

# Turning lectures into learning



Turning Technologies User Conference  
London, UK, 24 October 2016



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

# Turning lectures into learning



**@eric\_mazur**

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London, UK, 24 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**



What are the following...  
A...  
The...  
The...  
The...  
The...  
The...

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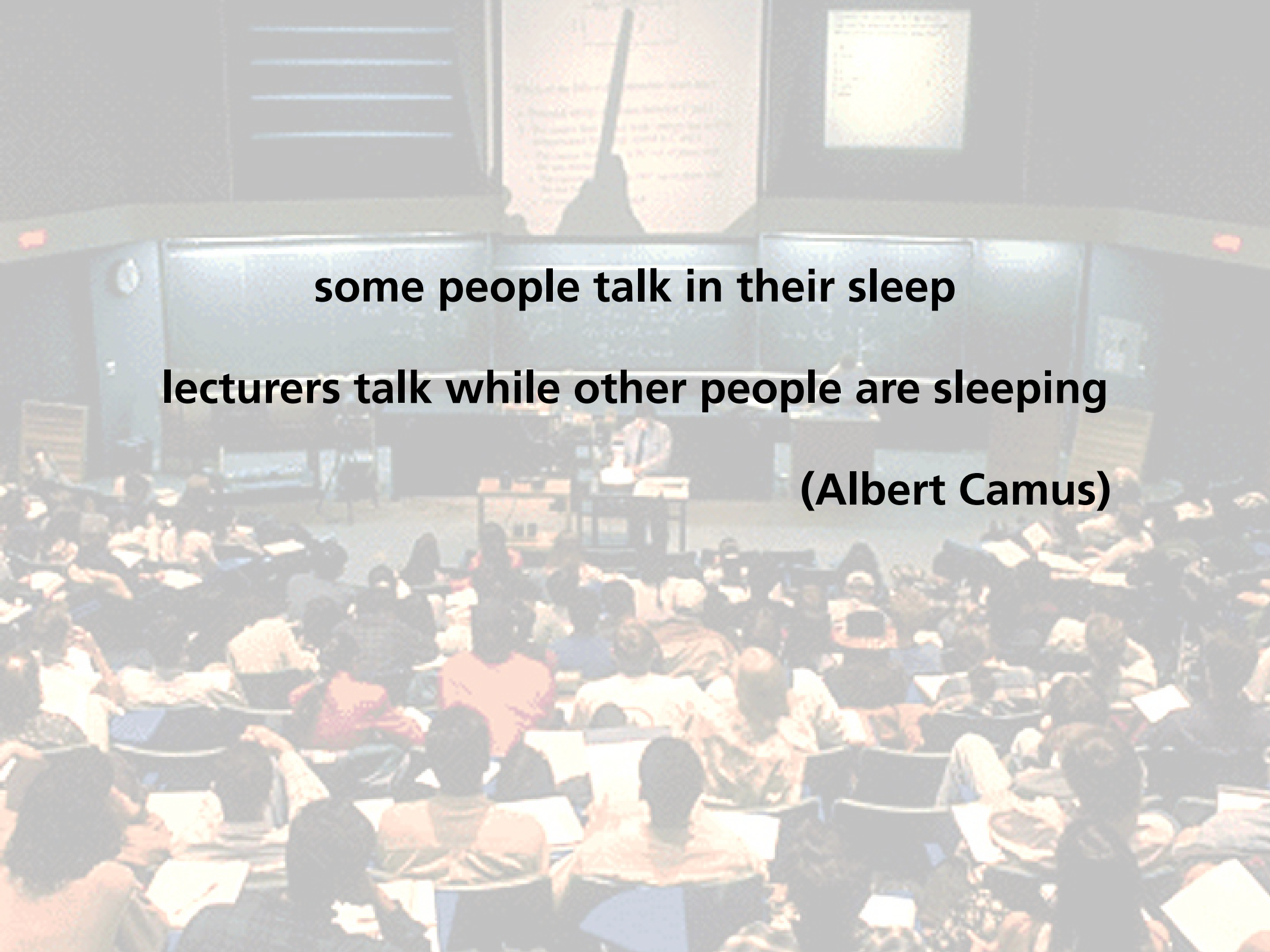
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A large lecture hall with a professor at a podium and students in the audience. The professor is standing at a podium on a stage, facing the audience. The audience is seated in rows of chairs, many with papers on their desks. The room has a curved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

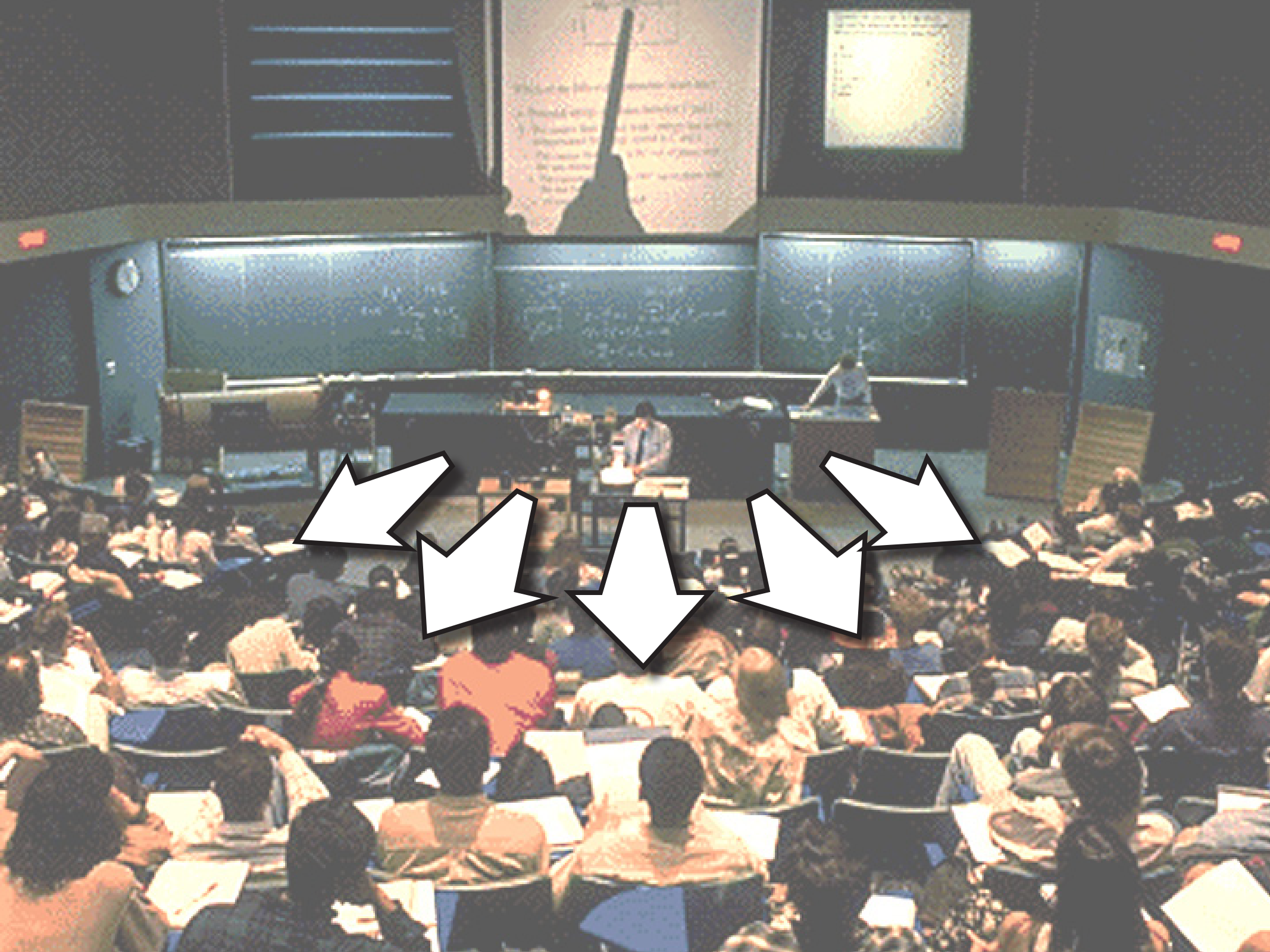
**some people talk in their sleep**

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. The students are seated in rows of desks, many with papers and laptops. The room has a curved wall and a large screen at the front. The text is overlaid on the image.

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

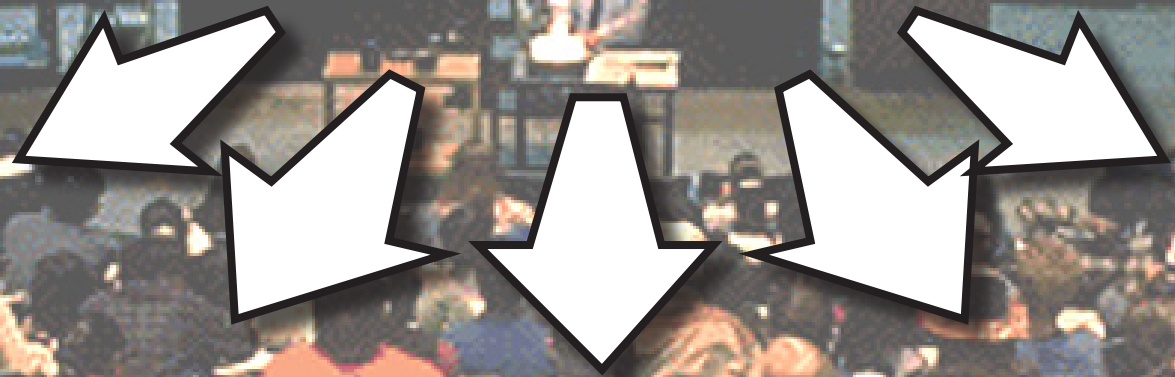




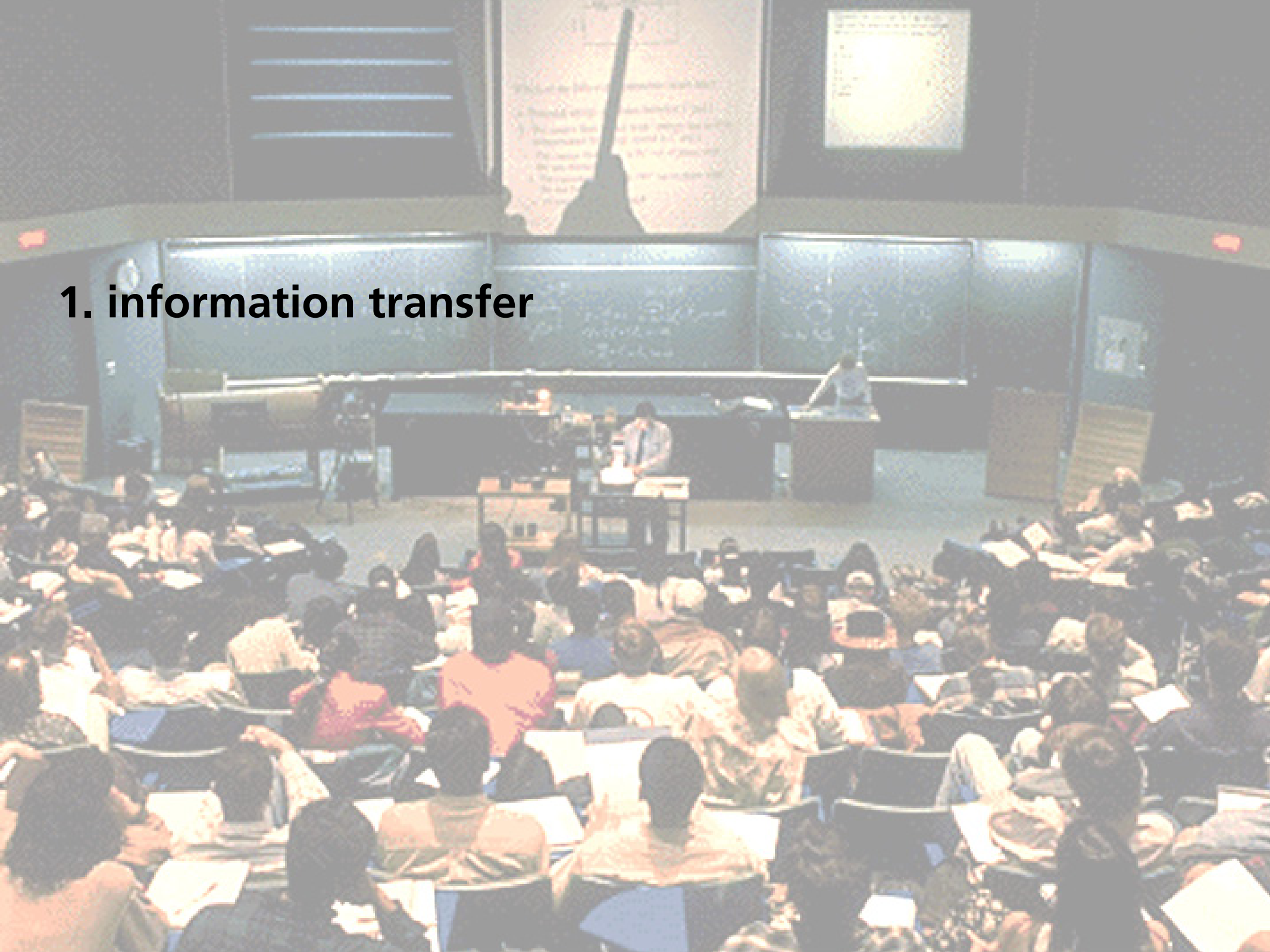


What are the following...  
A...  
The...  
The...  
The...  
The...  
The...  
The...  
The...  
The...

- 1. ...
- 2. ...
- 3. ...
- 4. ...
- 5. ...
- 6. ...
- 7. ...
- 8. ...
- 9. ...
- 10. ...



# 1. information transfer



A large lecture hall with a professor at a podium and students seated at desks. The room features a large screen at the front displaying text, and a chalkboard with diagrams. The audience is seen from behind, seated at rows of desks.

**1. information transfer**

**2. assimilation of information**

A large lecture hall with a professor at a podium and students at desks. The professor is standing at a podium on the stage, facing the audience. The students are seated at desks, many with papers and laptops. The room is dimly lit, with the stage lights illuminating the professor and the podium. There are large screens or posters on the wall behind the professor.

**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

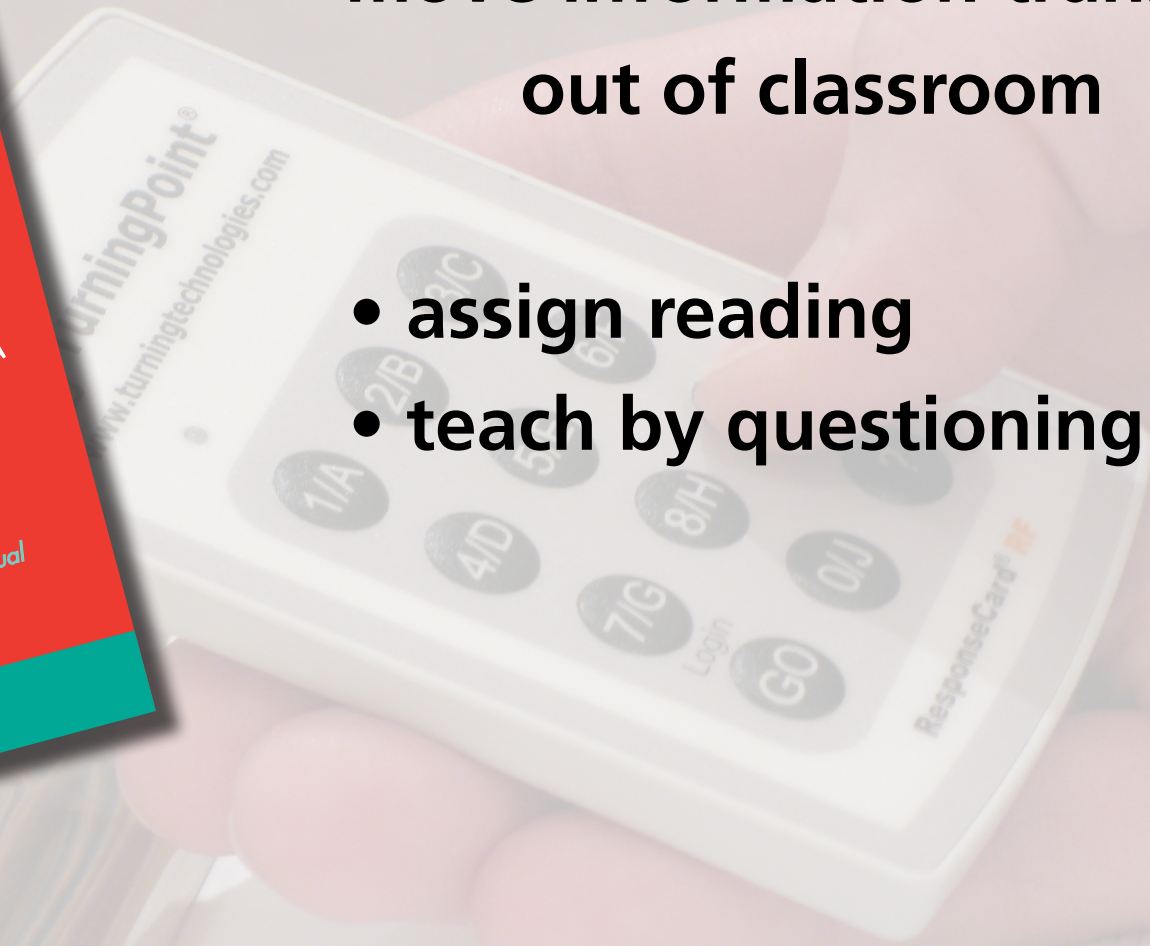
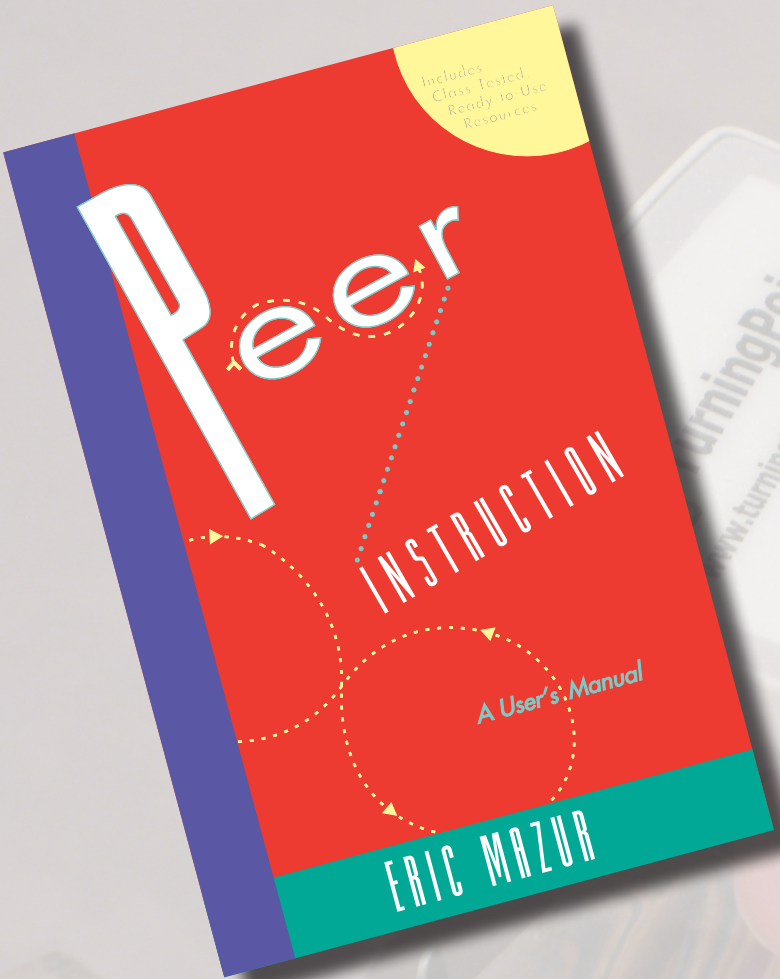
**2** let's try it!

**3** results

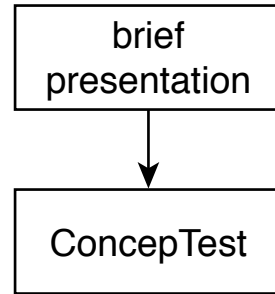


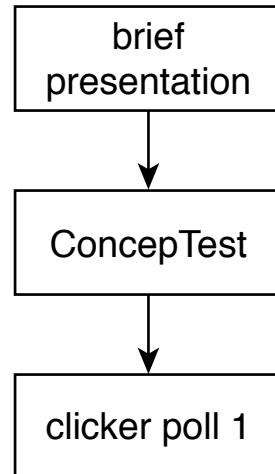
**move information transfer  
out of classroom**

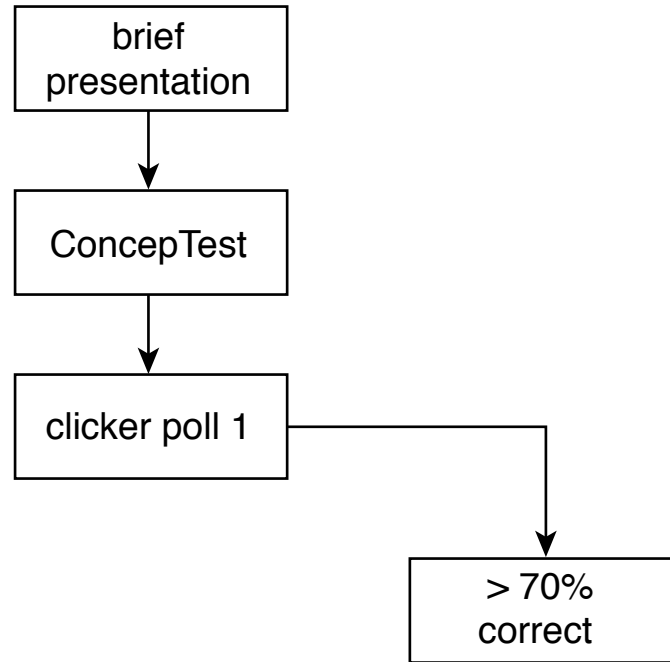
- **assign reading**
- **teach by questioning**

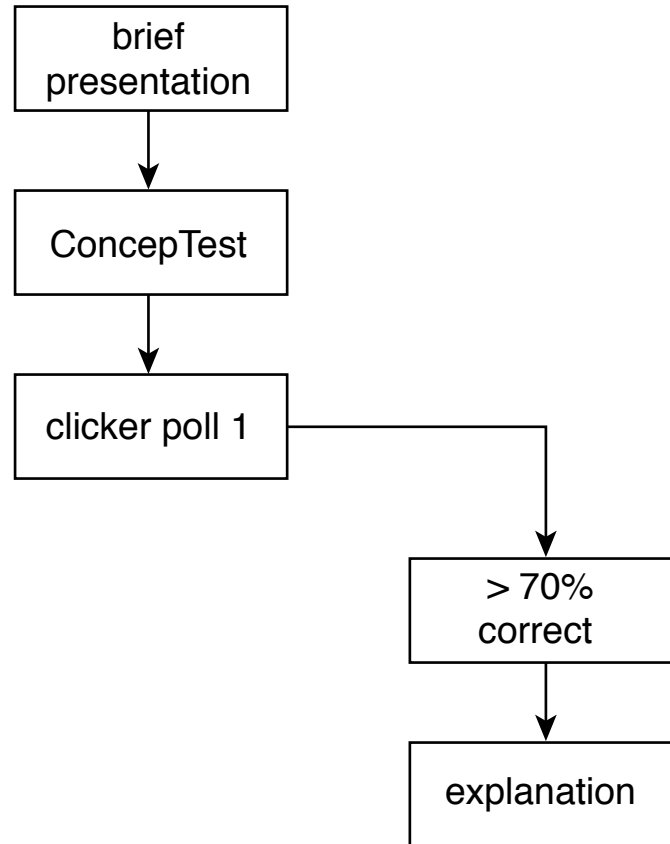


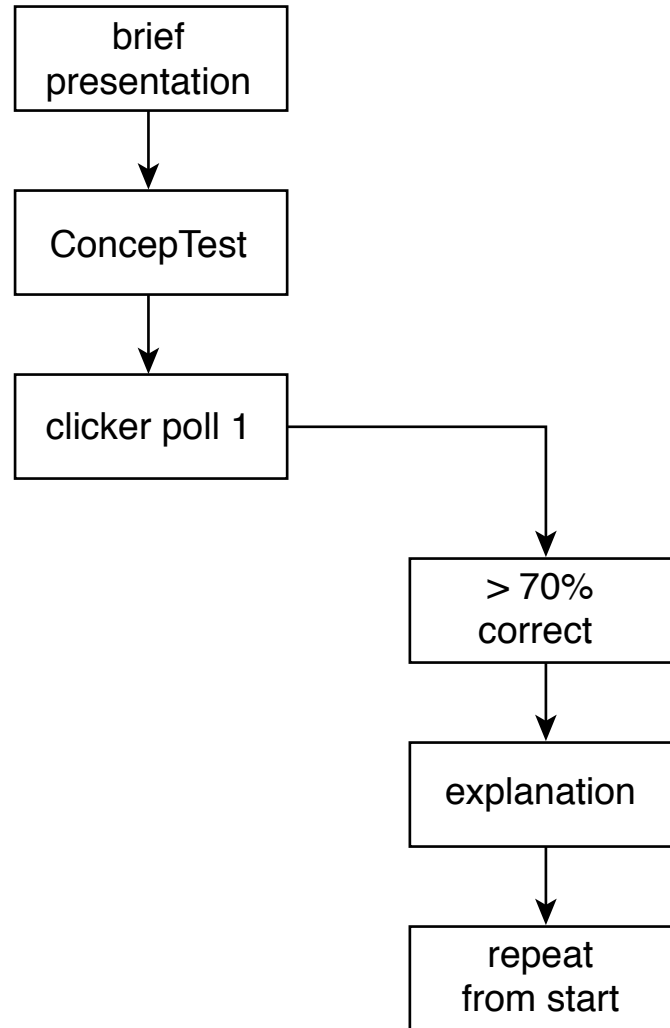
brief  
presentation

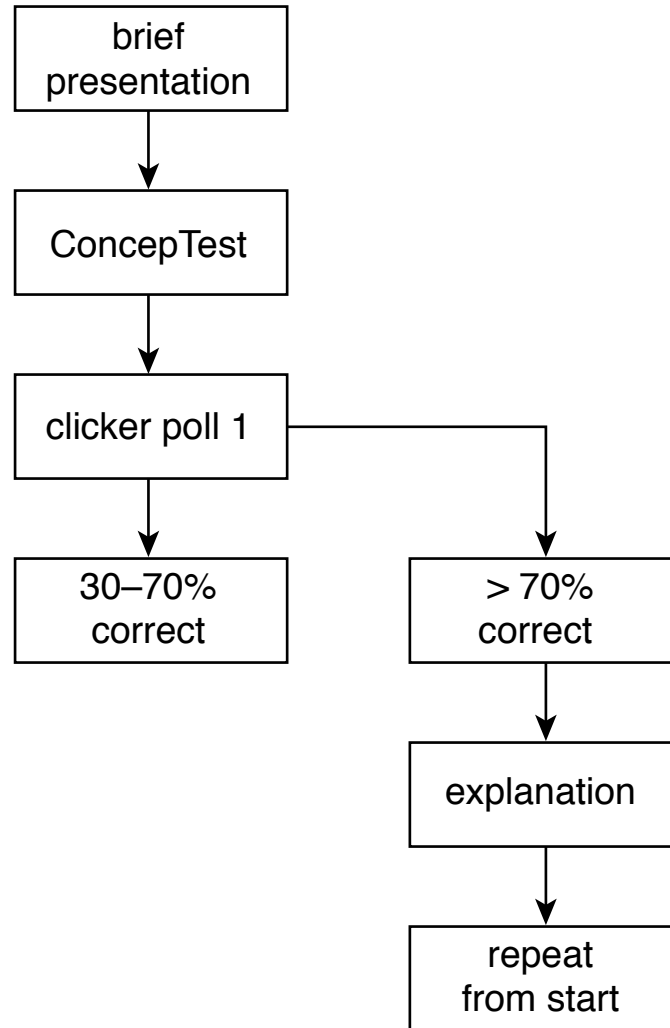




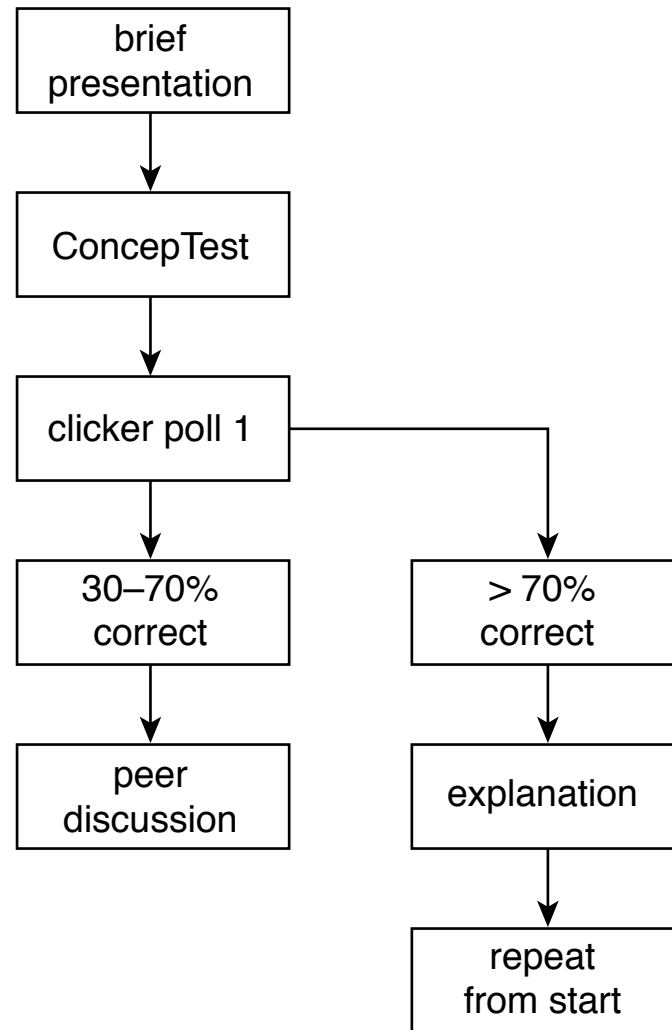


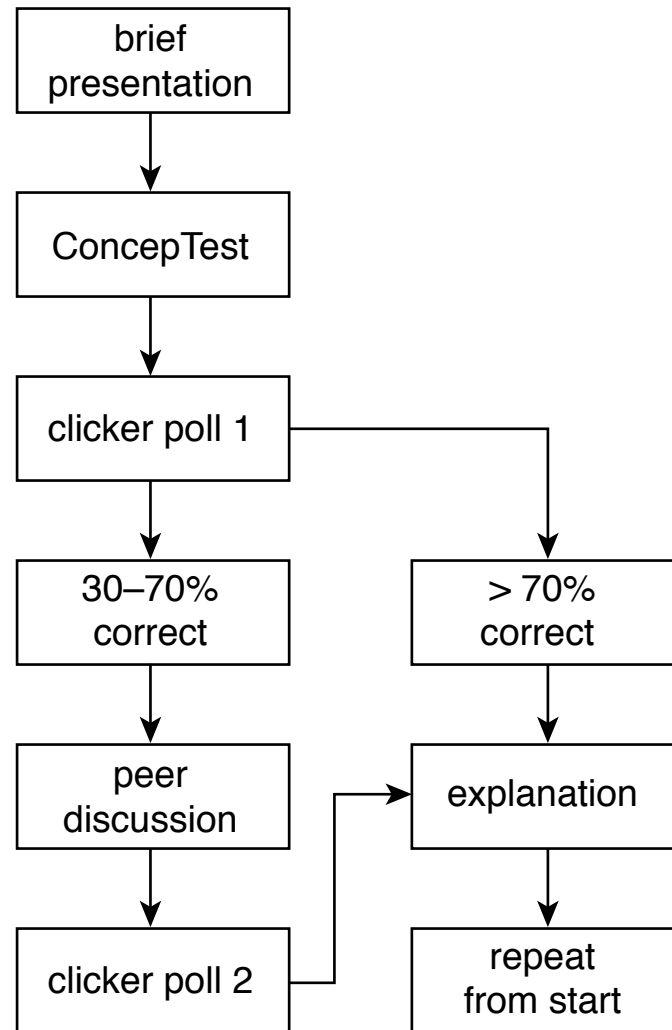


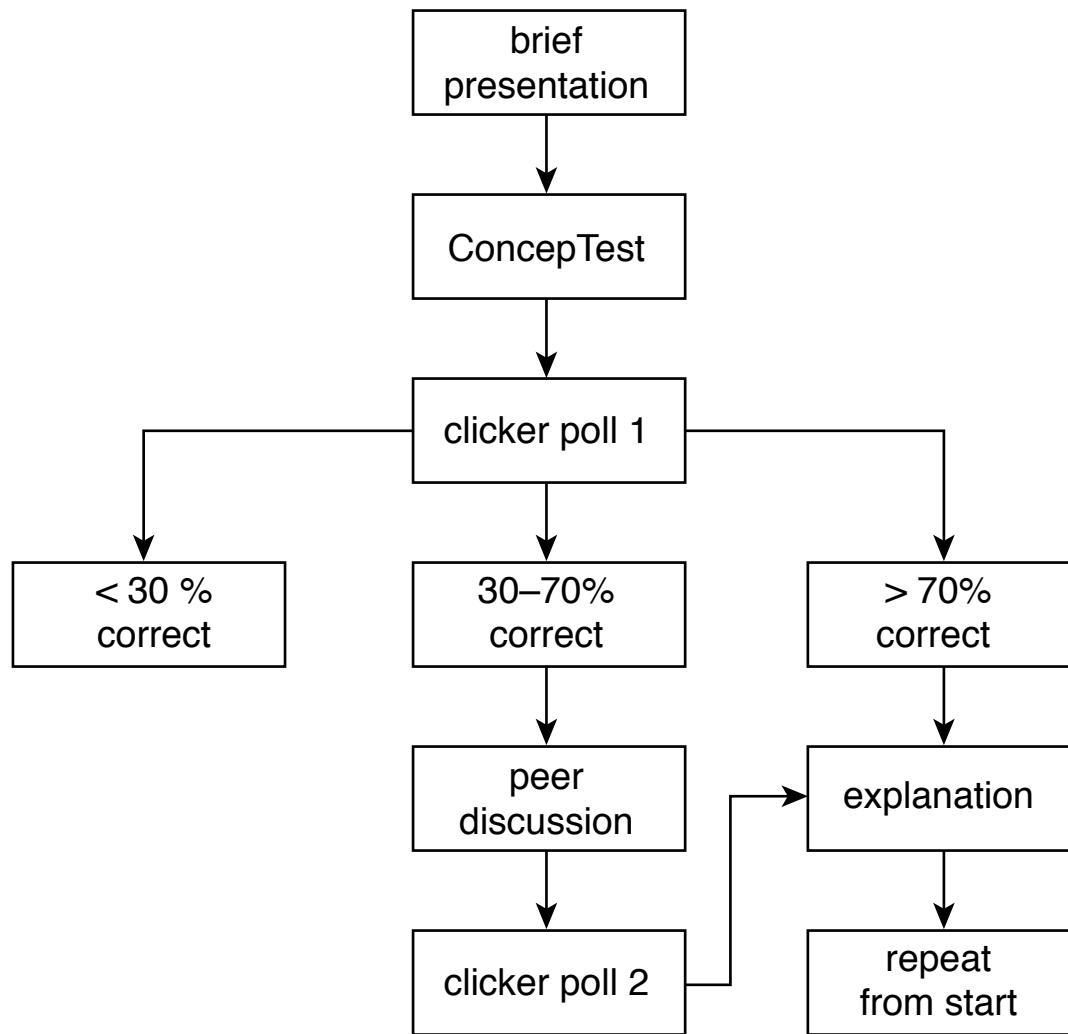


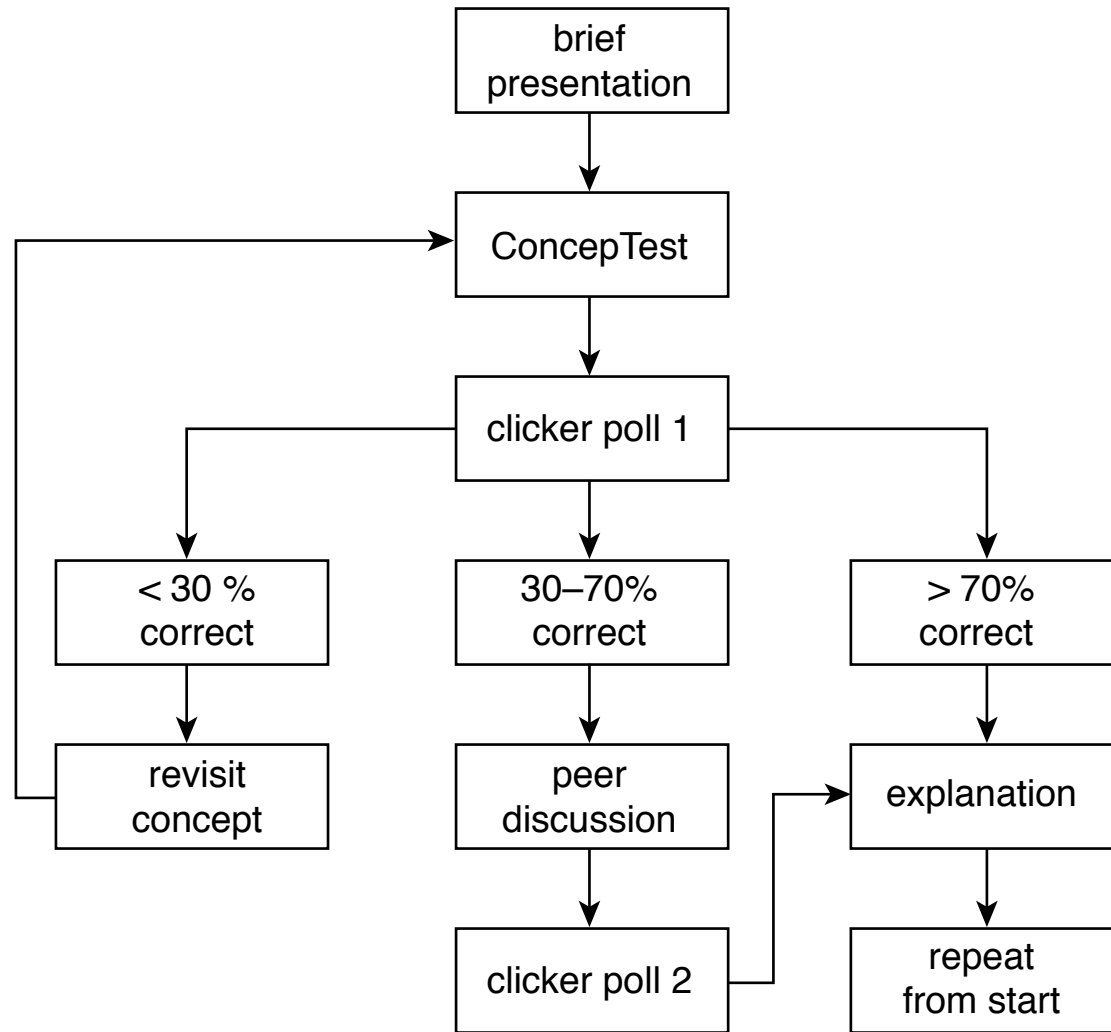


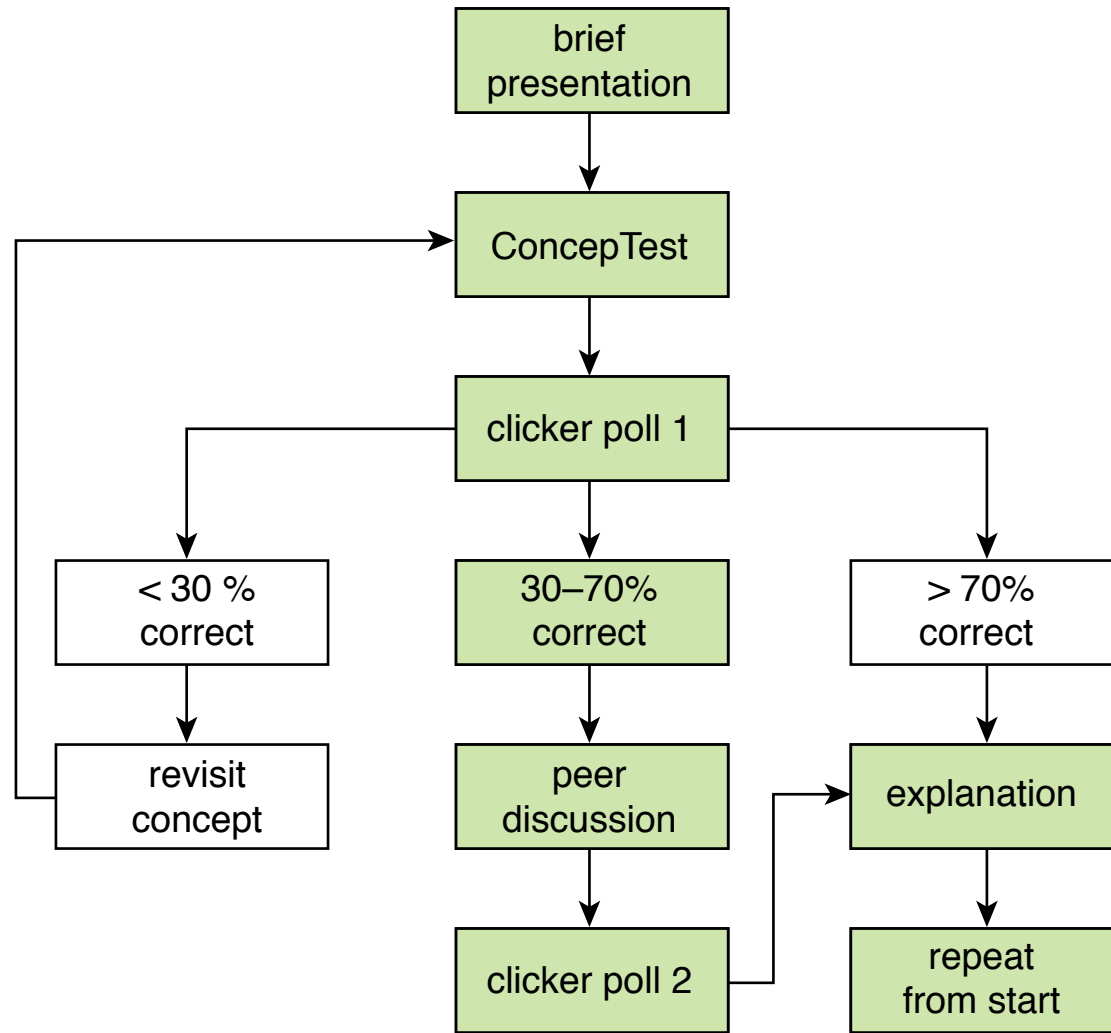












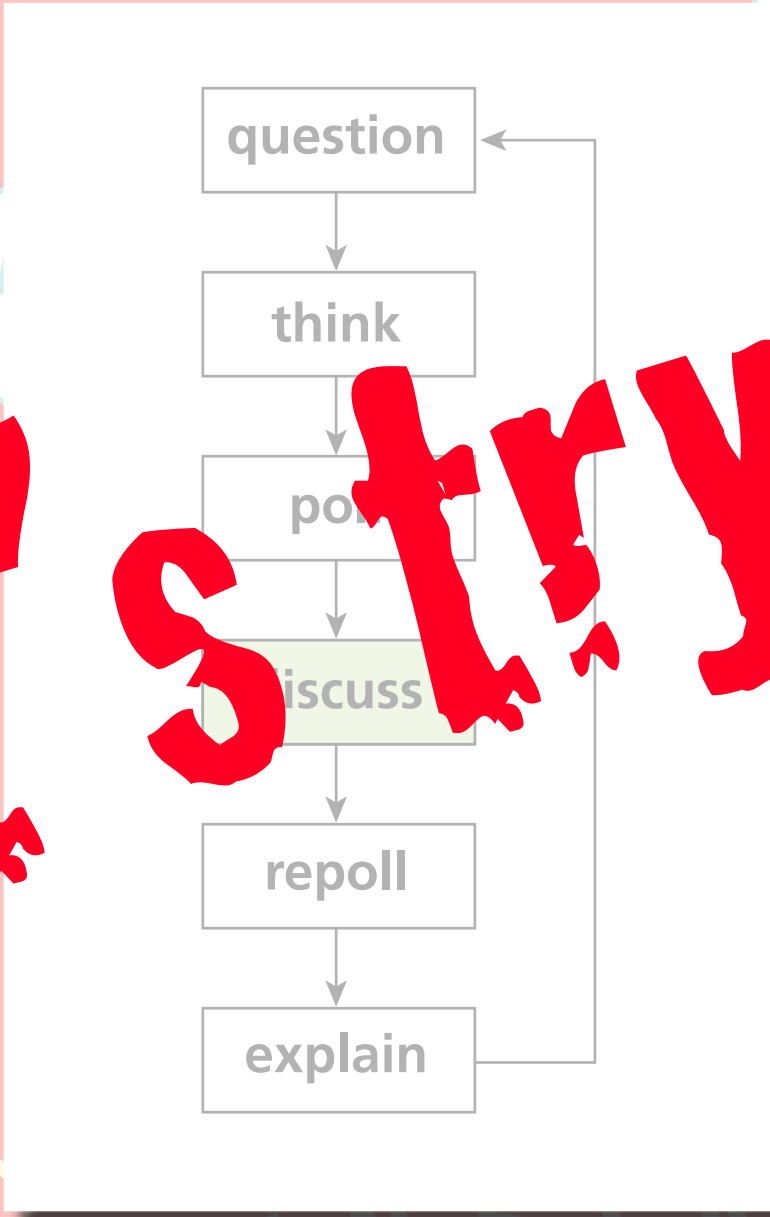


Let's try it!

QUESTION

Let's try it!

ACTION



1 Peer Instruction

2 let's try it!

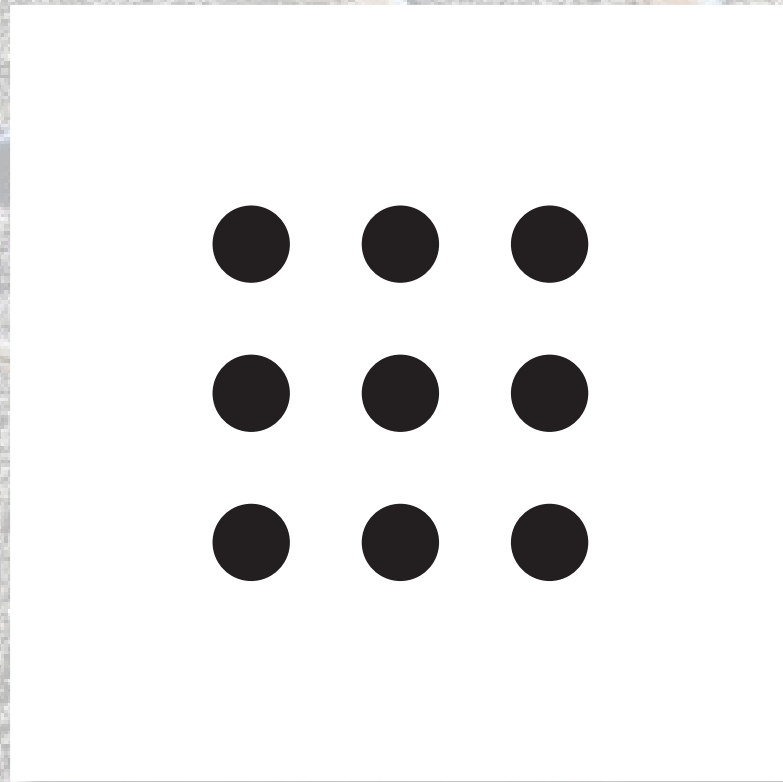


**thermal expansion**

**1 Peer Instruction**

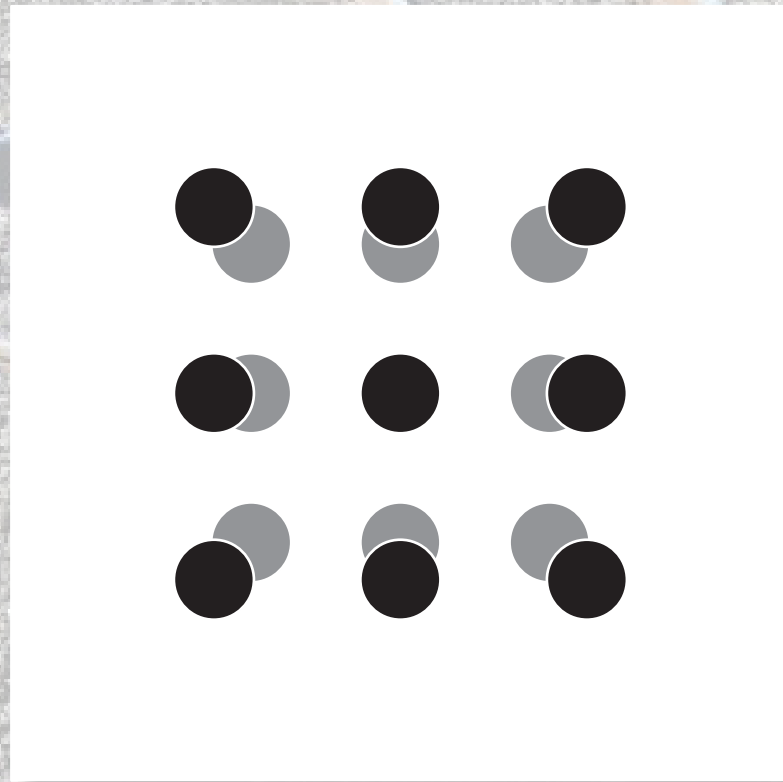
**2 let's try it!**





**1** Peer Instruction

**2** let's try it!



**1** Peer Instruction

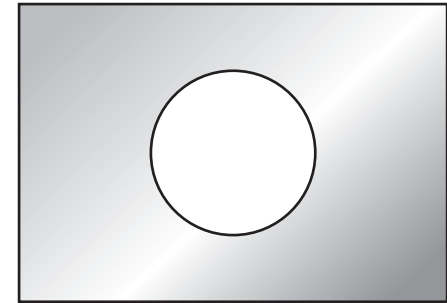
**2** let's try it!

**all of them!**

**1 Peer Instruction**

**2 let's try it!**

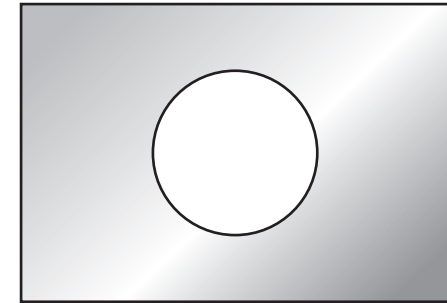
**Consider a rectangular metal plate  
with a circular hole in it.**



**1 Peer Instruction**

**2 let's try it!**

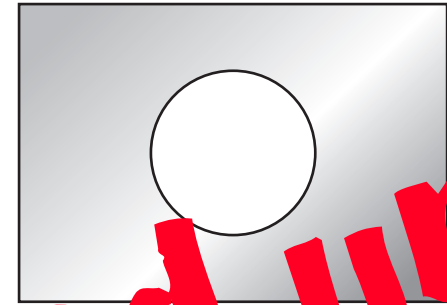
**Consider a rectangular metal plate with a circular hole in it.**



**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.

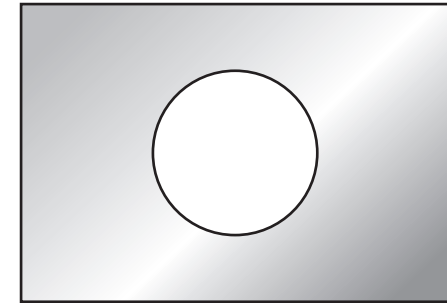


When the plate is uniformly heated, the diameter of the hole

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...**

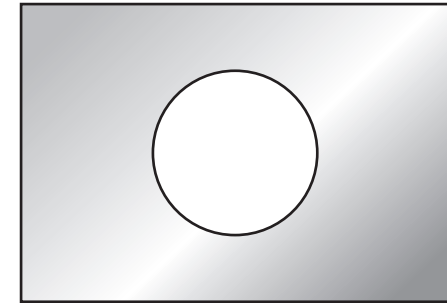
- 1. made a commitment**
- 2. externalized your answer**
- 3. moved from the answer/fact to reasoning**

**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**

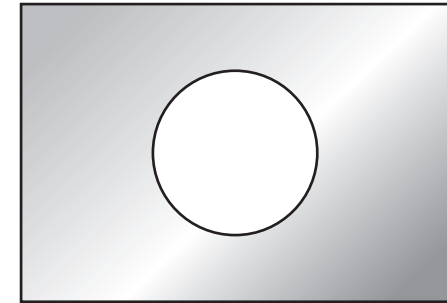
**Consider a rectangular metal plate with a circular hole in it.**



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- 2. stays the same.**
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Consider a rectangular metal plate with a circular hole in it.

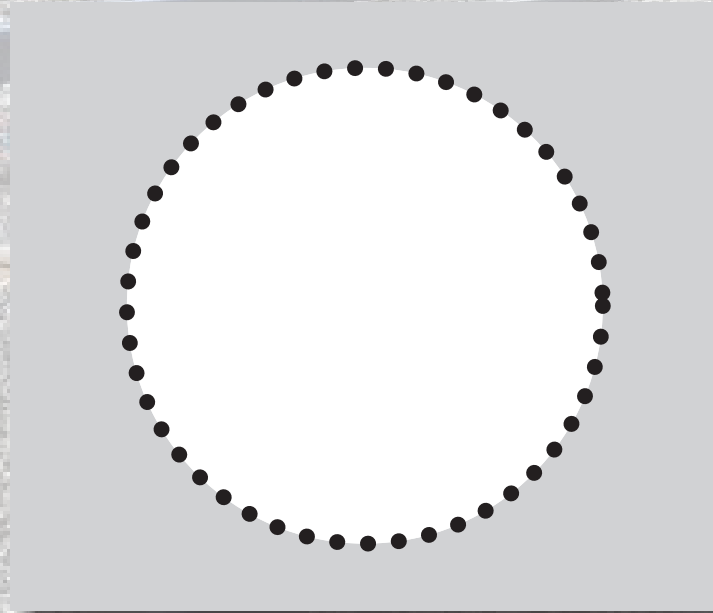


When the plate is uniformly heated, the diameter of the hole

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



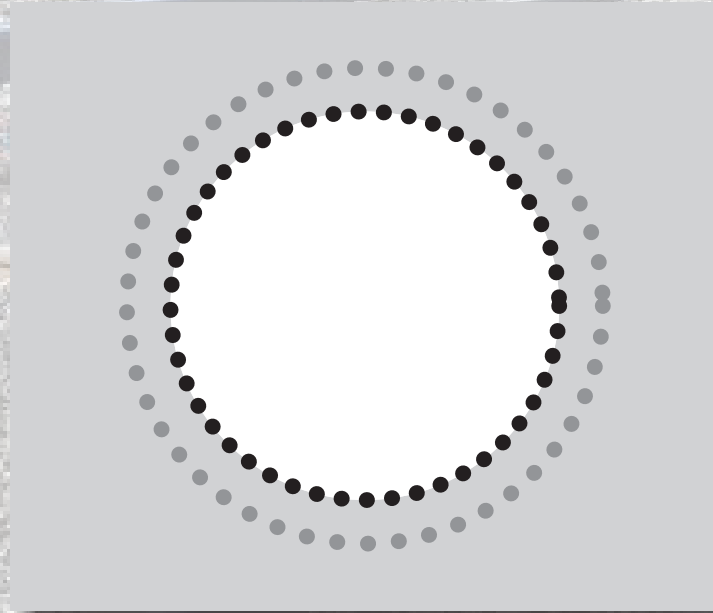
consider atoms at rim of hole



**1** Peer Instruction

**2** let's try it!

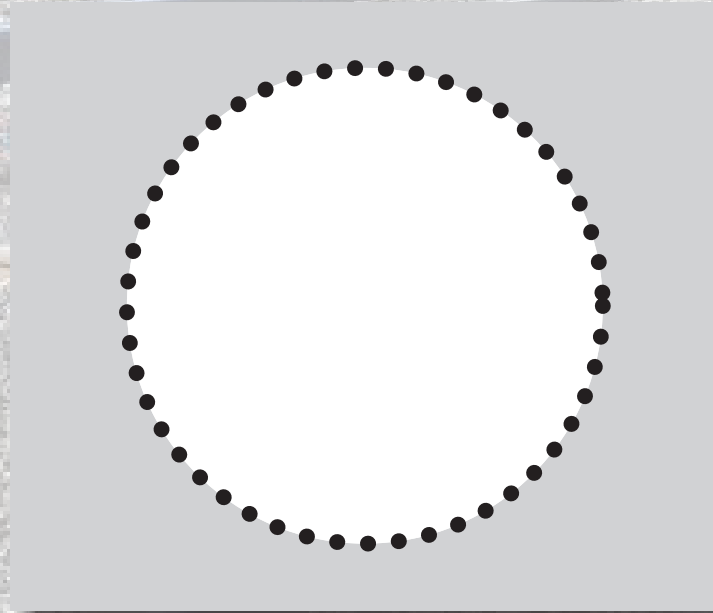
consider atoms at rim of hole



**1** Peer Instruction

**2** let's try it!

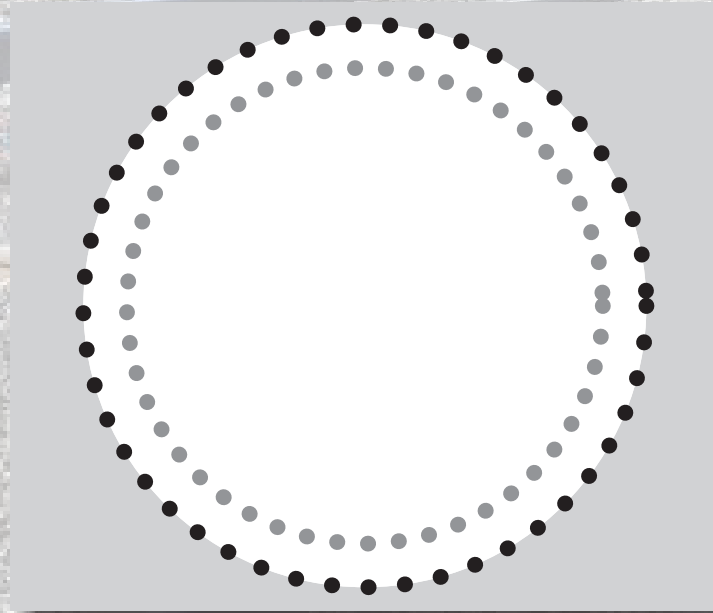
consider atoms at rim of hole



**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

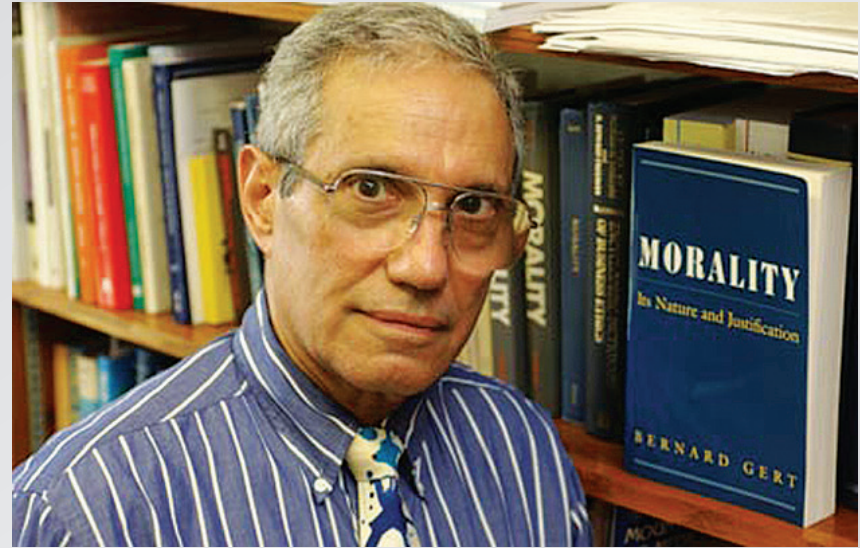
1 Peer Instruction

2 let's try it!

**Bernard Gert (1934 – 2011)**

**Moral philosopher**

**Professor at Dartmouth**

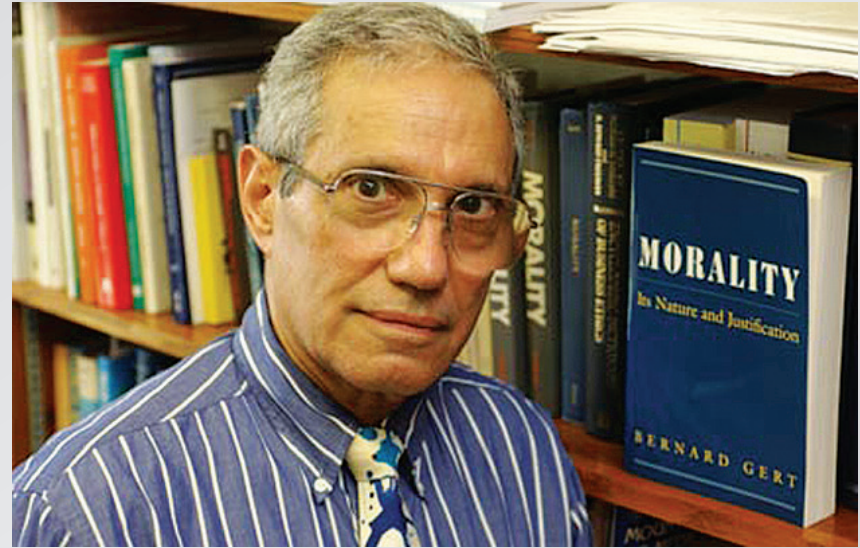


**1 Peer Instruction**

**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**
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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

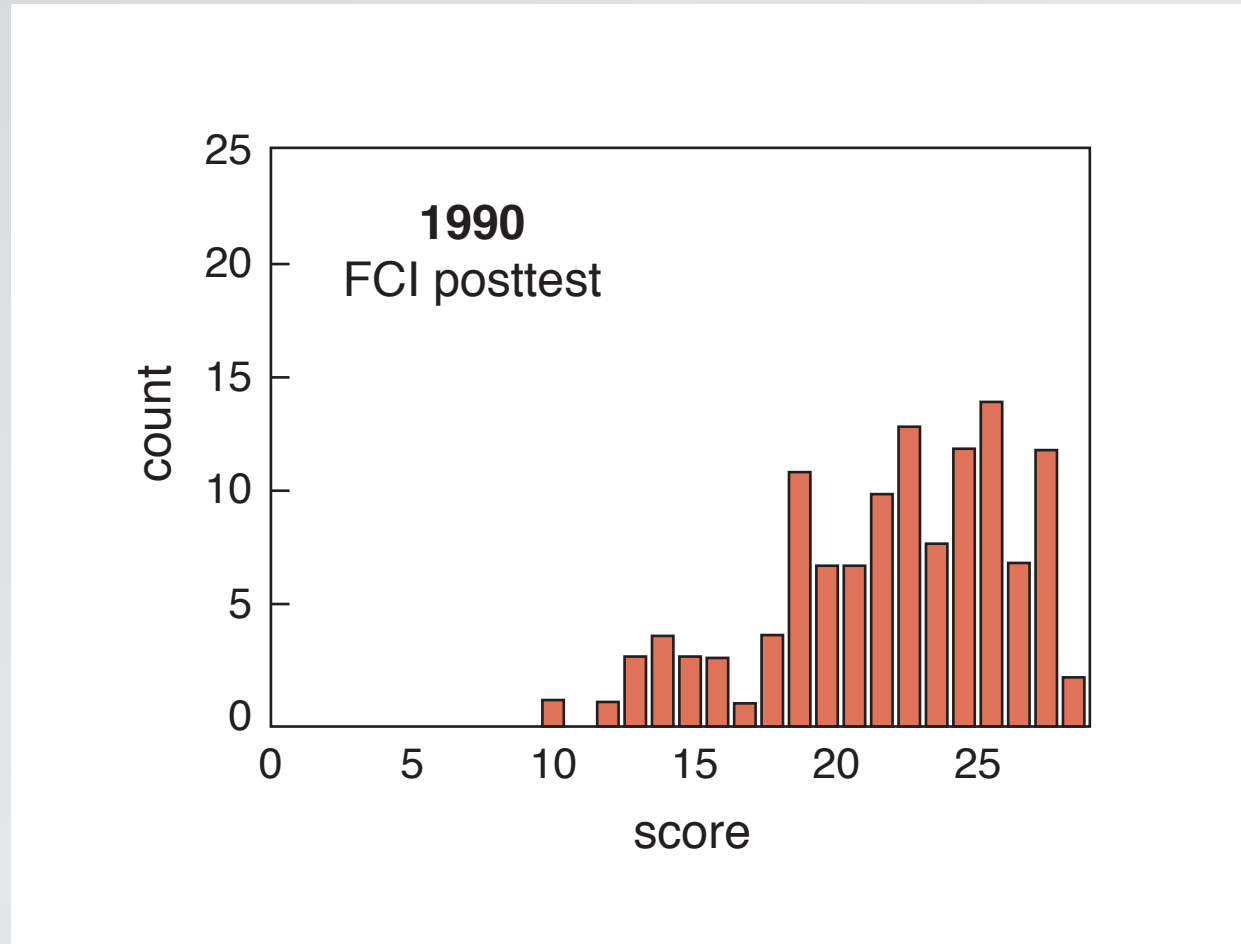
**you got all engaged!**



**1 Peer Instruction**

**2 let's try it!**

## traditional instruction

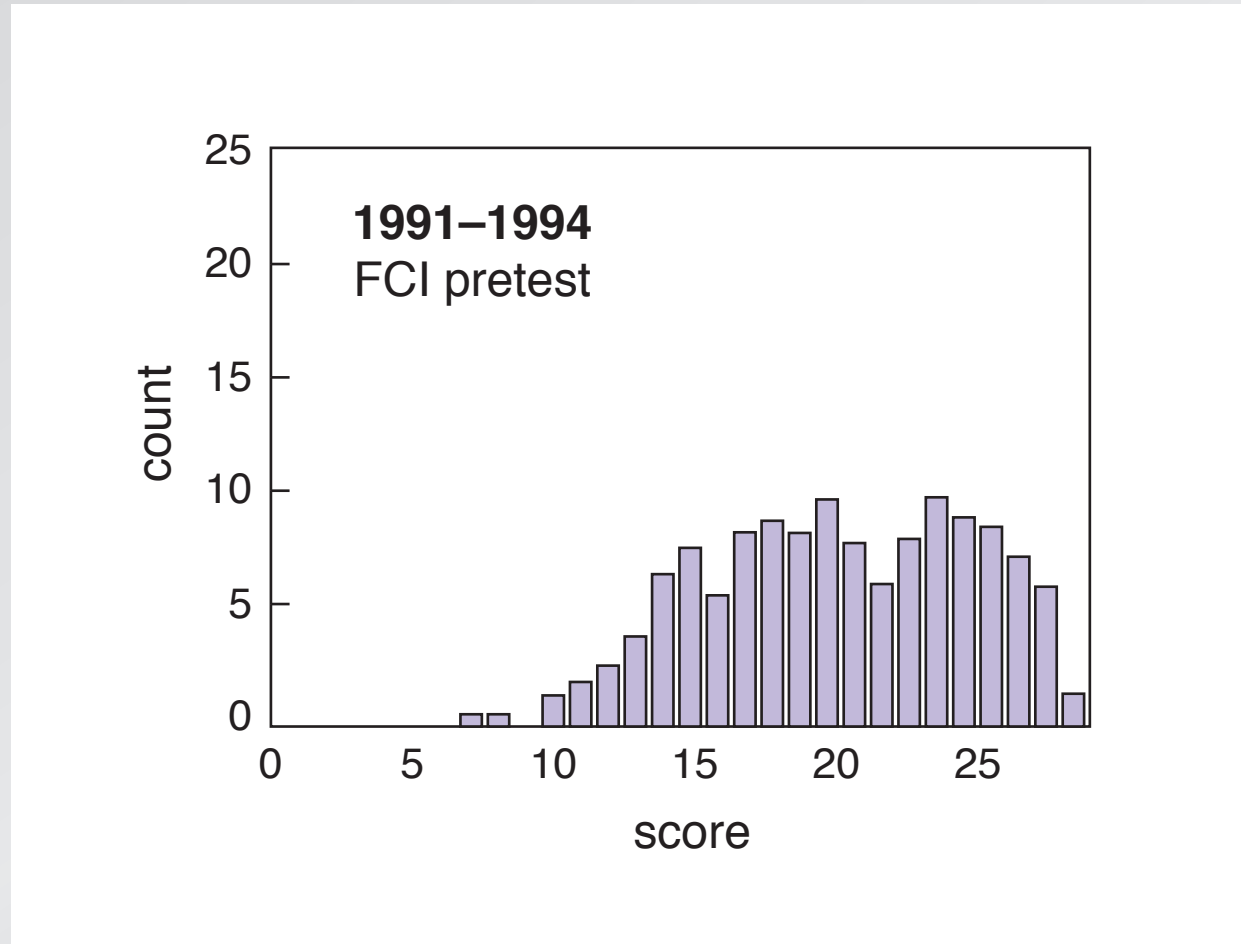


**1** Peer Instruction

**2** let's try it!

**3** results

## traditional instruction



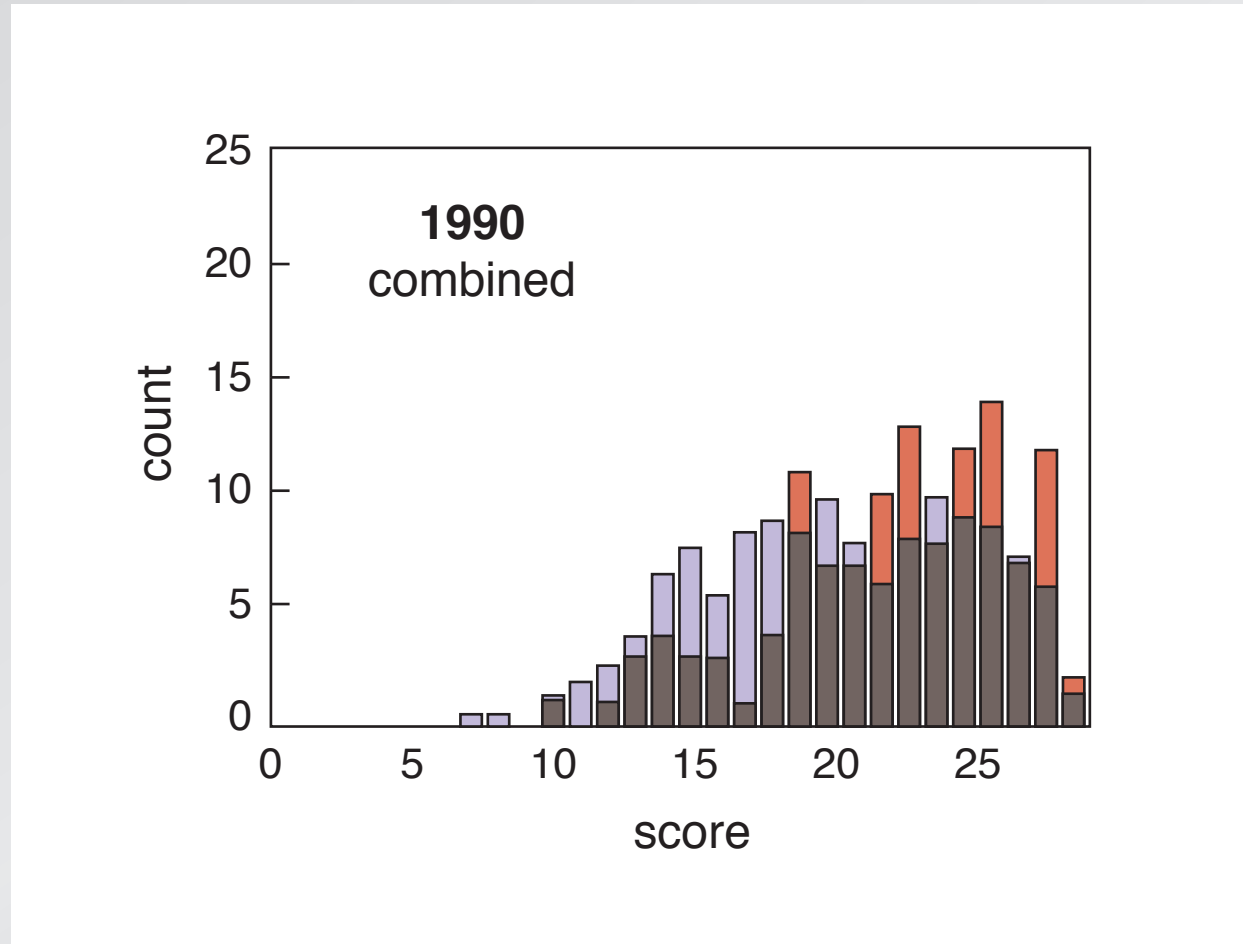
**1** Peer Instruction

**2** let's try it!

**3** results



# traditional instruction

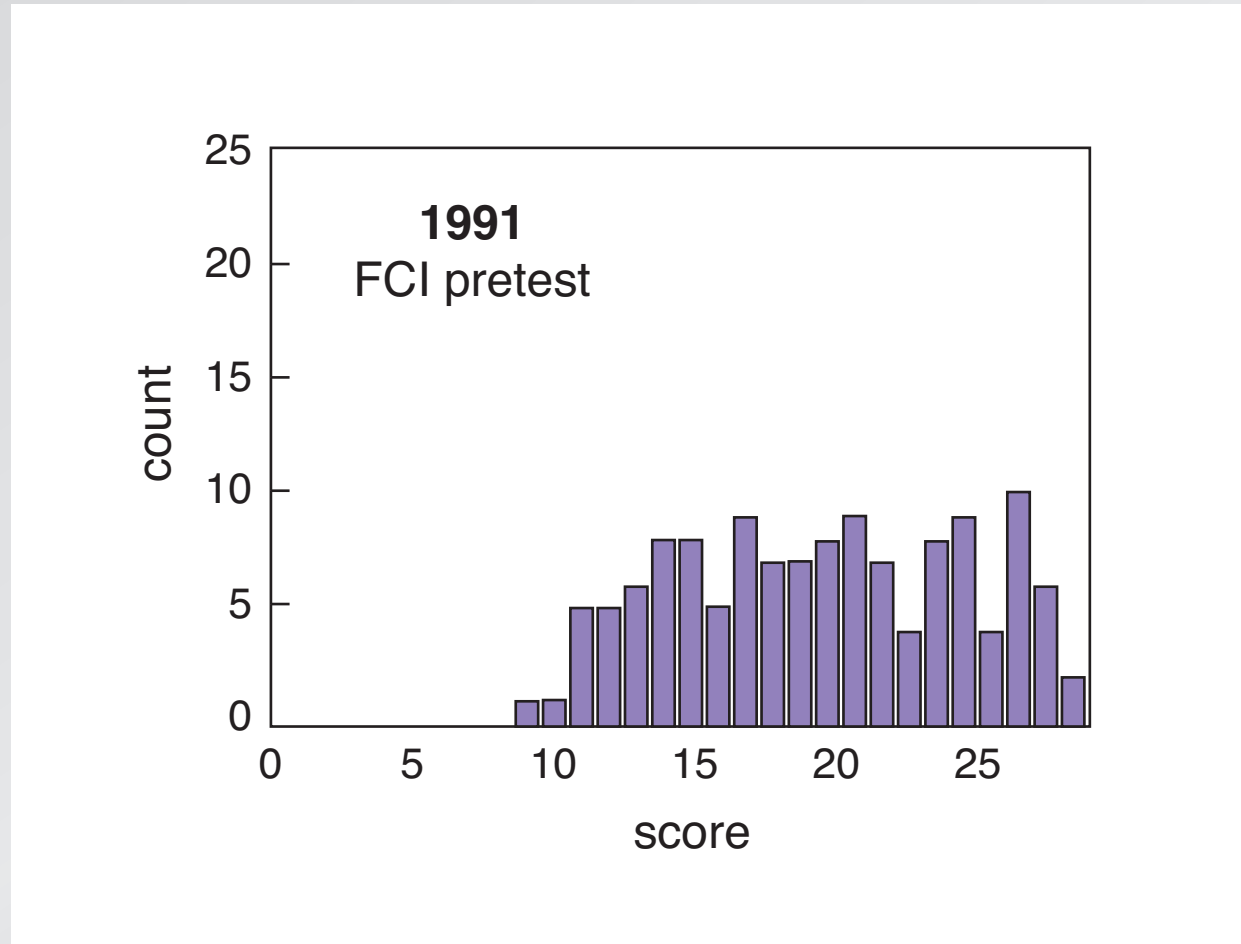


1 Peer Instruction

2 let's try it!

3 results

## first year of implementing PI

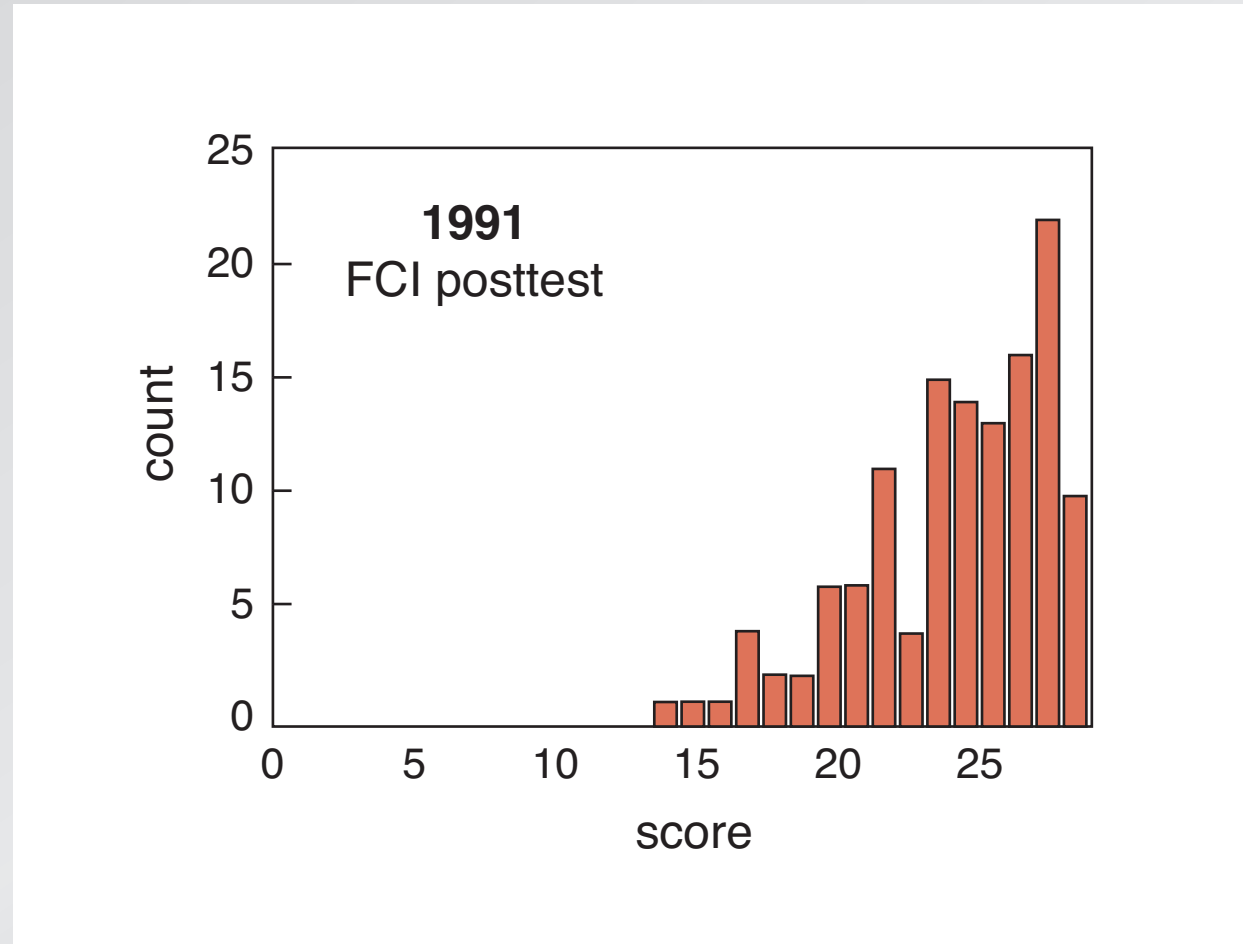


1 Peer Instruction

2 let's try it!

3 results

## first year of implementing PI

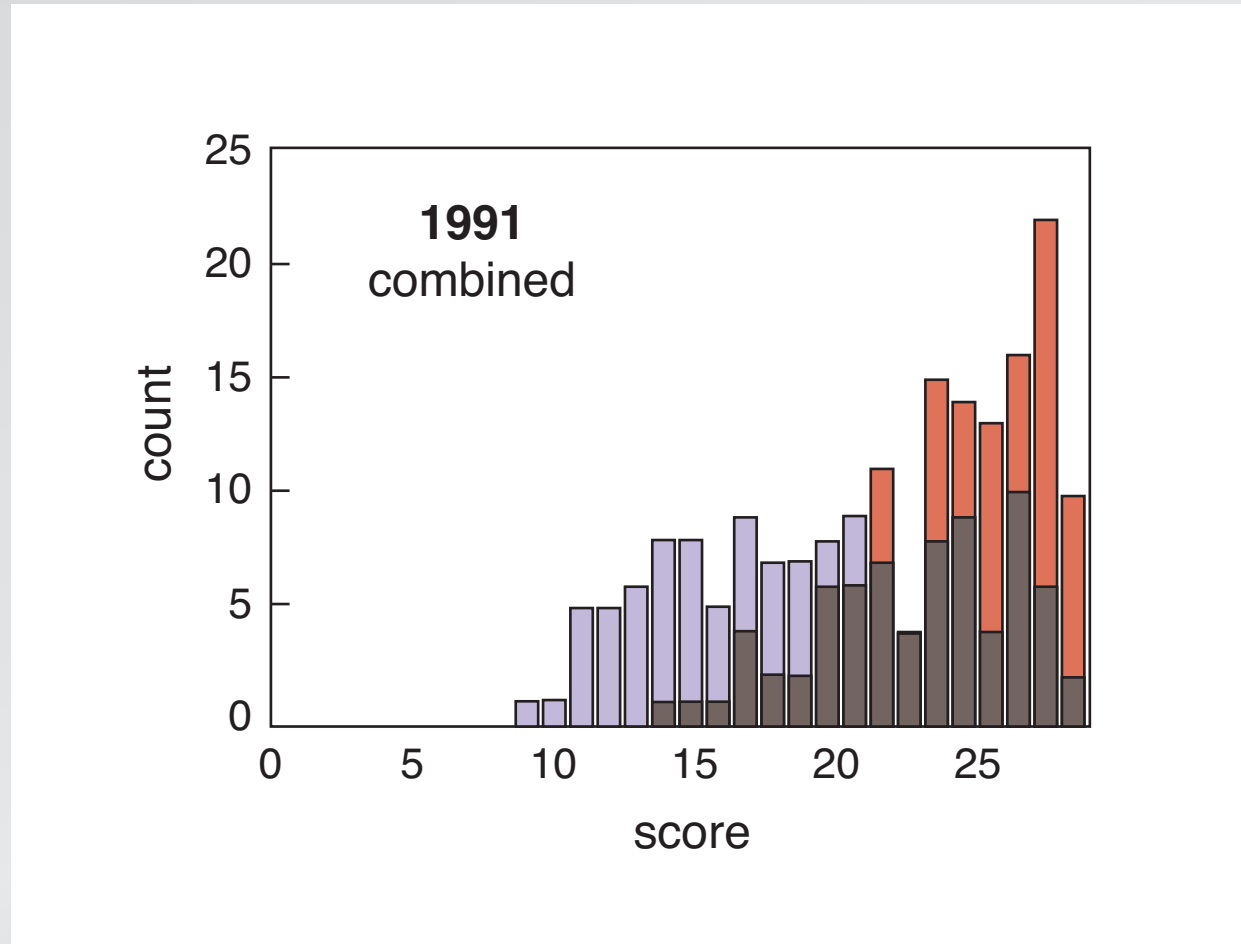


**1** Peer Instruction

**2** let's try it!

**3** results

## first year of implementing PI



1 Peer Instruction

2 let's try it!

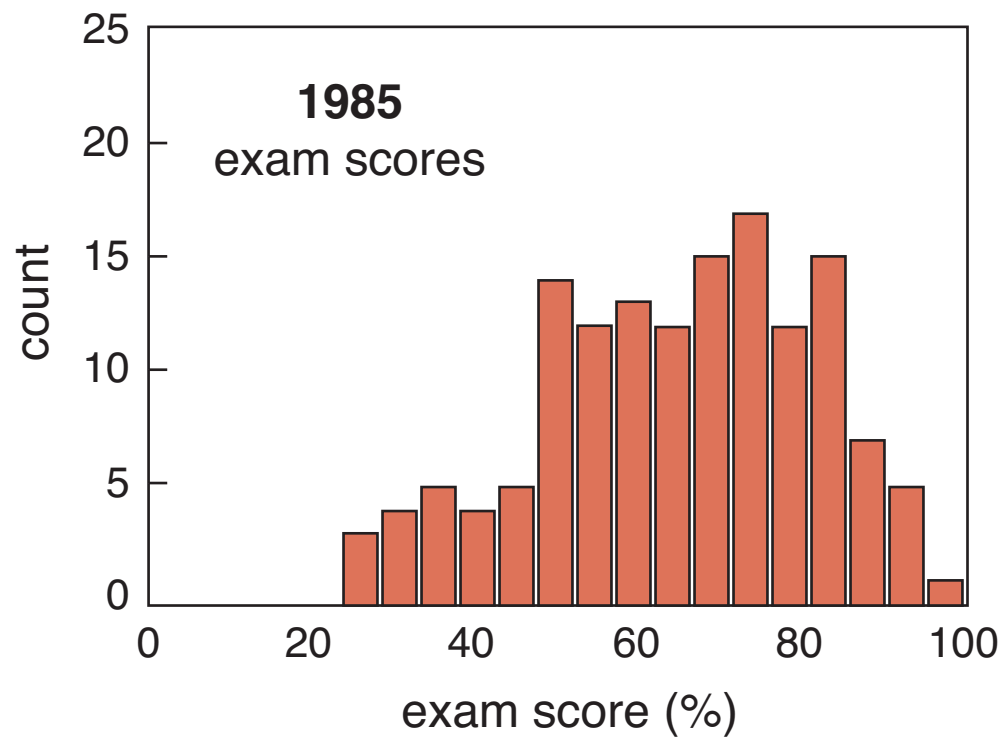
3 results

**what about problem solving?**

**1 Peer Instruction**

**2 let's try it!**

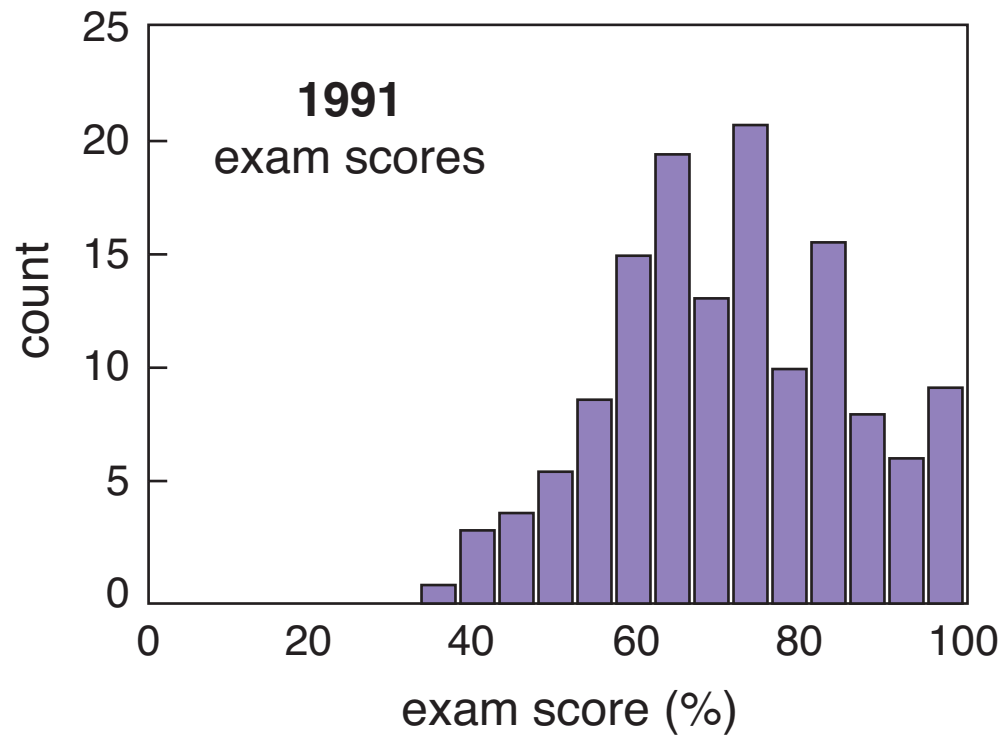
**3 results**



**1** Peer Instruction

**2** let's try it!

**3** results

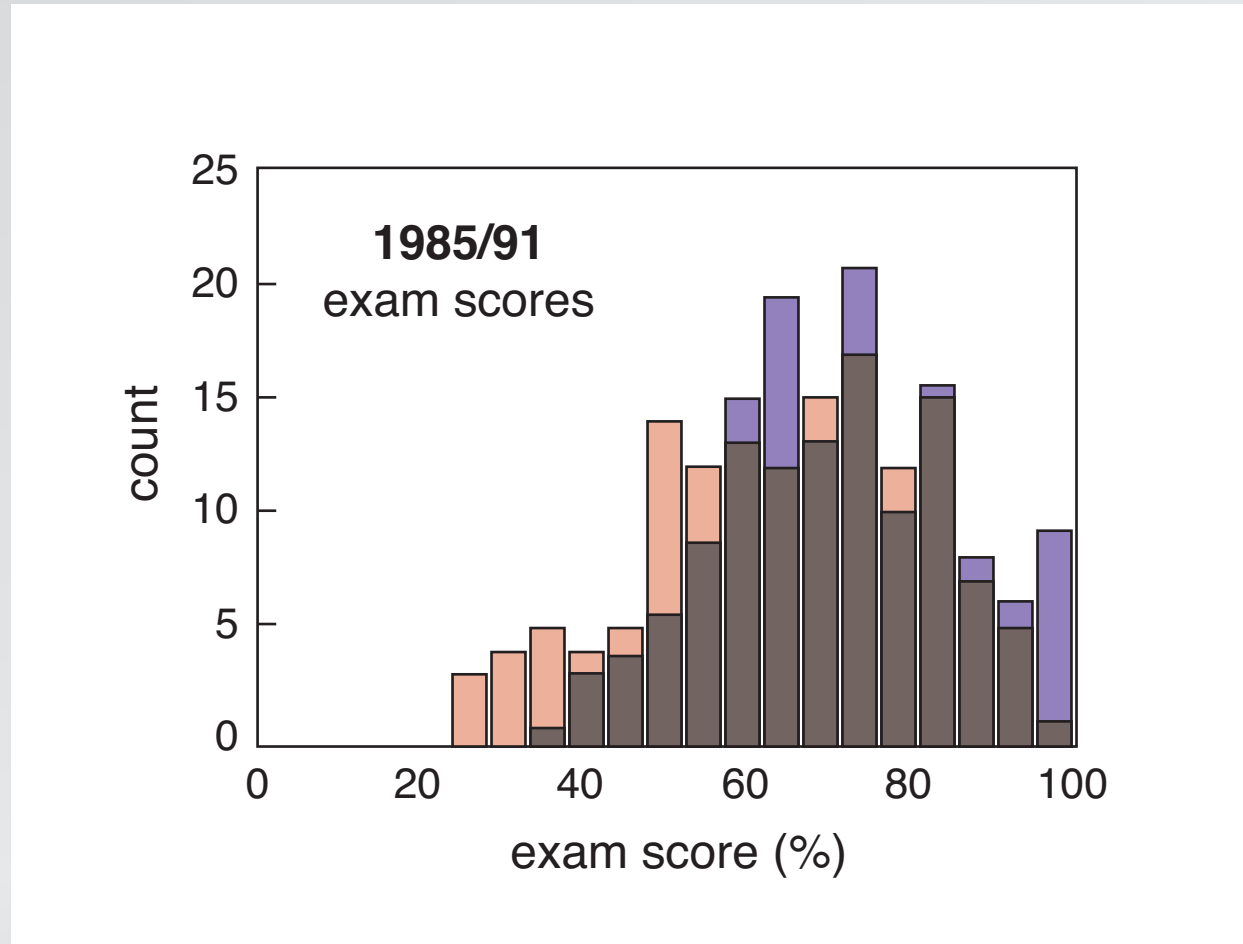


**1** Peer Instruction

**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 blurred and has a semi-transparent white overlay.

**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

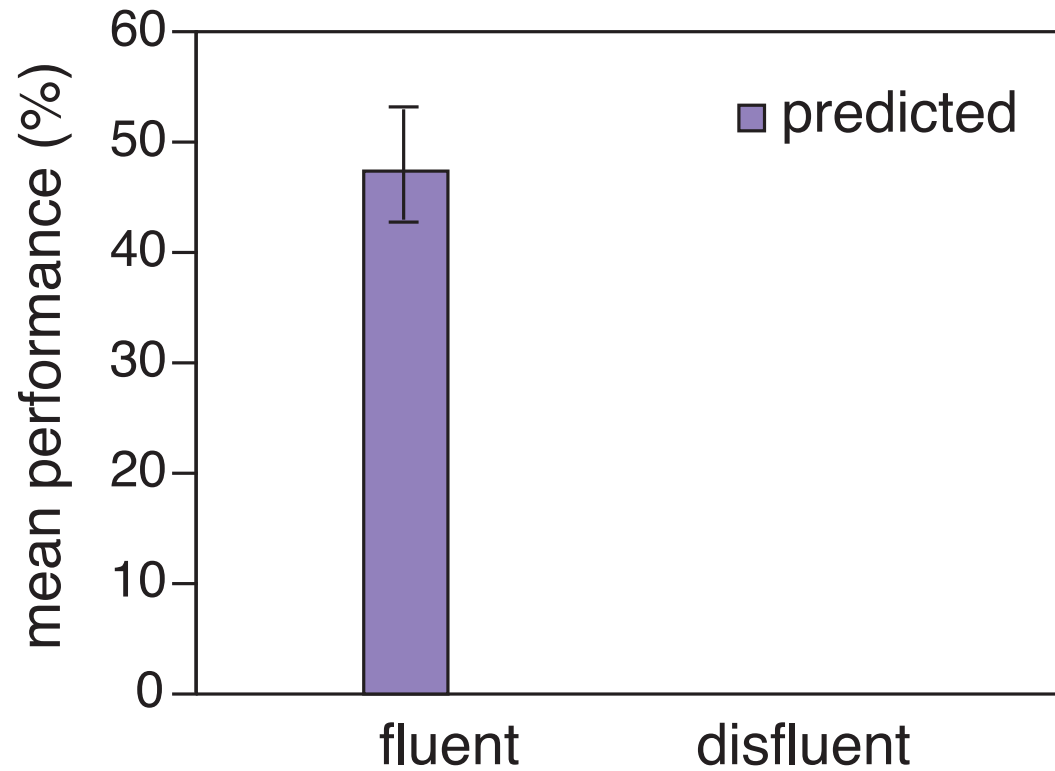
**1 Peer Instruction**

**2 let's try it!**

**3 results**



## judgement of learning



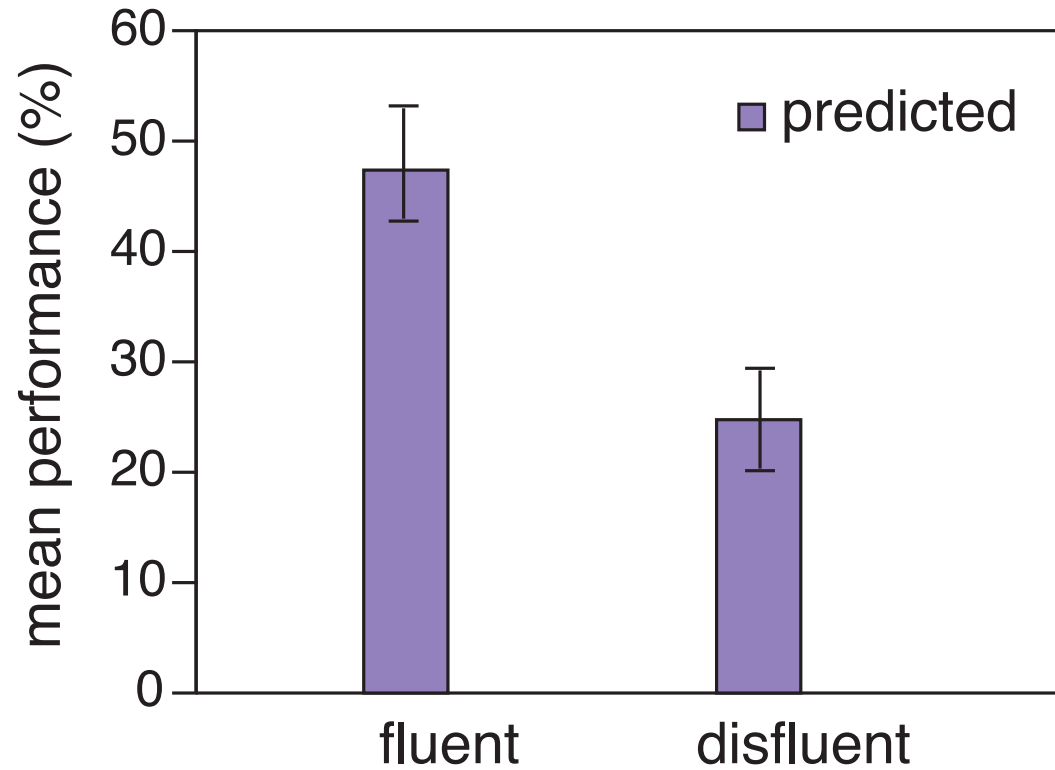
doi: 10.3758/s13423-013-0442-z

**1** Peer Instruction

**2** let's try it!

**3** results

## judgement of learning



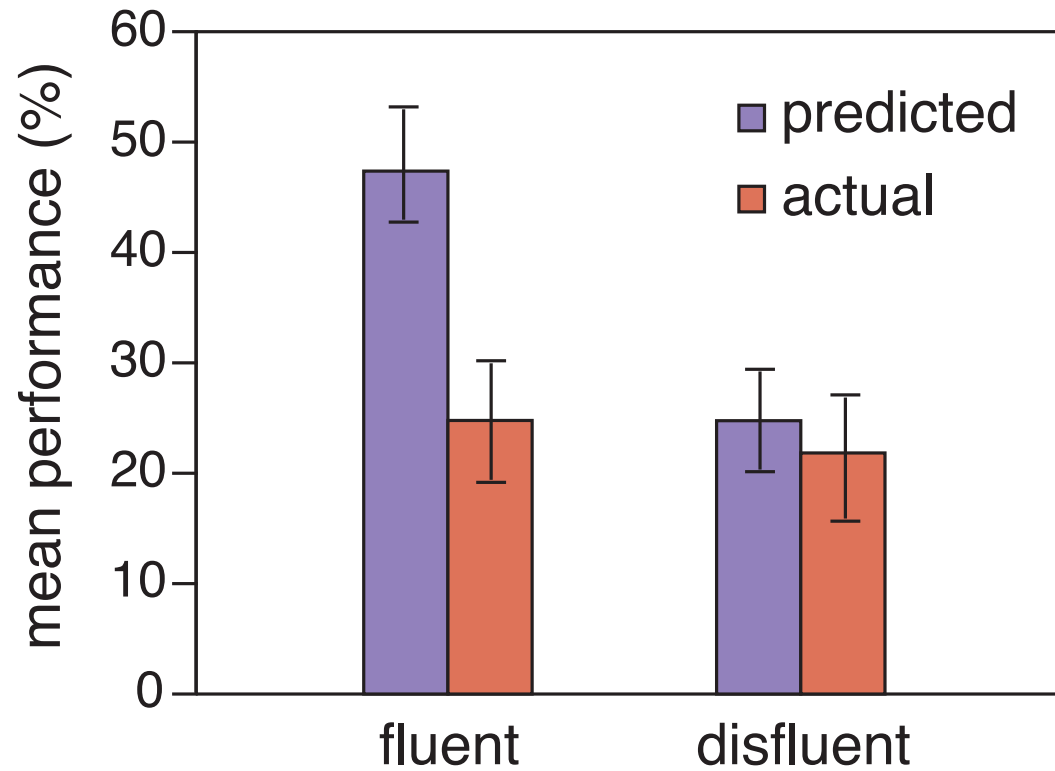
doi: 10.3758/s13423-013-0442-z

**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**

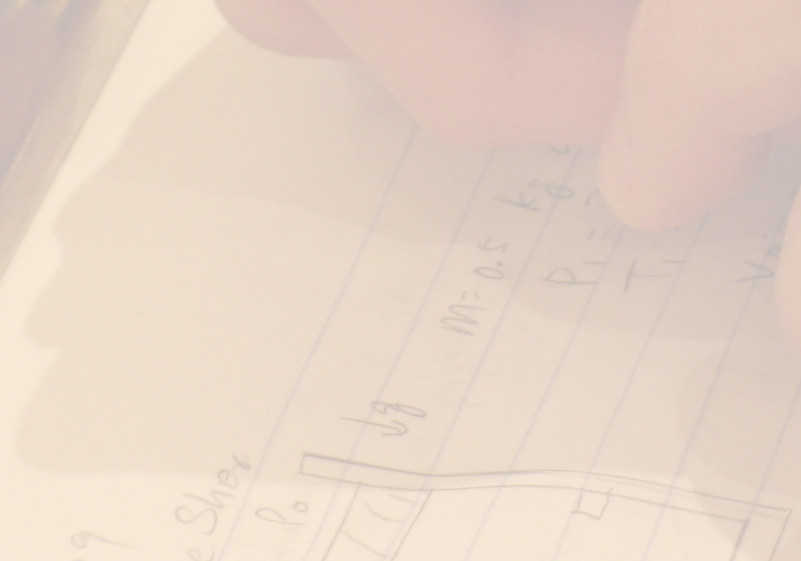
**active participation a must!**

**1 Peer Instruction**

**2 let's try it!**

**3 results**

**not just a polling tool, but an engagement tool!**





**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**

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