding leads to better problem solving



1 Peer Instruction

2 let's try it!

3 results



1 Peer Instruction

2 let's try it!

3 results

in a lecture, students...

1 Peer Instruction

2 let's try it!

3 results

in a lecture, students...

1. don't pay utmost attention

1 Peer Instruction

2 let's try it!

3 results

in a lecture, students...

- 1. don't pay utmost attention**
- 2. think they know it**



<http://www.babble.com>

1 Peer Instruction

2 let's try it!

3 results

A close-up photograph of a calico cat's face, showing its green eyes and orange, white, and black fur. The image is slightly faded to allow text to be overlaid.

2 short video lectures on calico cats, same content

doi: [10.3758/s13423-013-0442-z](https://doi.org/10.3758/s13423-013-0442-z)

1 Peer Instruction

2 let's try it!

3 results

2 short video lectures on calico cats, same content

fluent video



speaks fluidly w/o notes

upright

maintains eye contact

doi: 10.3758/s13423-013-0442-z

1 Peer Instruction

2 let's try it!

3 results

2 short video lectures on calico cats, same content

fluent video



**speaks fluidly w/o notes
upright
maintains eye contact**

disfluent video



**speaks haltingly from notes
slumped
looks away**

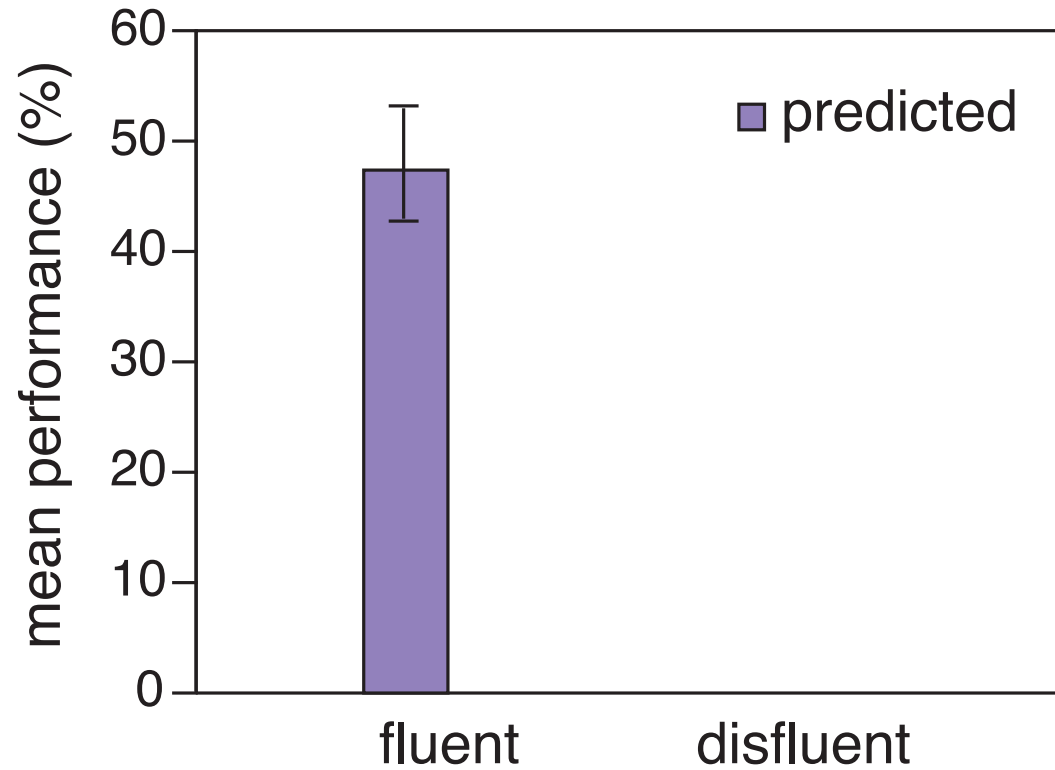
doi: 10.3758/s13423-013-0442-z

1 Peer Instruction

2 let's try it!

3 results

judgement of learning



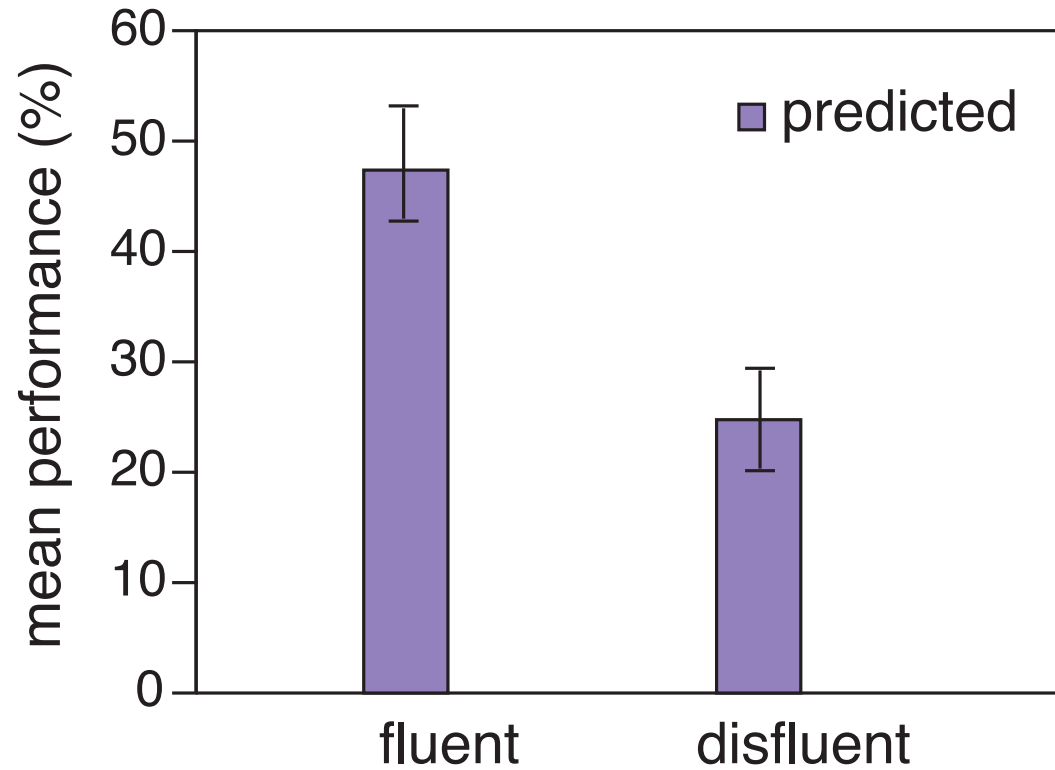
doi: 10.3758/s13423-013-0442-z

1 Peer Instruction

2 let's try it!

3 results

judgement of learning



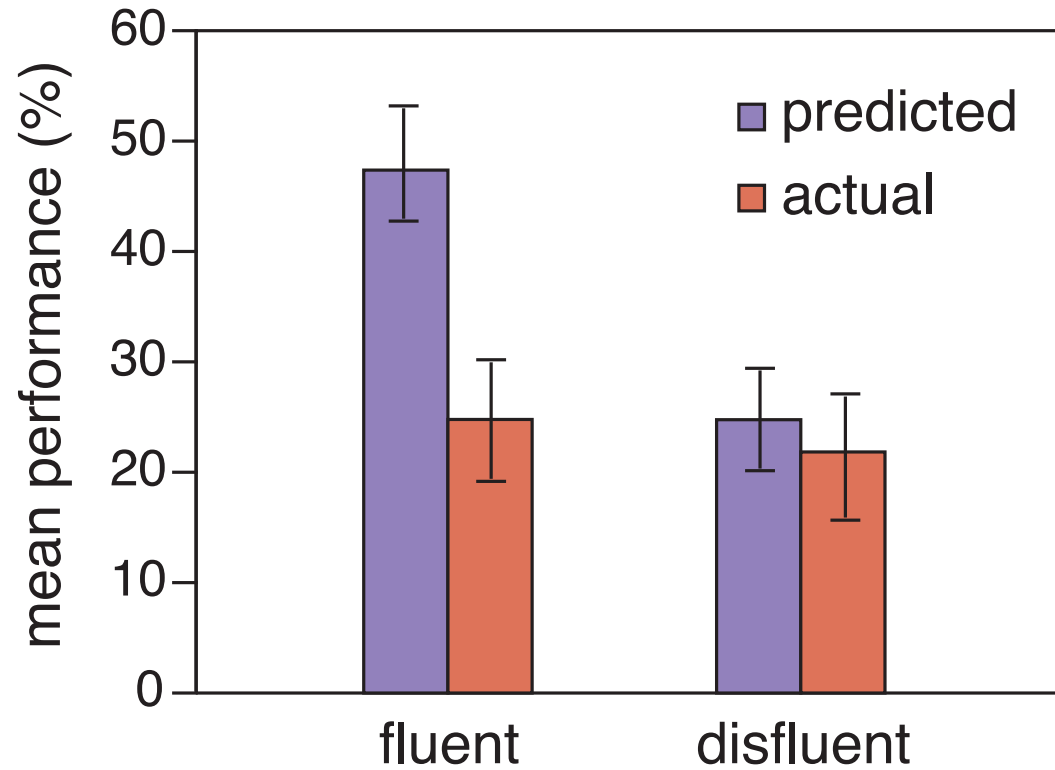
doi: 10.3758/s13423-013-0442-z

1 Peer Instruction

2 let's try it!

3 results

judgement of learning



doi: 10.3758/s13423-013-0442-z

1 Peer Instruction

2 let's try it!

3 results

in a lecture, students...

- 1. don't pay utmost attention**
- 2. think they know it**

in a lecture, students...

- 1. don't pay utmost attention**
- 2. think they know it**
- 3. are not confronted with misconceptions**

in a lecture, students...

1. don't pay utmost attention

2. think they know it

3. are not confronted with misconceptions

false
sense of security

① Peer Instruction

② let's try it!

③ results



1 Peer Instruction

2 let's try it!

3 results



an illusion. . .

1 Peer Instruction

2 let's try it!

3 results



Education is not just about:

- **transferring information**
- **getting students to do what we do**

1 Peer Instruction

2 let's try it!

3 results



Education is not just about:

- **transferring information**
- **getting students to do what we do**

active participation a must!

1 Peer Instruction

2 let's try it!

3 results

not just a polling tool, but an engagement tool!



19
e Sher
P₀
m = 0.5 kg
P₁ =
T₁
V₁





Join now!

PeerInstruction.net

Research Funding:

Pew Charitable Trust, Pearson/Prentice Hall, Davis Foundation, Engineering Information Foundation, Derek Bok Center for Teaching and Learning, National Science Foundation

for a copy of this presentation:

<http://mazur.harvard.edu>

more information:

www.turningtechnologies.com

Follow me!



eric_mazur

Google™

Google Search

I'm Feeling Lucky

Google™

mazur

Google Search

I'm Feeling Lucky

Google™

Google Search

I'm Feeling Lucky

Google™

Google Search

I'm Feeling Lucky

Research Funding:

Pew Charitable Trust, Pearson/Prentice Hall, Davis Foundation, Engineering Information Foundation, Derek Bok Center for Teaching and Learning, National Science Foundation

for a copy of this presentation:

<http://mazur.harvard.edu>

more information:

www.turningtechnologies.com

Follow me!



eric_mazur