

# Turning lectures into learning



Turning Technologies User Conference  
Akademia Finansów i Biznesu Vistula  
Warsaw, Poland, 26 October 2015



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



# Turning lectures into learning



**@eric\_mazur**

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**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?**



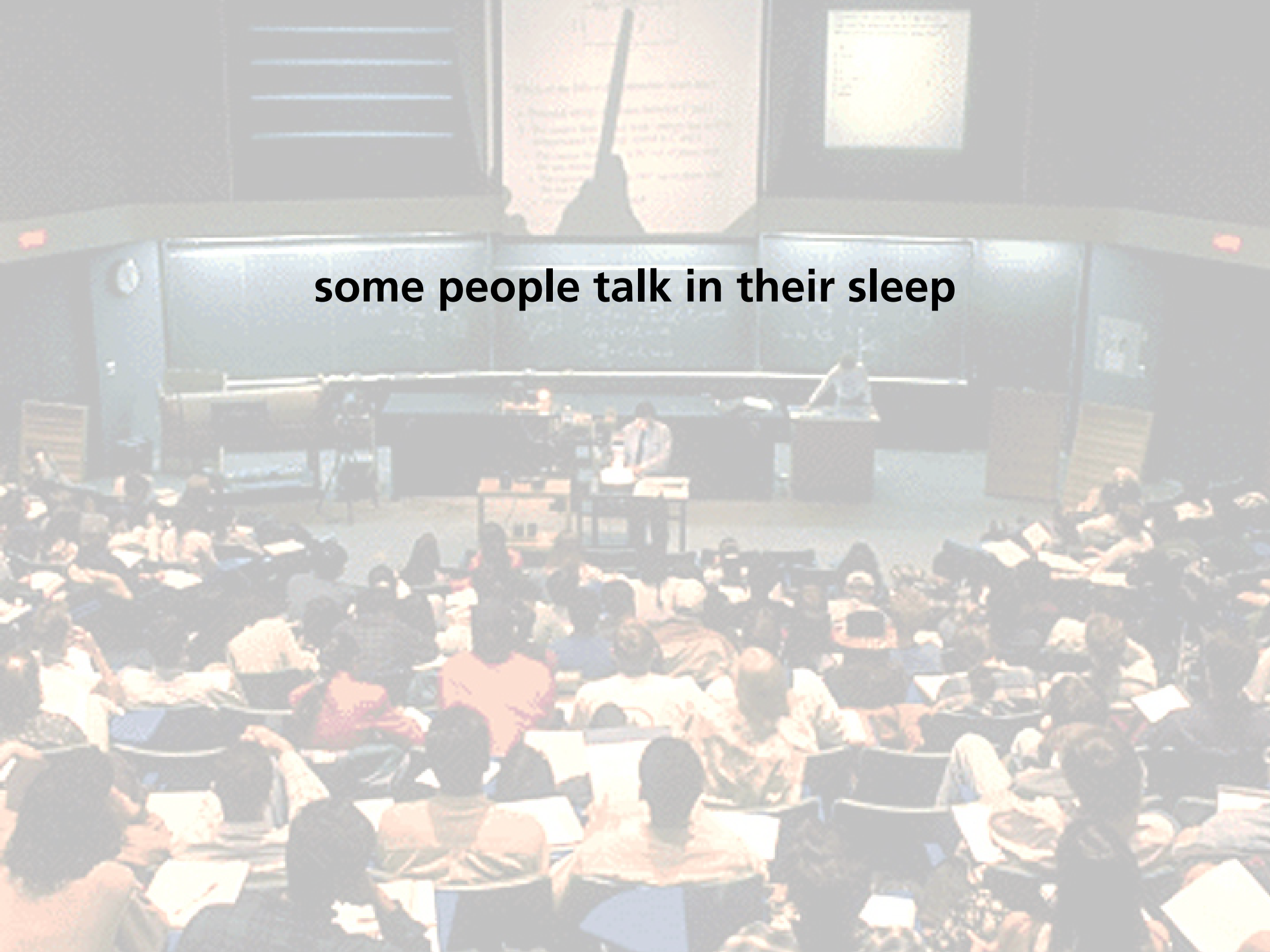
**Became good at it by:**

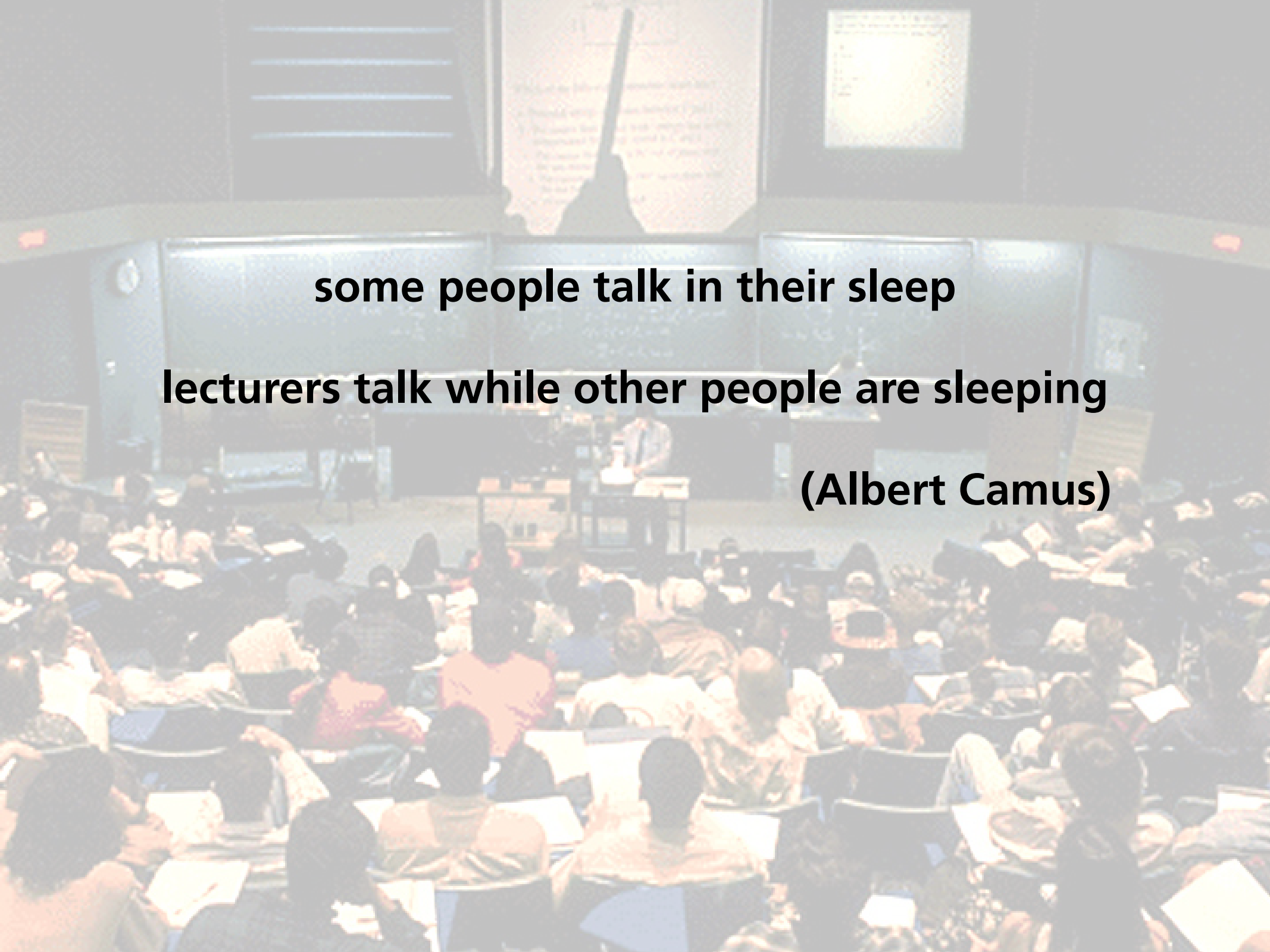
- 1. trial and error**
- 2. lectures**
- 3. practicing**
- 4. apprenticeship**
- 5. other**





**some people talk in their sleep**



A photograph of a large lecture hall. In the foreground, many students are seated at desks, many of whom appear to be sleeping or resting with their heads down. Some have papers or books open. In the background, a lecturer is standing at a podium, addressing the class. The room has a curved wall and large windows or screens at the front.

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





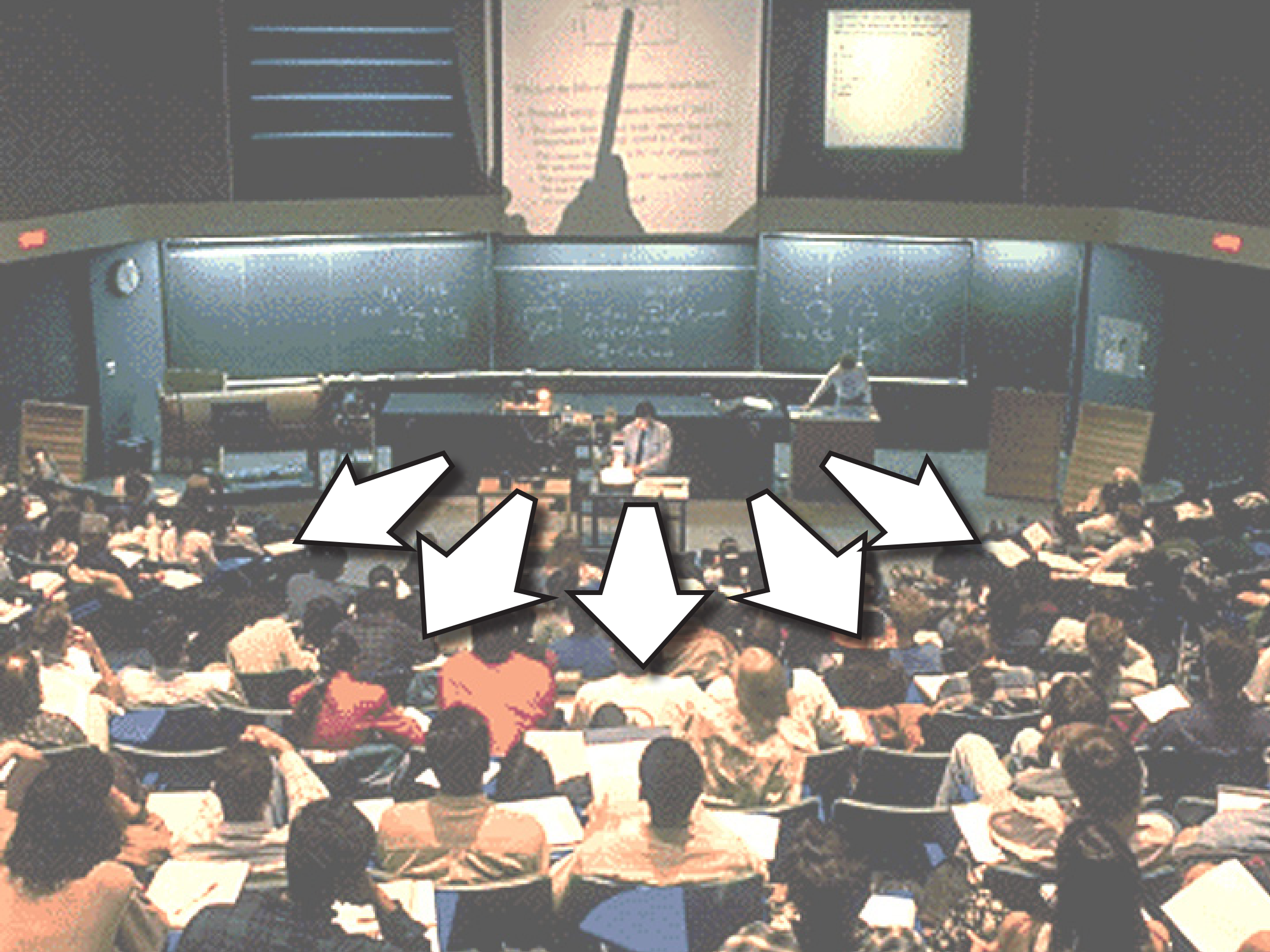
1. The first of the following statements is true  
2. The second statement is false  
3. The third statement is true  
4. The fourth statement is false  
5. The fifth statement is true  
6. The sixth statement is false  
7. The seventh statement is true  
8. The eighth statement is false  
9. The ninth statement is true  
10. The tenth statement is false

Year	Score
1990	85
1991	88
1992	90
1993	92
1994	95
1995	98
1996	100

1. The first of the following statements is true  
2. The second statement is false  
3. The third statement is true  
4. The fourth statement is false  
5. The fifth statement is true  
6. The sixth statement is false  
7. The seventh statement is true  
8. The eighth statement is false  
9. The ninth statement is true  
10. The tenth statement is false

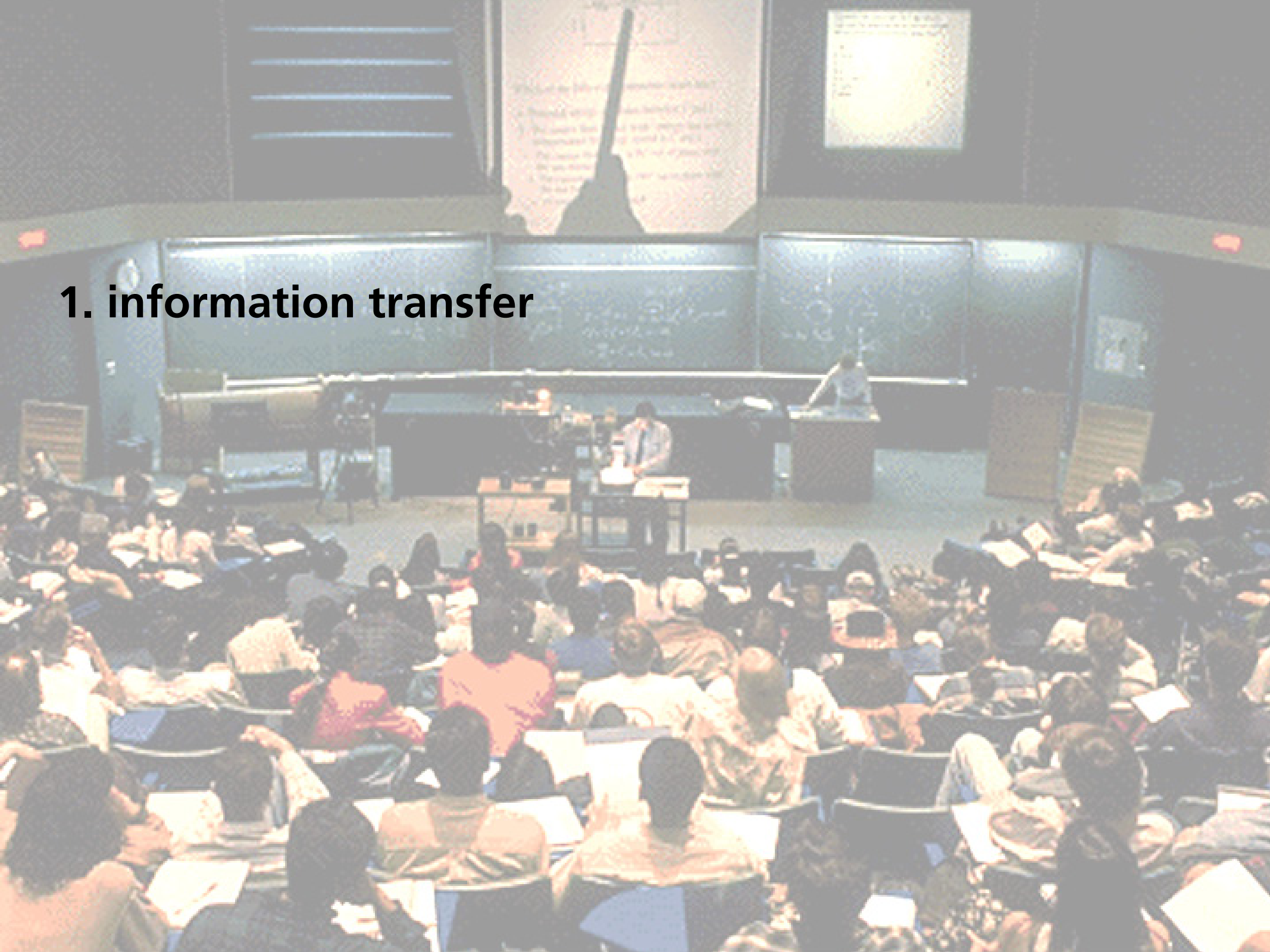
1. The first of the following statements is true  
2. The second statement is false  
3. The third statement is true  
4. The fourth statement is false  
5. The fifth statement is true  
6. The sixth statement is false  
7. The seventh statement is true  
8. The eighth statement is false  
9. The ninth statement is true  
10. The tenth statement is false







# 1. information transfer



A large lecture hall filled with students seated at desks, facing a stage. The stage features a large screen displaying a presentation, a chalkboard with handwritten notes, and a lecturer standing near a podium. The students are mostly seen from behind, looking towards the front of the room.

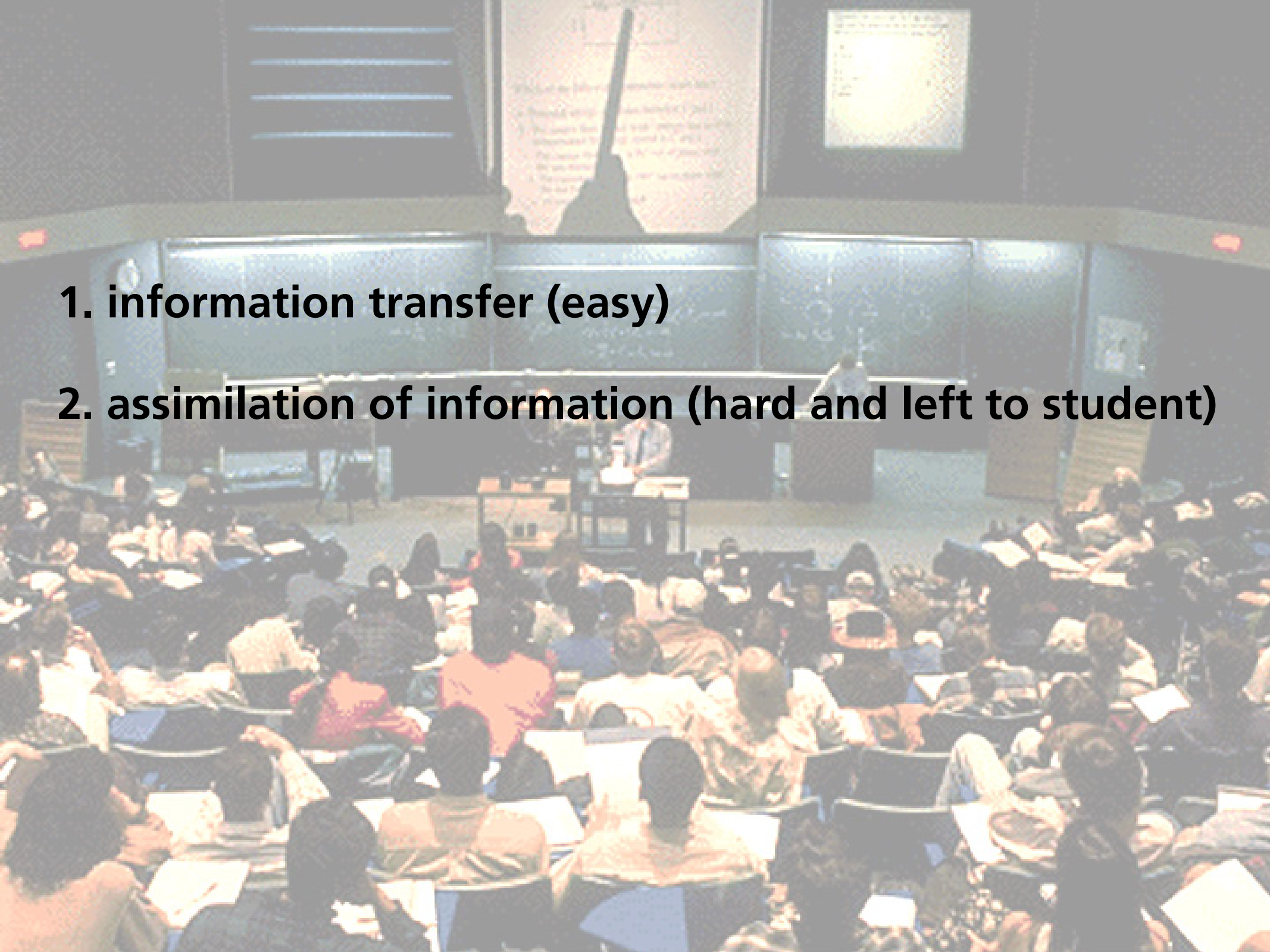
**1. information transfer**

**2. assimilation of information**



**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

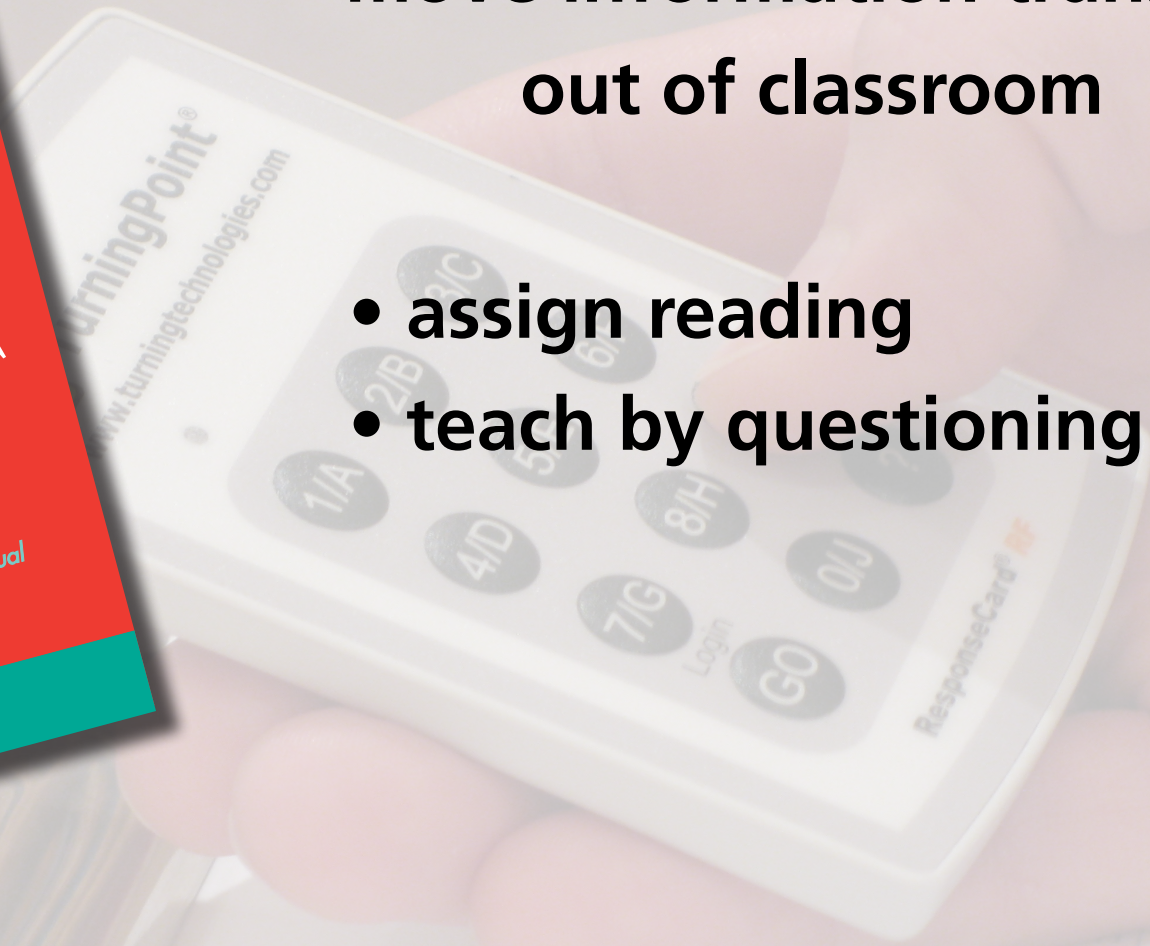
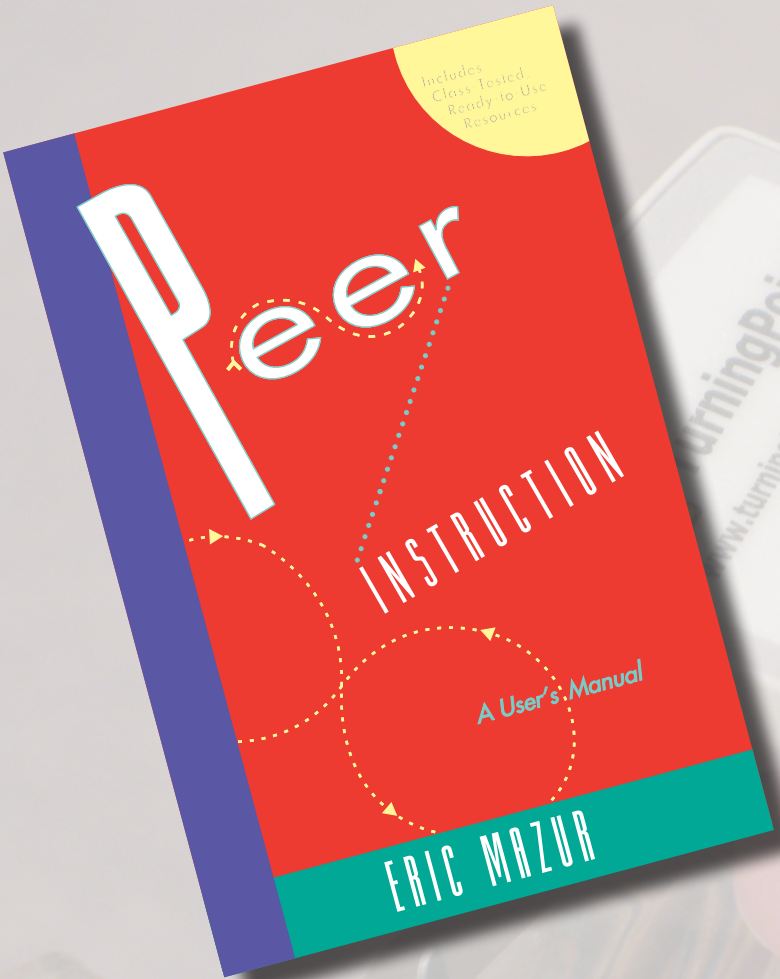
2 let's try it!

3 results



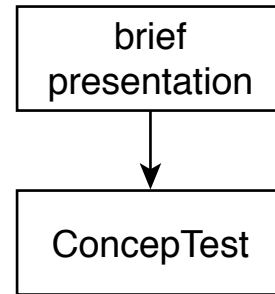
**move information transfer  
out of classroom**

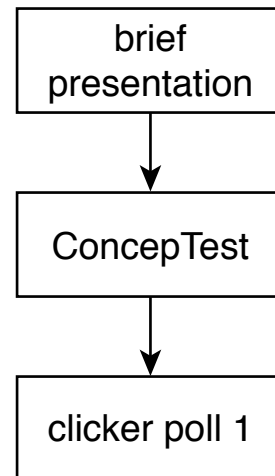
- assign reading
- teach by questioning

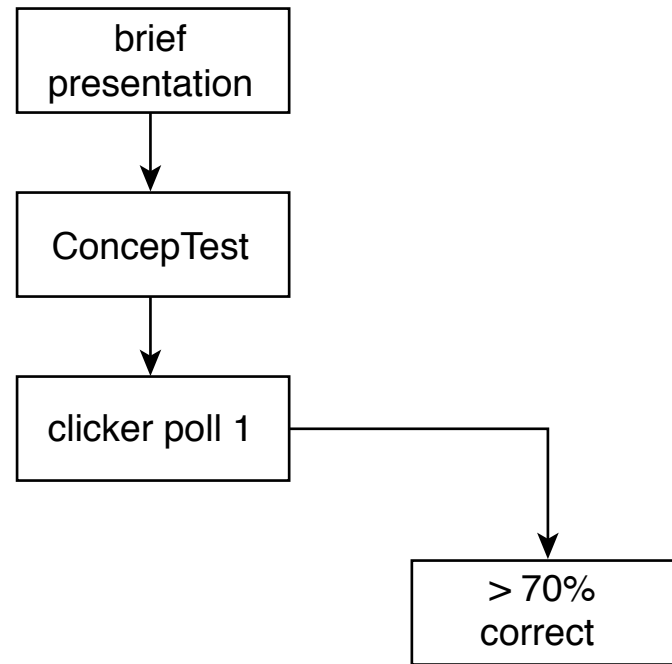


brief  
presentation

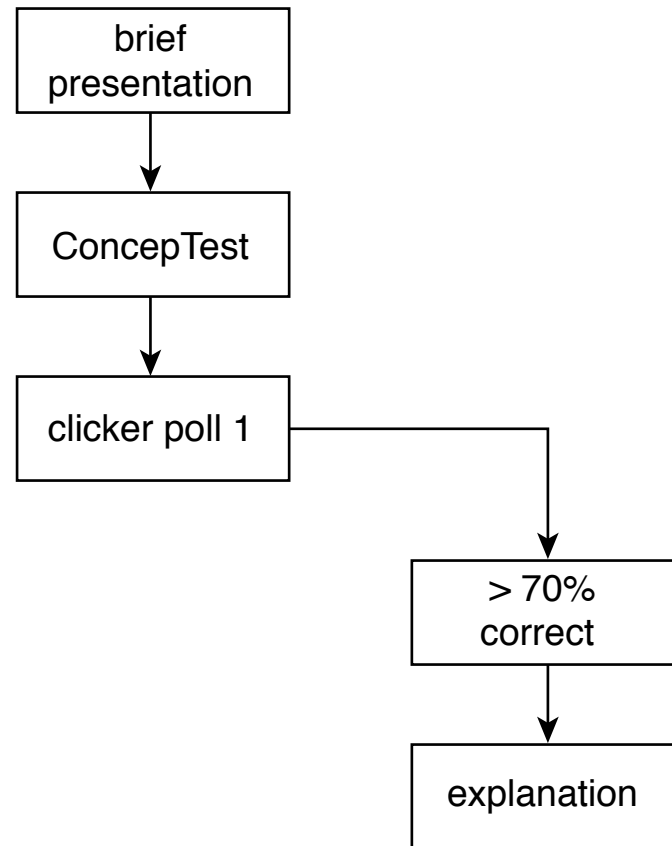


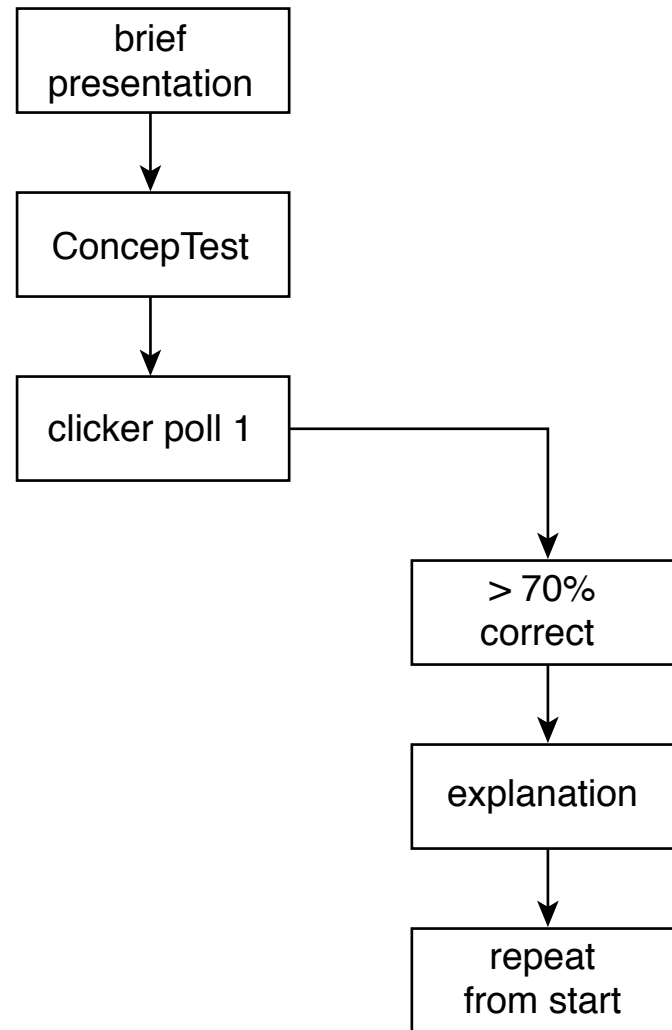


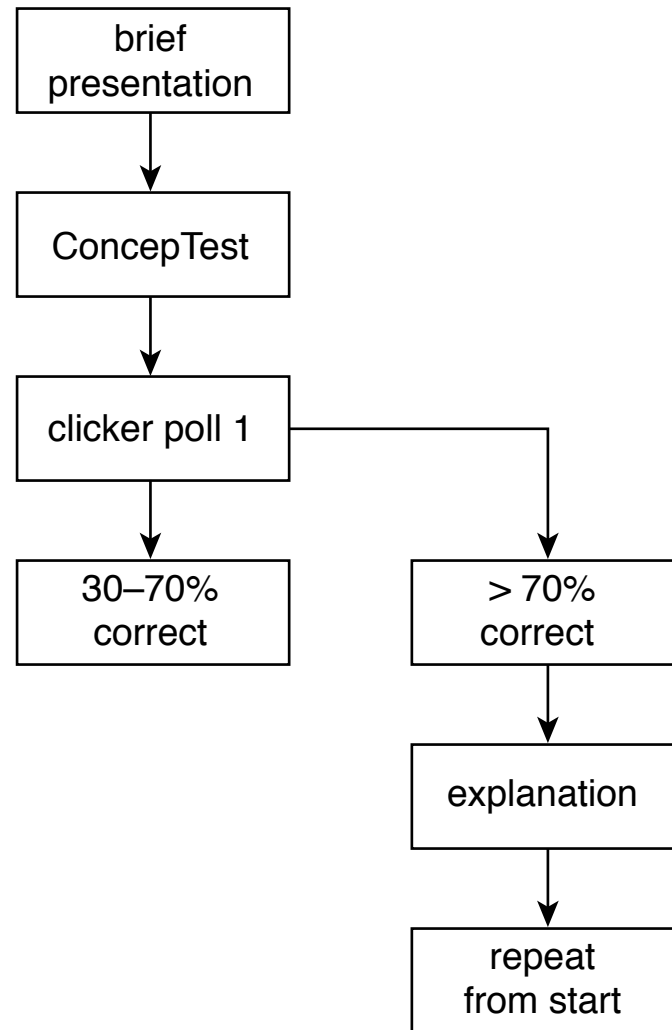




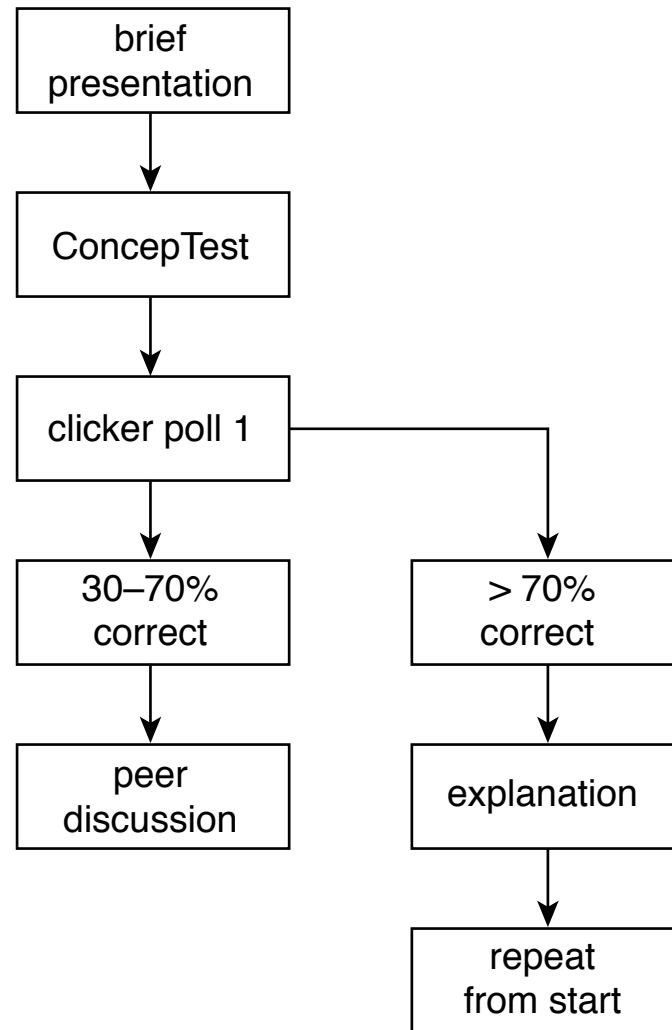


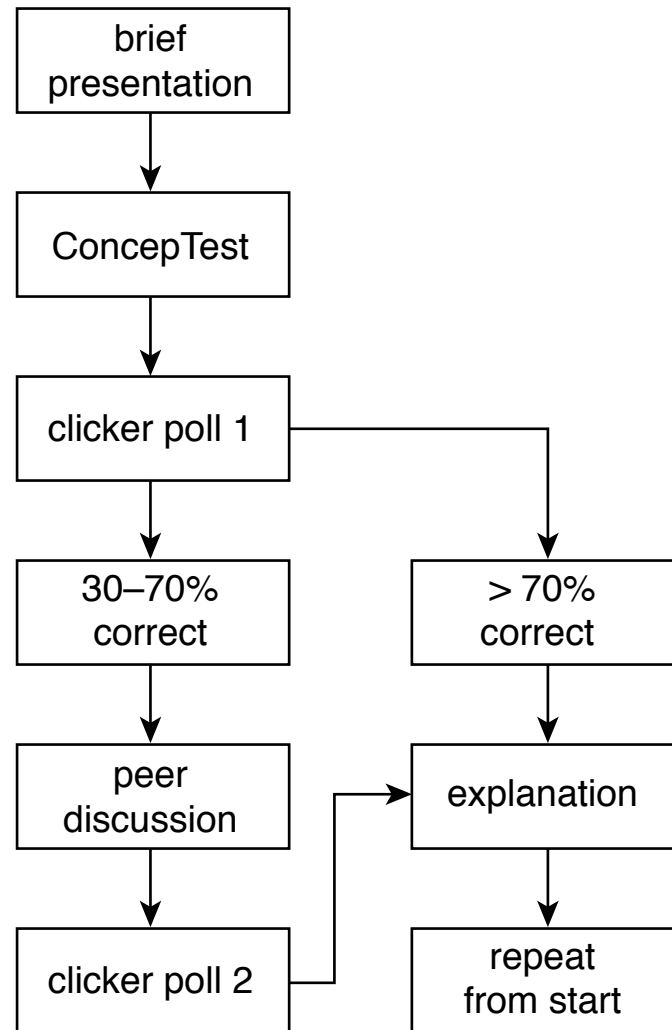


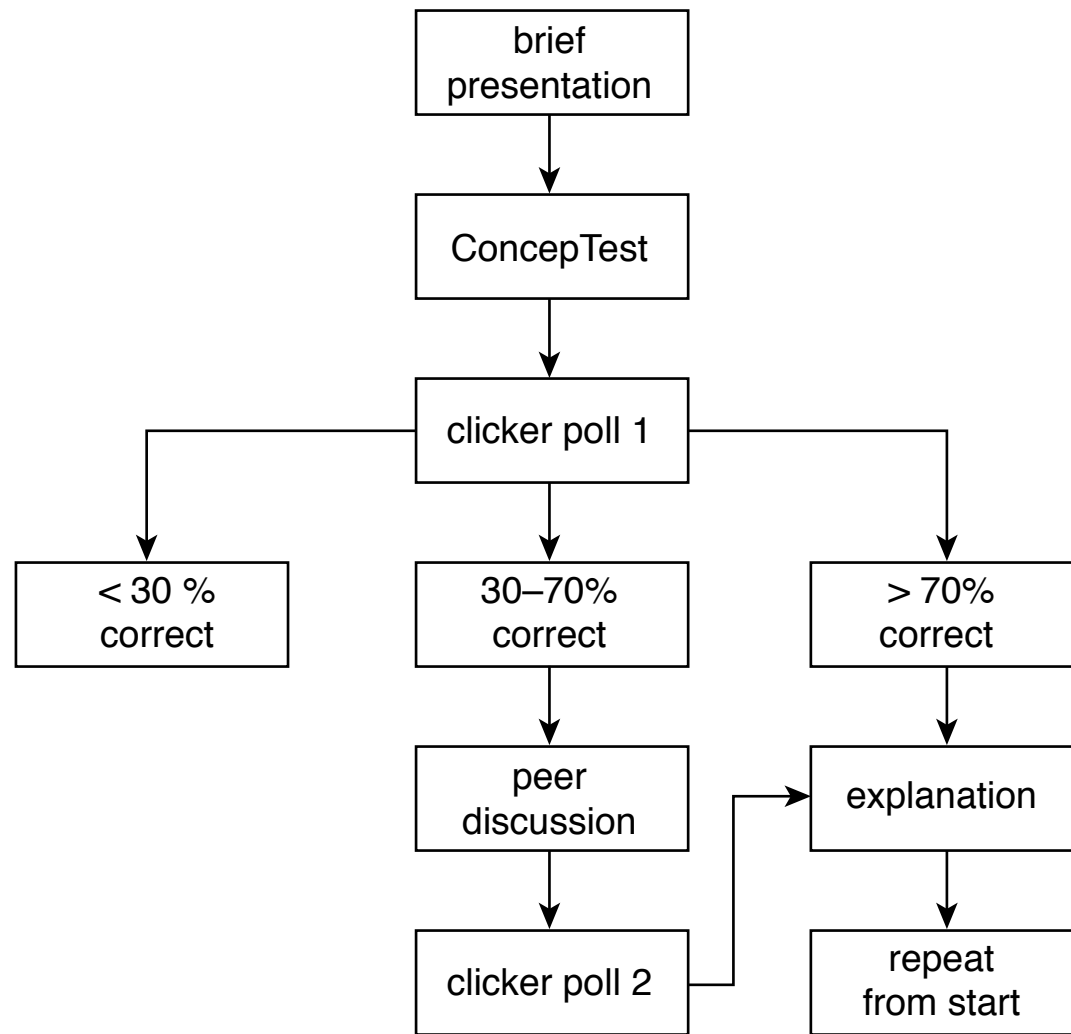


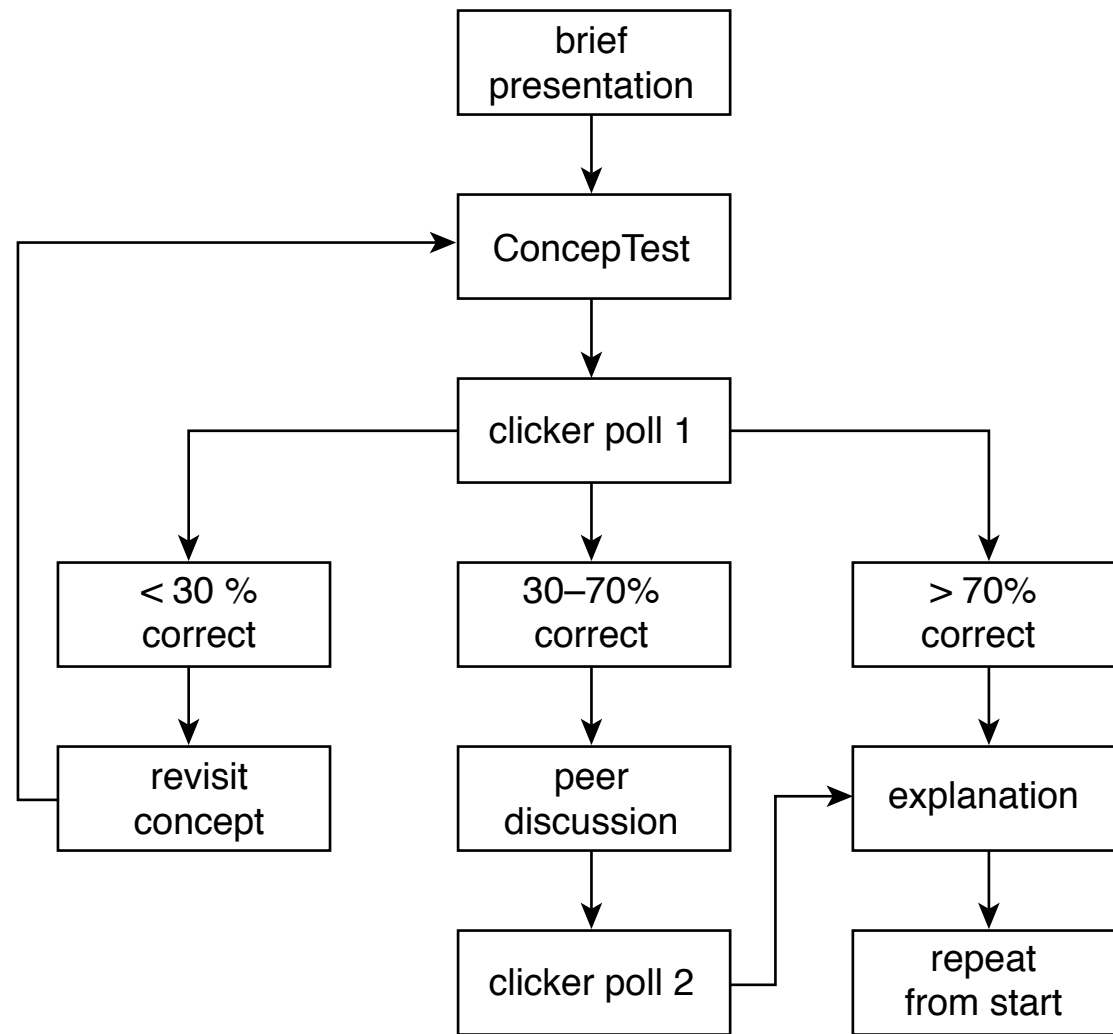




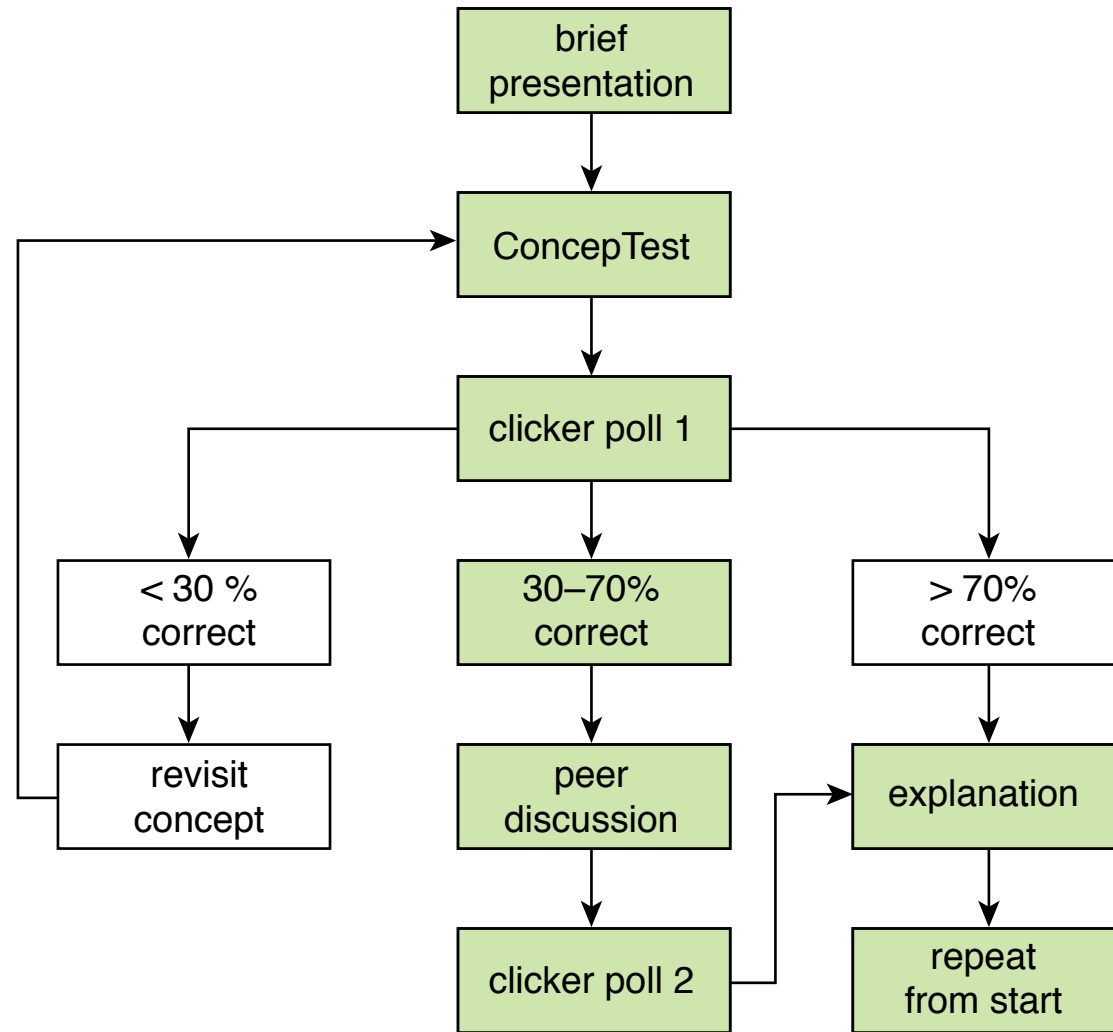






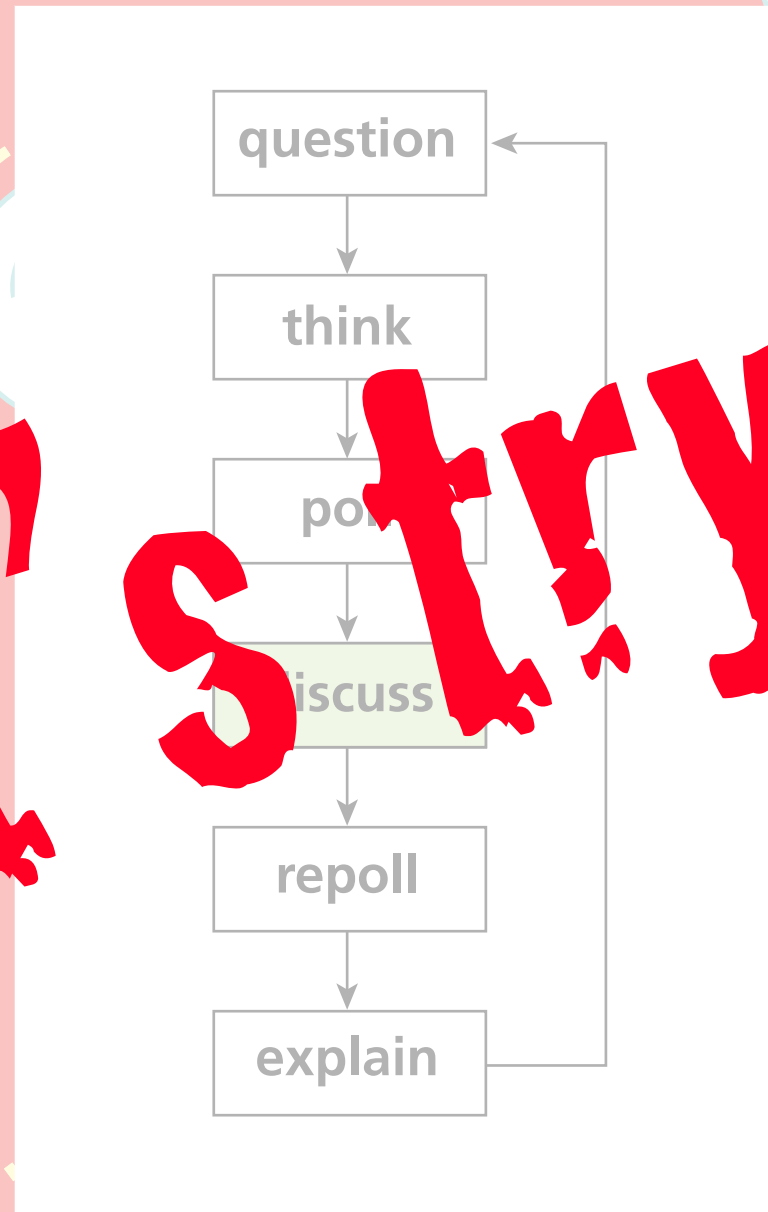








Let's try it!



1 Peer Instruction

2 let's try it!

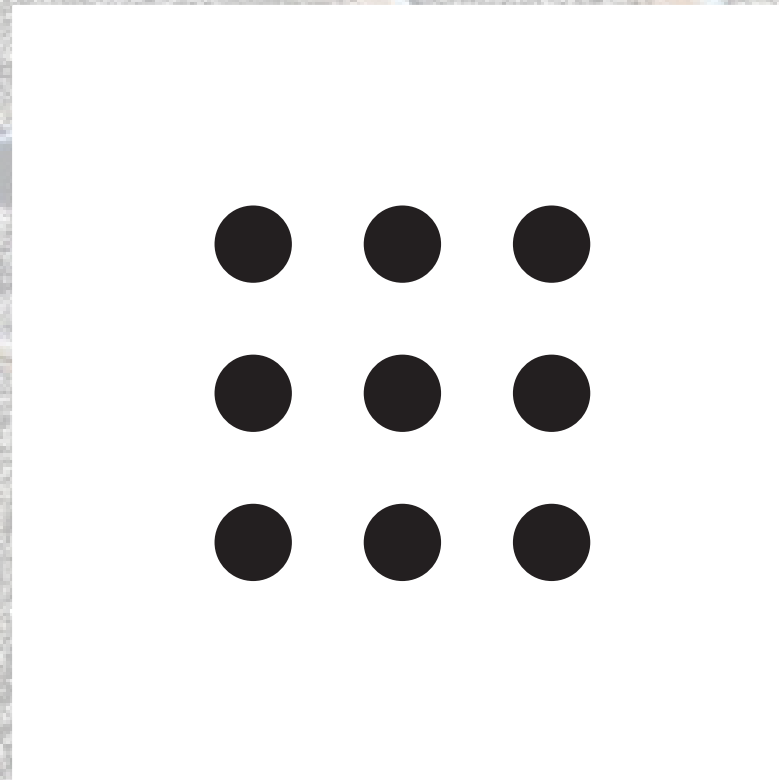
A photograph of a railroad track on a gravel bed. The track is wavy, curving back and forth across the frame. The rails are a reddish-brown color, and the gravel is grey. The background shows green grass. The text "thermal expansion" is overlaid in the center of the image.

**thermal expansion**

**1 Peer Instruction**

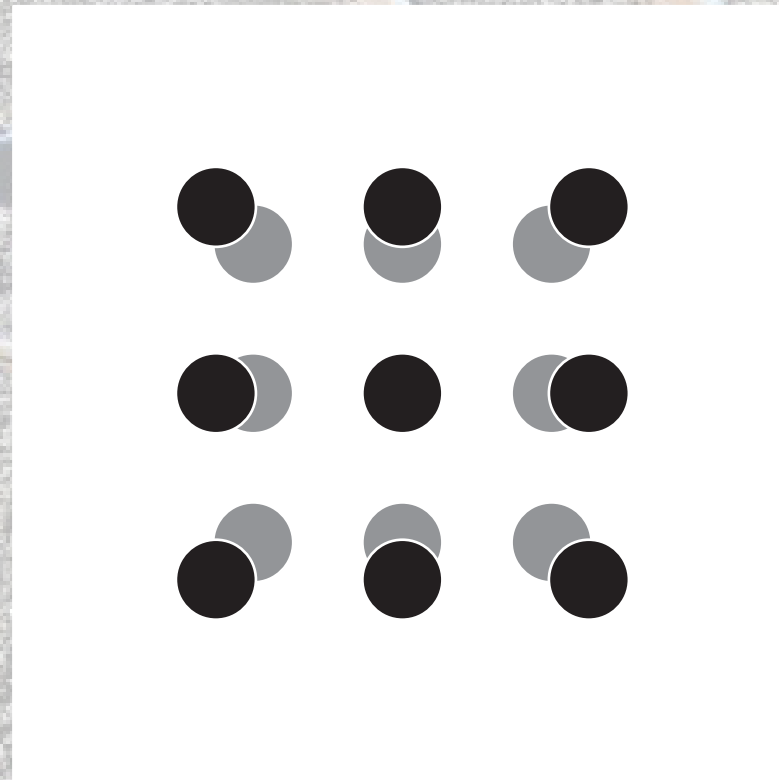
**2 let's try it!**





**1** Peer Instruction

**2** let's try it!



**1** Peer Instruction

**2** let's try it!

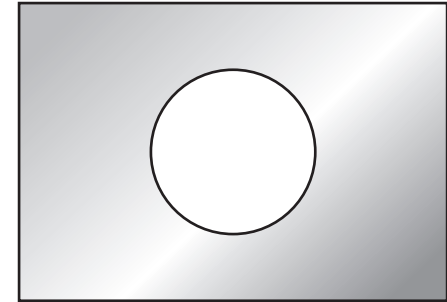
**all of them!**



**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!**



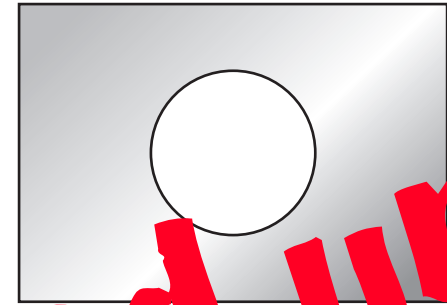
**Consider a rectangular metal plate with a circular hole in it.**



**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.

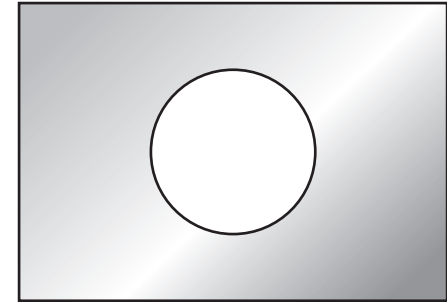


When the plate is uniformly heated, the diameter of the hole

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**

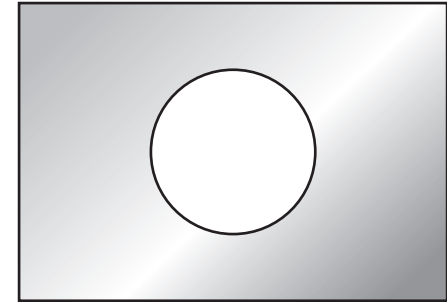
**Consider a rectangular metal plate with a circular hole in it.**



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

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

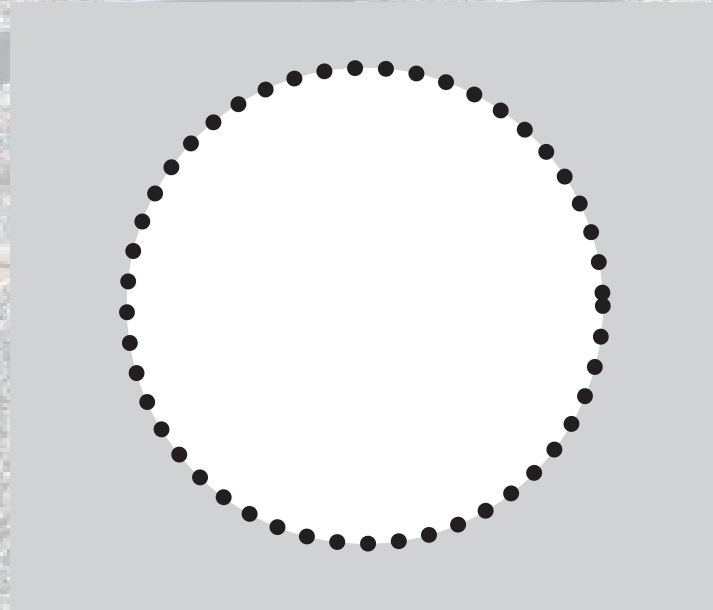
**Consider a rectangular metal plate with a circular hole in it.**



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

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

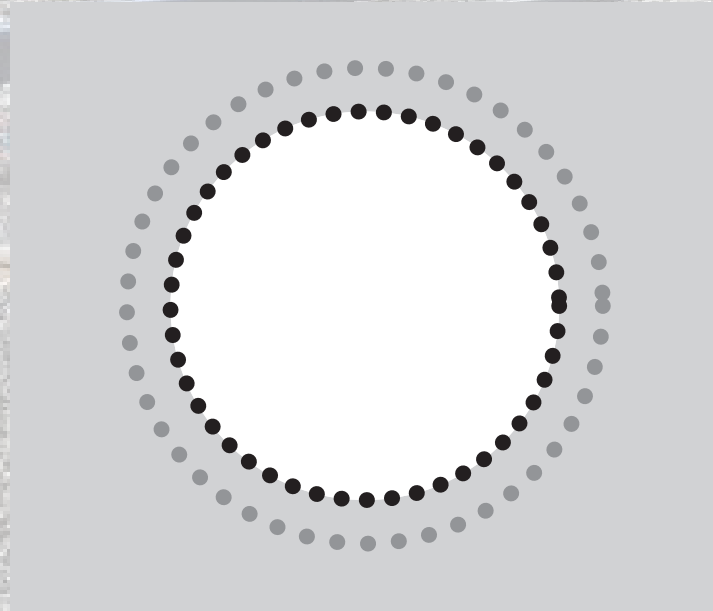
consider atoms at rim of hole



**1** Peer Instruction

**2** let's try it!

consider atoms at rim of hole

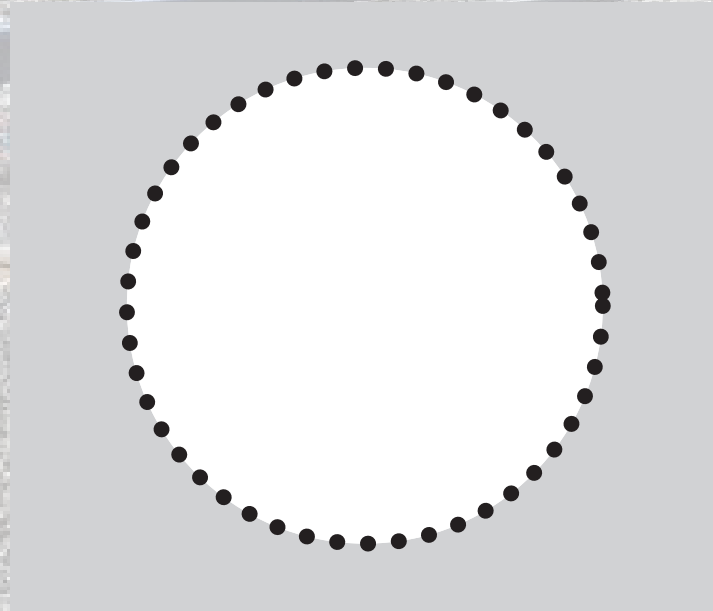


**1** Peer Instruction

**2** let's try it!



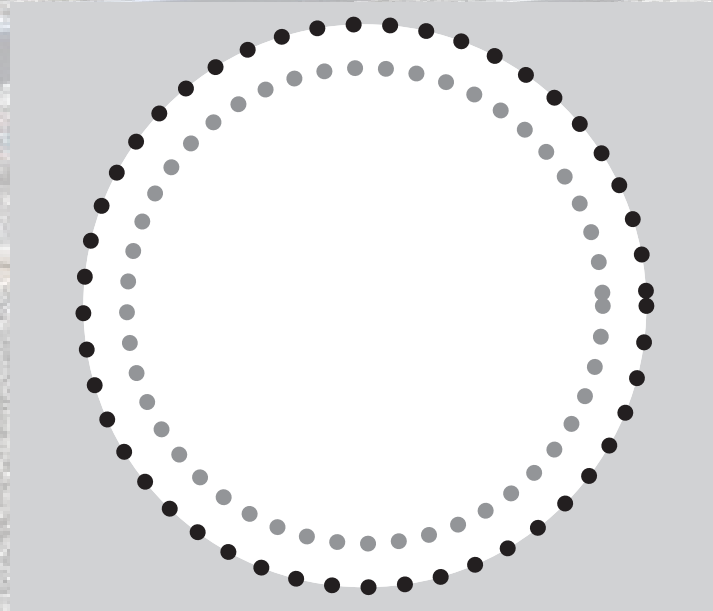
consider atoms at rim of hole



**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

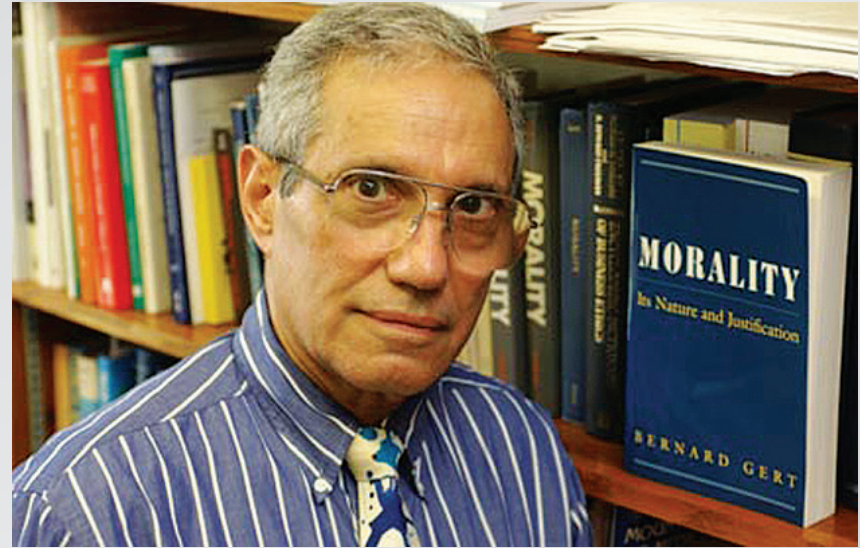
INSTRUCTION

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.

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:**

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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
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7. Keep your promises
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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?

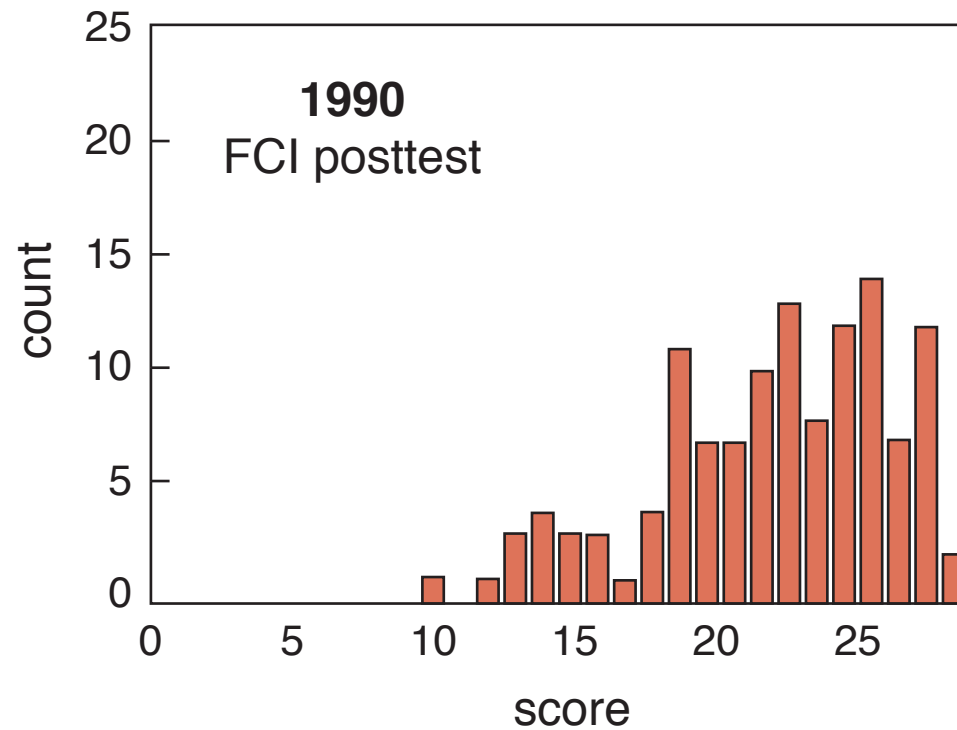
1. Yes
2. No



**1** Peer Instruction

**2** let's try it!

## traditional instruction

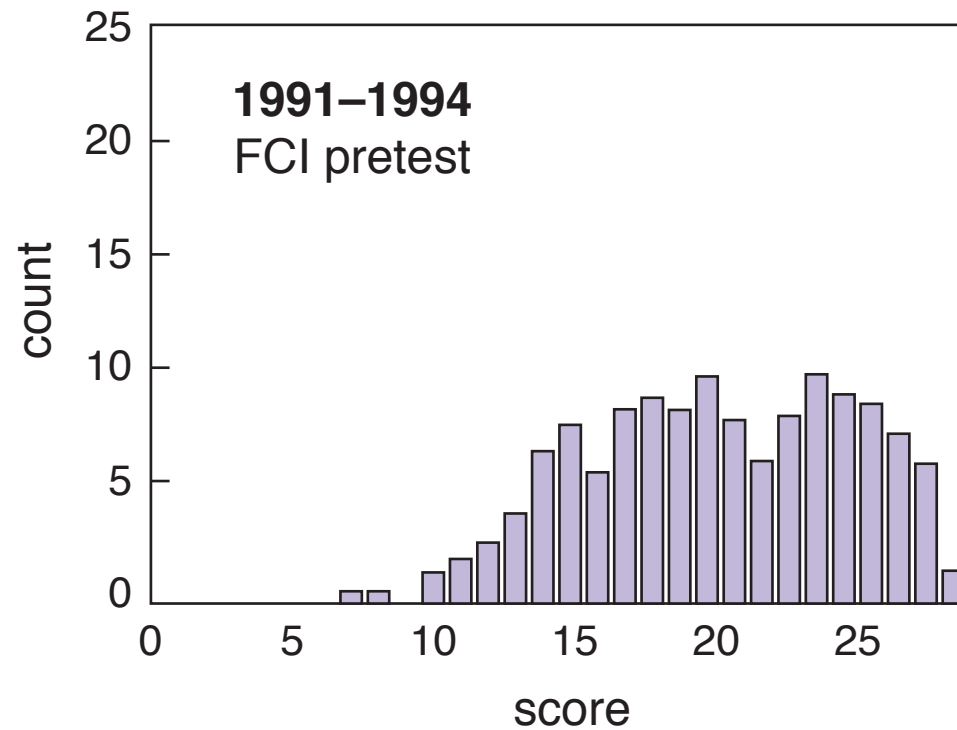


1 Peer Instruction

2 let's try it!

3 results

## traditional instruction

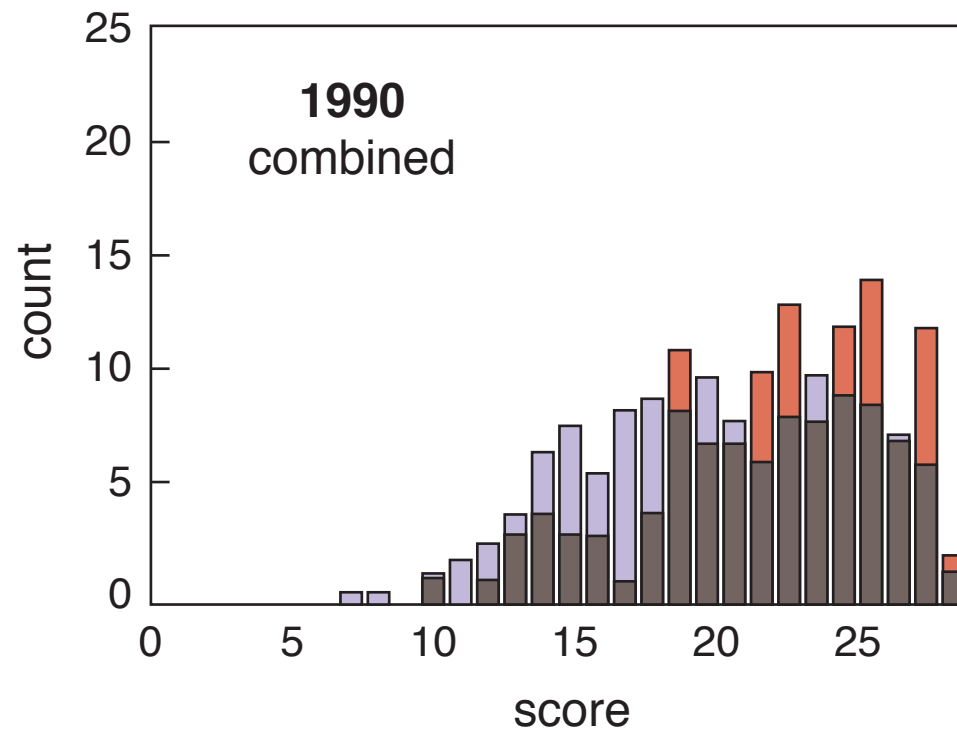


**1** Peer Instruction

**2** let's try it!

**3** results

## traditional instruction

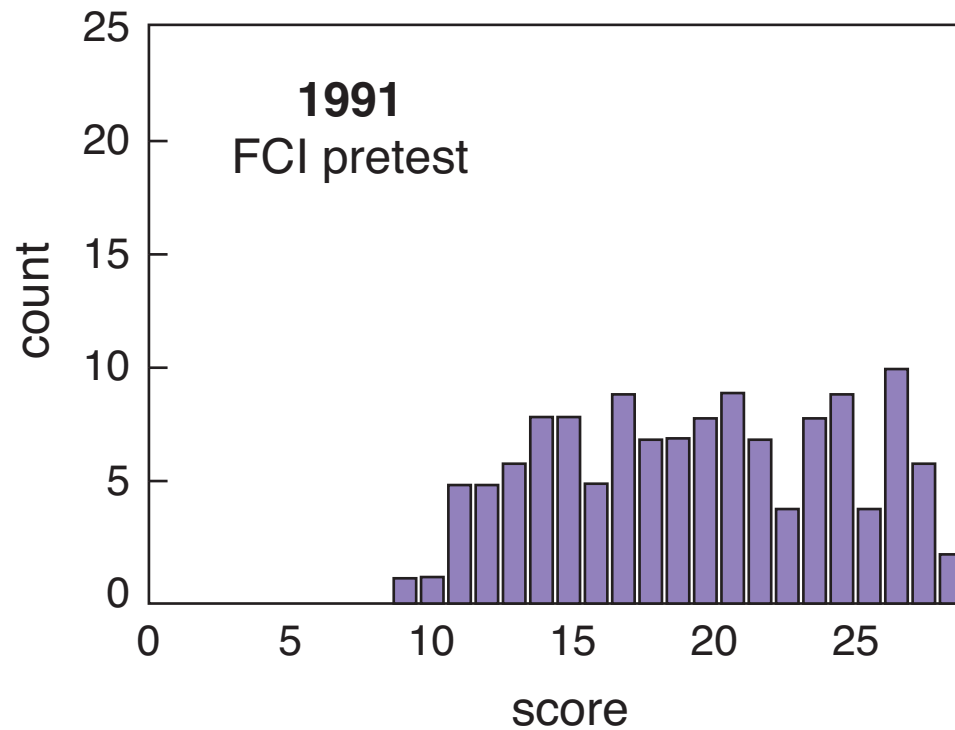


1 Peer Instruction

2 let's try it!

3 results

## first year of implementing PI



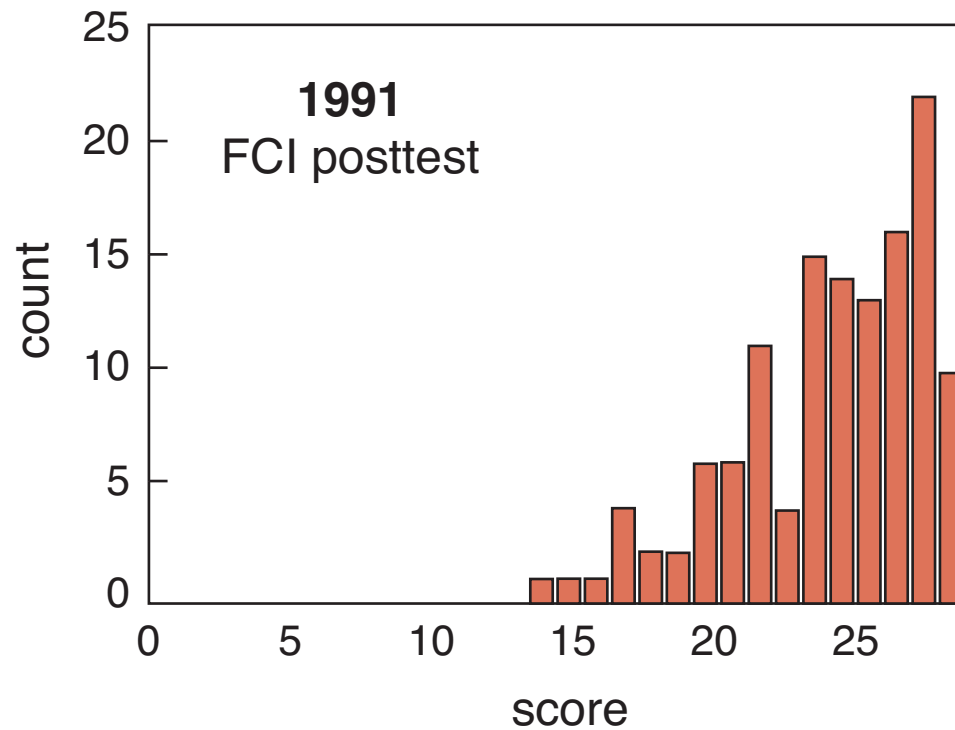
**1** Peer Instruction

**2** let's try it!

**3** results



## first year of implementing PI

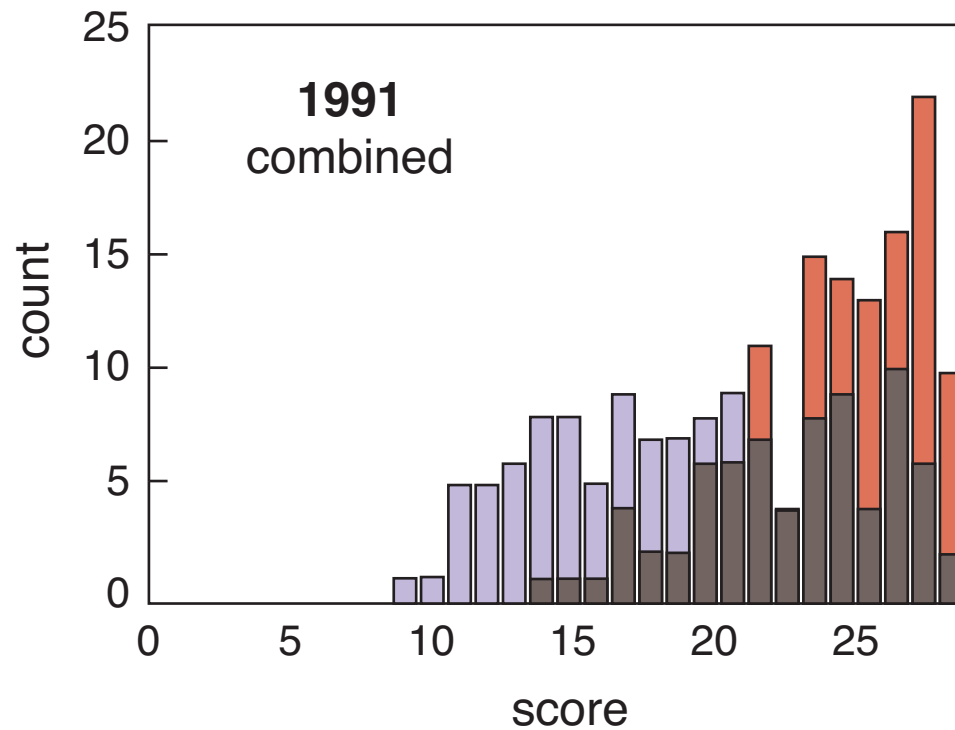


**1** Peer Instruction

**2** let's try it!

**3** results

## first year of implementing PI



**1** Peer Instruction

**2** let's try it!

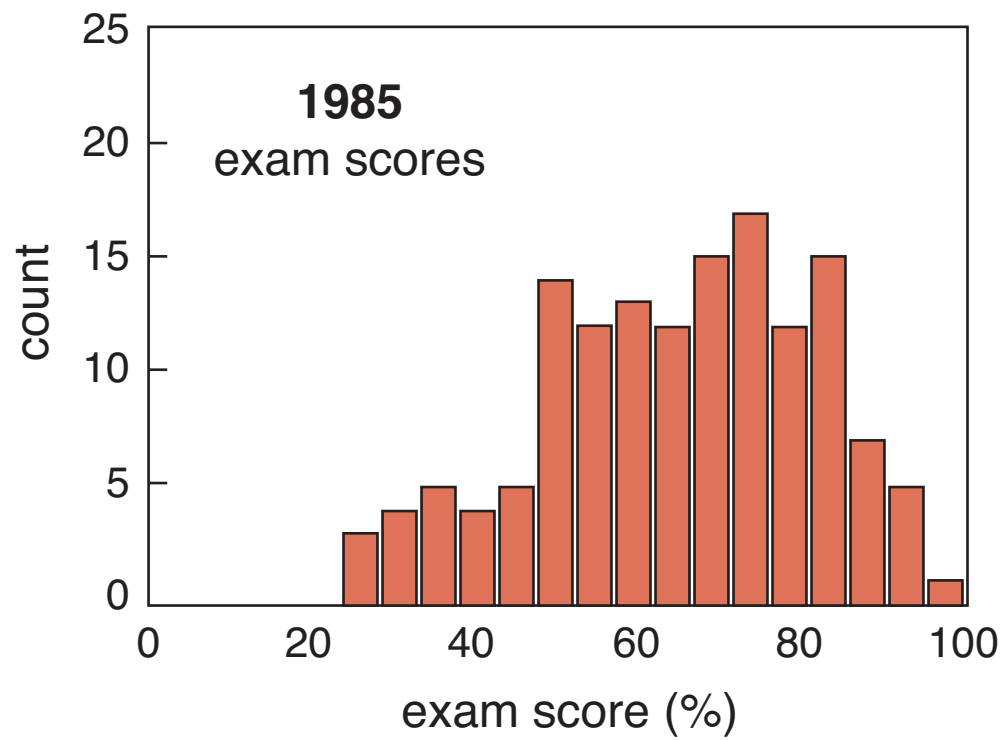
**3** results

**what about problem solving?**

**1 Peer Instruction**

**2 let's try it!**

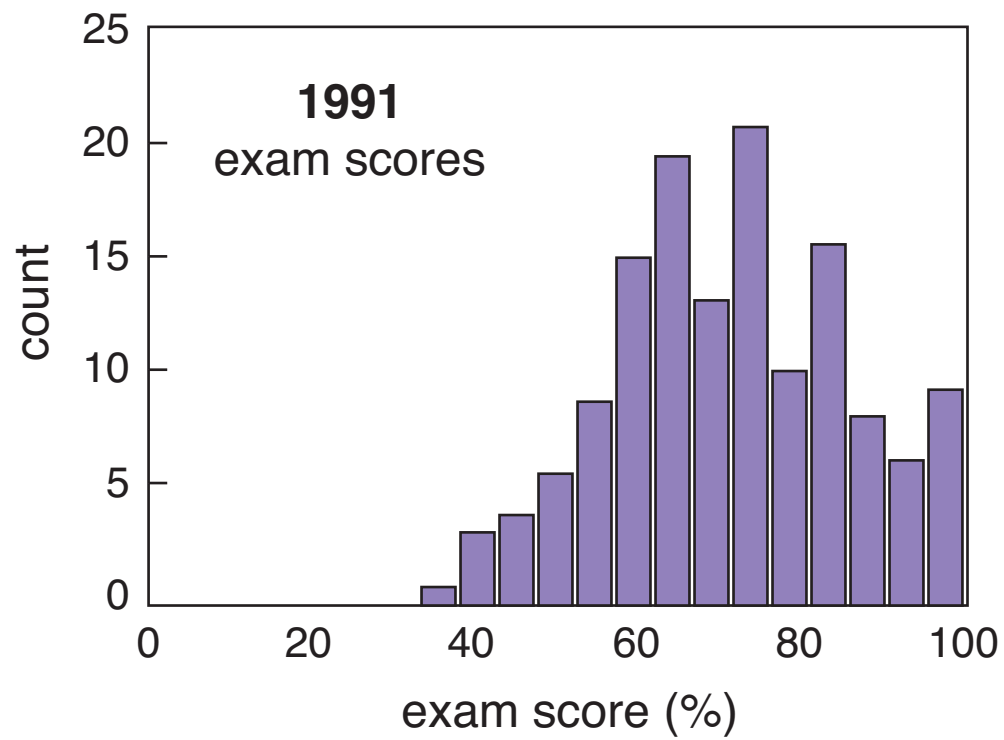
**3 results**



**1** Peer Instruction

**2** let's try it!

**3** results

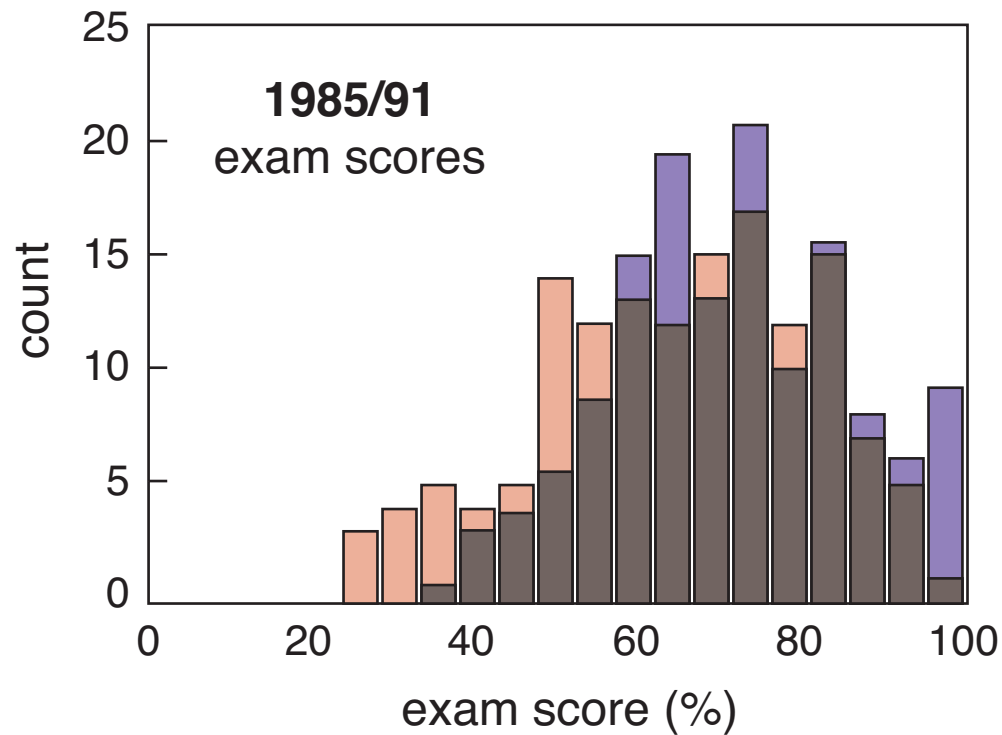


**1** Peer Instruction

**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

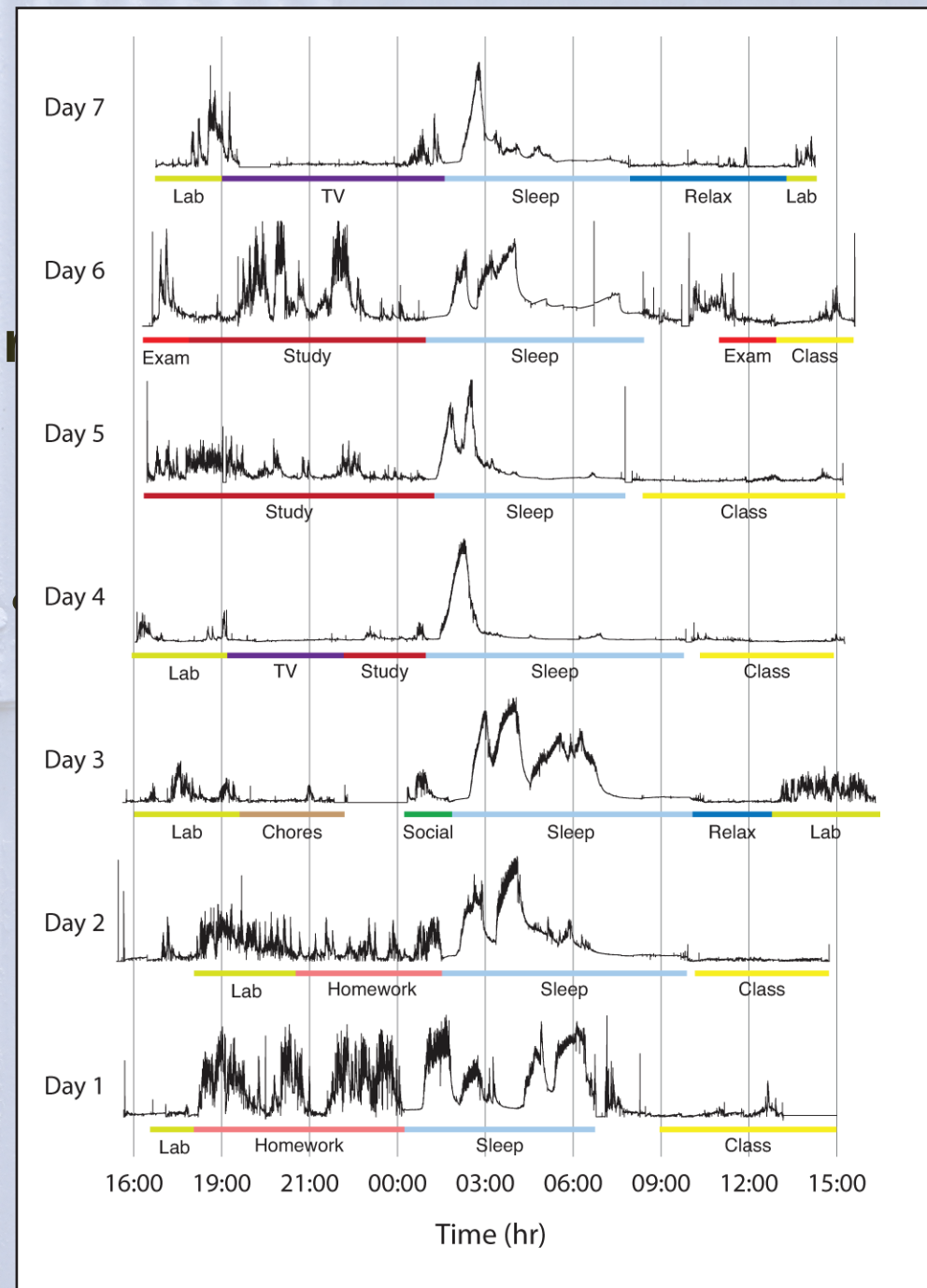
**2** let's try it!

**3** results



in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

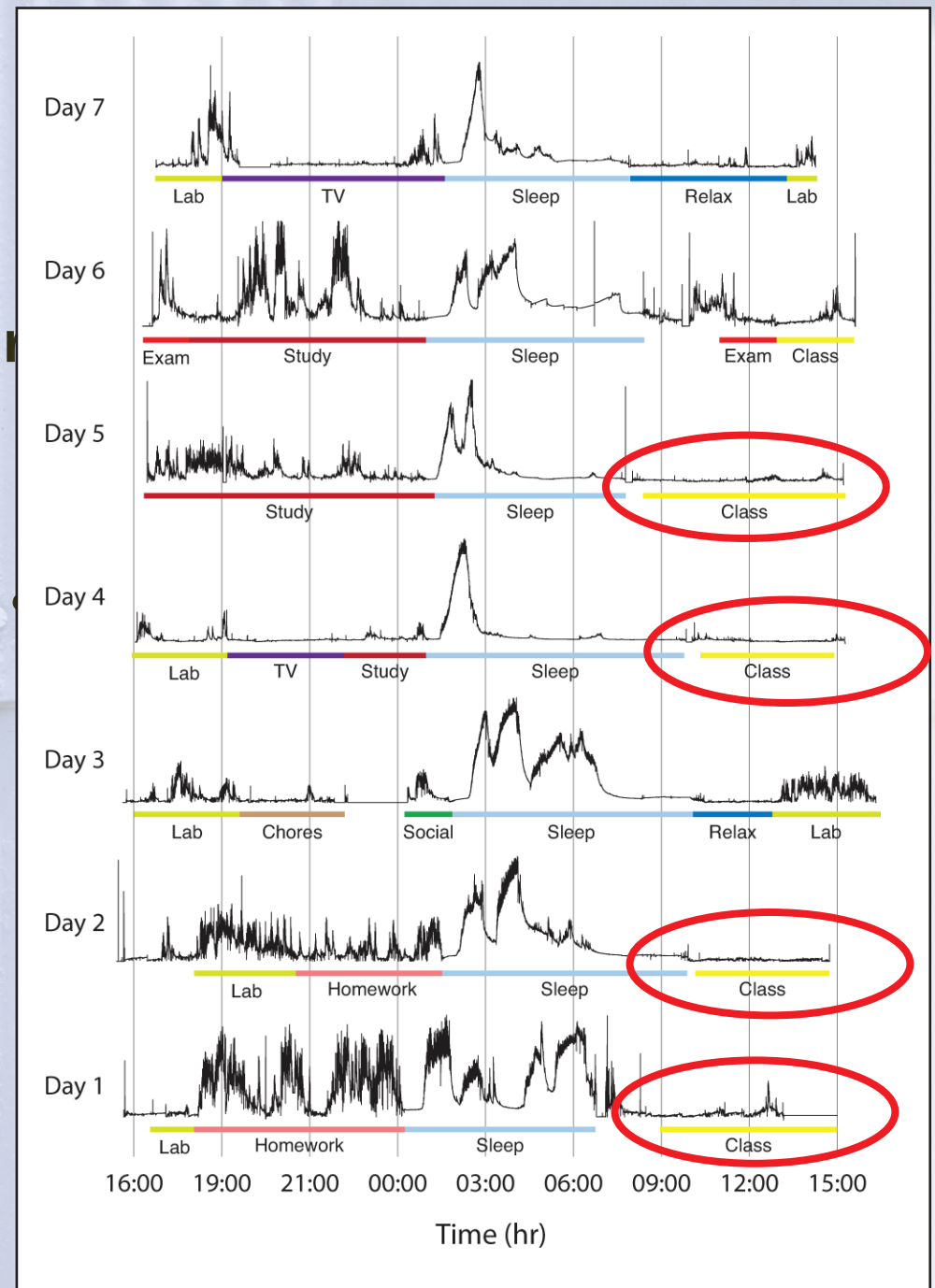
1 Peer Instruction

2 let's try it!

3 results

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

1 Peer Instruction

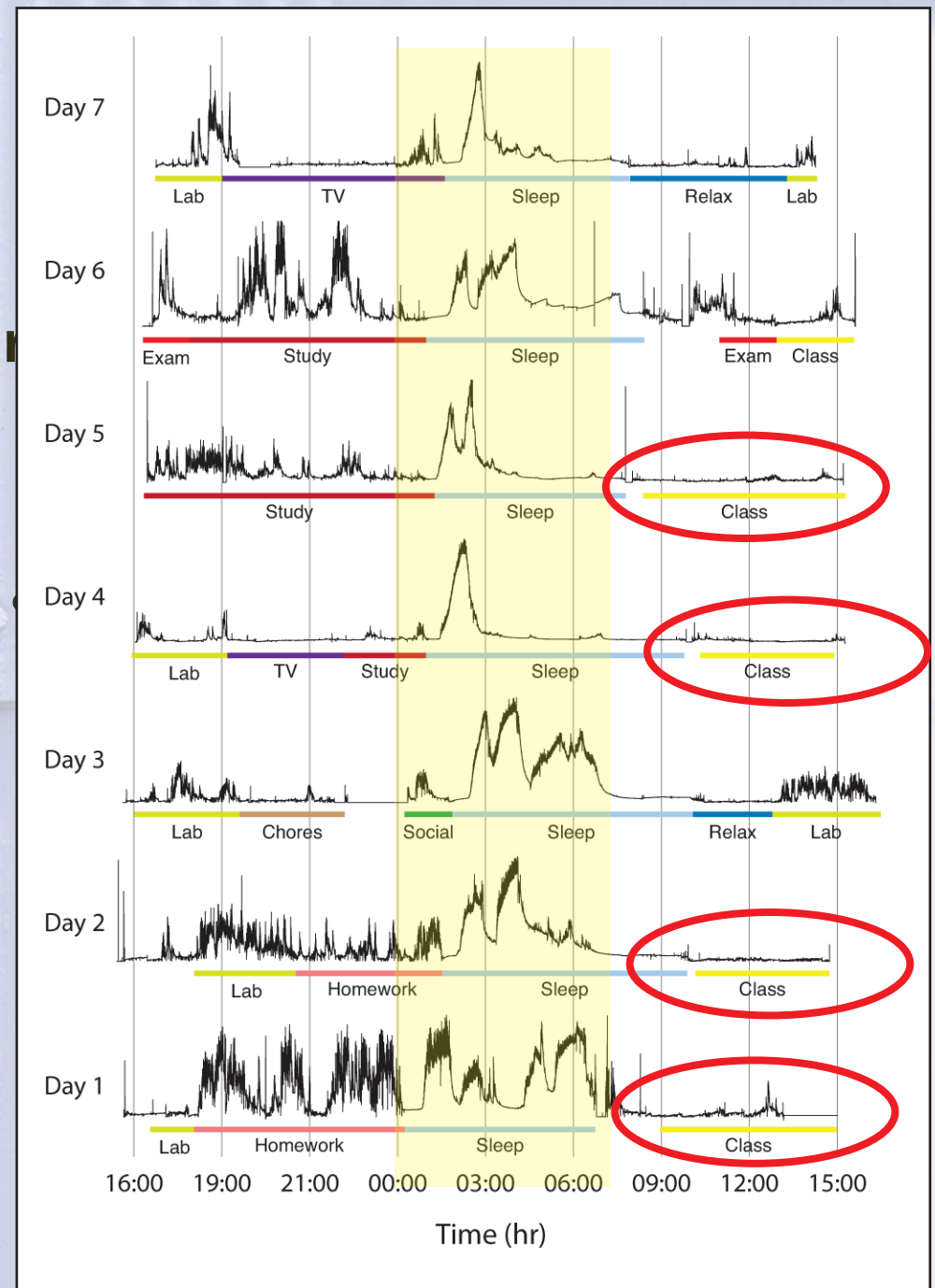
2 let's try it!

3 results



in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

1 Peer Instruction

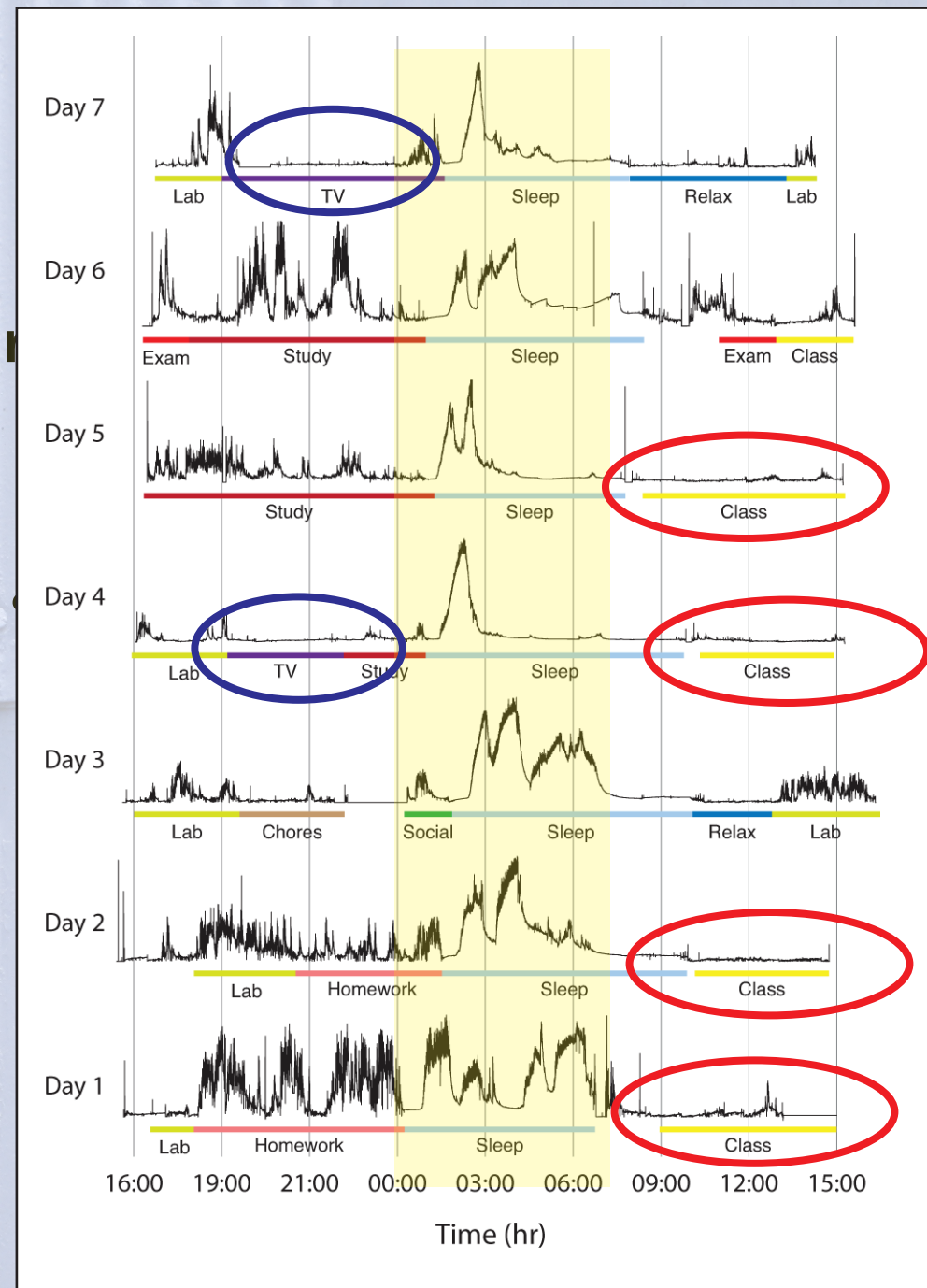
2 let's try it!

3 results



in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

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





**2 short video lectures on calico cats, same content**

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**

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**

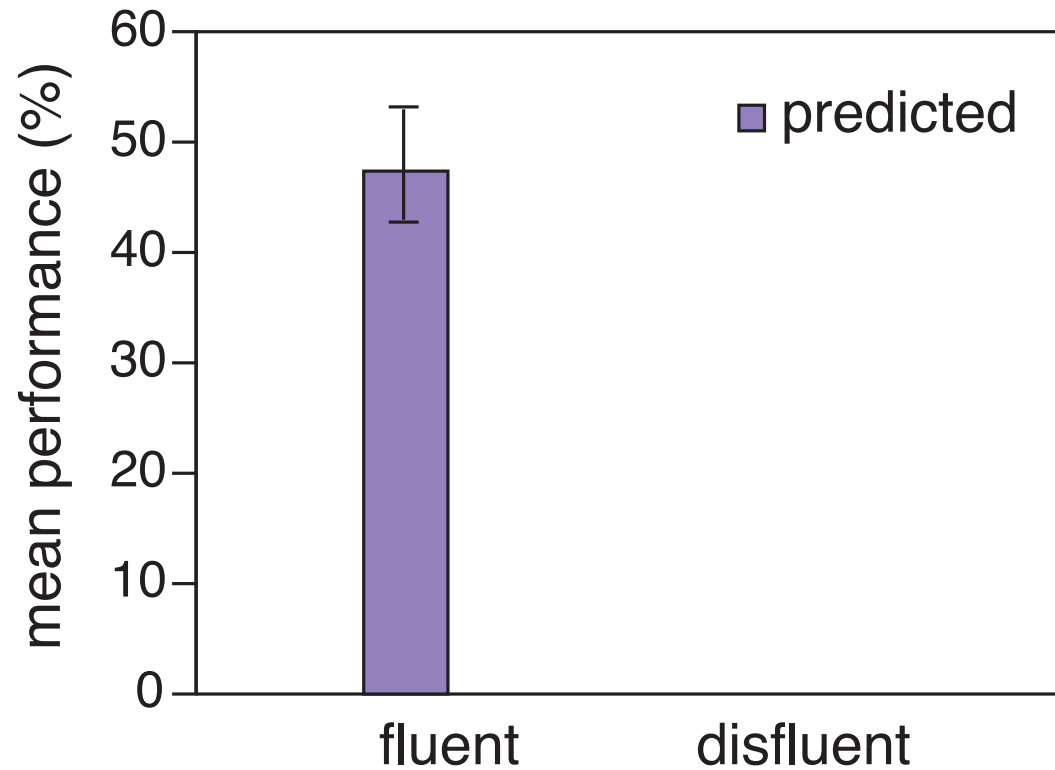
doi: 10.3758/s13423-013-0442-z

**1 Peer Instruction**

**2 let's try it!**

**3 results**

## judgement of learning



doi: 10.3758/s13423-013-0442-z

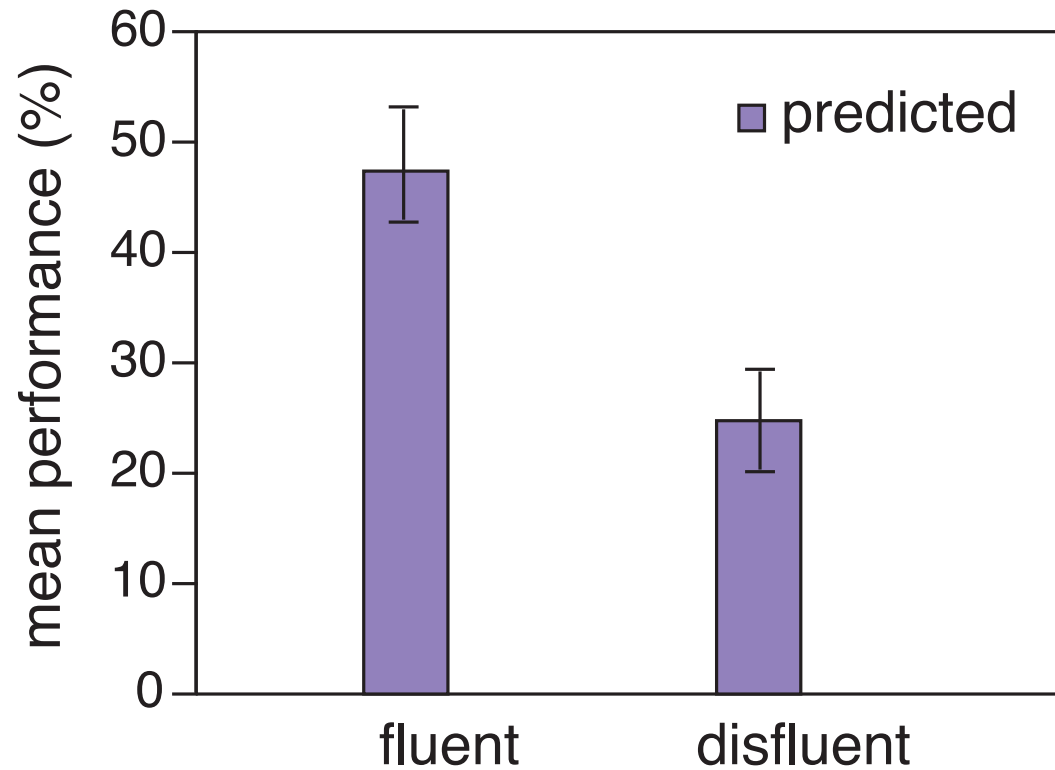
**1** Peer Instruction

**2** let's try it!

**3** results



## judgement of learning



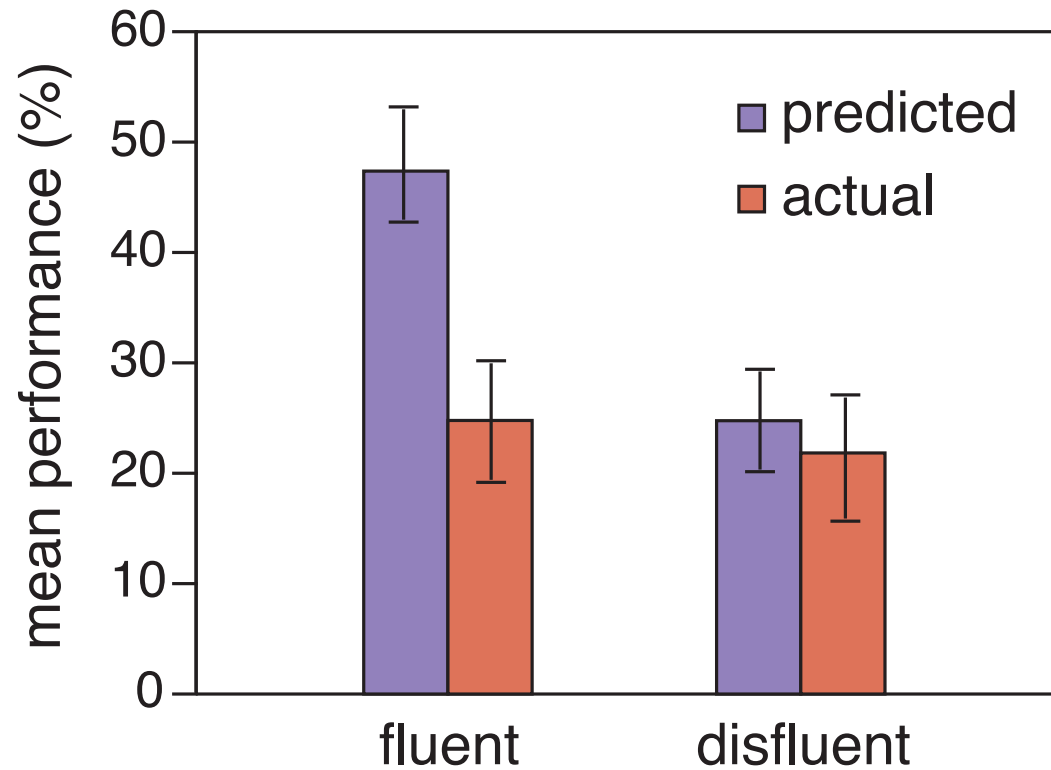
doi: 10.3758/s13423-013-0442-z

**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



The background is a faded, classical-style painting. It depicts a face with multiple eyes, a common motif in religious art representing omniscience. The face is pale with blue and grey tones, and the eyes are large and detailed. The painting is set against a background of vertical stripes in yellow and red.

**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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