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**3. Join session 1234567**

**EDUCACION**

# Peer Instruction Workshop



EDUCACION

SSAT 20th National Conference: Innovating Learning  
Liverpool, UK, 4 December 2012



# Peer Instruction Workshop



@eric\_mazur

SSAT 20th National Conference: Innovating Learning  
Liverpool, UK, 4 December 2012





**1** lecture

**2** PI

**3** PI 2.0

in a lecture, students...

**1** education

**2** PI

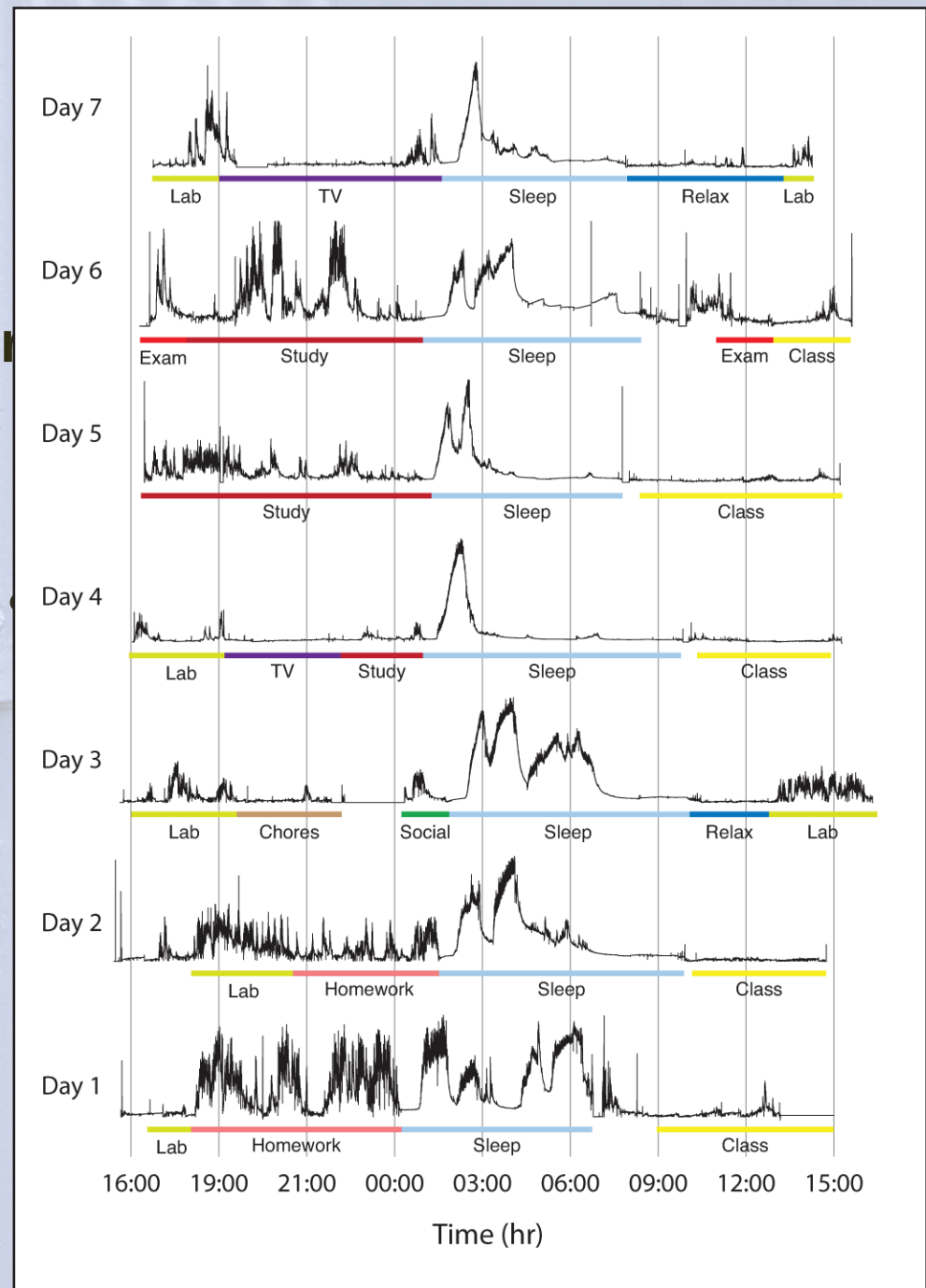
**3** PI 2.0

**in a lecture, students...**

**1. don't pay utmost attention**

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

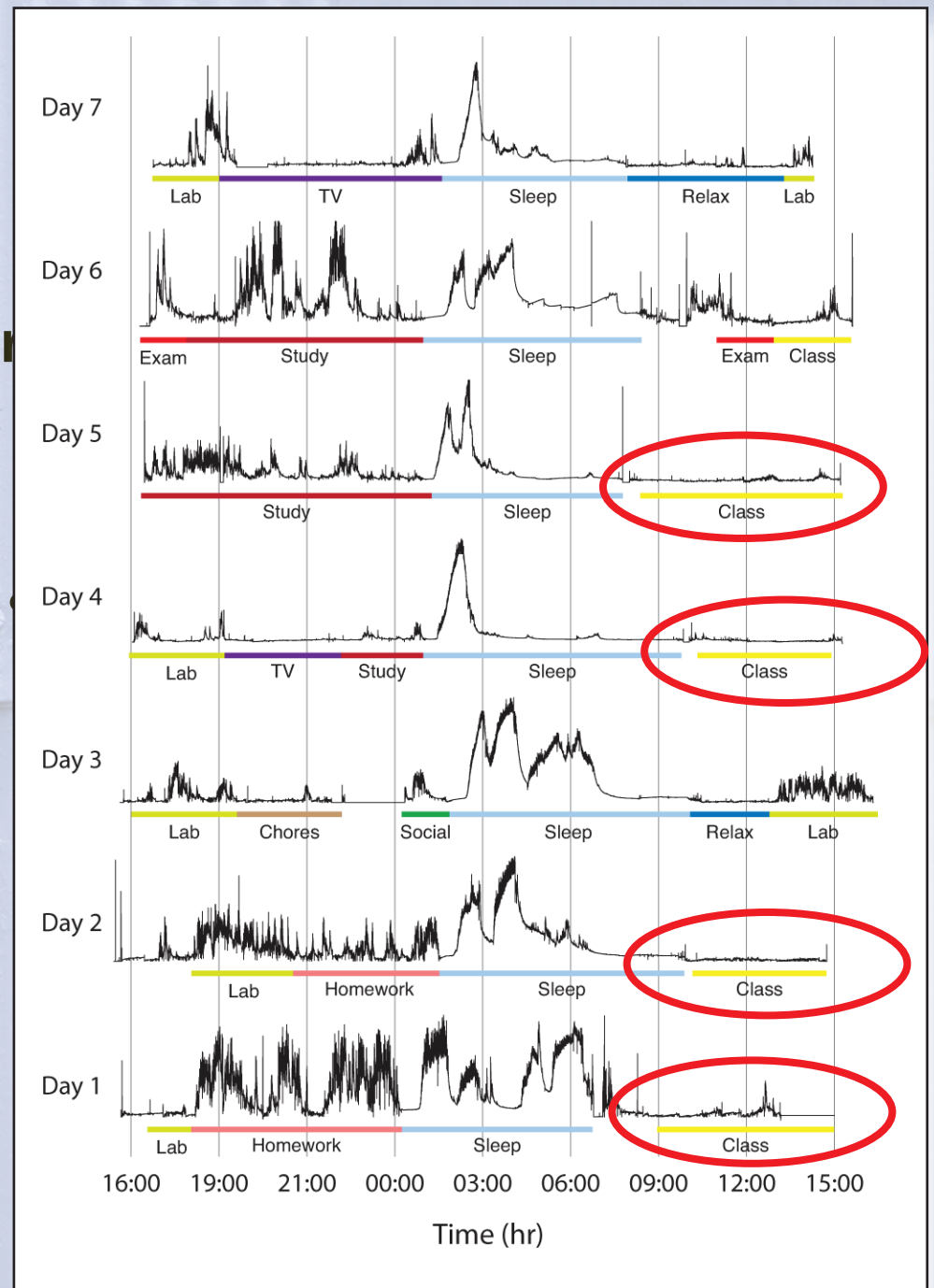
1 education

2 PI

3 PI 2.0

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

1 education

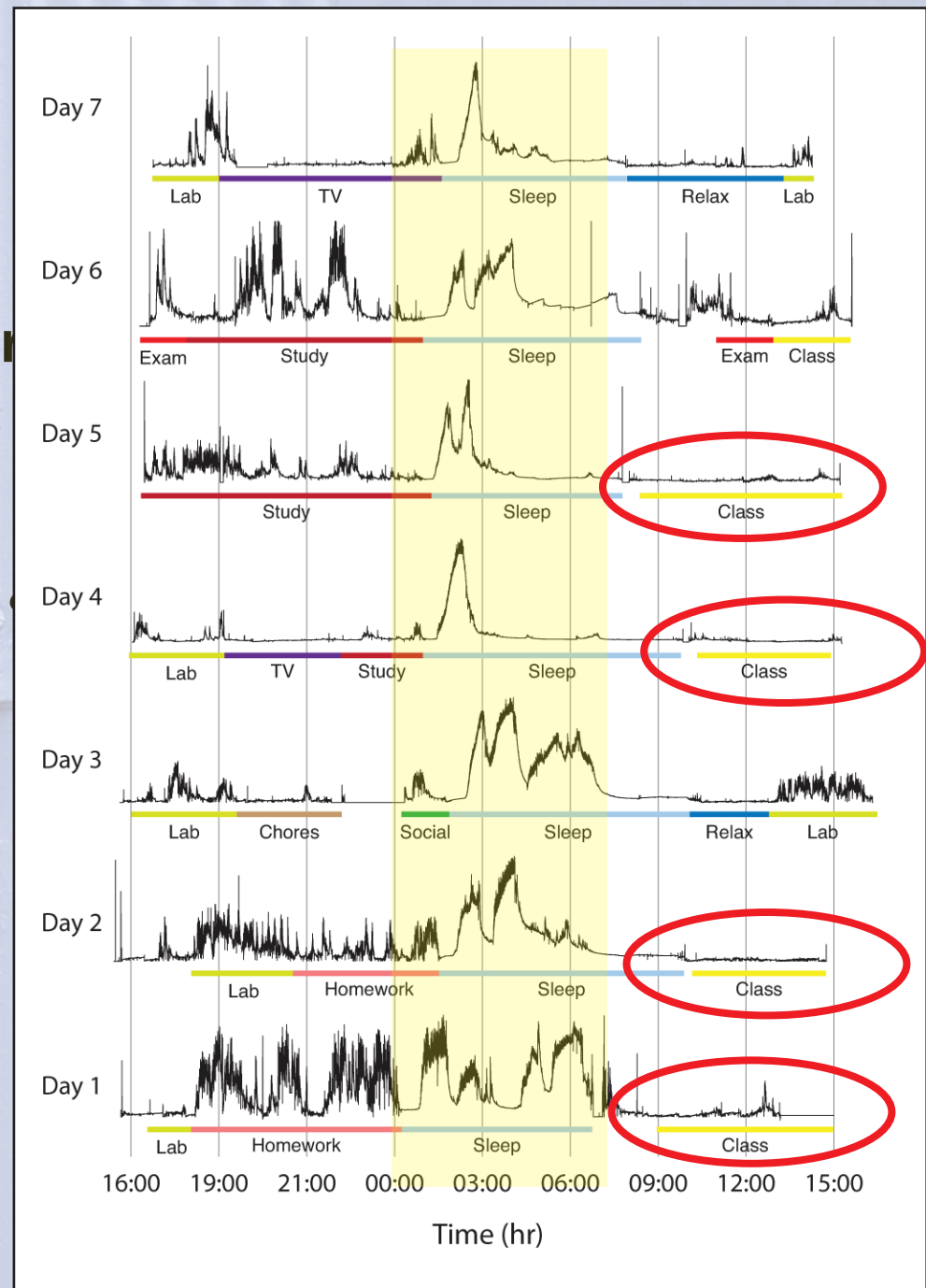
2 PI

3 PI 2.0



in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

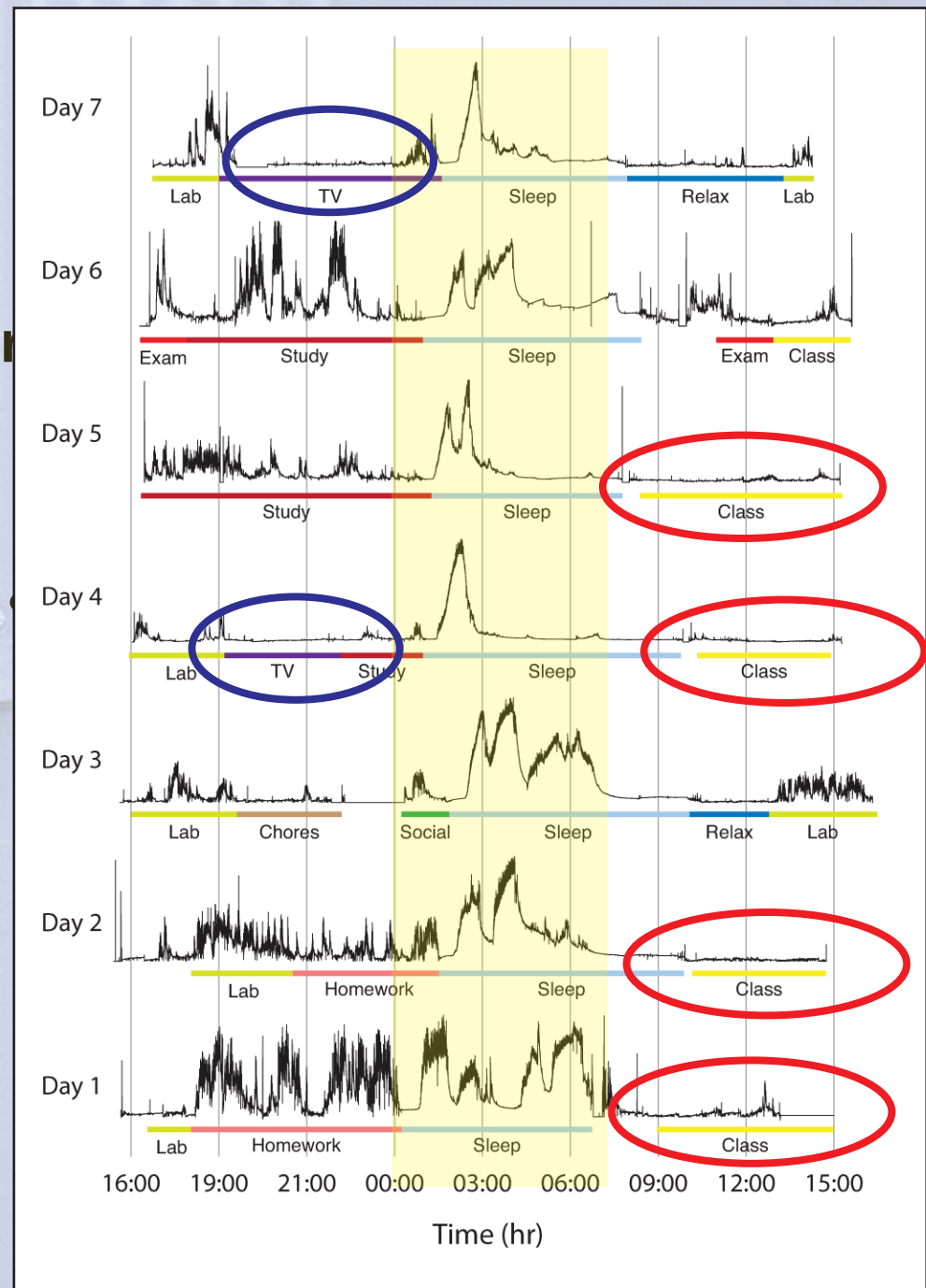
1 education

2 PI

3 PI 2.0

in a lecture

1. don't pay utmost



doi: 10.1109/TBME.2009.2038487

1 education

2 PI

3 PI 2.0

**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**

brief  
presentation

**1** education

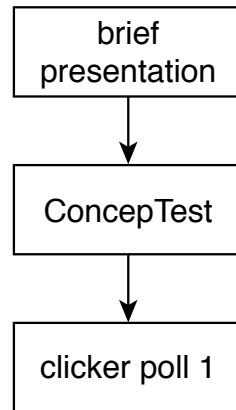
**2** PI

**3** PI 2.0

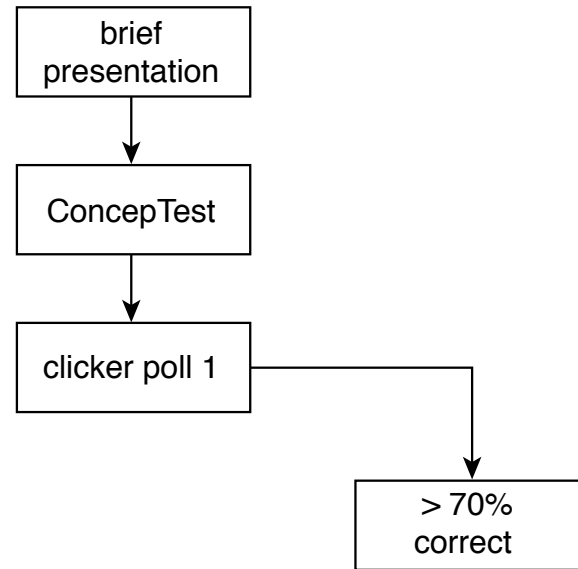
brief  
presentation

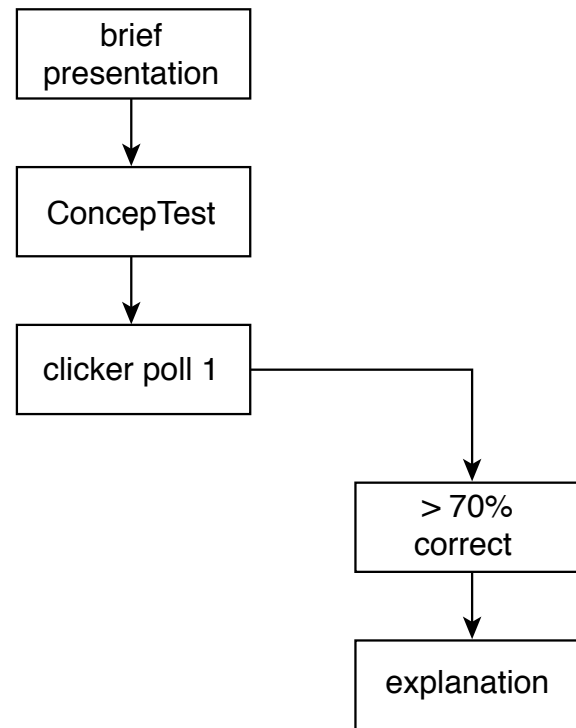


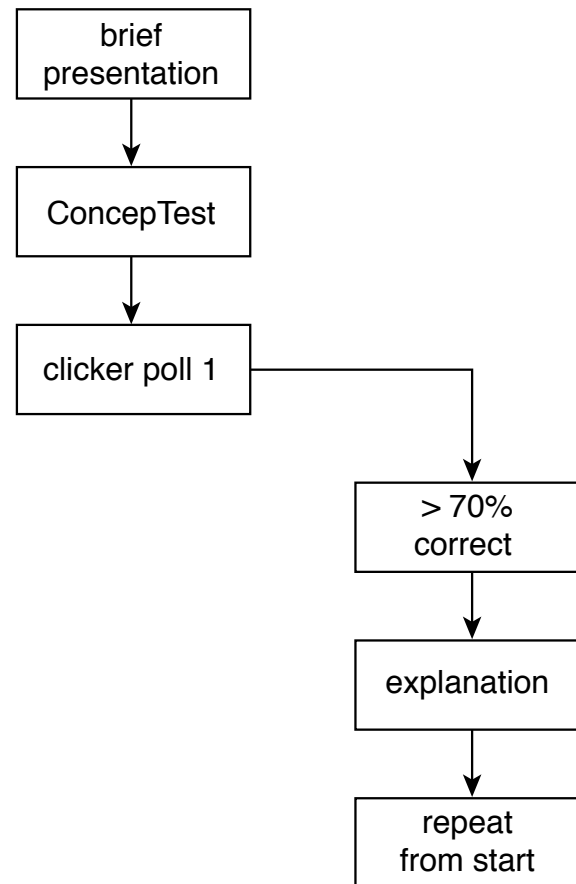
ConcepTest

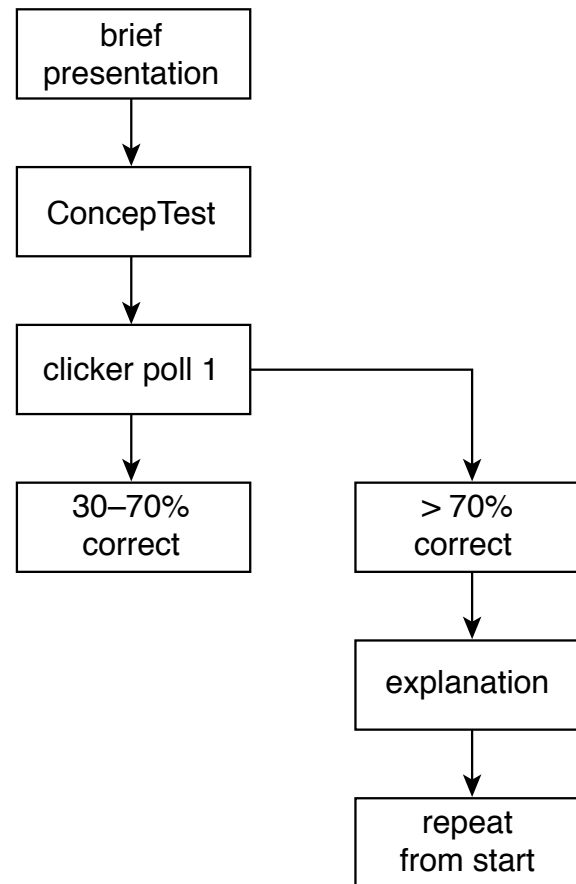


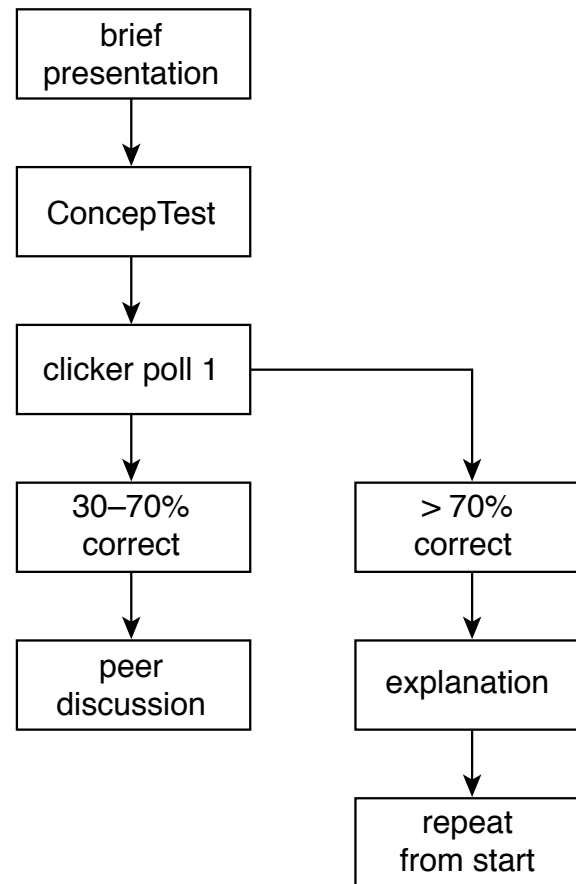


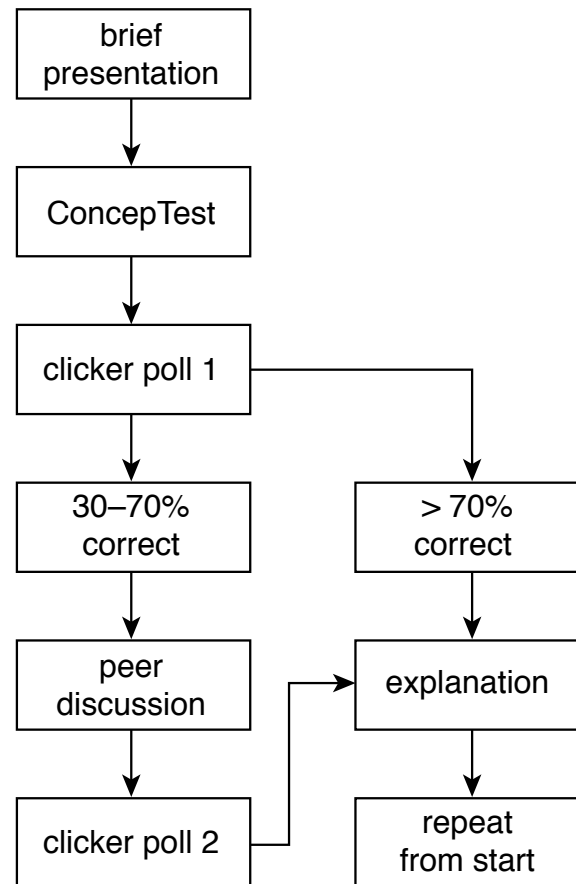


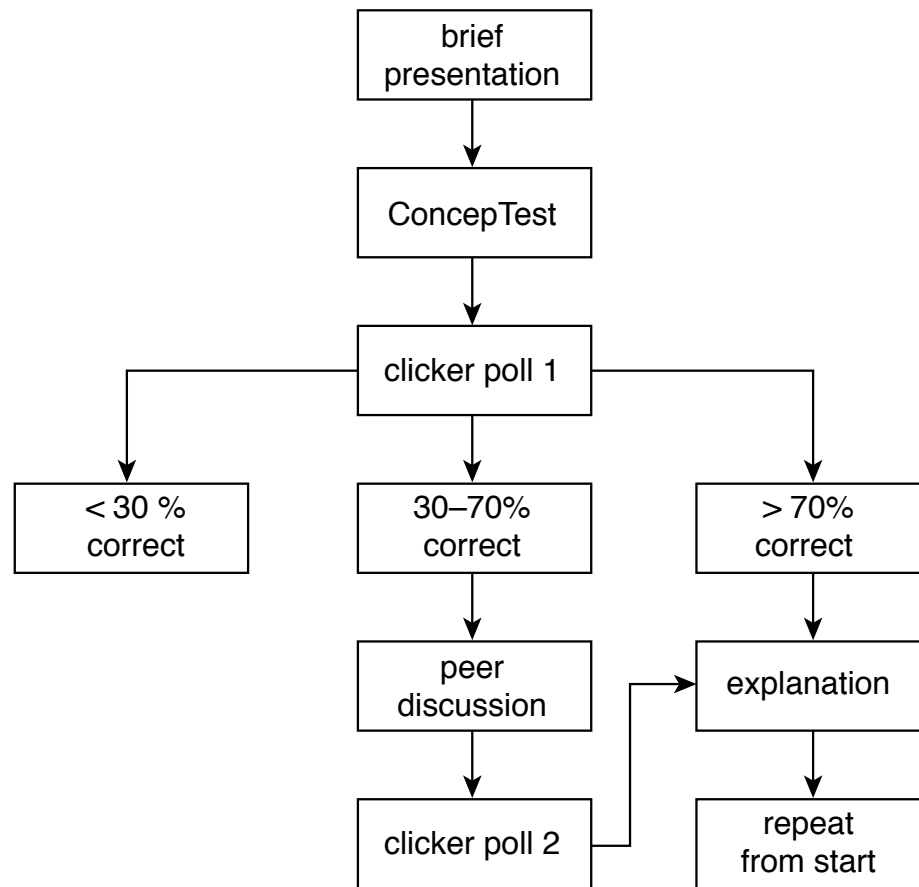


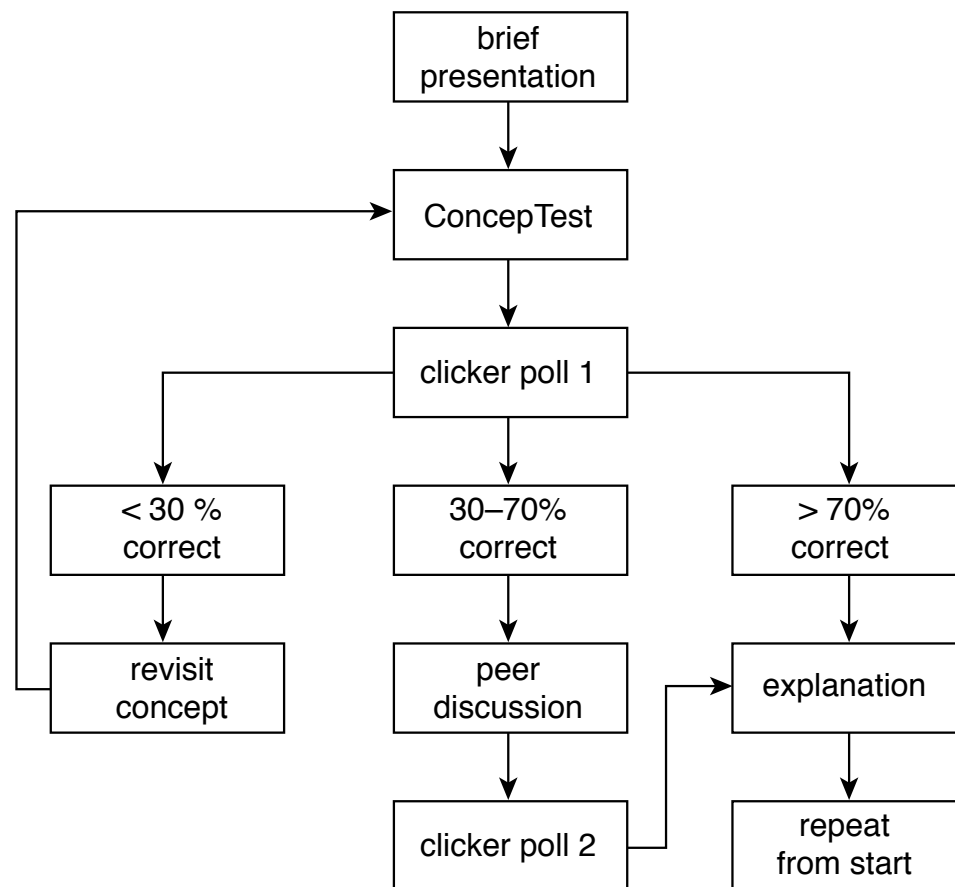




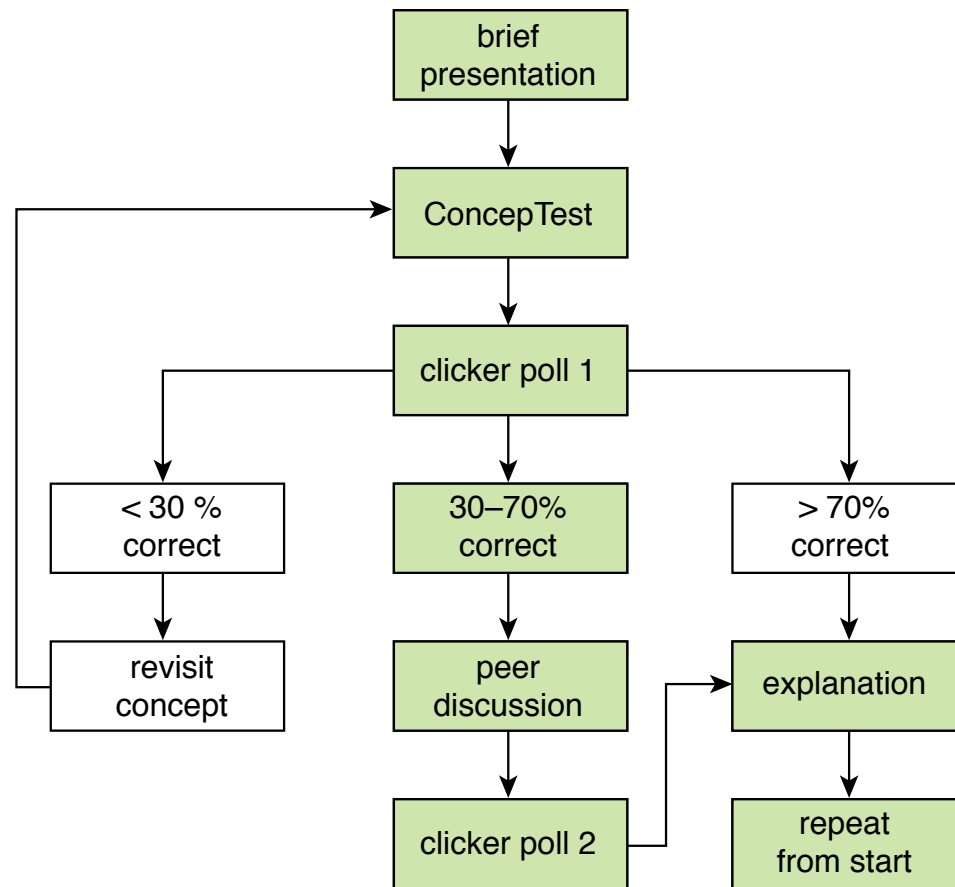












**feedback**

**1** lecture

**2** PI

**3** PI 2.0



1991



1 lecture

2 PI

3 PI 2.0



1993

A black handheld remote control is shown at an angle. It features a numeric keypad with buttons for digits 1 through 9, 0, and a red power 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
- learning | catalytics

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

## extensible plug-in architecture for question types

- a. A 30-year fixed rate mortgage at 12%
- b. A 15-year fixed rate mortgage at 12%
- c. A 30-year fixed rate mortgage at 12%
- d. A 15-year fixed rate mortgage at 12%

2. The biggest factor that leads American companies to manufacture their products over India is:

- a. Higher quality of craftsmanship
- b. Lower labor costs
- c. Decreased transportation costs
- d. Effective legal systems

3. Which of the following correctly summarizes the accounting equation for a sole proprietorship?

- a.  $Assets = Liabilities + Owners' equity$
- b.  $Liabilities = Assets + Owners' equity$
- c.  $Owner's equity = Assets + Liabilities$
- d.  $Revenue = Assets - Liabilities$

4. In order to present a business plan to a group of potential investors, a businessperson should most likely use which of the following?

- a. Powerpoint
- b. Quickbooks
- c. Peoplesoft
- d. Excel

5. In order to start an online business, an individual would need all but which of the following:

business model

## Sample question types:

- direction
- expression
- long answer, short answer, word cloud (fill in text)
- multiple-choice, many-choice
- numerical (enter a number)
- ranking
- region (select point on image)
- sketch

**Think of something you are good at**

**EDUCACION**

**Think of something you are good at**

***How did you become good at this?***

**EDUCACION**



**Became good at it by:**

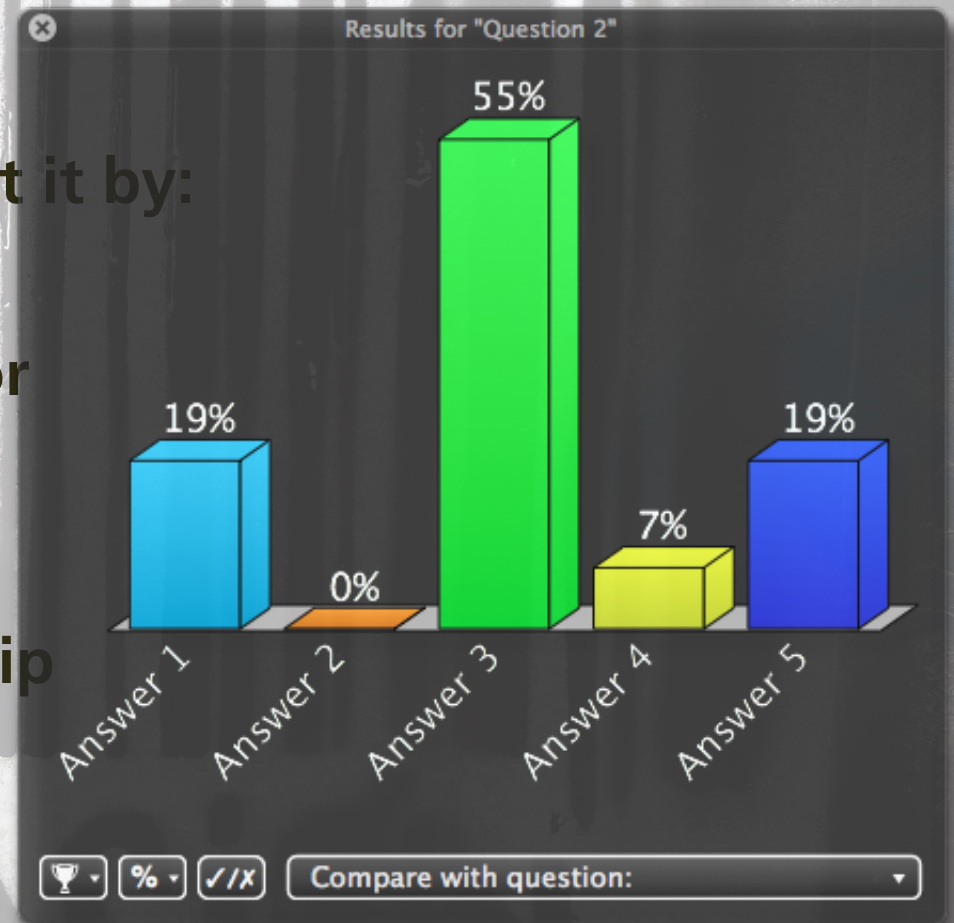
- 1. trial and error**
- 2. lectures**
- 3. practicing**
- 4. apprenticeship**
- 5. other**

**EDUCACION**



Became good at it by:

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





Carrier

10:24 PM

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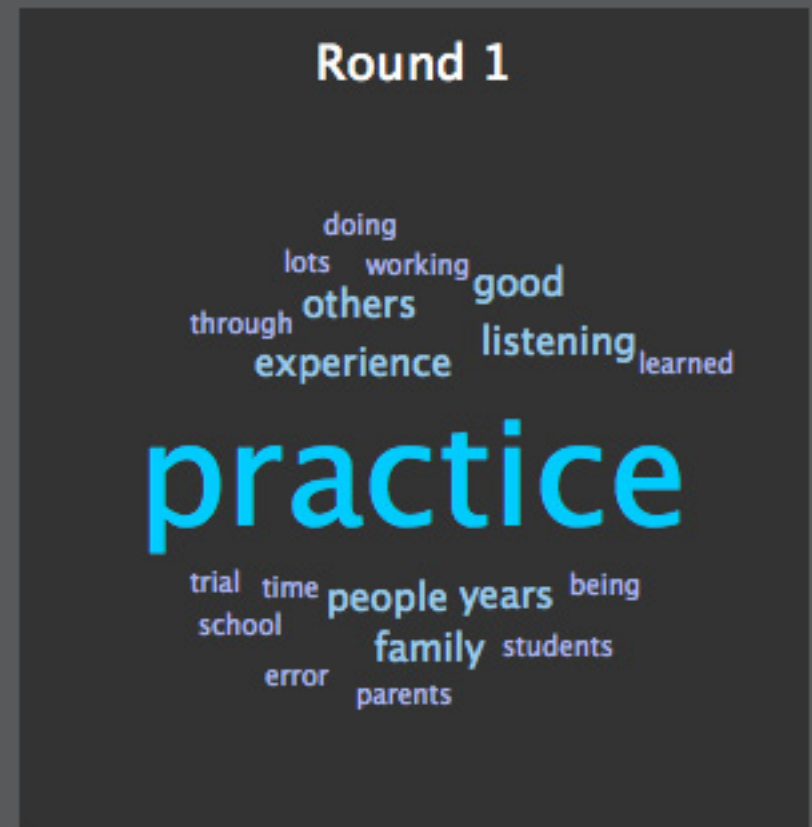
session 123456

Now describe in a couple of words how you became good at whatever it is you entered in the previous question.

Submit response

## Class session: 123456

Now describe in a couple of words how you became good at whatever it is you entered in the previous question.



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1 [lccatalytics.com](https://lccatalytics.com) 2 create instructor account 3 ID 1234567

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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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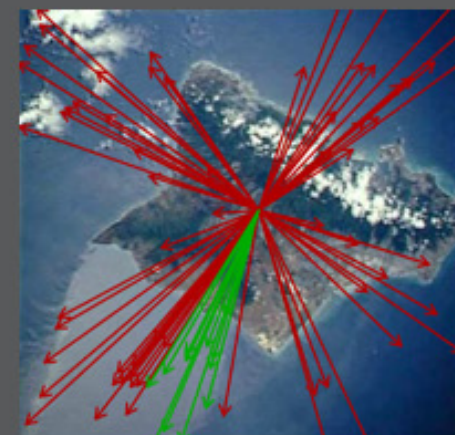
4. direction  
prevailing

...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

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1

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6

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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 education

2 PI

3 PI 2.0

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current session: **766079** | 69 students

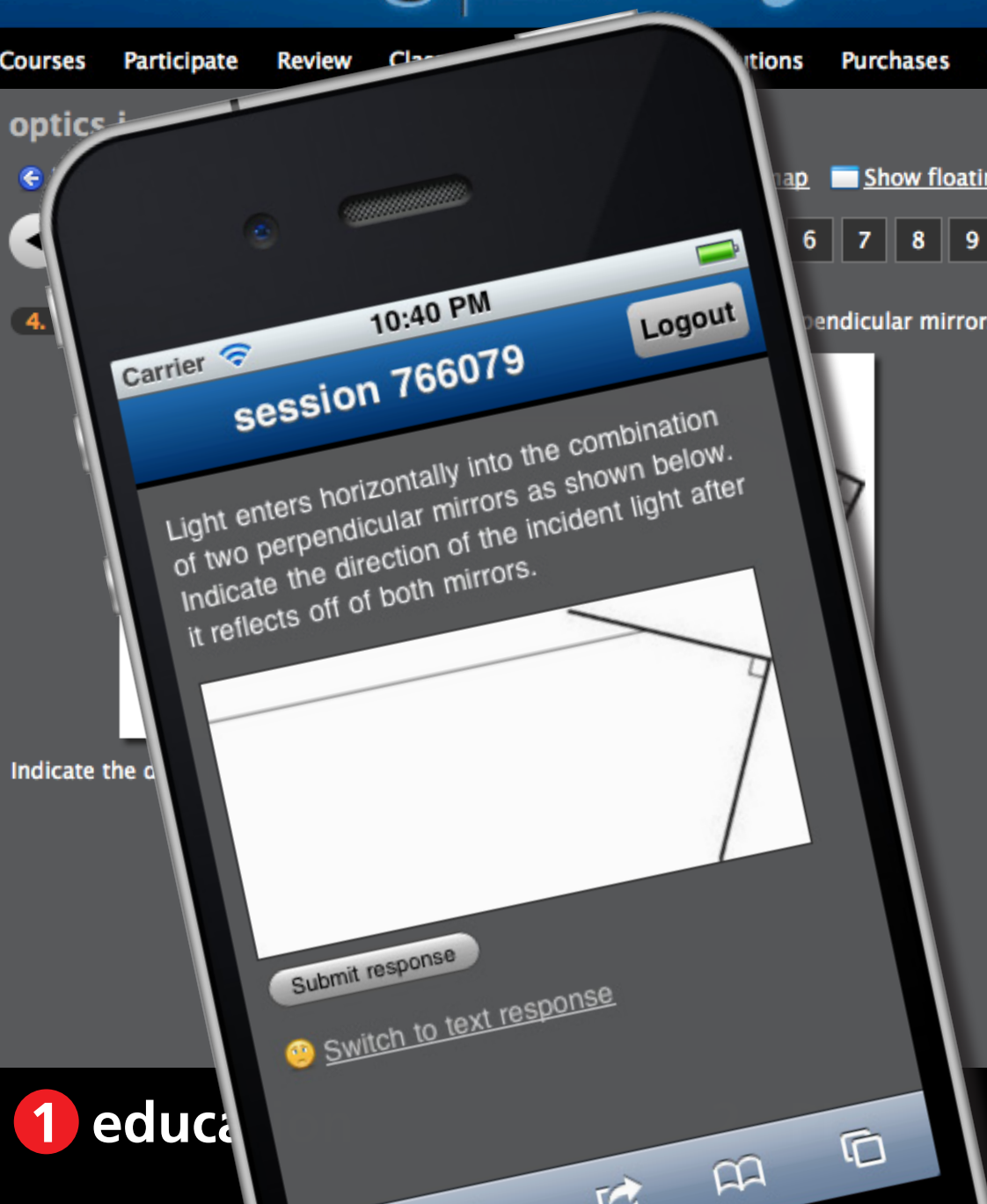
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6 7 8 9 10 11 12 13 14 15

perpendicular mirrors as shown below.

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current session: **766079** | 69 students

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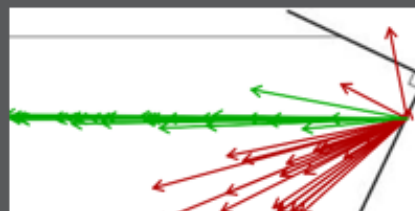
6 7 8 9 10 11 12 13 14 15



perpendicular mirrors as shown below.

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Round 1   
● 57 responses, 58% correct



[feedback & support](#)



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current session: **766079** | 69 students

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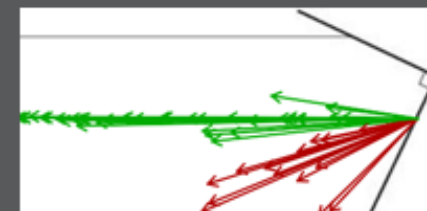
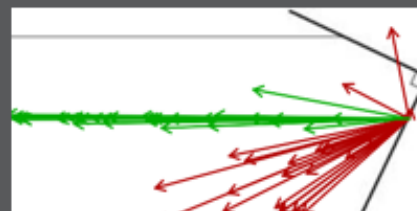
6 7 8 9 10 11 12 13 14 15

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](#)



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## transformations of parabolas

current session: **773885** | 9 students

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1

2

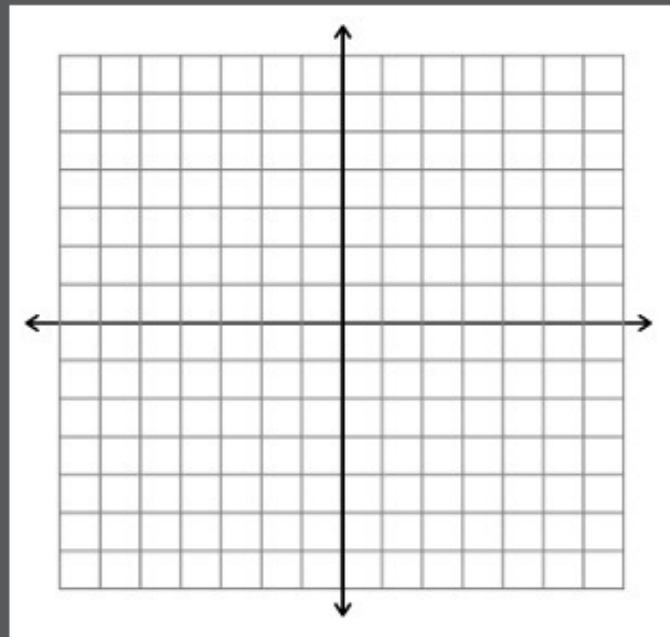
3

4



4. sketch Sketch a graph of the function  $f(x) = (x - 3)^2 + 2$ .

[✖ Stop delivery](#) [🔄 Deliver again](#) [👥 Assign groups](#) [📊 Show all results](#)



1 education

2 PI

3 PI 2.0

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## transformations of parabolas

current session: **773885** | 9 students

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1

2

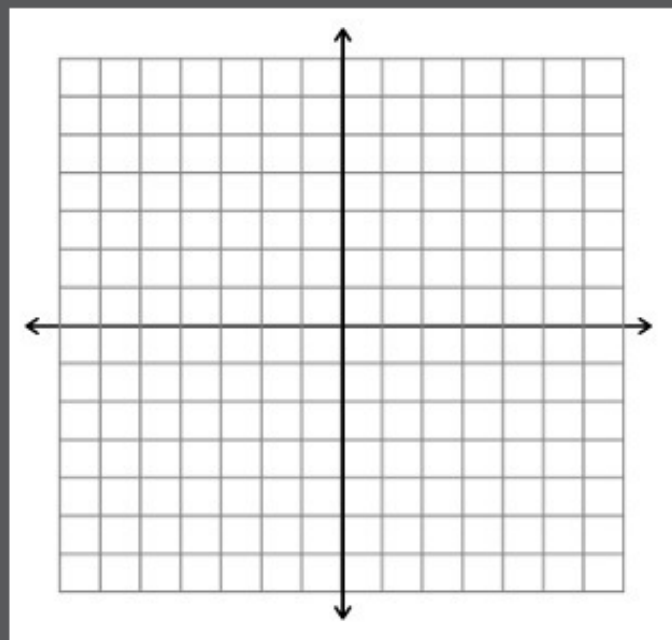
3

4



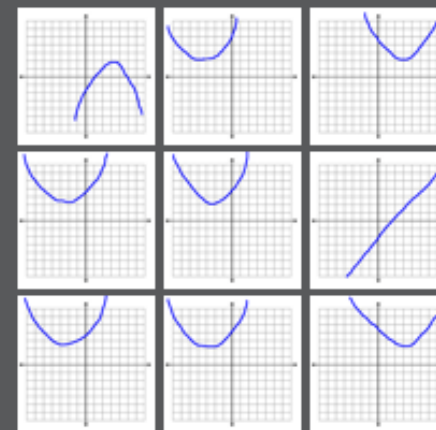
4. sketch Sketch a graph of the function  $f(x) = (x - 3)^2 + 2$ .

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Round 1

9 responses



1 education

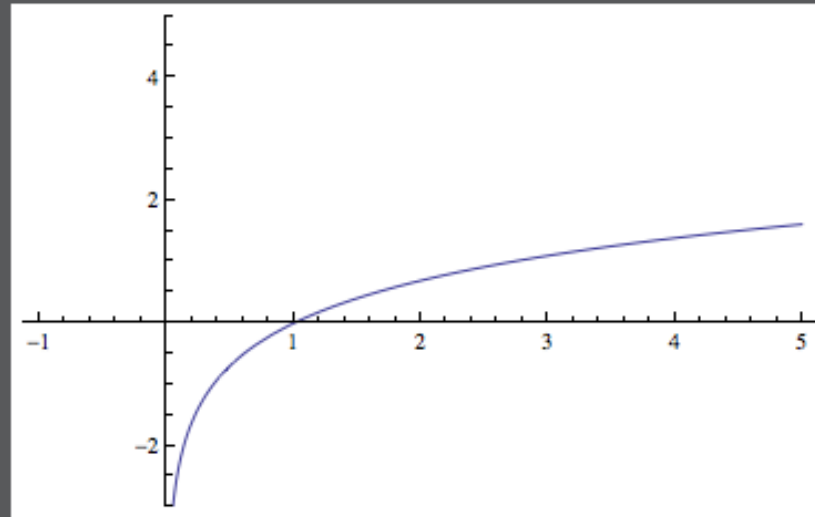
2 PI

3 PI 2.0

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



1 education

2 PI

3 PI 2.0

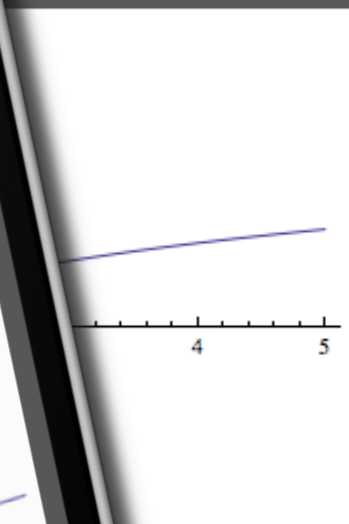


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This is a graph of  $f(x) =$



**1** education

**3** PI 2.0

# learning | catalytics

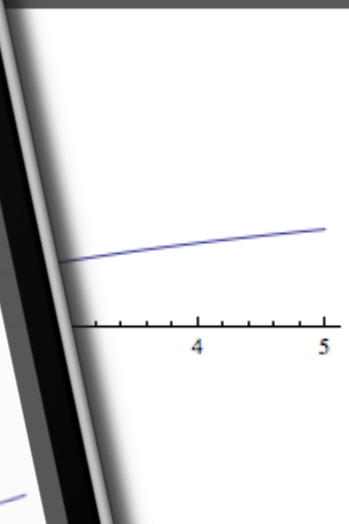
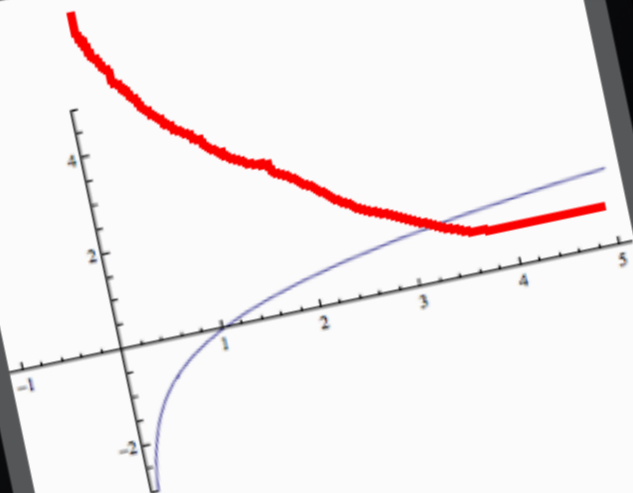
Courses Participate

ases Users Tour Help

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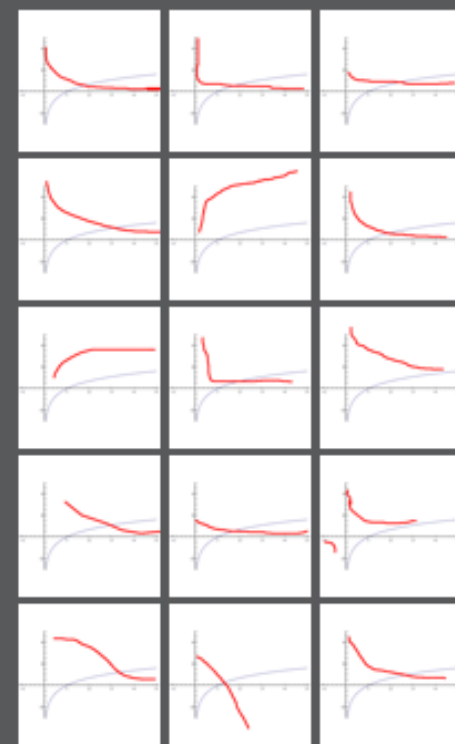


This is a graph of  $f(x) = \ln x$ . Sketch a graph of the derivative  $f'(x)$ .



Round 1

15 responses



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

1 education

3 PI 2.0

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1. highlighting What do you see as the most important part of this Shakespeare sonnet? [Stop delivery](#) [Deliver again](#) [Assign groups](#) [Show all results](#)

For shame! deny that thou bear'st love to any,  
Who for thyself art so unprovident.  
Grant, if thou wilt, thou art beloved of many,  
But that thou none lovest is most evident;  
For thou art so possess'd with murderous hate  
That 'gainst thyself thou stick'st not to conspire.  
Seeking that beauteous roof to ruinate  
Which to repair should be thy chief desire.  
O, change thy thought, that I may change my mind!  
Shall hate be fairer lodged than gentle love?  
Be, as thy presence is, gracious and kind,  
Or to thyself at least kind-hearted prove:  
Make thee another self, for love of me,  
That beauty still may live in thine or thee.

1 education

2 PI

3 PI 2.0

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1. highlighting  
sonnet?

this Shakespeare

[Stop delivery](#)

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1 educa

3 PI 2.0

# learning | catalytics

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1. highlighting  
sonnet?

this Shakespeare

[Stop delivery](#)

[Deliver again](#)

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## Round 1

3 responses

For shame! deny that thou bear'st  
love to any,  
Who for thyself art so  
unprovident.

Grant, if thou wilt, thou art  
beloved of many,

But that thou none lovest is most  
evident;

For thou art so possess'd with  
murderous hate

That 'gainst thyself thou stick'st  
not to conspire.

**Seeking that beauteous roof to  
ruinate**

Which to repair should be thy  
chief desire.

O, change thy thought, that I may  
change my mind!

Shall hate be fairer lodged than  
gentle love?

Be, as thy presence is, gracious  
and kind,



What do you see as the most important part  
of this Shakespeare sonnet?  
**Highlight the passage below by clicking or  
tapping once to set the beginning of your  
highlight, and then clicking or tapping  
again to set the end.**

For shame! deny that thou bear'st love to any,  
Who for thyself art so unprovident.  
Grant, if thou wilt, thou art beloved of many,  
But that thou none lovest is most evident;  
For thou art so possess'd with murderous hate  
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**Seeking that beauteous roof to ruinate  
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O, change thy thought, that I may change my  
mind!

## Sample question types:

- direction
- expression
- long answer, short answer, word cloud (fill in text)
- multiple choice, many choice
- numerical (enter a number)
- ranking
- region (select point on image)
- sketch

**data analytics**



1 lecture

2 PI

3 PI 2.0



# human interaction

1 lecture

2 PI

3 PI 2.0



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

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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

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 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



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.



A. positive  
 B. zero  
 C. negative  
 D. depends on the path taken from A to B  
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**Round 1**  
 74 responses, 61% correct

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C. 35%
D. 0%
E. 0%

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

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

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

1 lecture

2 PI

3 PI 2.0

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

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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 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



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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# learning catalytics

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. 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%

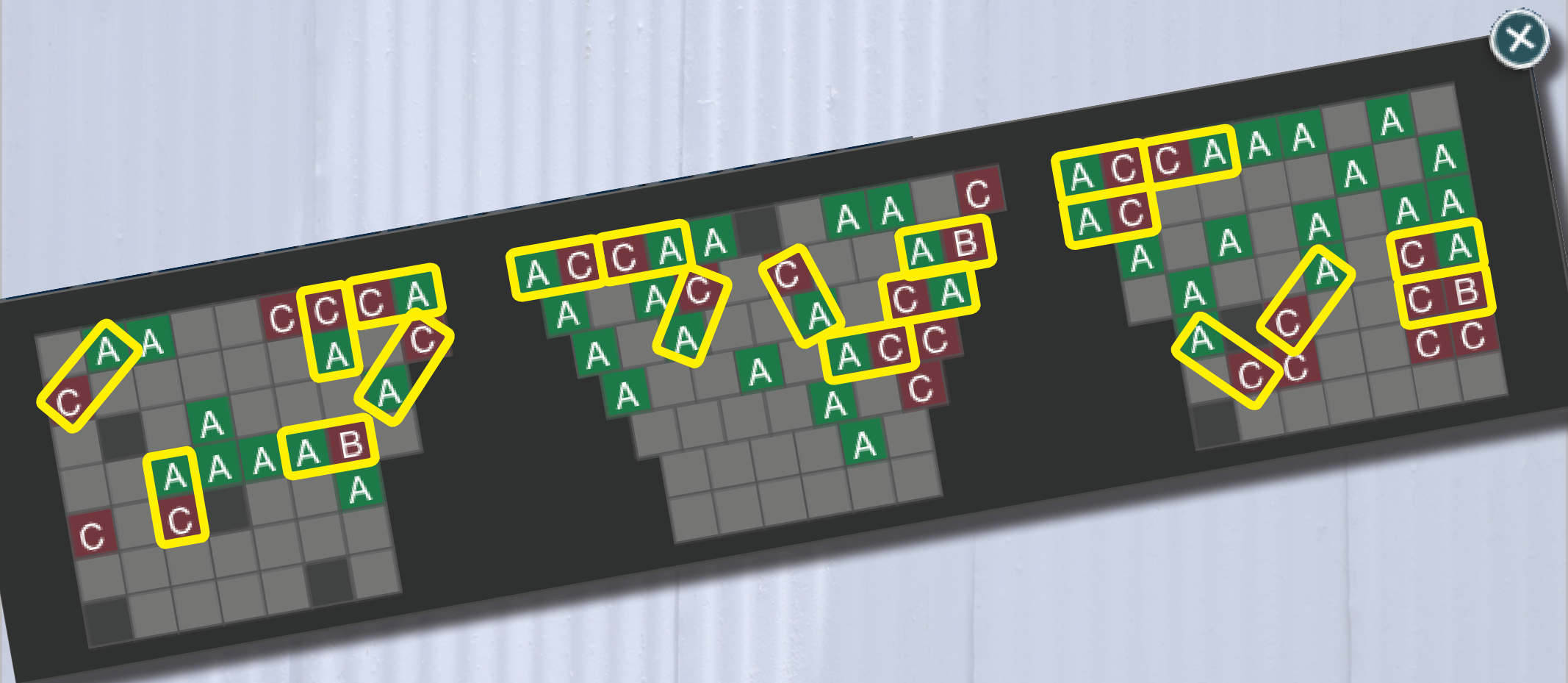
Search: \_\_\_\_\_

1 lecture

2 PI

3 PI 2.0

let system manage pairing



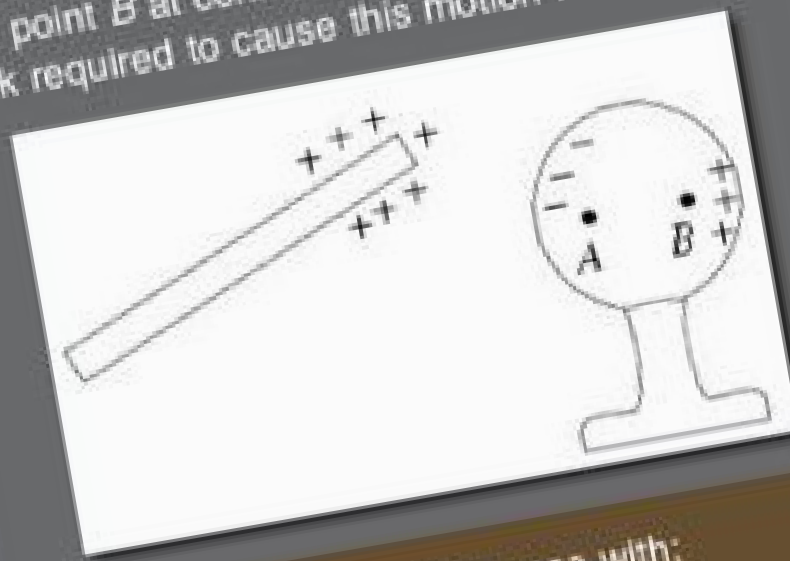
1 lecture

2 PI

3 PI 2.0

Leave

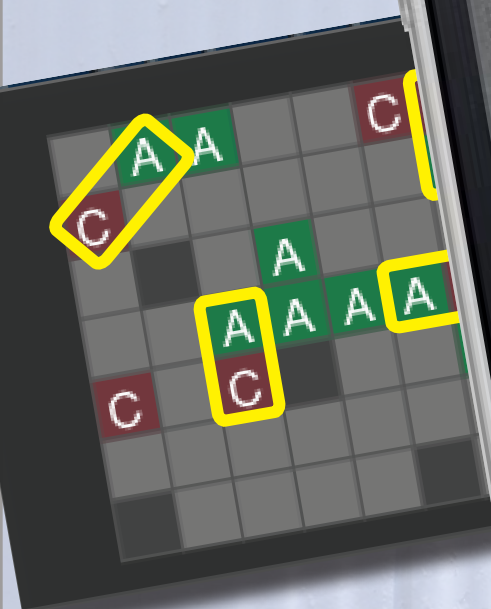
A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B at constant speed. The mechanical work required to cause this motion is



Please discuss your response with:

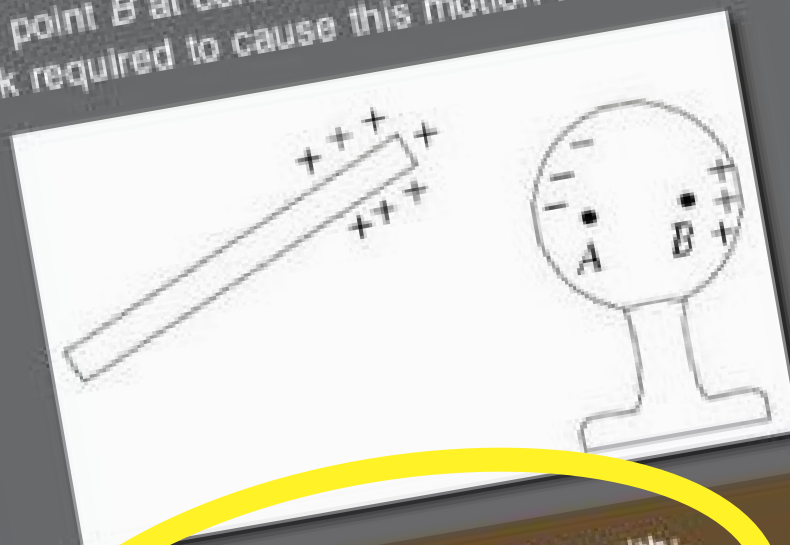
- Brian Lukoff (to your left)

I am talking to this person/people



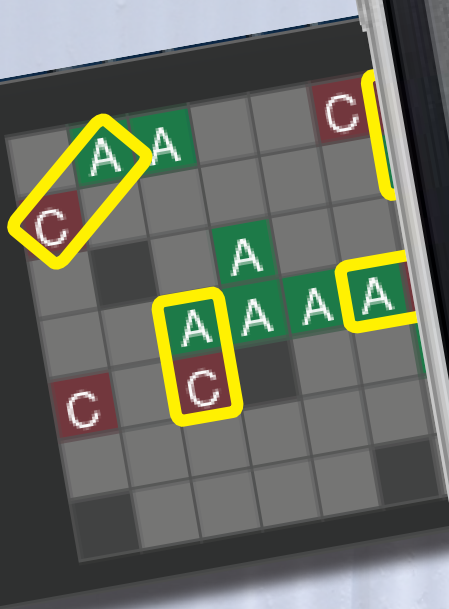
Leave

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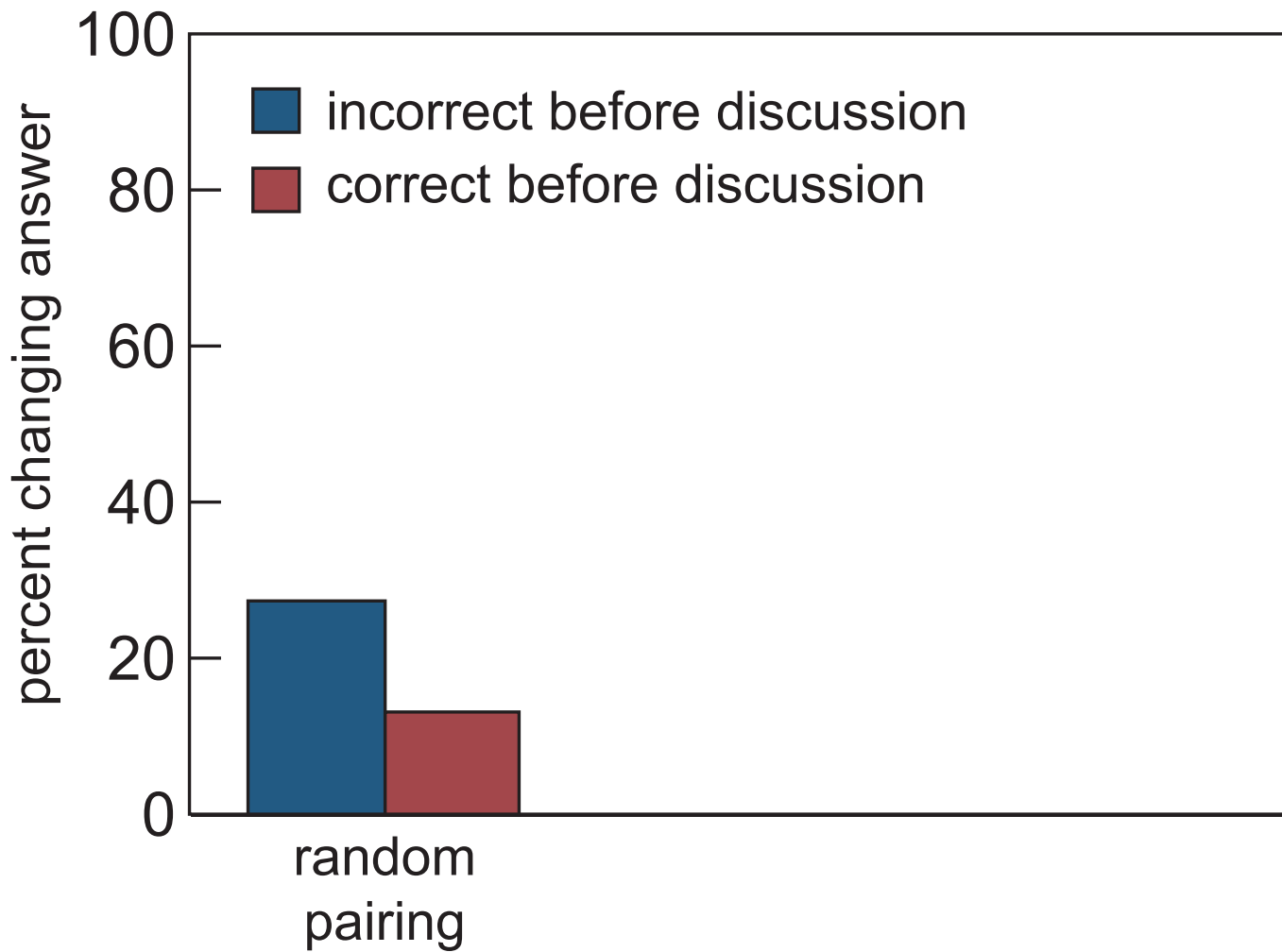


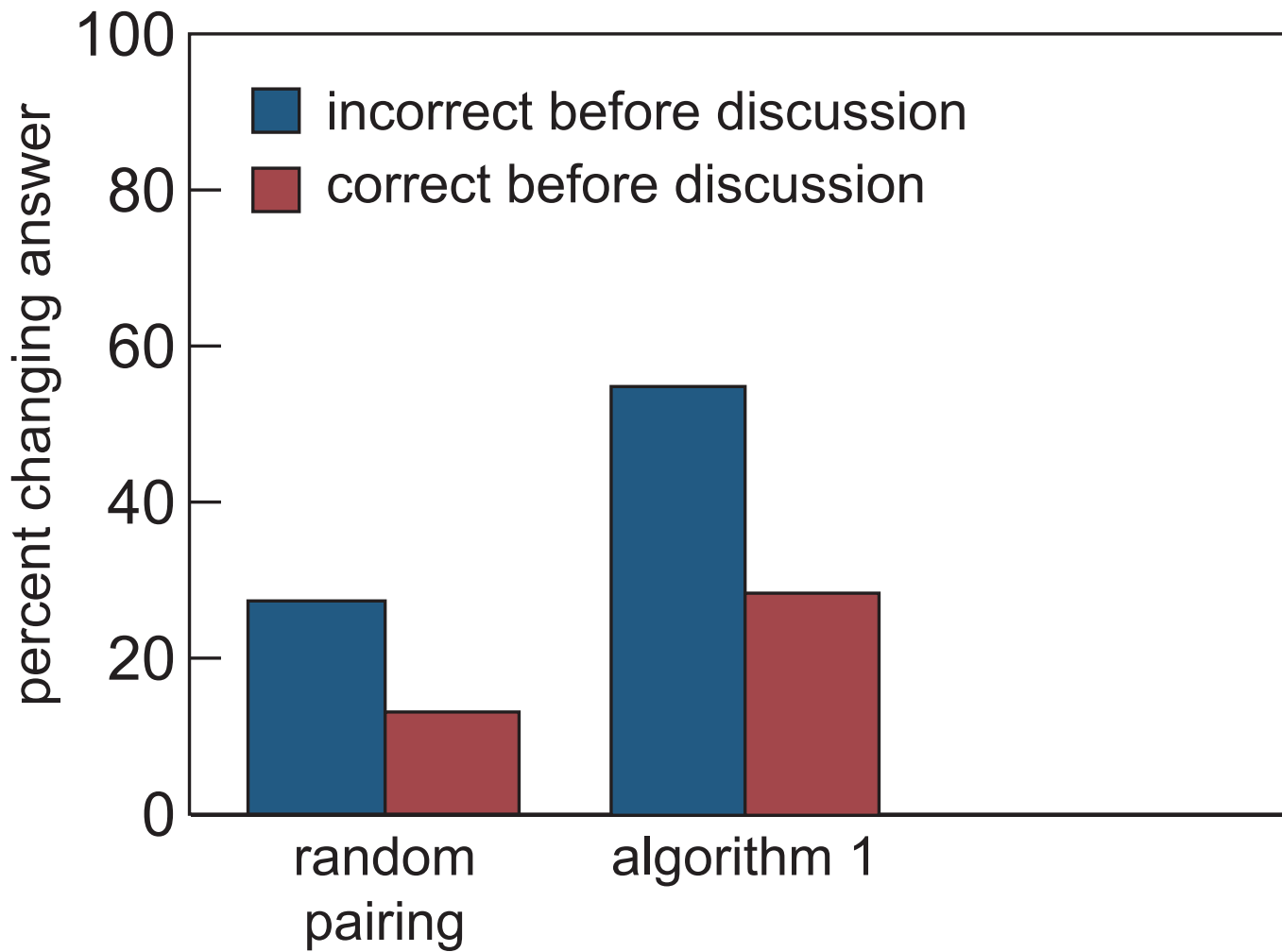
Please discuss your response with:

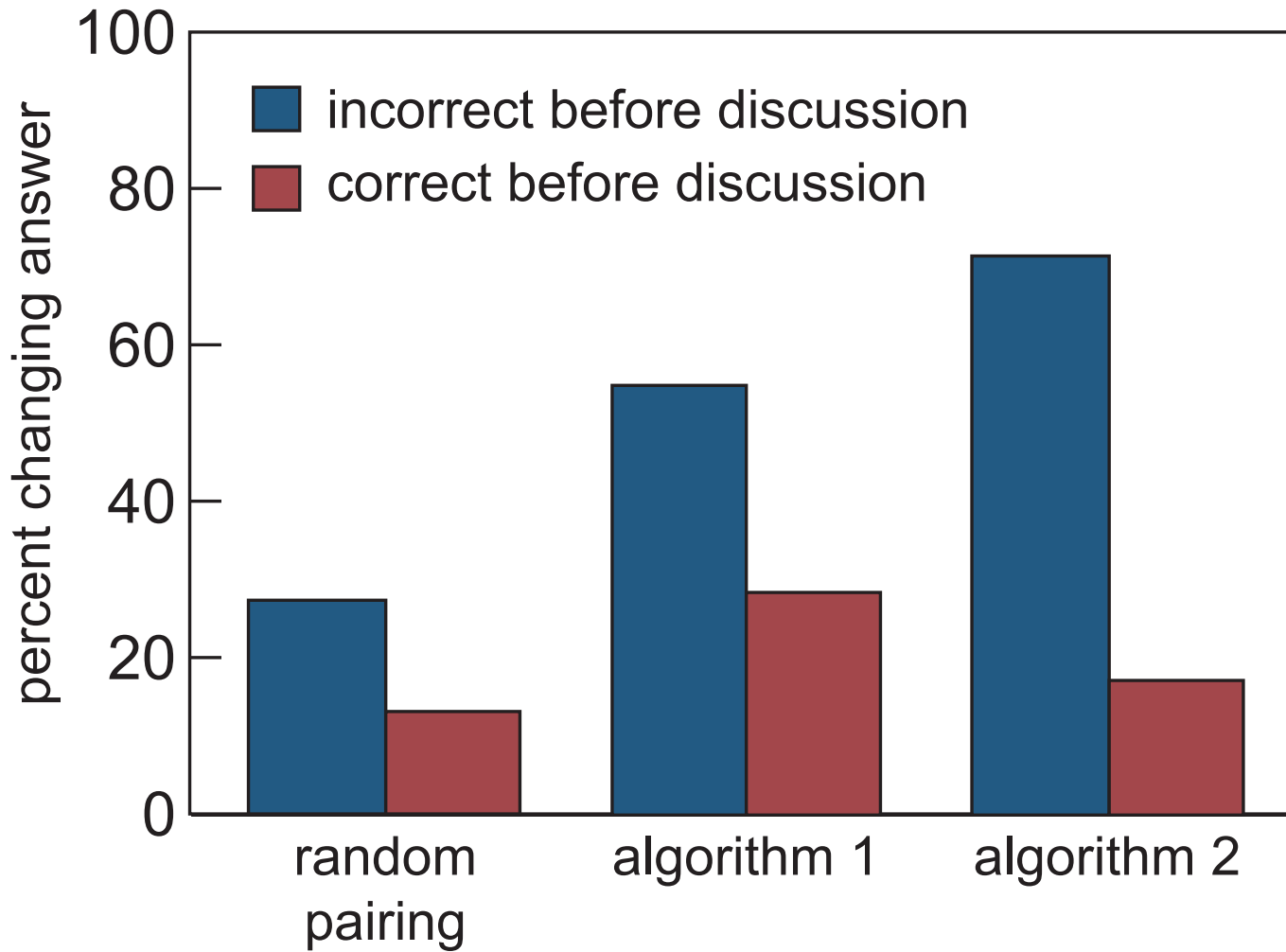
- Brian Lukoff (to your left)













1 lecture

2 PI

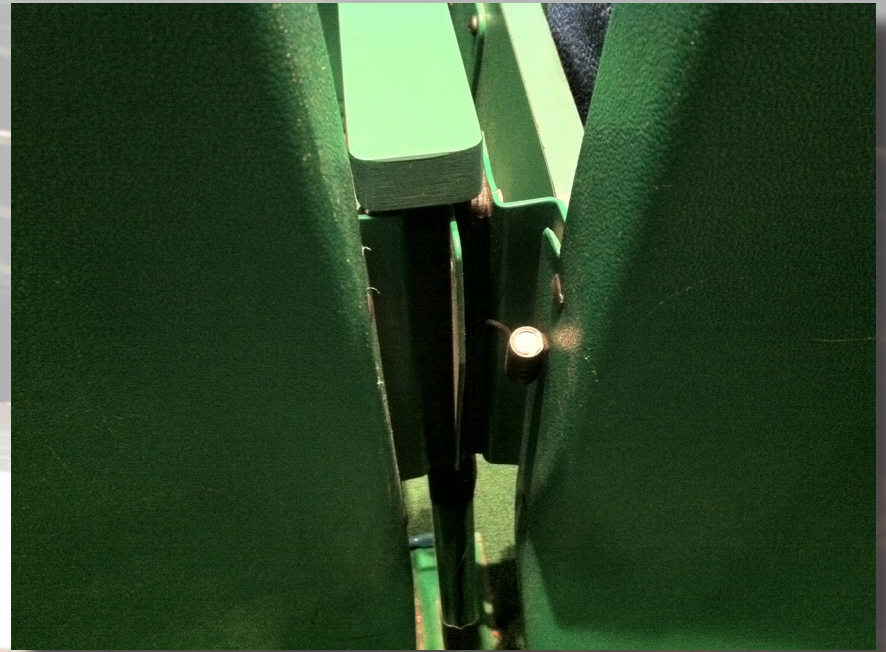
3 PI 2.0



**1** lecture

**2** PI

**3** PI 2.0



**1** lecture

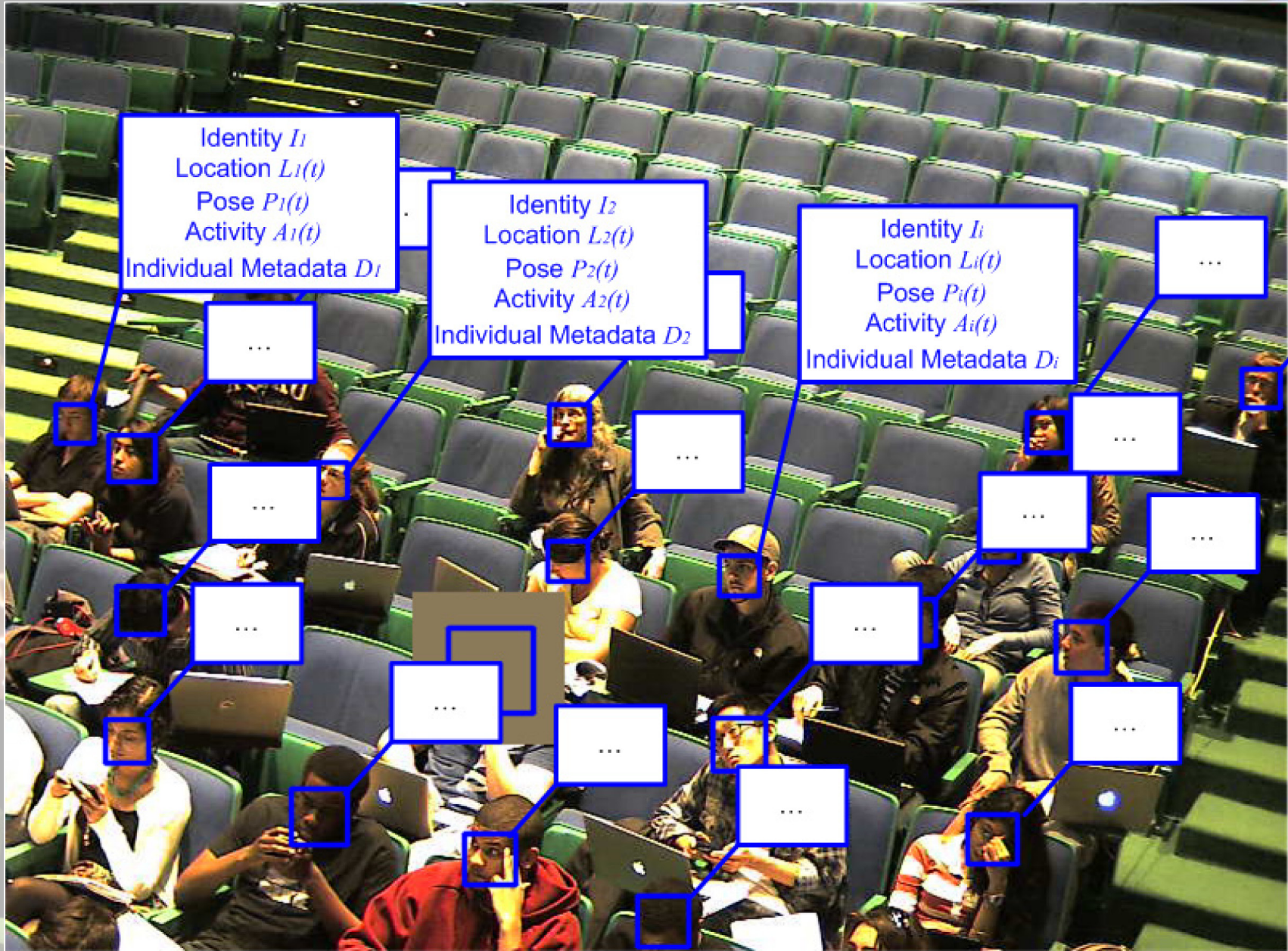
**2** PI

**3** PI 2.0

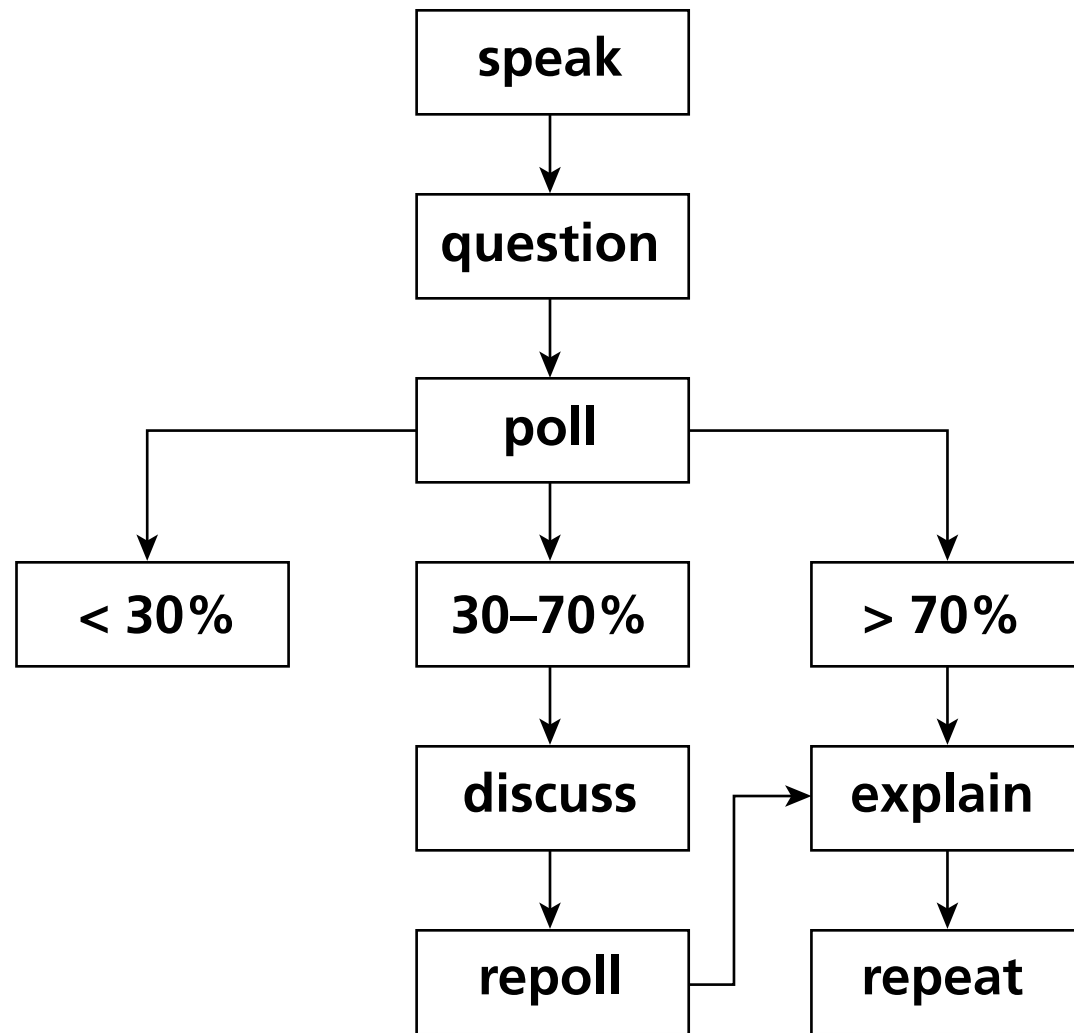
**1** lecture

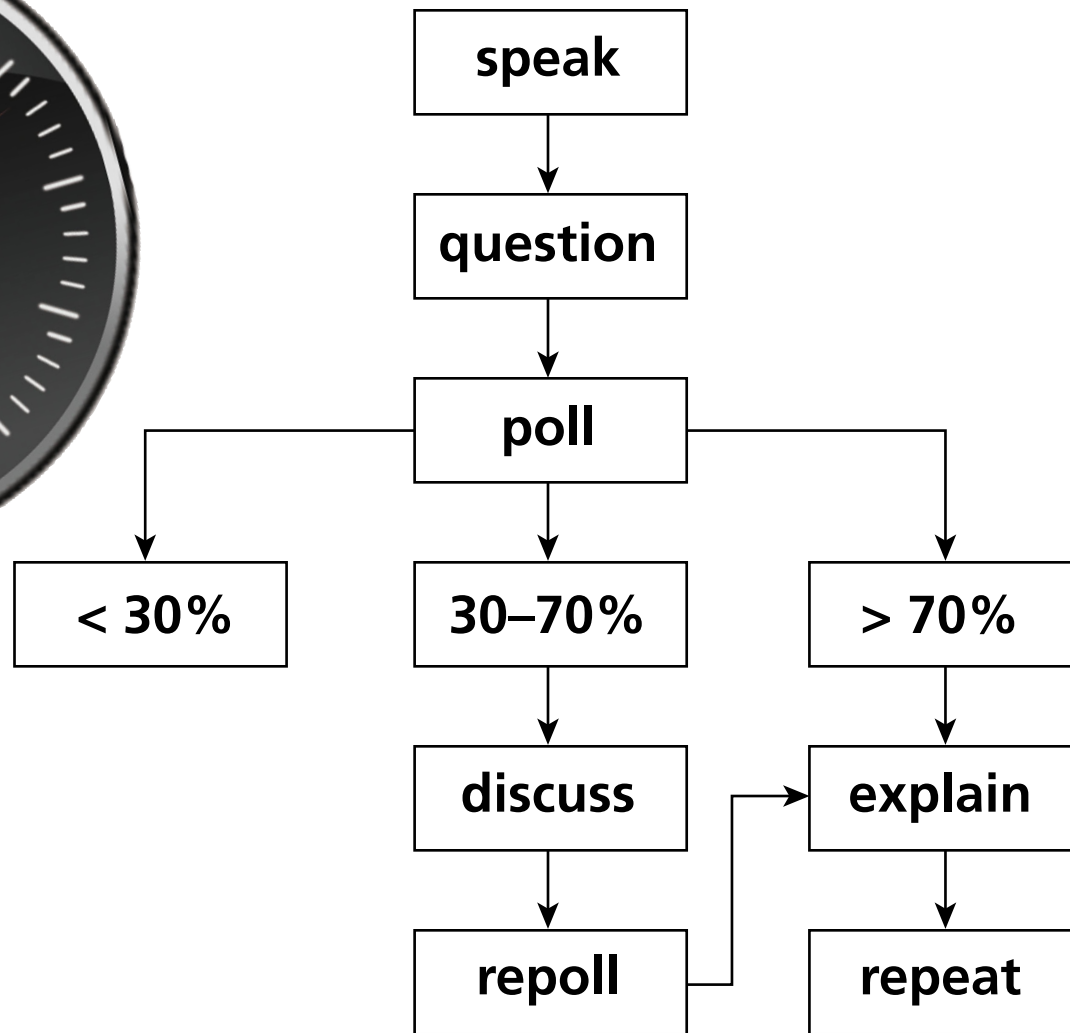
**2** PI

**3** PI 2.0











**1** lecture

**2** PI

**3** PI 2.0



**1** education

**2** PI

**3** PI 2.0



## Learning Catalytics:

- implement proven, researched pedagogy



## Learning Catalytics:

- implement proven, researched pedagogy
- 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*