

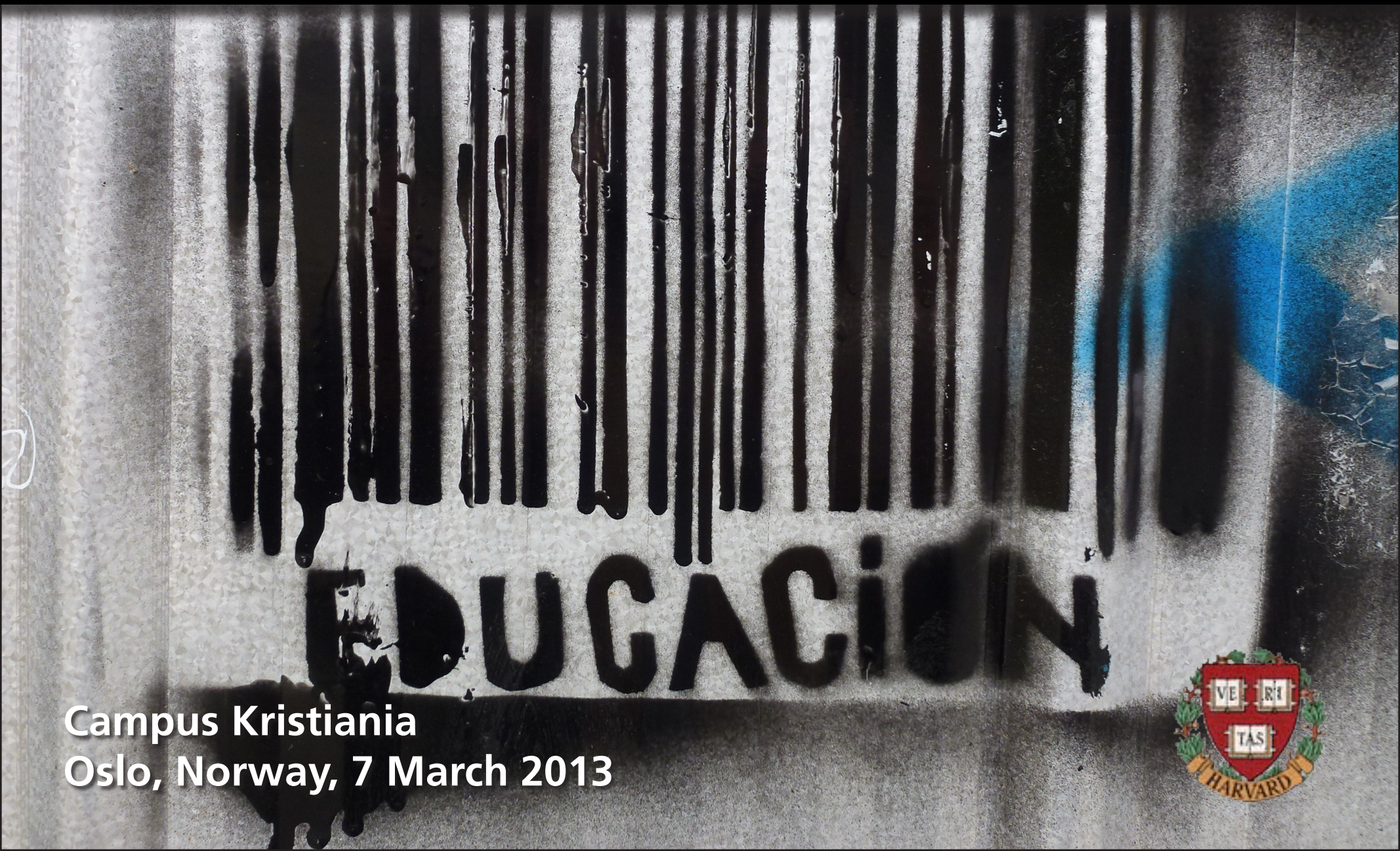
**1. Go to <http://LCatalytics.com>**

**2a. If you have instructor account: Log in, click "Student view"**

**2b. Otherwise: Create *student* account with signup code DEMO**

**3. Join session 1234567**

# Peer Instruction Workshop: Part I



Campus Kristiania  
Oslo, Norway, 7 March 2013



# Peer Instruction Workshop: Part I



@eric\_mazur

Campus Kristiania  
Oslo, Norway, 7 March 2013





**1** lecture



1 lecture

2 PI



**1** lecture

**2** PI

**3** PI 2.0



**EXCITING  
stuff!**

**1** lecture

**2** PI

**3** PI 2.0



**1** lecture



Think of something you are good at

EDUCACION

1 [lcatalytics.com](https://lcatalytics.com)

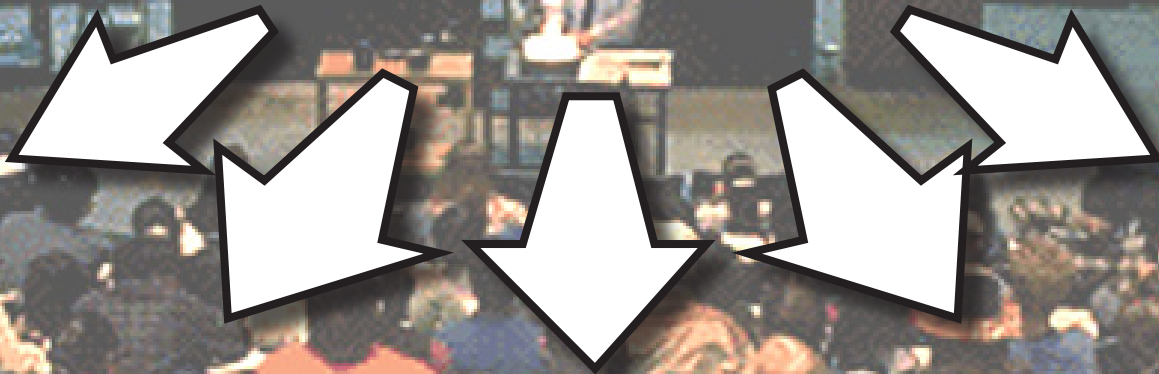
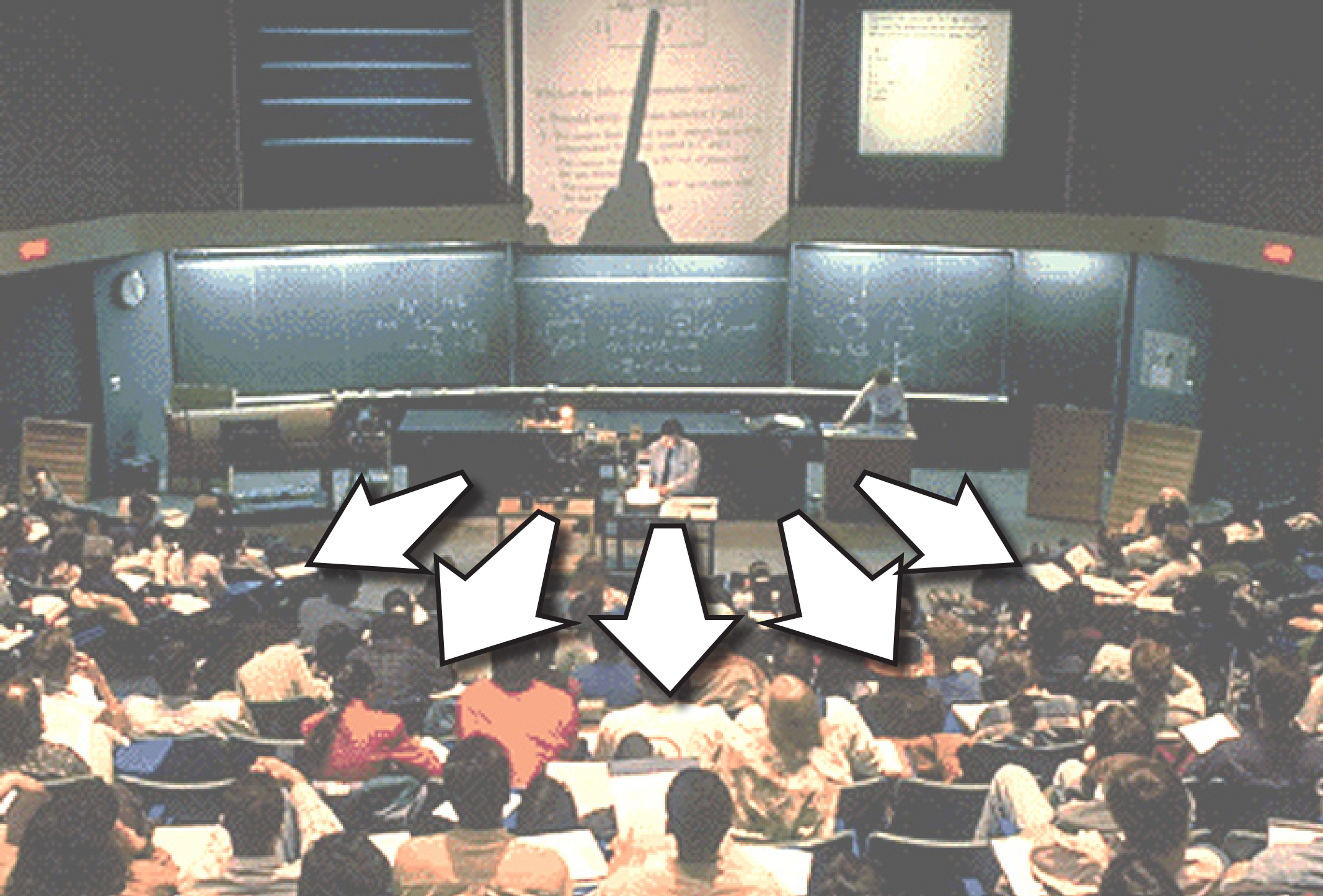
2 create student account

3 ID 1234567

Now think how you became good at it



- 1 [lcatalytics.com](http://lcatalytics.com)
- 2 create student account
- 3 ID 1234567

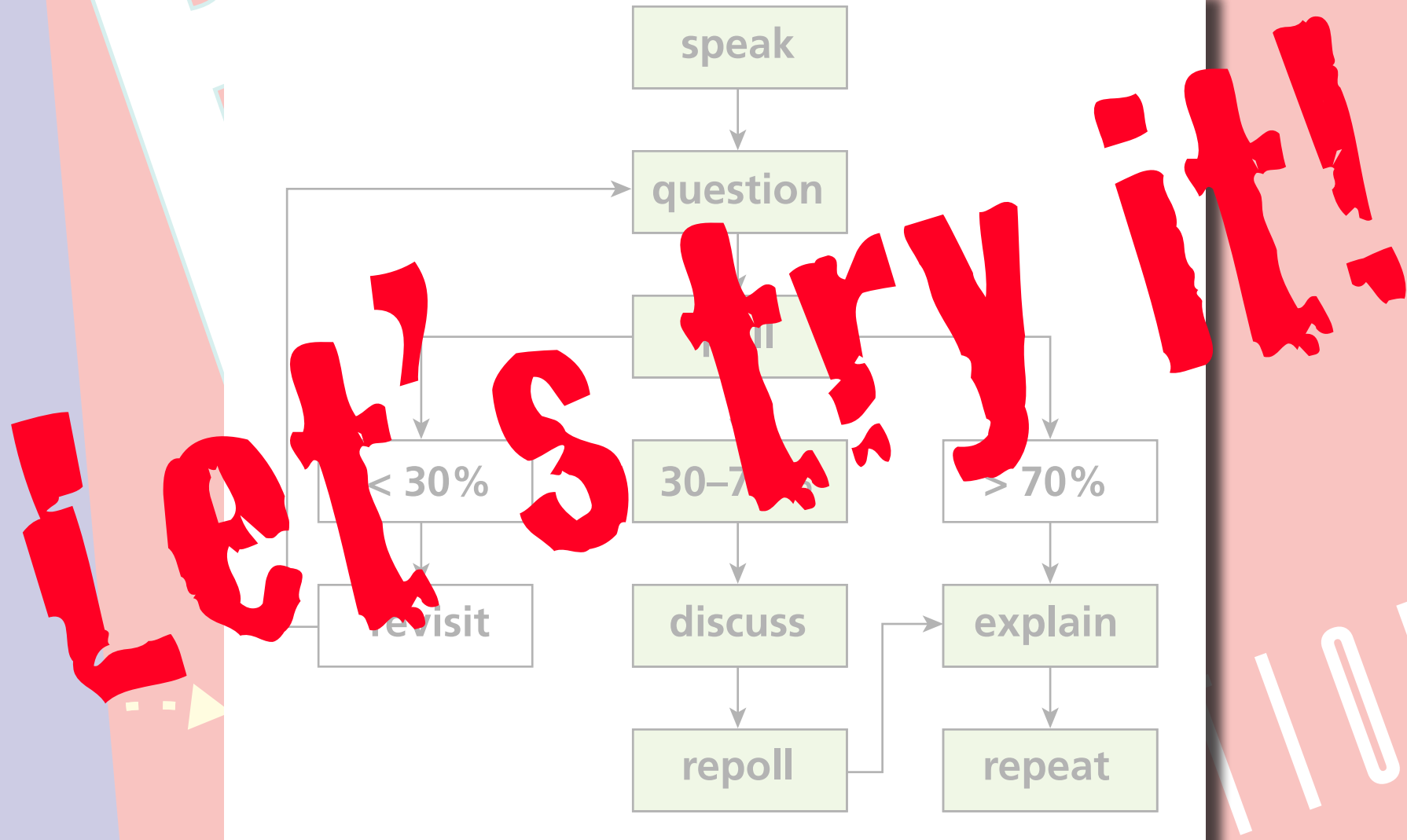


# Peer INSTRUCTION

The title 'Peer INSTRUCTION' is displayed in a large, white, sans-serif font. The word 'Peer' is positioned above 'INSTRUCTION'. The 'e's in 'Peer' are highlighted with a dashed yellow line and a yellow arrow pointing to the right. A dotted blue line starts from the right side of the 'e's and curves downwards towards the 'INSTRUCTION' text. The background is a light red color with a blue vertical stripe on the left side.

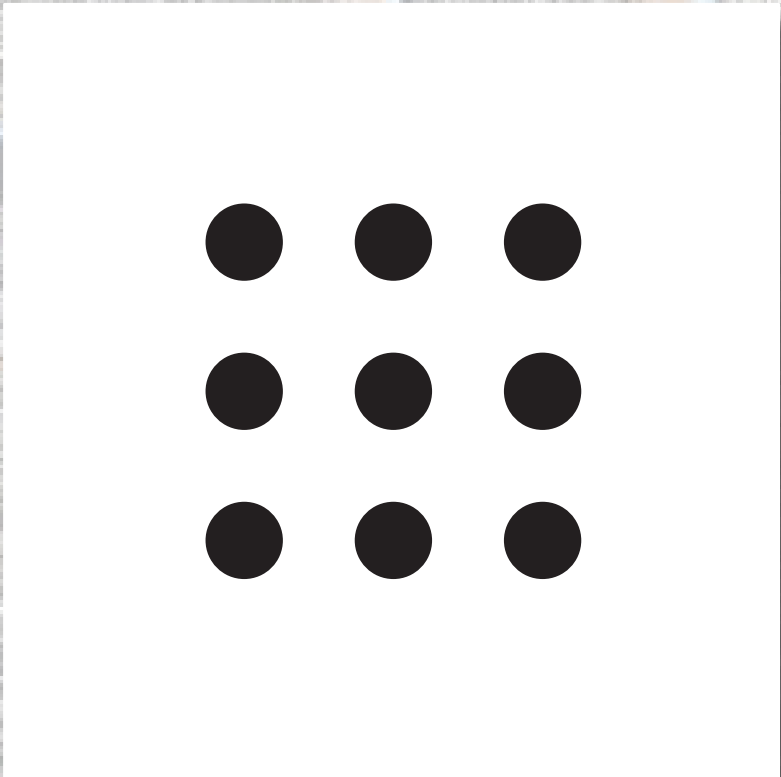
1 lecture

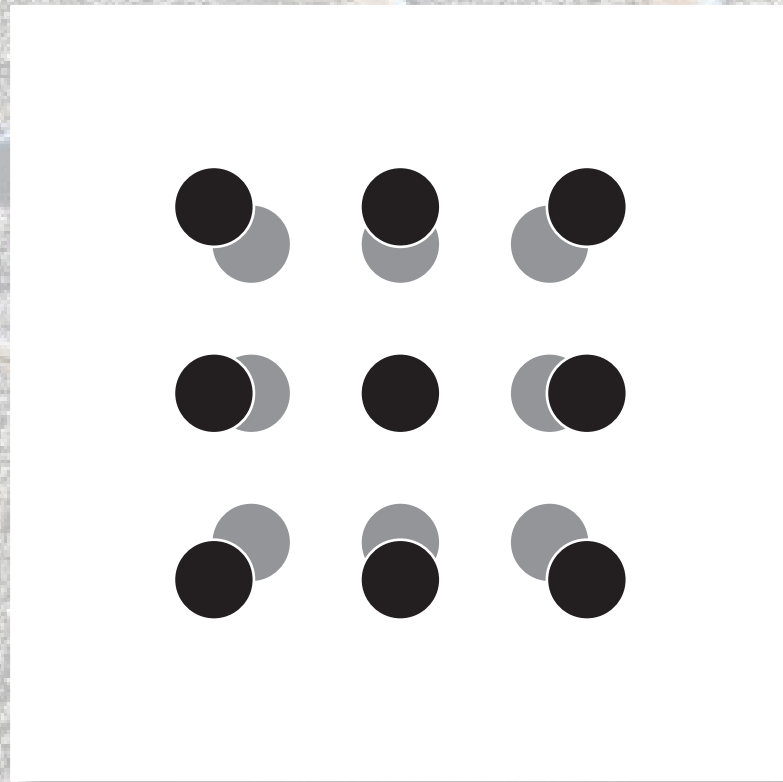
2 PI



An aerial photograph showing a long, wavy metal expansion joint installed on a gravel surface. The joint is made of a dark, possibly steel, material and is designed to allow for thermal expansion and contraction. The gravel is a mix of grey and brown tones. The joint is set in a series of connected, rounded curves that run diagonally across the frame. The background shows a green lawn on either side of the gravel area.

**thermal expansion**



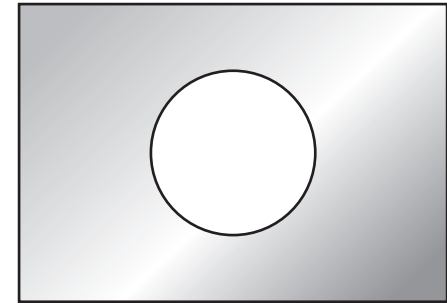




all of them

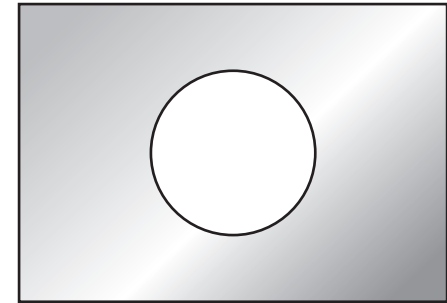


**Consider a rectangular metal plate  
with a circular hole in it.**



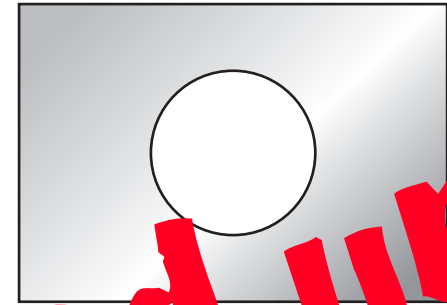
**Consider a rectangular metal plate with a circular hole in it.**

**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.



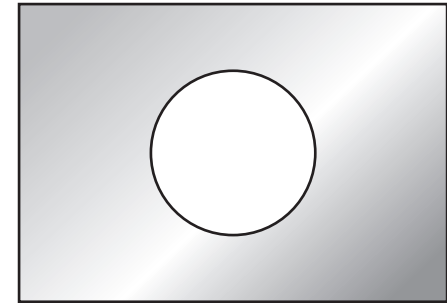
When the plate is uniformly heated, the diameter of the hole

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, let's analyze what happened.**

**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**

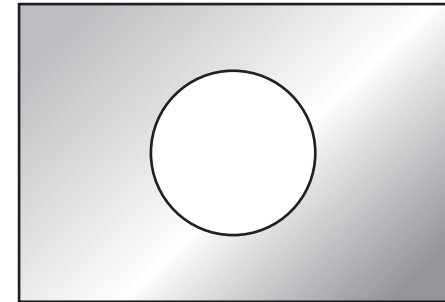
**Before I tell you the answer, let's analyze what happened.**

**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**

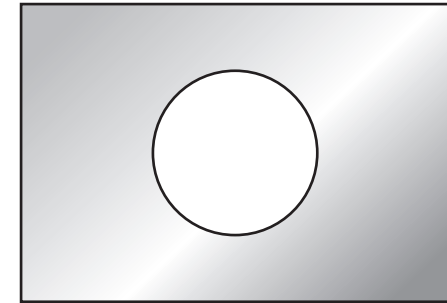
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**When the plate is uniformly heated, the diameter of the hole**



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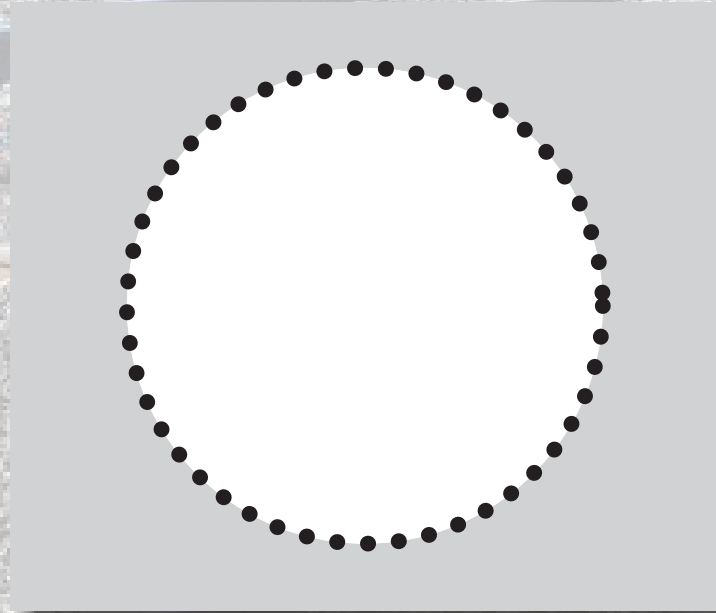
**Consider a rectangular metal plate with a circular hole in it.**



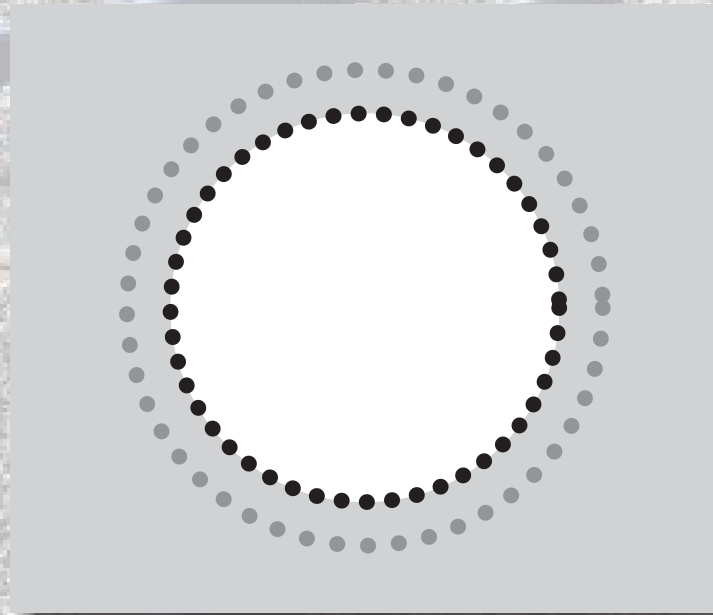
**When the plate is uniformly heated, the diameter of the hole**

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

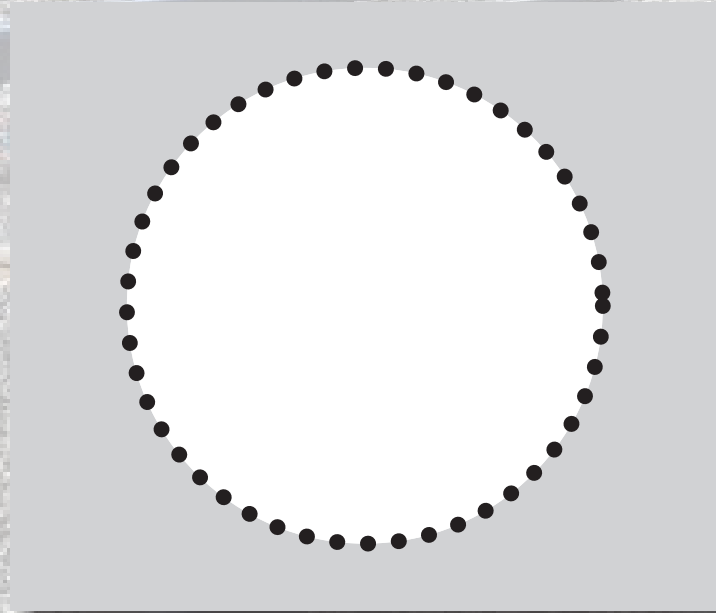
consider atoms at rim of hole



consider atoms at rim of hole

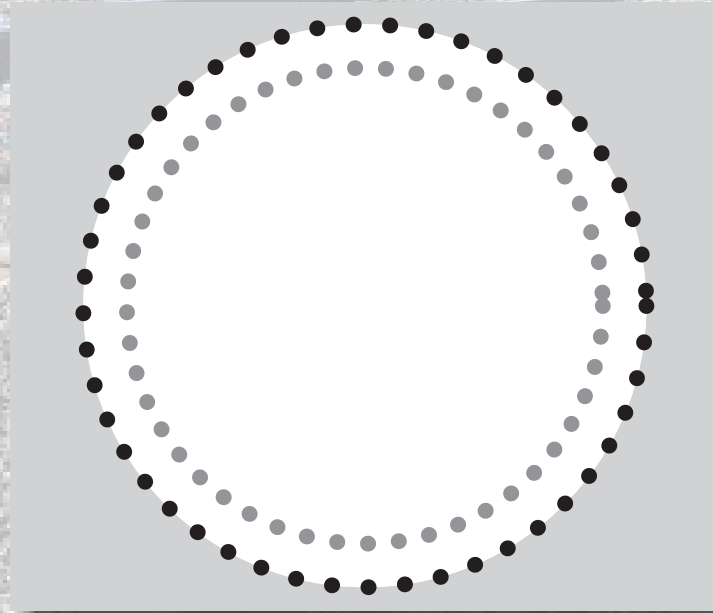


consider atoms at rim of hole





consider atoms at rim of hole



consider atoms at rim of hole

**you won't forget this**





**Join now!**

**PeerInstruction.net**



**1** lecture

**2** PI

**3** PI 2.0

**feedback**

**1** lecture

**2** PI

**3** PI 2.0



1991



1 lecture

2 PI

3 PI 2.0



1993

A black handheld device, possibly a remote control or a small keypad, is shown at an angle. It features a numeric keypad with buttons labeled 1 through 9, 0, and a red button. A green logo with the letters 'FRS' is visible on the bottom right. The year '1998' is overlaid in large white text in the center.

# 1998





1 lecture

2 PI

3 PI 2.0



# technology

1 lecture

2 PI

3 PI 2.0



How do I...

- design good questions?
- optimize the discussions?
- manage time?

# learning | catalytics

1 lecture

2 PI

3 PI 2.0

# learning | catalytics



Gary King



Brian Lukoff



Eric Mazur

**1** lecture

**2** PI

**3** PI 2.0

Use intelligent algorithms and data analytics to...

- improve questioning
- manage discussions
- facilitate time management/flow

- lowest
- A 30-year fixed rate mortgage at 12%
  - A 15-year fixed rate mortgage at 12%
  - A 30-year fixed rate mortgage at 12%
  - A 15-year fixed rate mortgage at 12%
2. The biggest factor that leads American companies to manufacture their products overseas in India is:
- Higher quality of craftsmanship
  - Lower labor costs
  - Decreased transportation costs
  - Effective legal systems
3. Which of the following correctly summarizes the accounting equation for a sole proprietorship?
- $\text{Assets} = \text{Liabilities} + \text{Owners' equity}$
  - $\text{Liabilities} = \text{Assets} + \text{Owners' equity}$
  - $\text{Owner's equity} = \text{Assets} + \text{Liabilities}$
  - $\text{Revenue} = \text{Assets} - \text{Liabilities}$
4. In order to present a business plan to a group of potential investors, a businessperson would most likely use which of the following?
- Powerpoint
  - Quickbooks
  - Peoplesoft
  - Excel
5. In order to start an online business, an individual would need all but which of the following:
- A business model
  - Depreciation?

## extensible plug-in architecture for question types

- lowest
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  - A 15-year fixed rate mortgage at 12%
  - A 30-year fixed rate mortgage at 12%
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  - $\text{Revenue} = \text{Assets} - \text{Liabilities}$
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- Powerpoint
  - Quickbooks
  - Peoplesoft
  - Excel
5. In order to start an online business, an individual would need all but which of the following:
- Business model
  - Appreciation?



## Sample question types:

- direction
- mathematical expression
- long answer, short answer, word cloud
- numerical, data collection
- ranking, priority
- region (select point on image)
- sketch, composite sketch
- highlight passage

## Sample question types:

- direction

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- highlight passage



1 [lccatalytics.com](https://lccatalytics.com)

2 create student account

3 ID 1234567

# learning | catalytics

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4. **direction** This image shows Oahu as seen from the Space Shuttle. The image provides several clues about the direction of prevailing winds in Oahu. Indicate this direction by drawing an arrow on your screen. [Deliver](#) [Show all results](#)

1 education

2 PI

3 PI 2.0

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4. direction  
prevailing

...le. The image provides several clues about the direction of  
...on your screen.

[Deliver](#) [Show all results](#)



1 educa

3 PI 2.0

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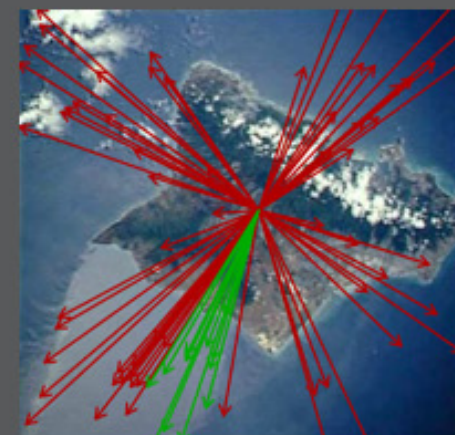
4. direction  
prevailing

...le. The image provides several clues about the direction of  
...on your screen.

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Round 1

77 responses, 16% correct



✓ 17 get it now  
✗ 3 still don't get it



1 educa

3 PI 2.0

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optics i

current session: 766079 | 69 students

[Back to all lectures](#) [Stop session](#) [Review results](#) [Seat map](#) [Show floating session ID](#) [Edit](#) [Delete](#)



Jump to ▾

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15



4. direction Light enters horizontally into the combination of two perpendicular mirrors as shown below.

[Deliver](#) [Show all results](#)



Indicate the direction of the incident light after it reflects off of both mirrors.



feedback & support

1 lecture

2 PI

3 PI 2.0

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current session: **766079** | 69 students

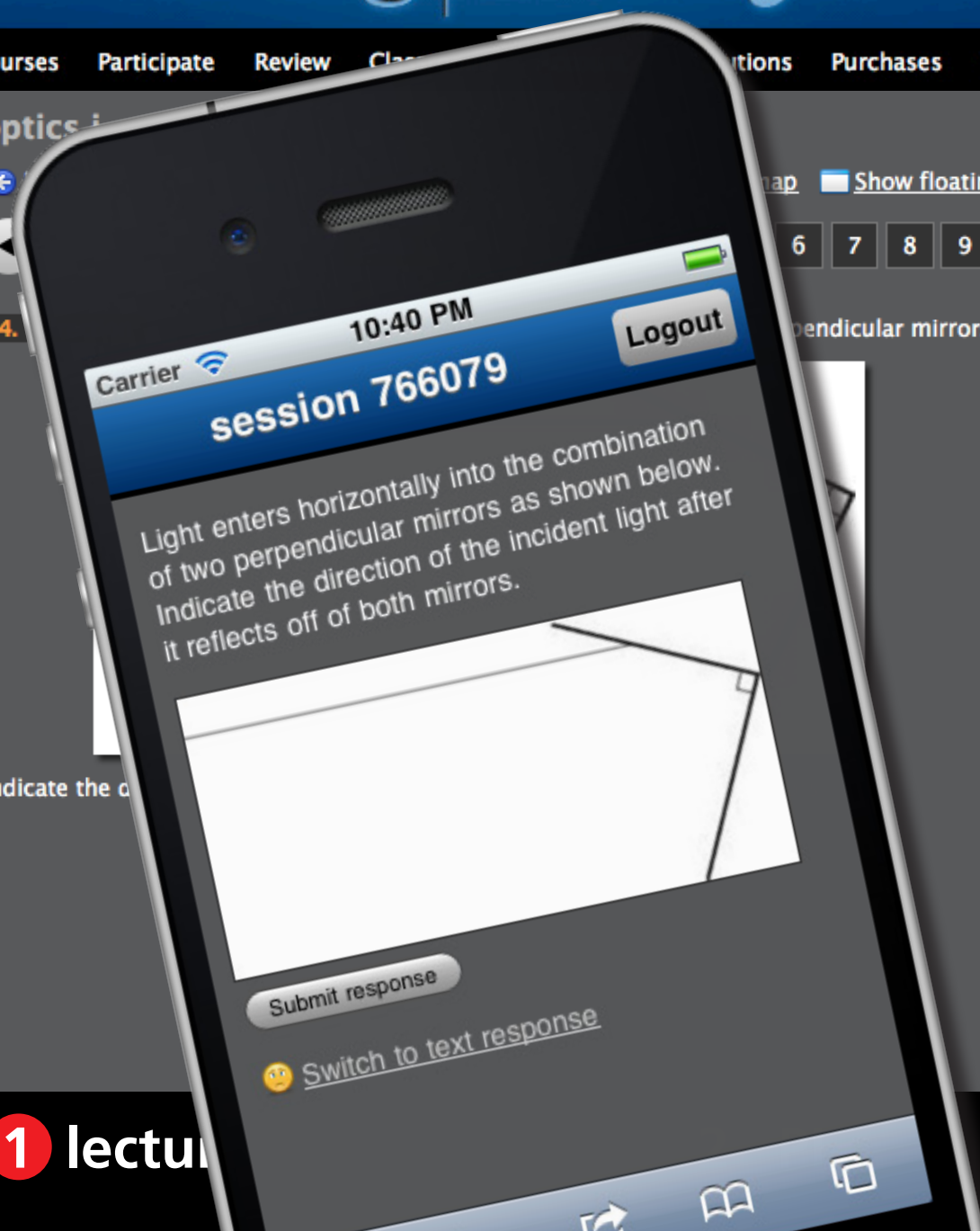
[Map](#) [Show floating session ID](#) [Edit](#) [Delete](#)

6 7 8 9 10 11 12 13 14 15

perpendicular mirrors as shown below.

[Deliver](#) [Show all results](#)

[feedback & support](#)



1 lecture

3 PI 2.0



# learning | catalytics

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current session: **766079** | 69 students

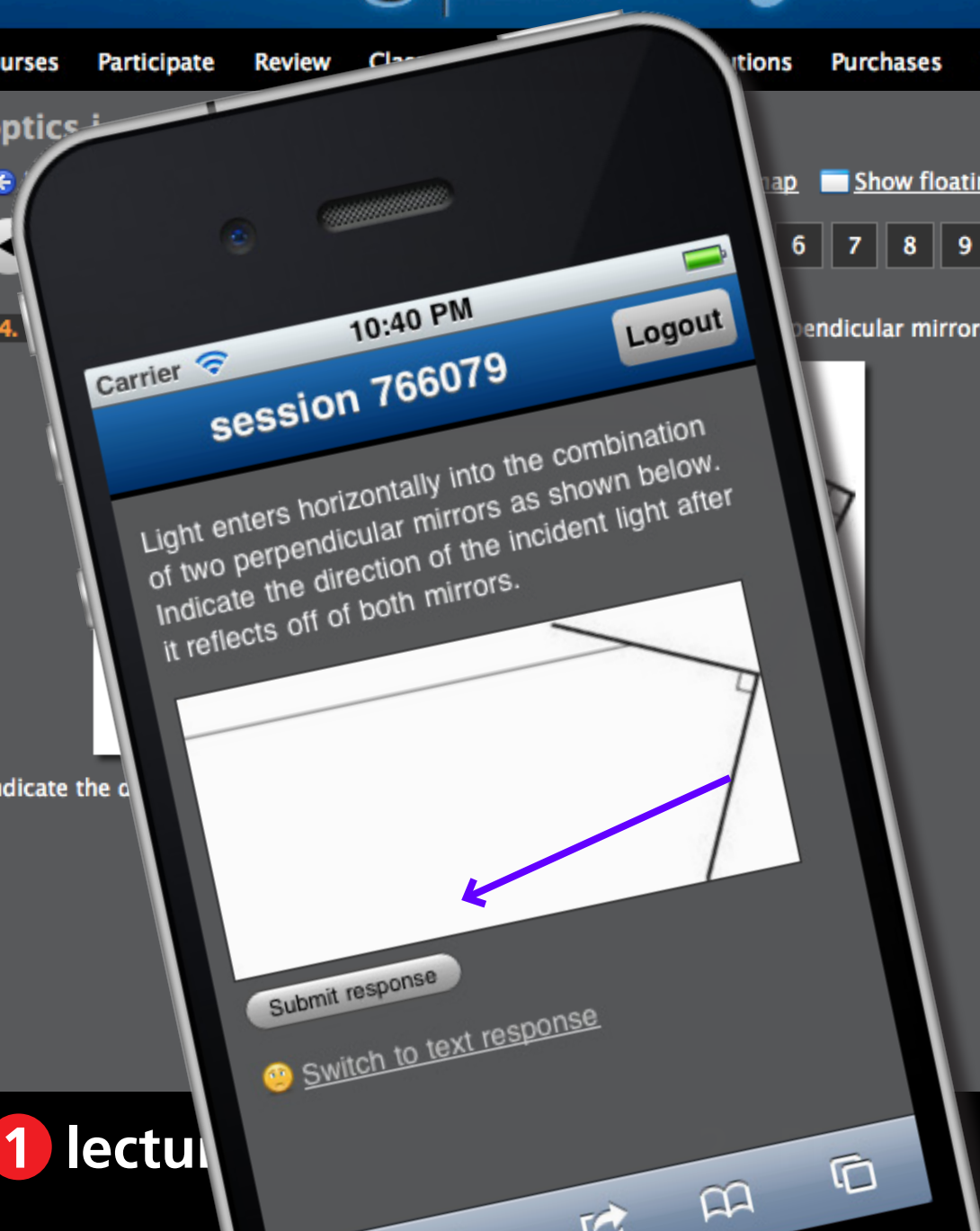
[Map](#)  [Show floating session ID](#) [Edit](#) [Delete](#)

6 7 8 9 10 11 12 13 14 15

perpendicular mirrors as shown below.

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[feedback & support](#)



1 lecture

3 PI 2.0

# learning | catalytics

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[Map](#) [Show floating session ID](#) [Edit](#) [Delete](#)

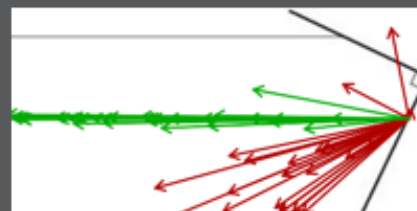
6 7 8 9 10 11 12 13 14 15



perpendicular mirrors as shown below.

[Deliver](#) [Show all results](#)

Round 1   
● 57 responses, 58% correct



[feedback & support](#)



1 lecture

3 PI 2.0

# learning | catalytics

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current session: **766079** | 69 students

Map  Show floating session ID  Edit  Delete

6 7 8 9 10 11 12 13 14 15

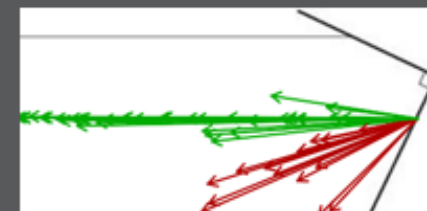
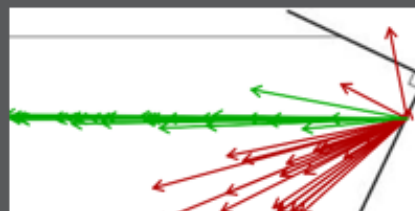


perpendicular mirrors as shown below.

Deliver  Show all results

Round 1     
● 57 responses, 58% correct

Round 2     
● 51 responses, 73% correct



✓ 8 get it now  
✗ 0 still don't get it

feedback & support



1 lectur

3 PI 2.0

## Sample question types:

- direction

- mathematical expression

- long answer, short answer, word cloud

- numerical, data collection

- ranking, priority

- region (select point on image)

- sketch, composite sketch

- highlight passage

**If  $2x - y = 4$ , then  $x =$**

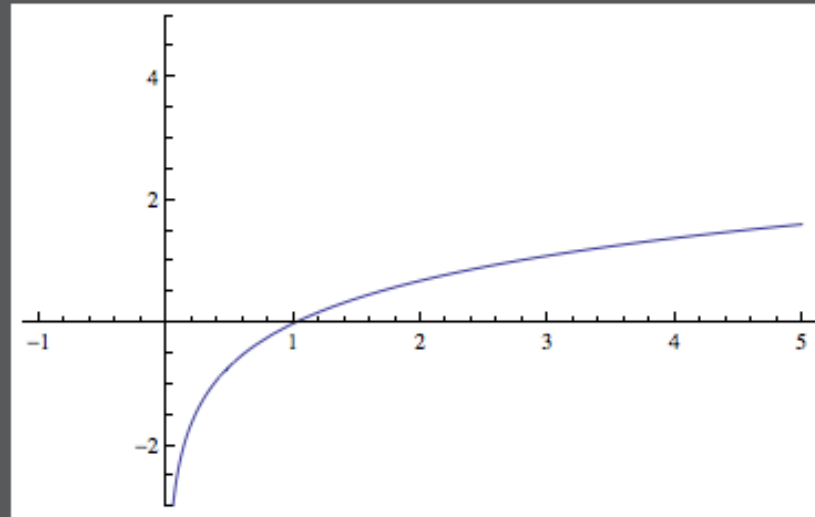
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- highlight passage

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This is a graph of  $f(x) = \ln x$ . Sketch a graph of the derivative  $f'(x)$ .



**1** lecture

**2** PI

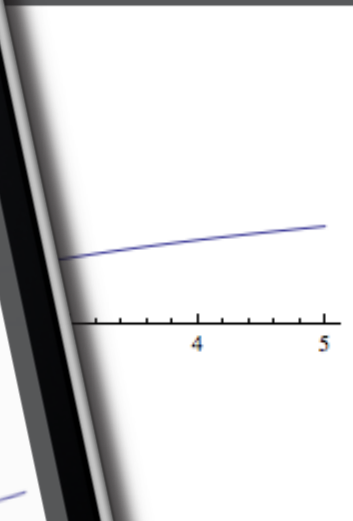
**3** PI 2.0

# learning | catalytics

Courses Participate

ases Users Tour Help

This is a graph of  $f(x) =$



**1** lecture

**3** PI 2.0



# learning | catalytics

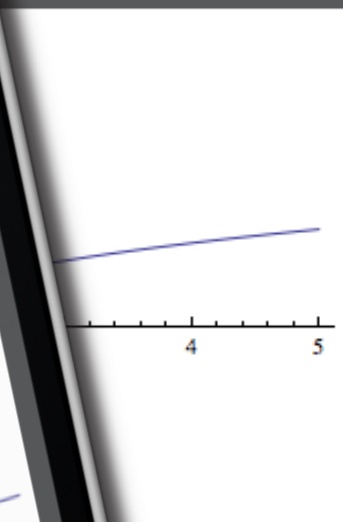
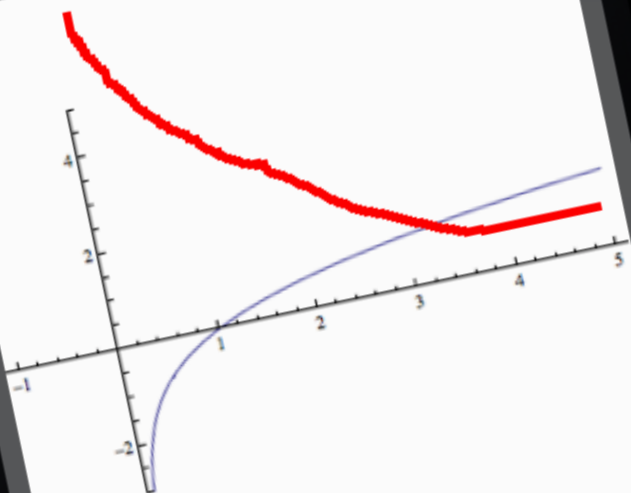
Courses Participate

ases Users Tour Help

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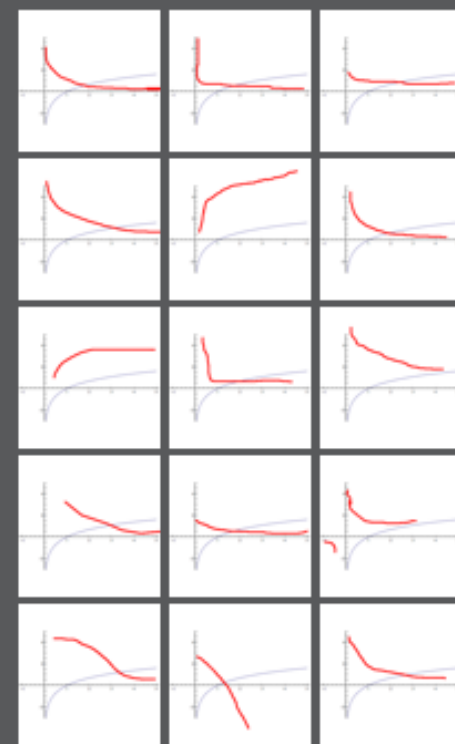


This is a graph of  $f(x) = \ln x$ . Sketch a graph of the derivative  $f'(x)$ .



Round 1

15 responses



✓ 6 get it now  
 ✗ 0 still don't get it

1 lecture

3 PI 2.0

## Sample question types:

- direction
- mathematical expression
- long answer, short answer, word cloud
- numerical data collection
- ranking priority
- region (select point on image)
- sketch, composite sketch
- highlight passage

**data analytics**



1 lecture

2 PI

3 PI 2.0



# human interaction

1 lecture

2 PI

3 PI 2.0

Carrier 9:31 PM 100%

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Jump to 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B

Round 1  
74 responses, 61% correct

A. 61%
B. 4%
C. 35%
D. 0%
E. 0%

Round 2  
75 responses, 83% correct

A. 83%
B. 0%
C. 17%
D. 0%
E. 0%

A. positive  
B. zero  
C. negative  
D. depends on the path taken from A to B  
E. cannot be determined without knowing more about the polarization induced in the sphere

Search:

1 lecture

2 PI

3 PI 2.0

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A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B as illustrated below. The potential difference from A to B is

A. positive  
 B. zero  
 C. negative  
 D. depends on the path taken from A to B  
 E. cannot be determined without knowing more about the polarization induced in the sphere

**Round 1**  
 74 responses, 61% correct

A. 61%
B. 4%
C. 35%
D. 0%
E. 0%

**Round 2**  
 75 responses, 83% correct

A. 83%
B. 0%
C. 17%
D. 0%
E. 0%

Search: \_\_\_\_\_

1 lecture

2 PI

3 PI 2.0

Carrier 9:31 PM 100%

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skywalker.seas.harvard.edu/class\_sessions/399757/review\_results

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## review results for session 399757 in electrostatic work and energy ii

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Search:

1 lecture

2 PI

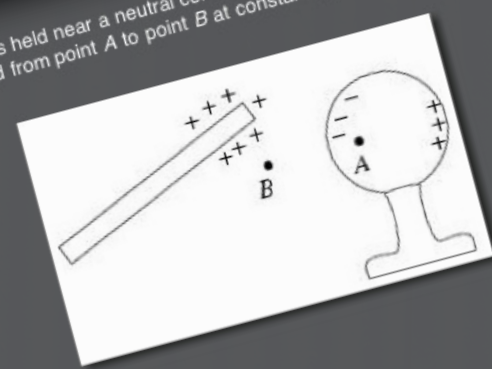
3 PI 2.0

Carrier 9:31 PM learning catalytics skywalker.seas.harvard.edu/class\_sessions/399757/review\_results Google Eric Mazur | Harvard University | Log out

# learning catalytics



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Search: \_\_\_\_\_

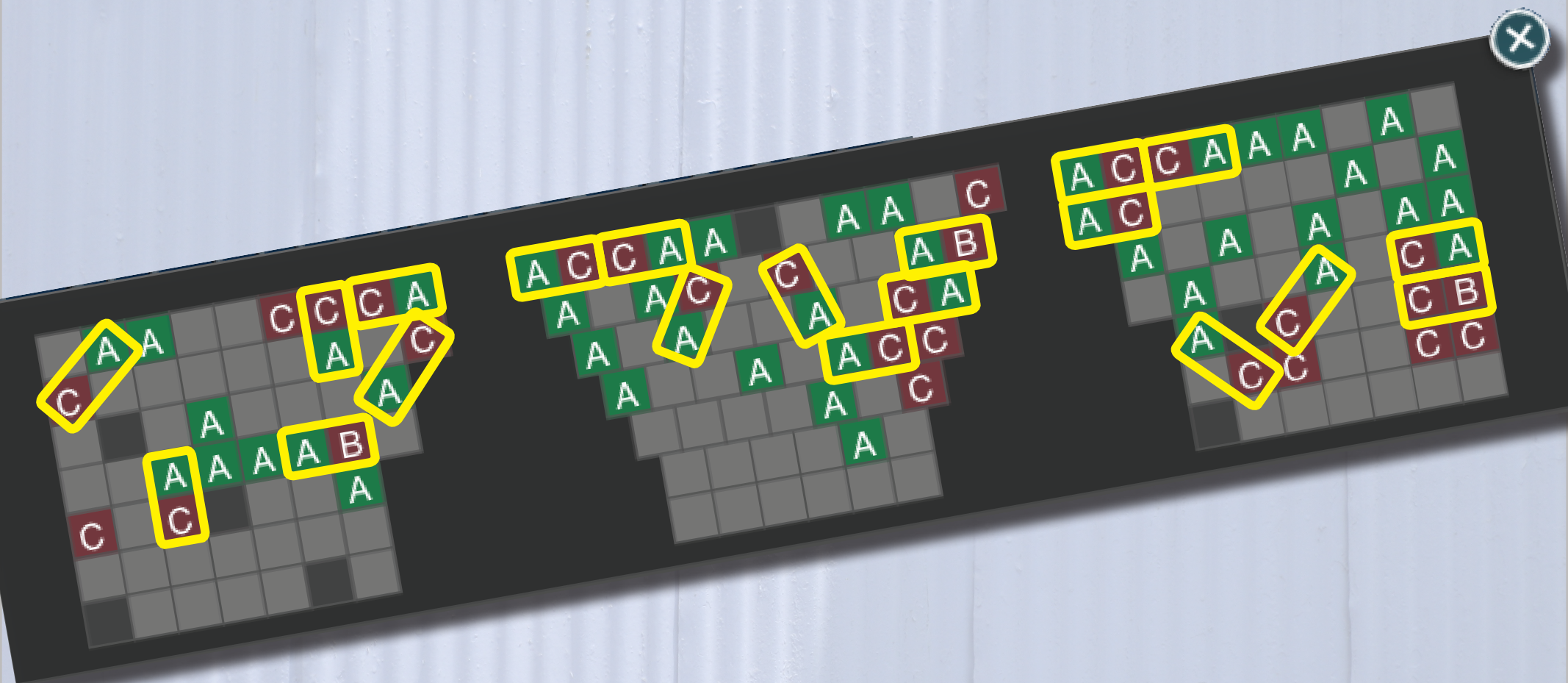
1 lecture

2 PI

3 PI 2.0



let system manage pairing



1 lecture

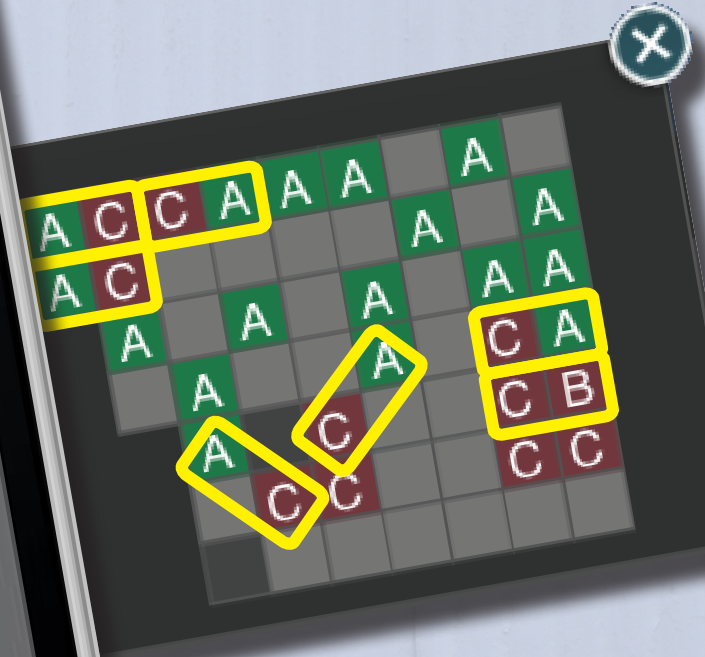
2 PI

3 PI 2.0

A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B at constant speed. The mechanical work required to cause this motion is

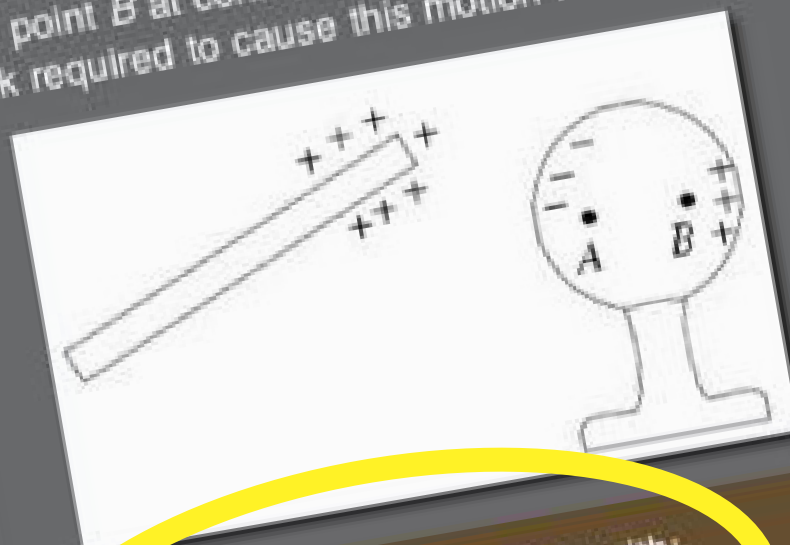


Please discuss your response with:  
• Brian Lukoff (to your left)  
✓ I am talking to this person/people



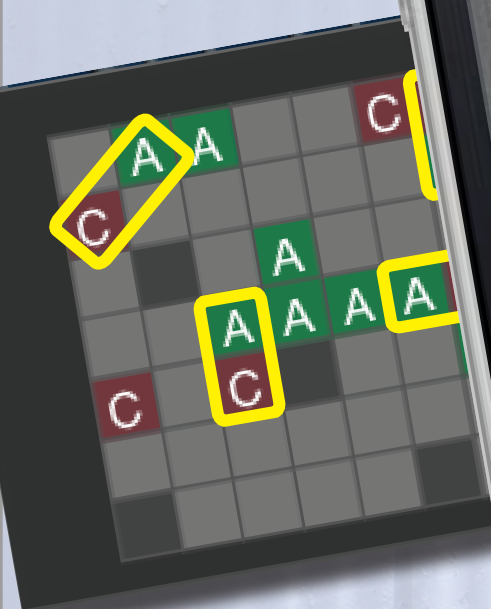
Leave

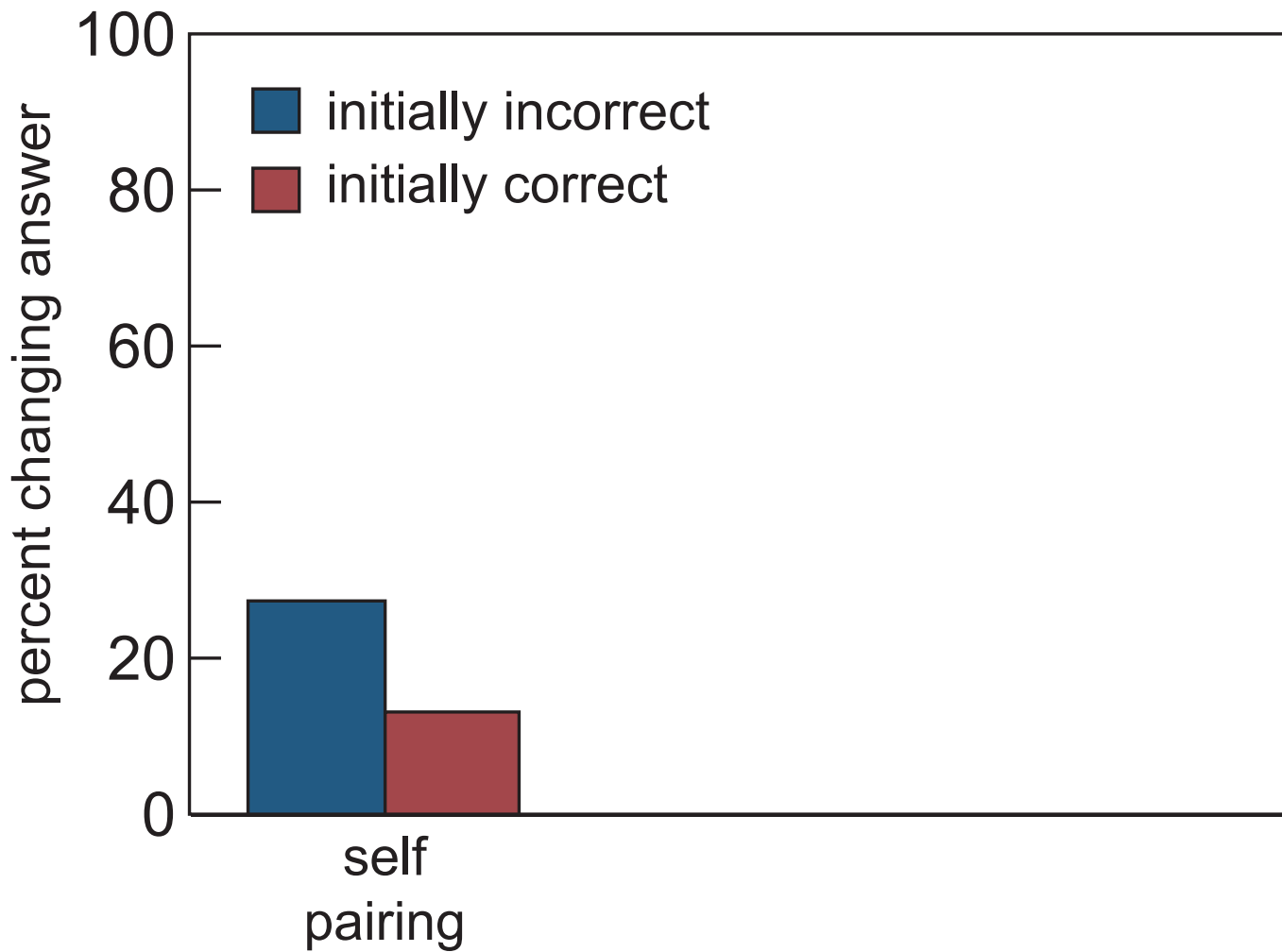
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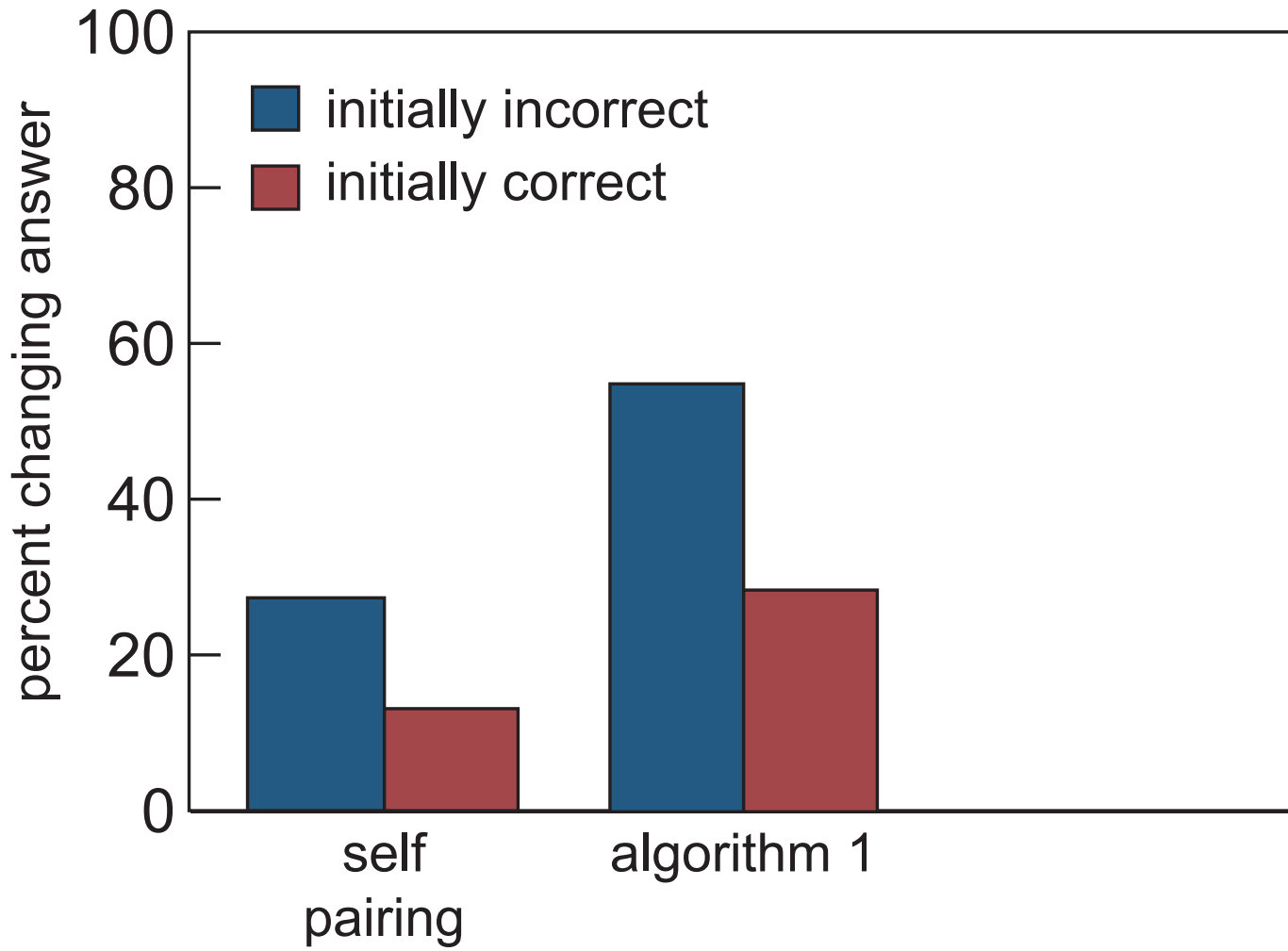


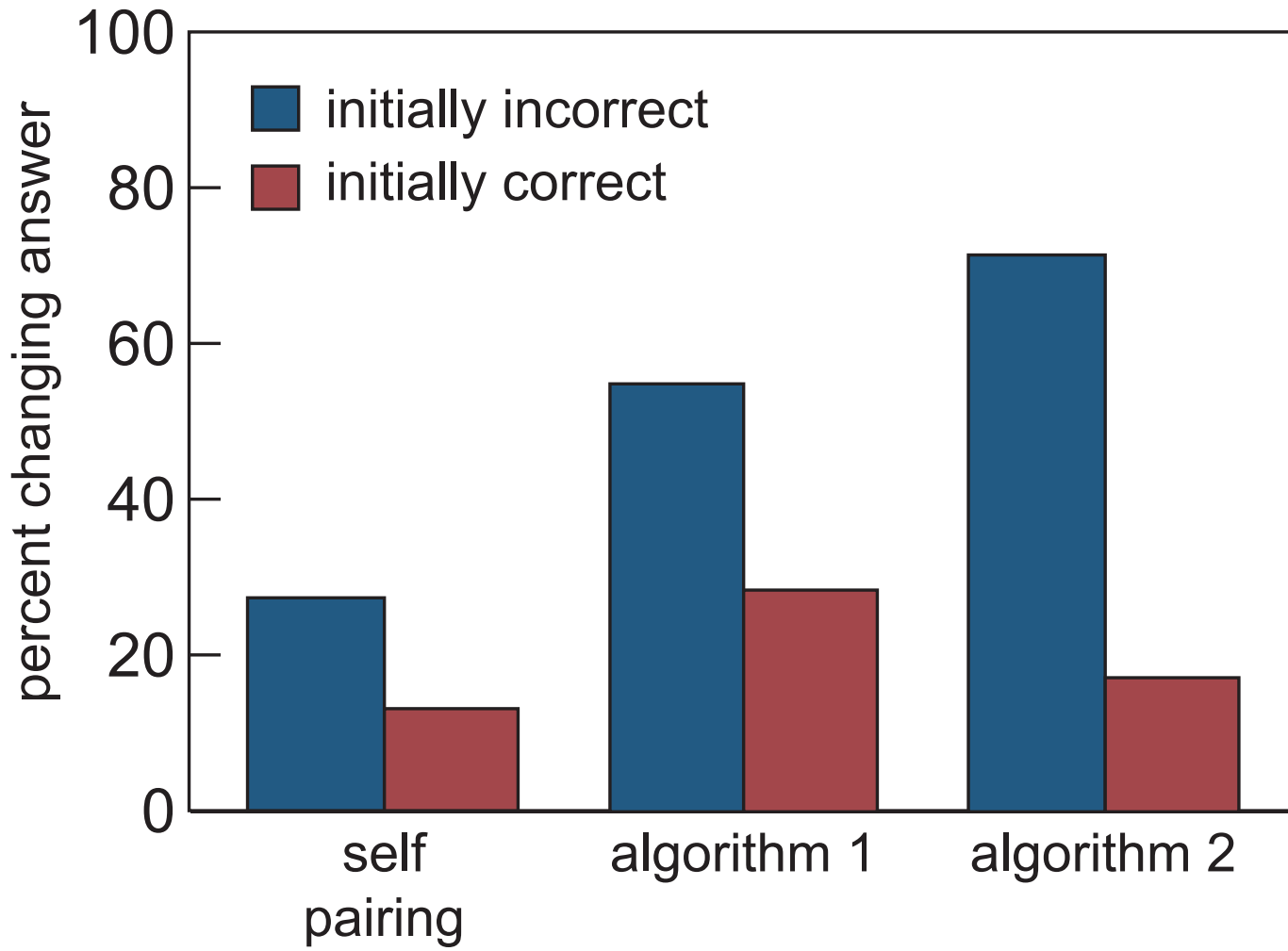
Please discuss your response with:

- Brian Lukoff (to your left)









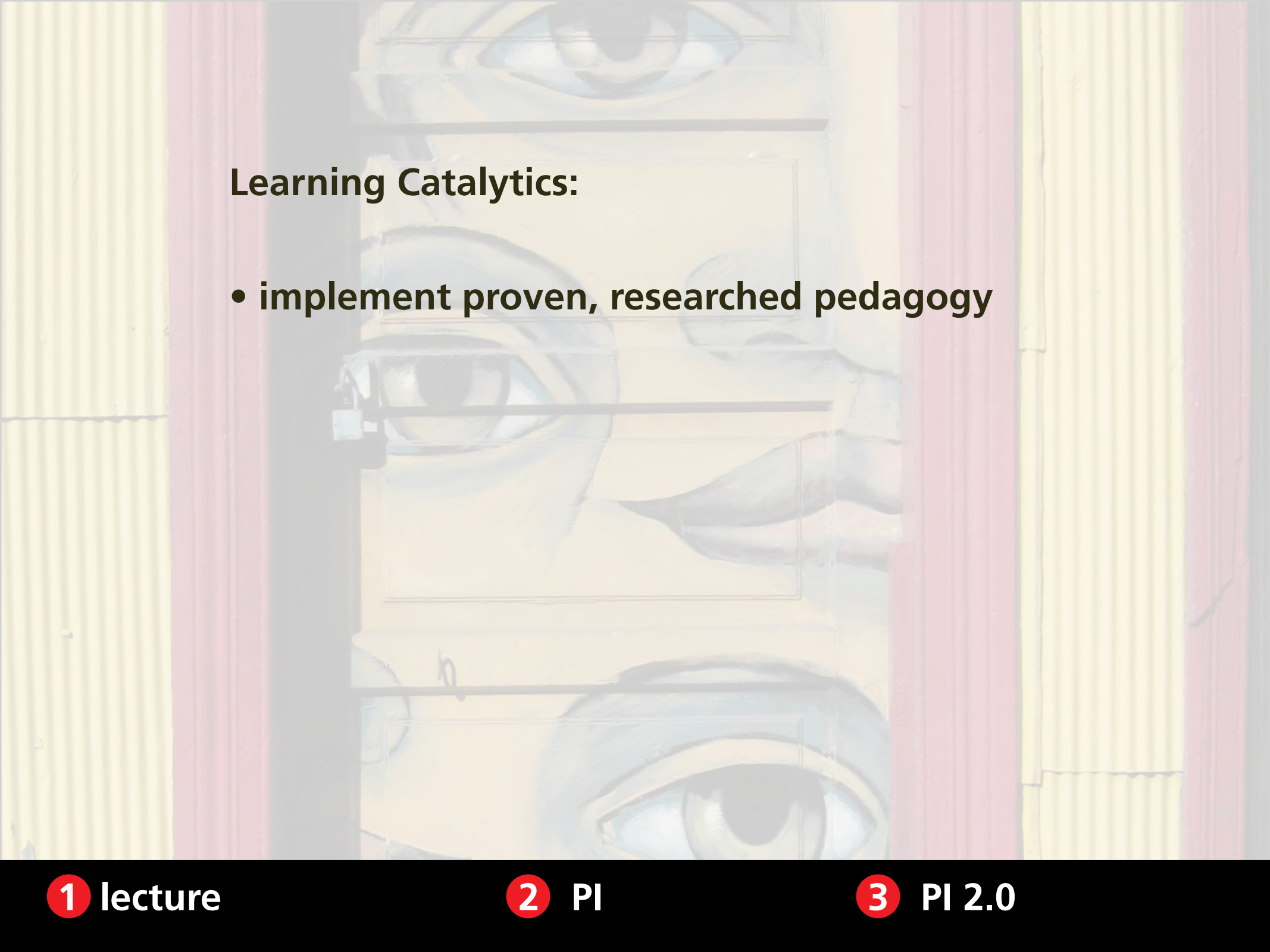


**1** lecture

**2** PI

**3** PI 2.0





## Learning Catalytics:

- implement proven, researched pedagogy



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- use consumer devices

## **Learning Catalytics:**

- **implement proven, researched pedagogy**
- **use consumer devices**
- **avoid pitfalls of MC assessment**

## Learning Catalytics:

- implement proven, researched pedagogy
- use consumer devices
- avoid pitfalls of MC assessment
- create a smart classroom *anywhere*