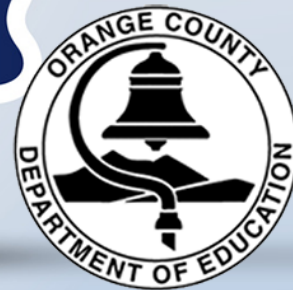


# Core Leadership Summit



Aug. 15, 2013 #core13



[www.core13.org](http://www.core13.org)

**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**

# Personalized learning



Core Leadership Summit  
Computer-Using Educators/Orange County DoE  
Costa Mesa, CA, 15 August 2013



# Personalized learning



@eric\_mazur

Core Leadership Summit  
Computer-Using Educators/Orange County DoE  
Costa Mesa, CA, 15 August 2013









1 education

2 PI



**1** education

**2** PI

**3** results






**1** lecture

**2** PI

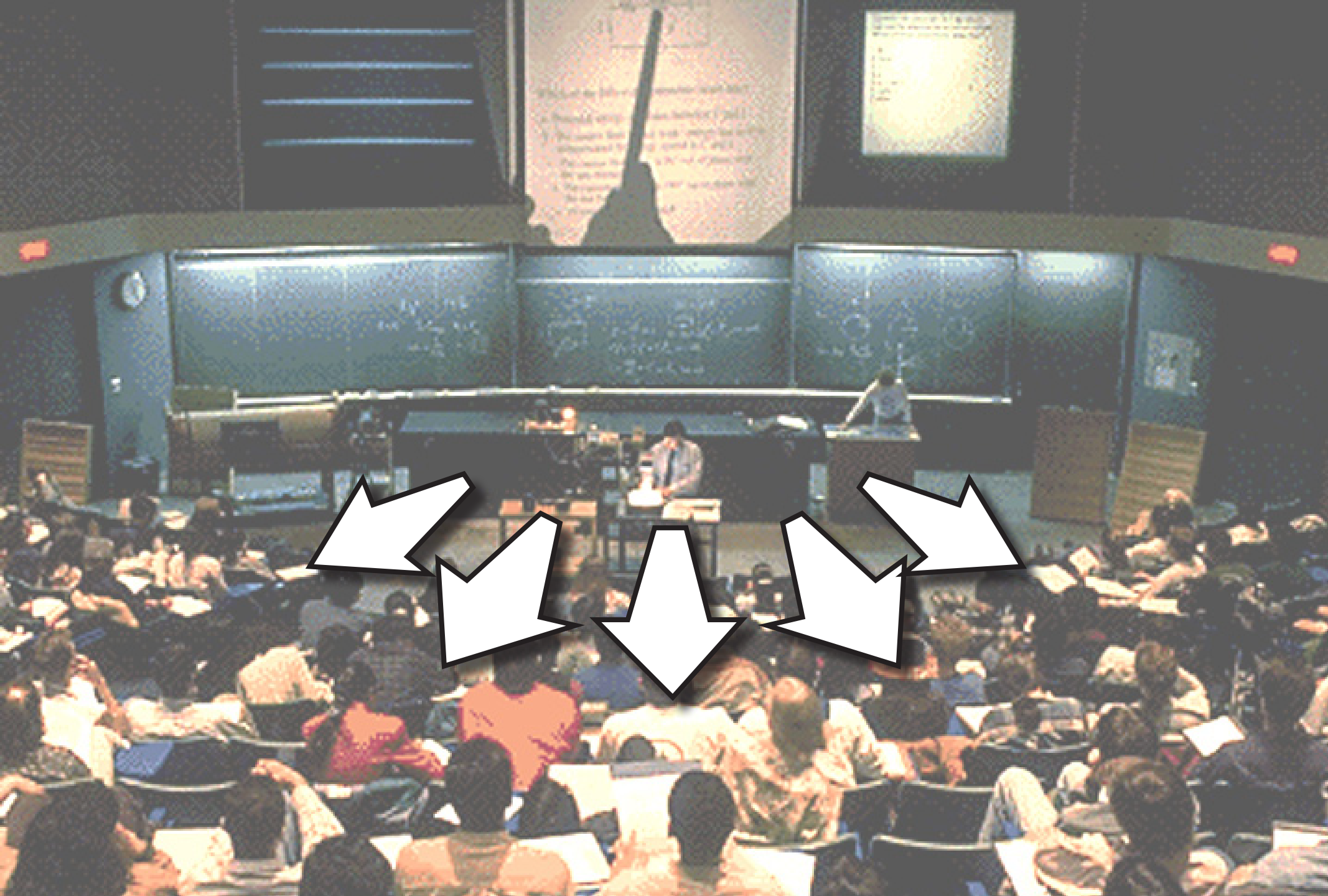
**3** PI 2.0



**What happens  
in a lecture?**



**1** lecture



The result?

EDUCACION

**Lack of learning**

EDUCACION

**Lack of learning**

**Lack of retention**



1 lecture

2 PI





# 1. transfer of information



**1. transfer of information**


**2. assimilation of that information**

- 
- 1. transfer of information (in class)**
  2. assimilation of that information



1. transfer of information (in class)

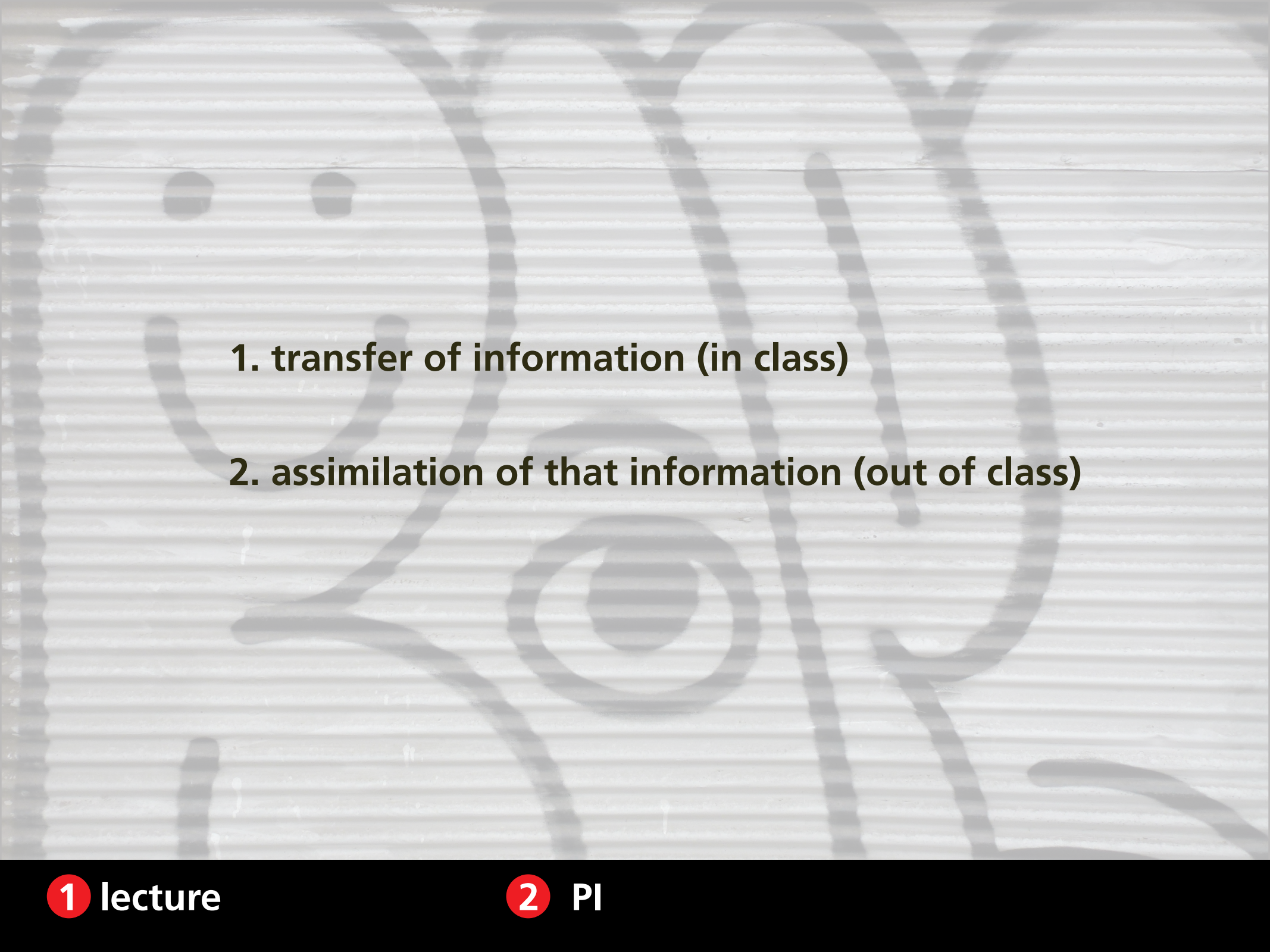
2. assimilation of that information (out of class)

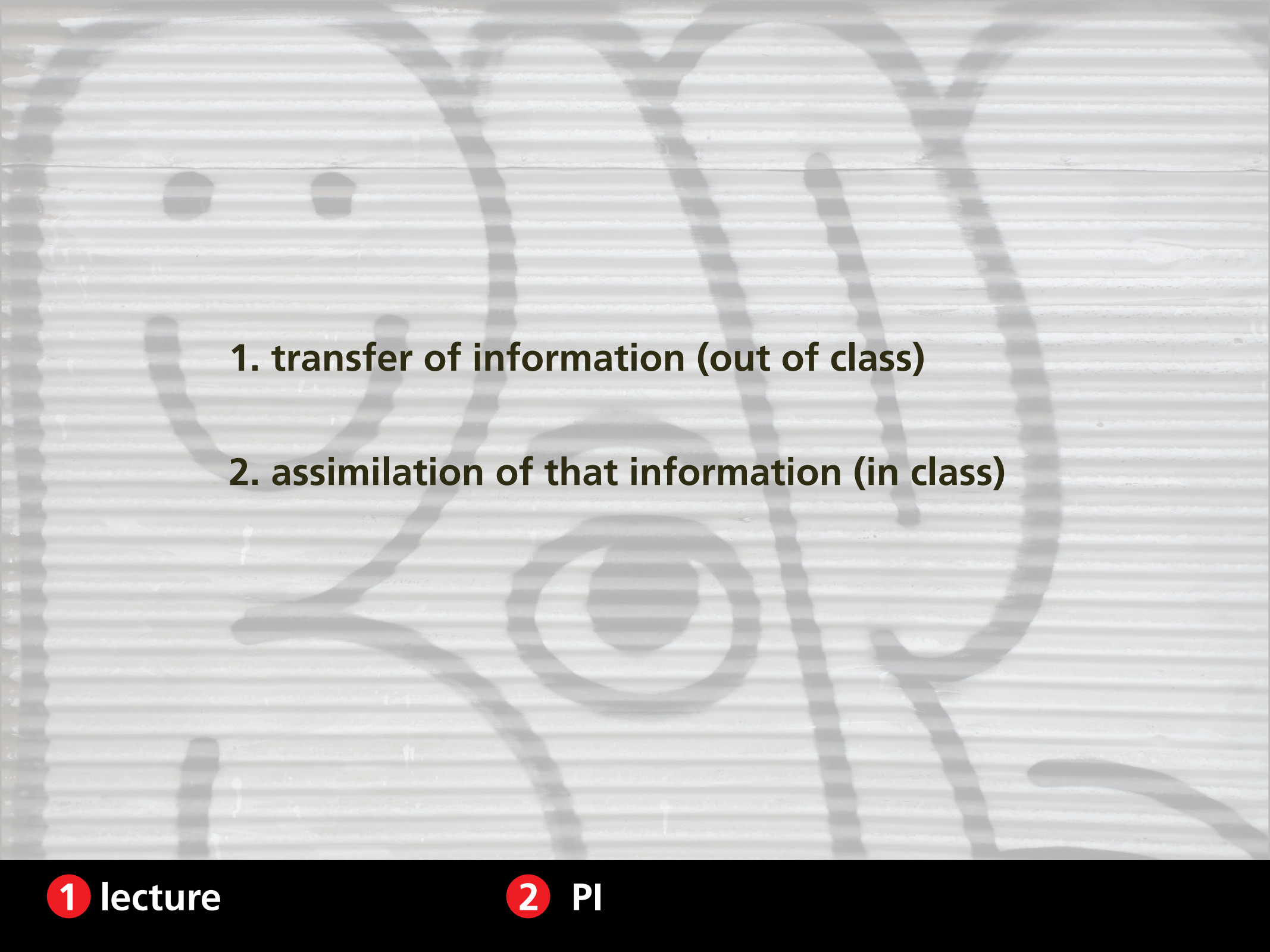


**Should focus  
on THIS!**

1. transfer of information (in class)

**2. assimilation of that information (out of class)**

- 
- 1. transfer of information (in class)**
  - 2. assimilation of that information (out of class)**

- 
1. transfer of information (out of class)
  2. assimilation of that information (in class)

A photograph of a man in a dark suit and red tie leaning over a group of students in a lecture hall. He is pointing at a document held by one of the students. The students are seated in green chairs, and the room has wood-paneled walls. The text is overlaid on the image.

**1. transfer of information (out of class)**

**2. assimilation of that information (in class)**

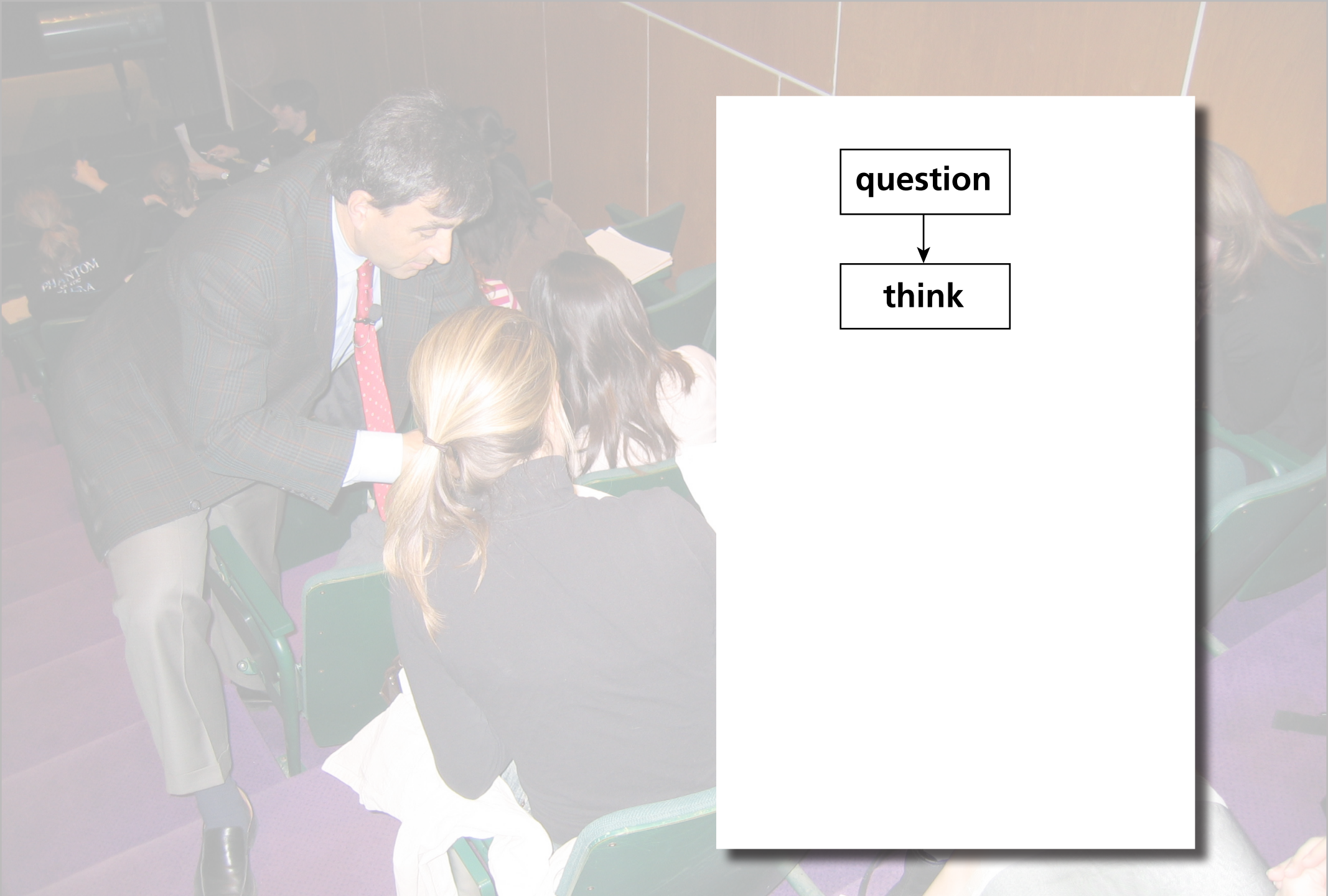


A man in a dark plaid suit and red tie is leaning over a woman with long blonde hair in a lecture hall. He appears to be adjusting her chair or providing assistance. Other people are visible in the background, some sitting at desks. The room has wood-paneled walls and purple carpeting.

question

1 lecture

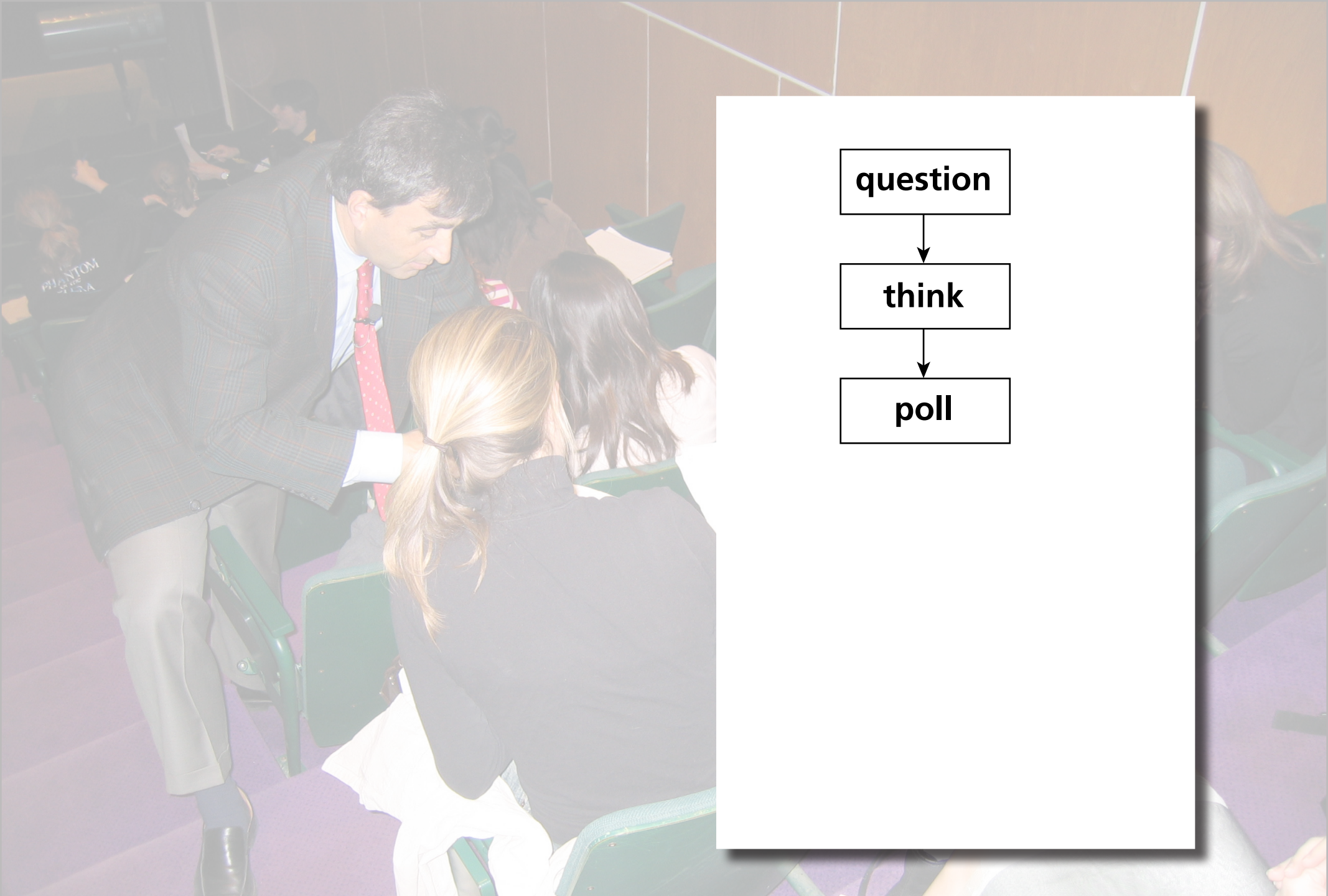
2 PI



question



think



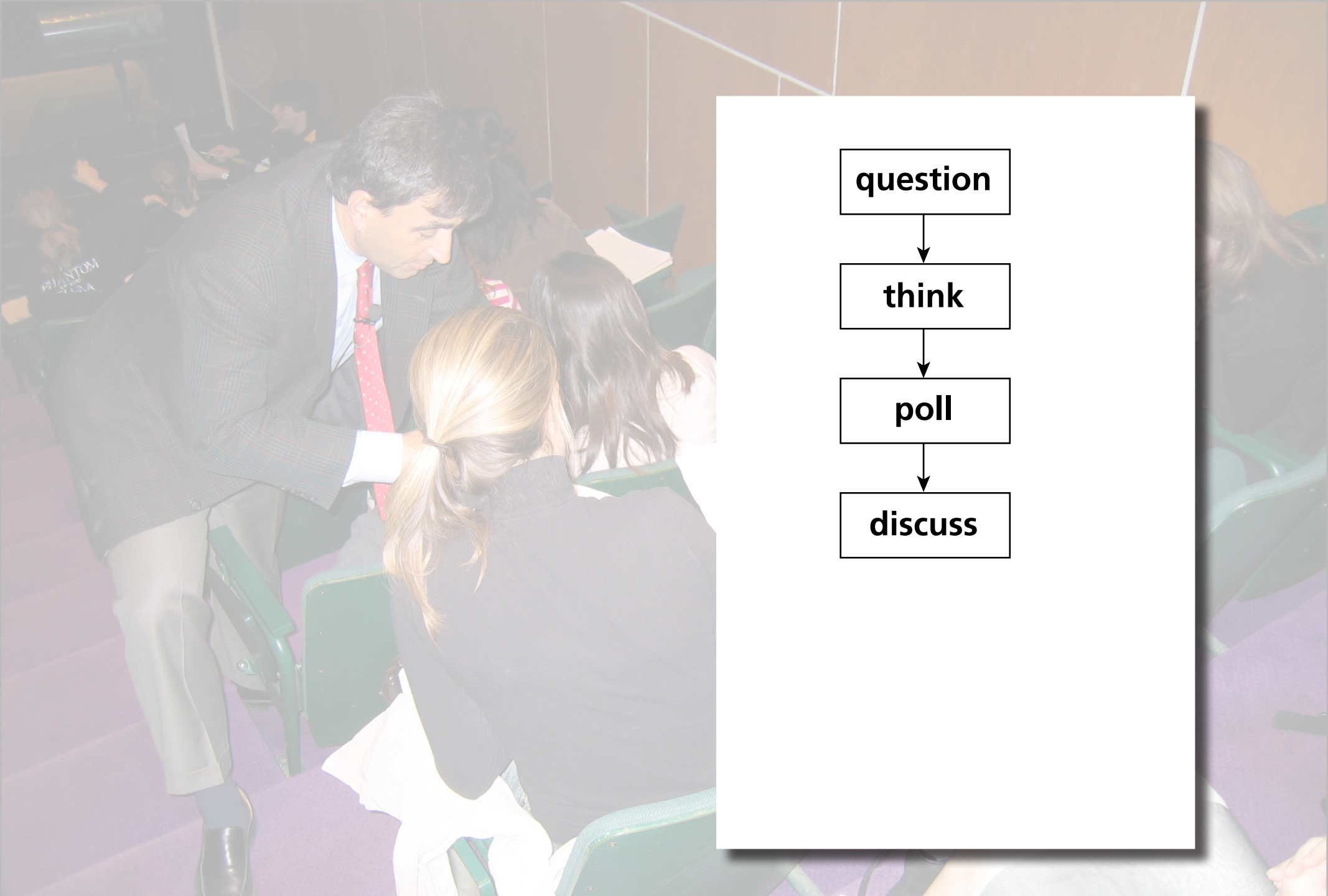
question



think



poll



**question**



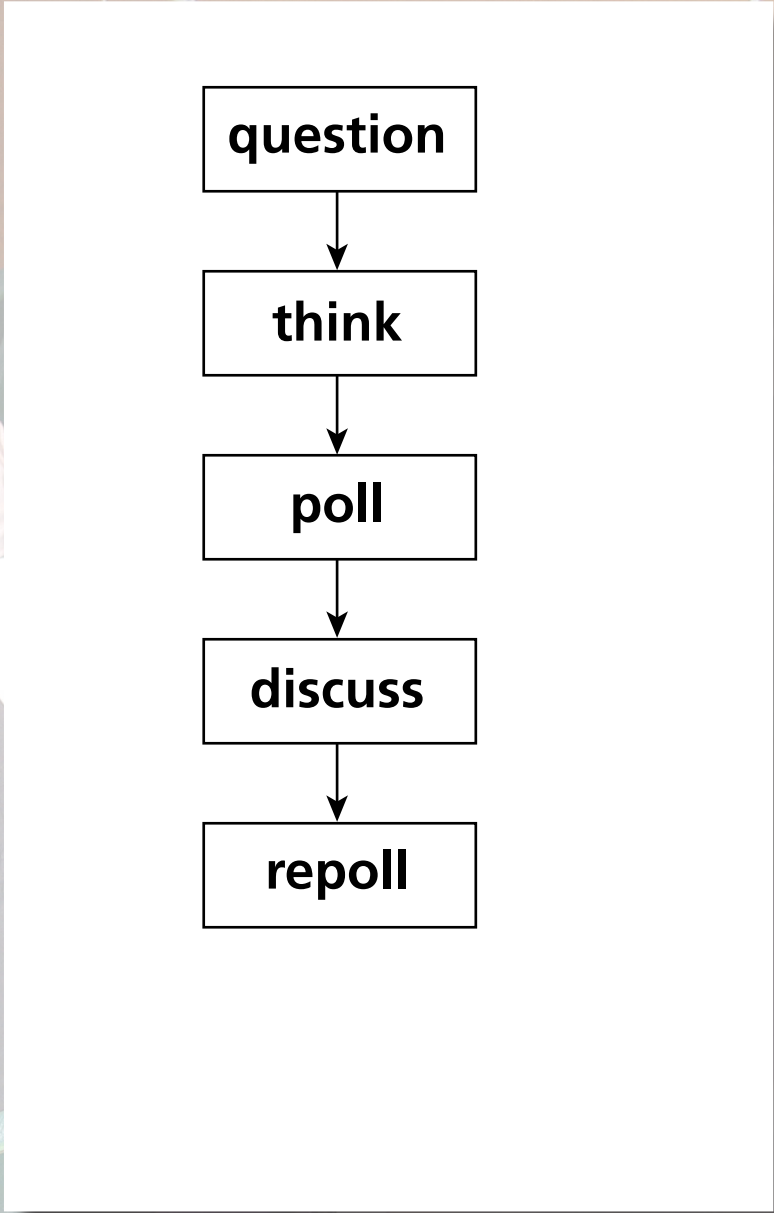
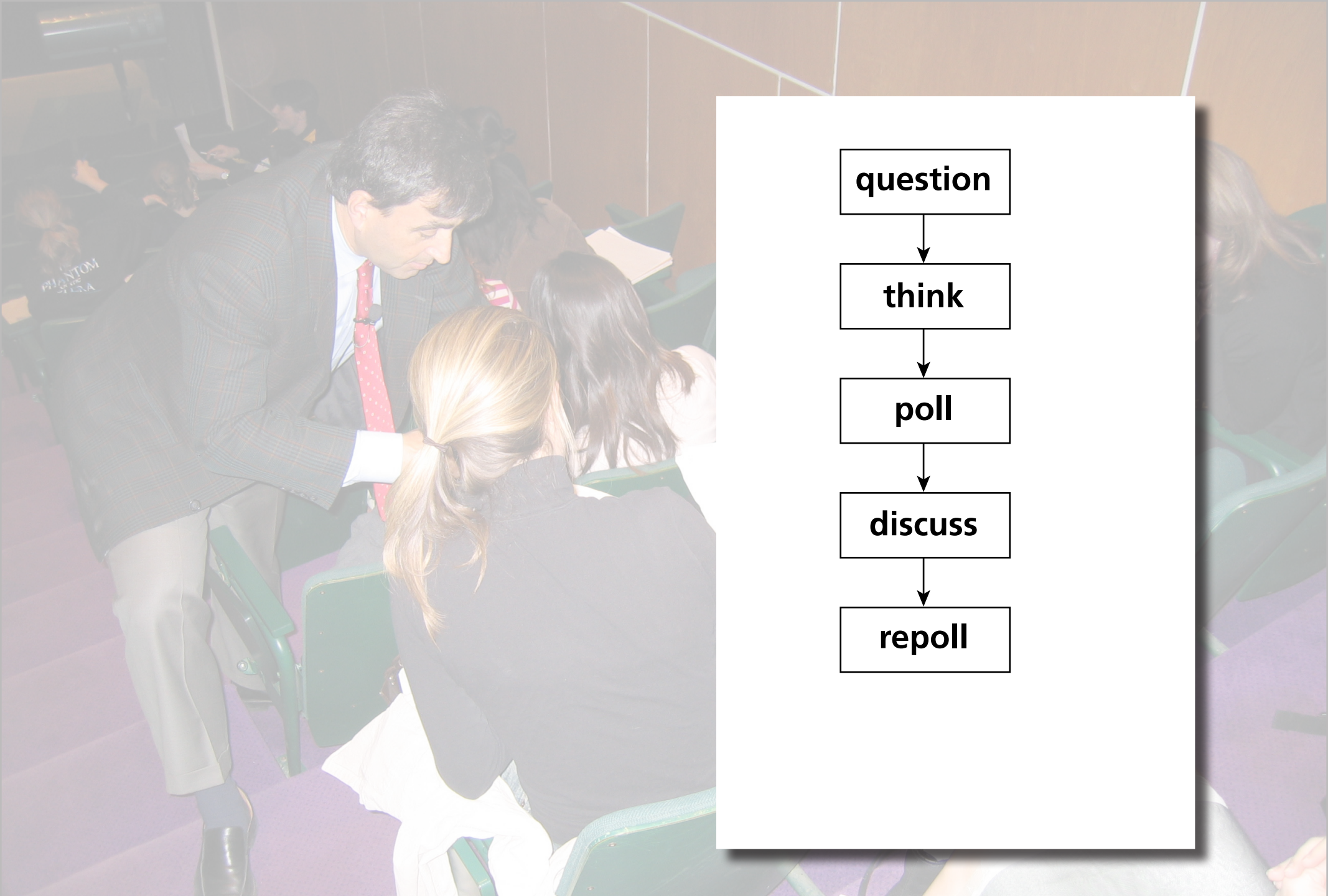
**think**

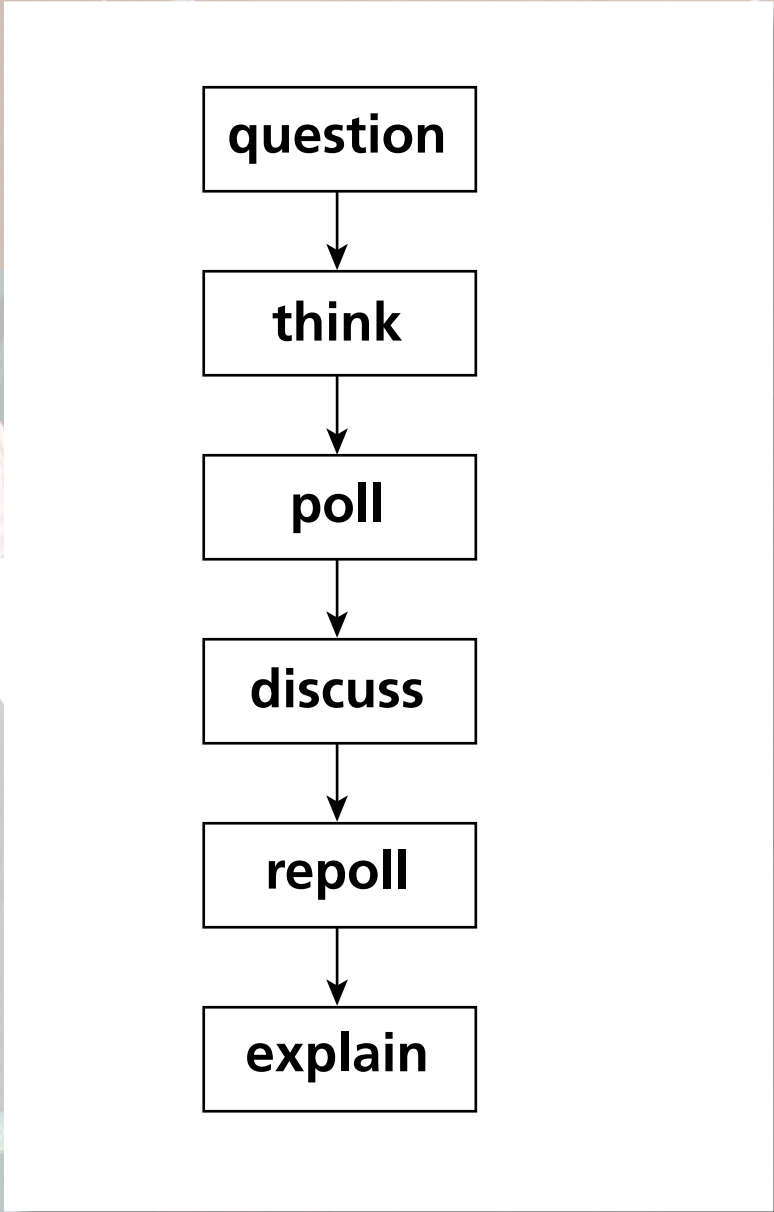
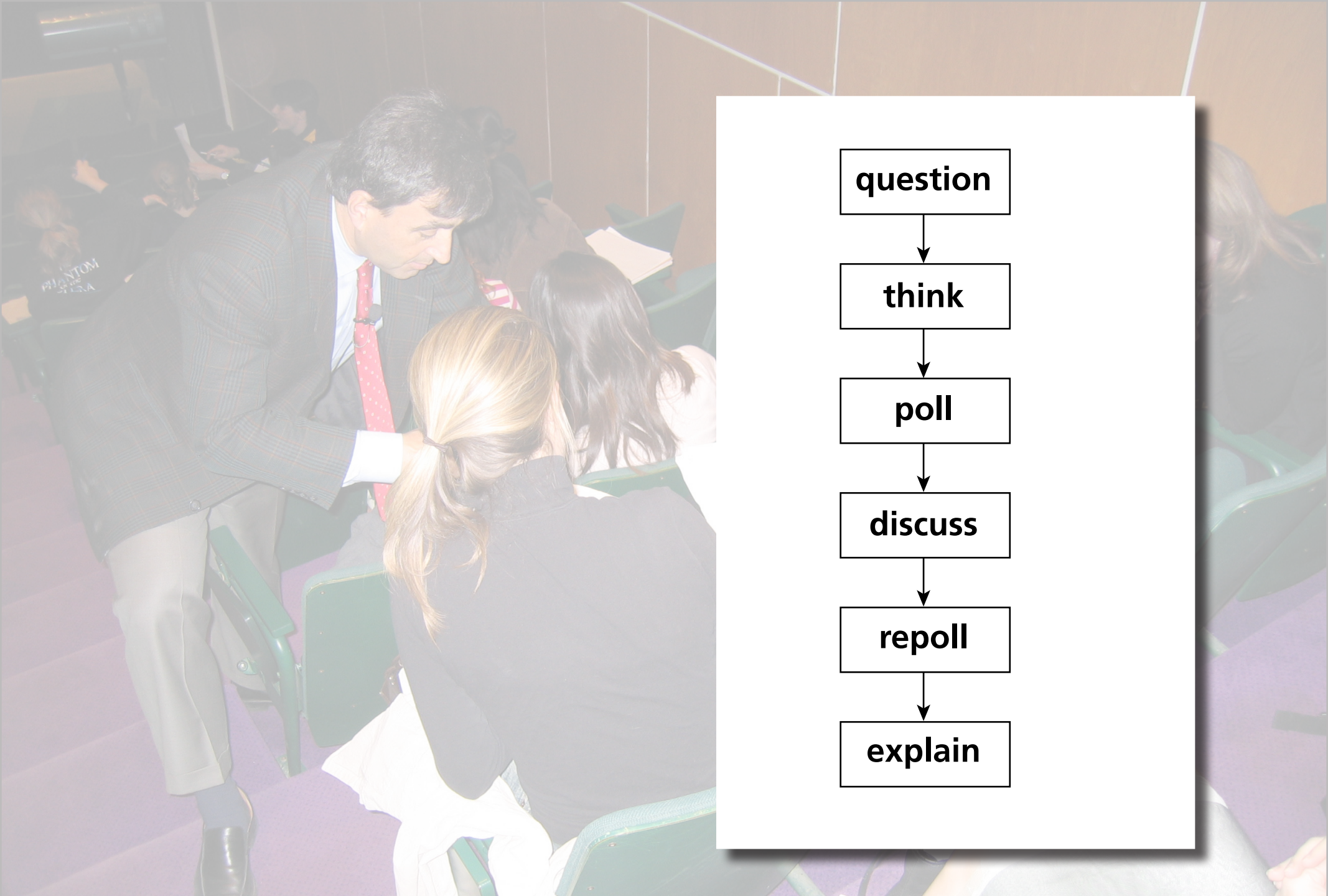


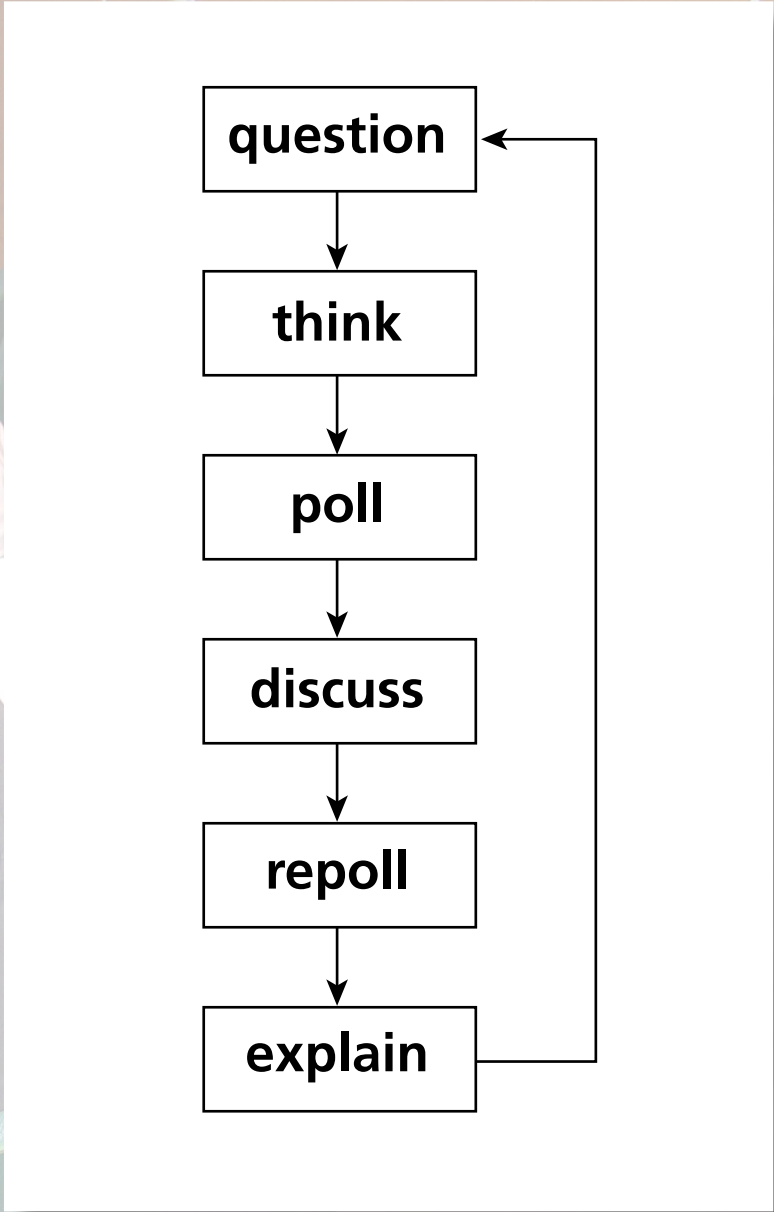
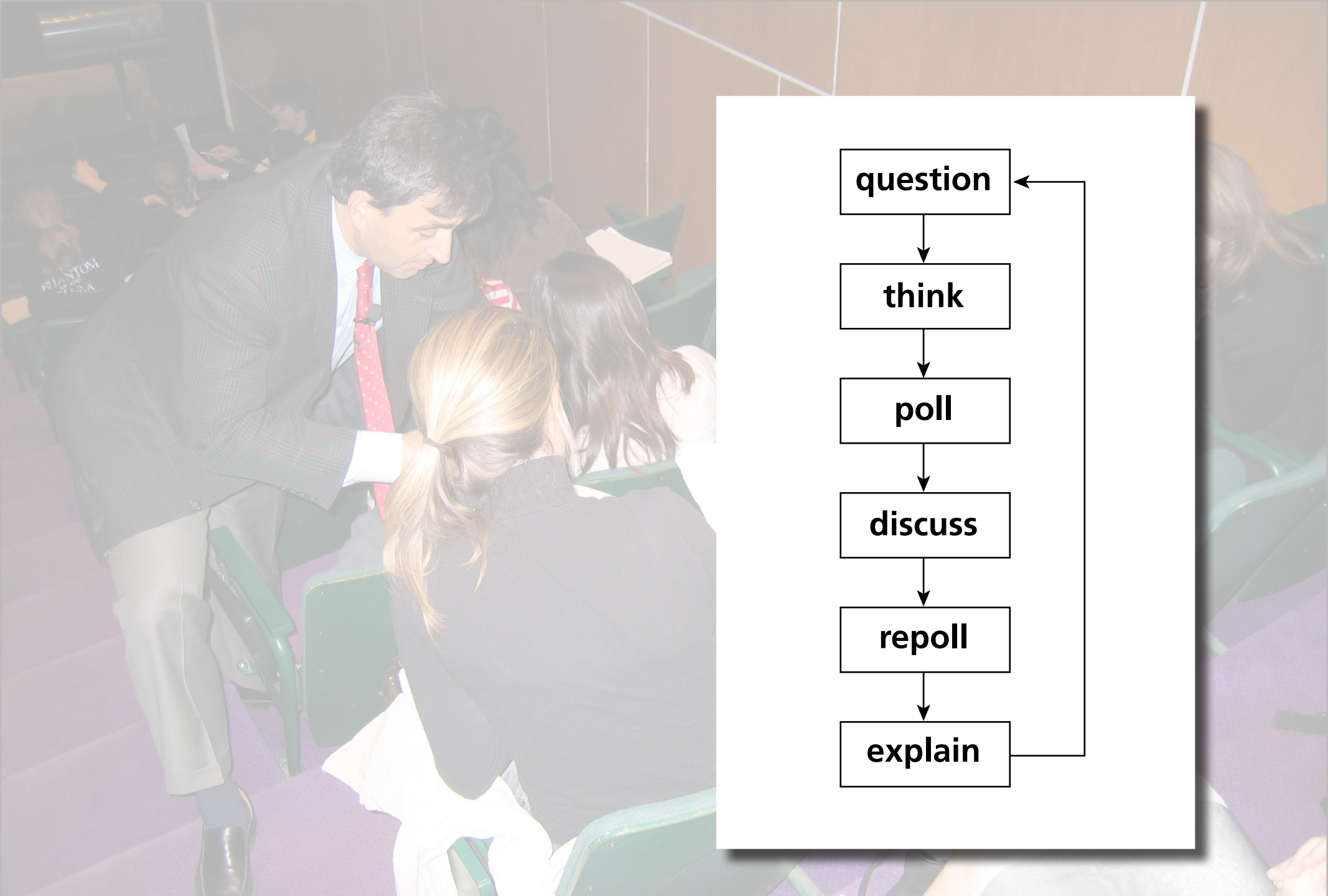
**poll**

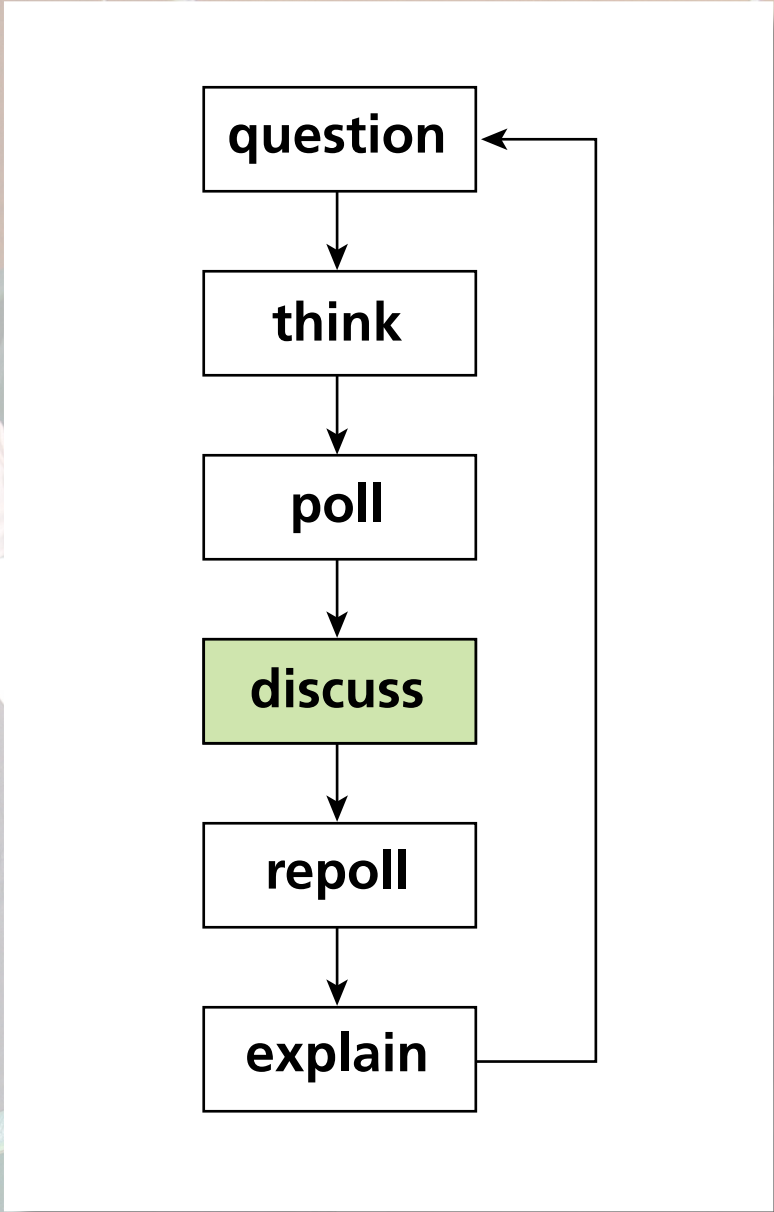
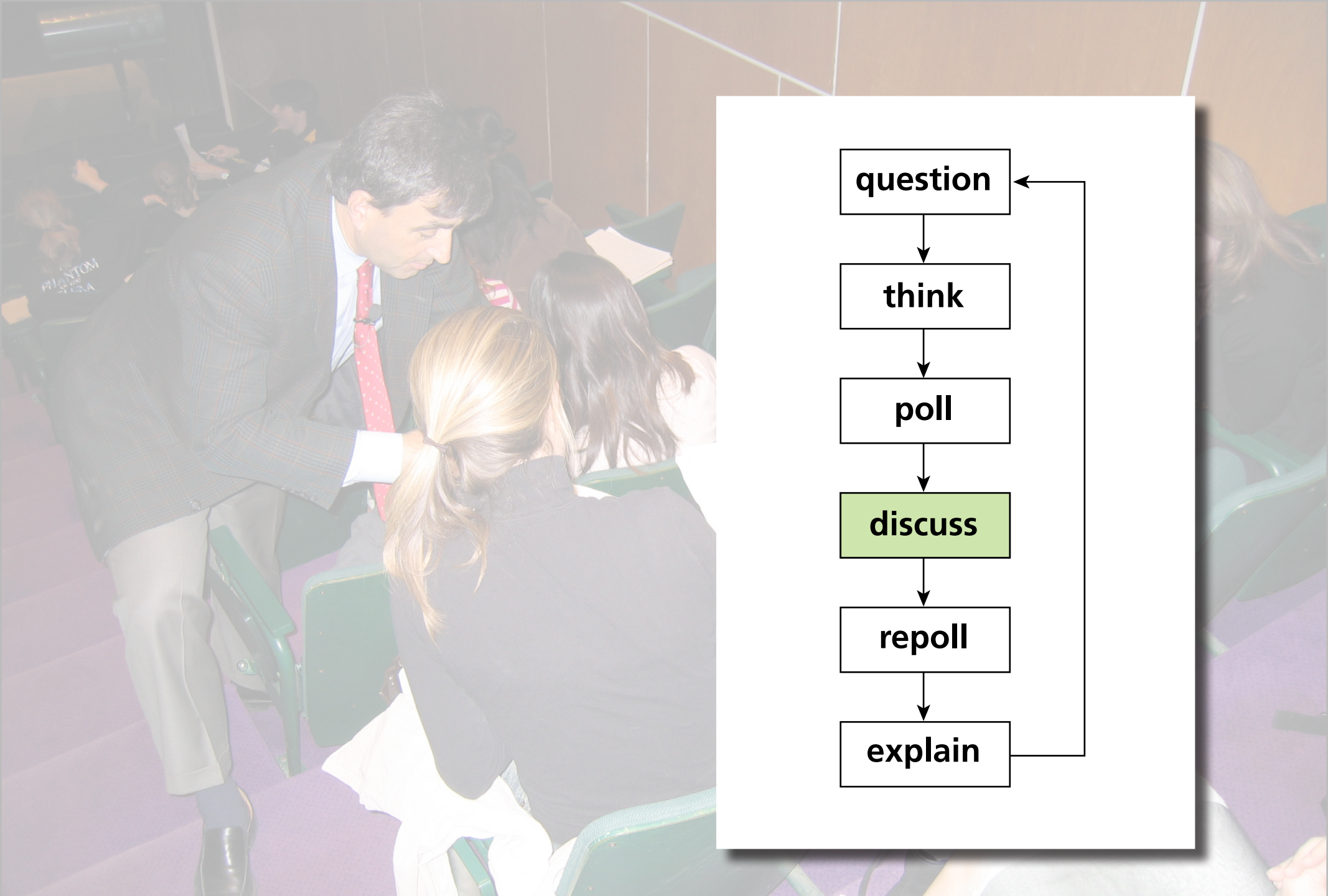


**discuss**





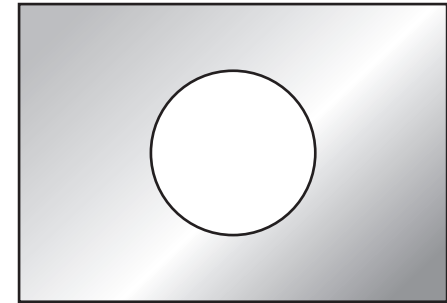






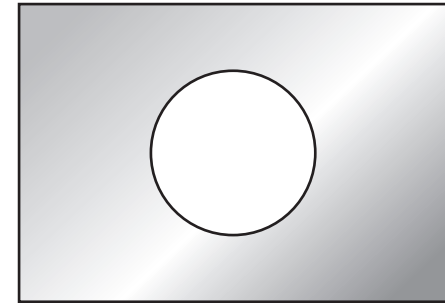


**Consider a rectangular metal plate  
with a circular hole in it.**



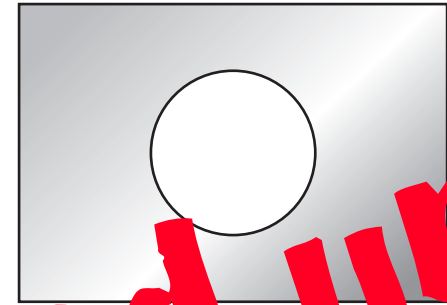
**Consider a rectangular metal plate with a circular hole in it.**

**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.



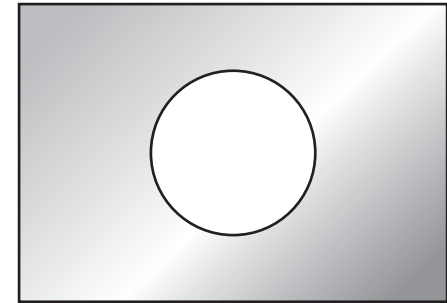
When the plate is uniformly heated, the diameter of the hole

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**

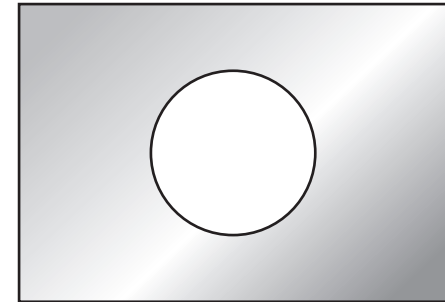
**Before I tell you the answer, let's analyze what happened.**

**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**

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

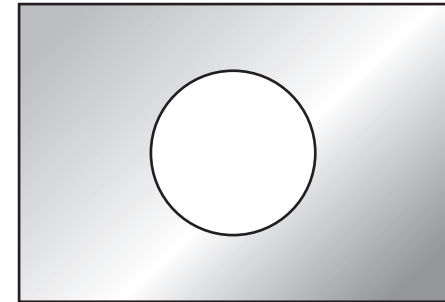
**When the plate is uniformly heated, the diameter of the hole**



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

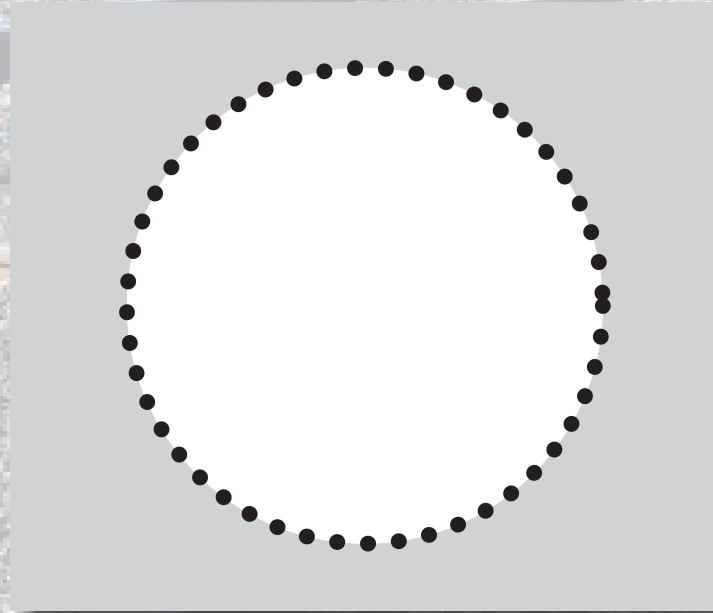
**Consider a rectangular metal plate with a circular hole in it.**

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

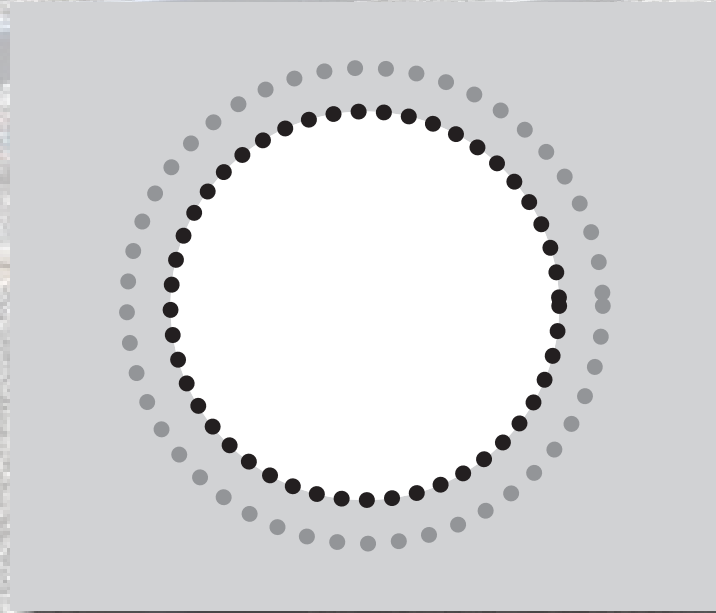


- 1. increases. ✓**
2. stays the same.
3. decreases.

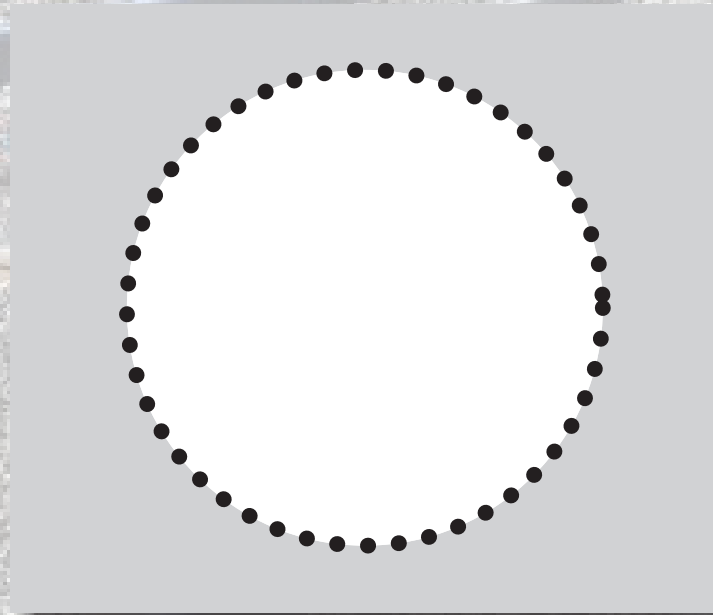
consider atoms at rim of hole



consider atoms at rim of hole

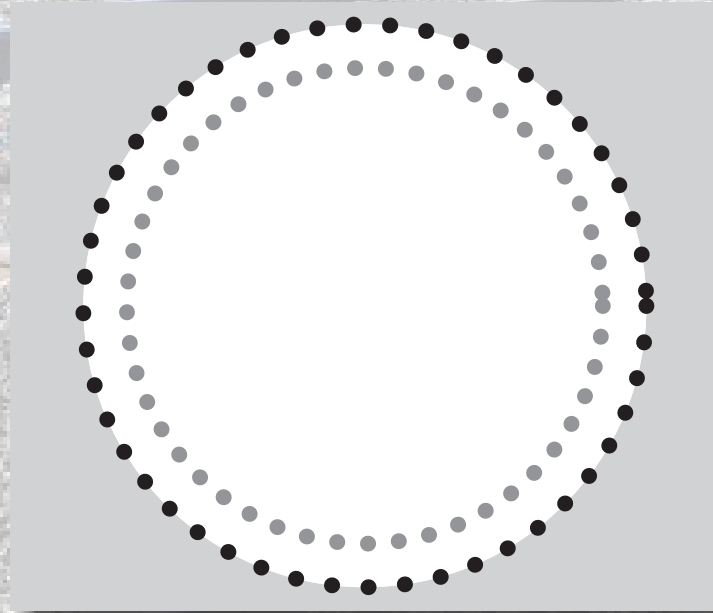


consider atoms at rim of hole





consider atoms at rim of hole



consider atoms at rim of hole

**you won't forget this**



**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?

Use intelligent algorithms and data analytics to...

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

- 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

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

**2. Create student account with signup code DEMO**

**3. Join session 1234567**

**4. Pick your seat from the seat map**



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

2 create student account

3 ID 1234567

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classrooms](#) [Account](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

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



# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classroom](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

4. direction of prevailing winds

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 educational

3 PI 2.0

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classroom](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

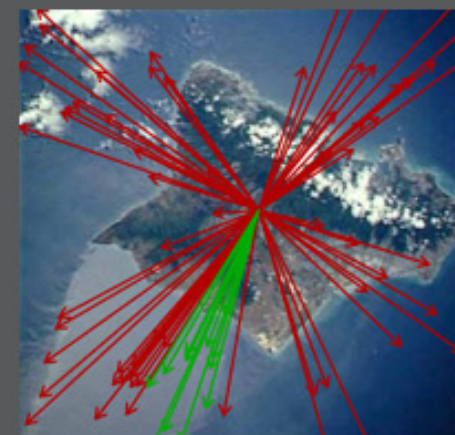
4. direction  
prevailing

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

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

Round 1

77 responses, 16% correct



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



1 educa

3 PI 2.0

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classrooms](#) [Account](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

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 education

2 PI

3 PI 2.0

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classifications](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

current session: **766079** | 69 students

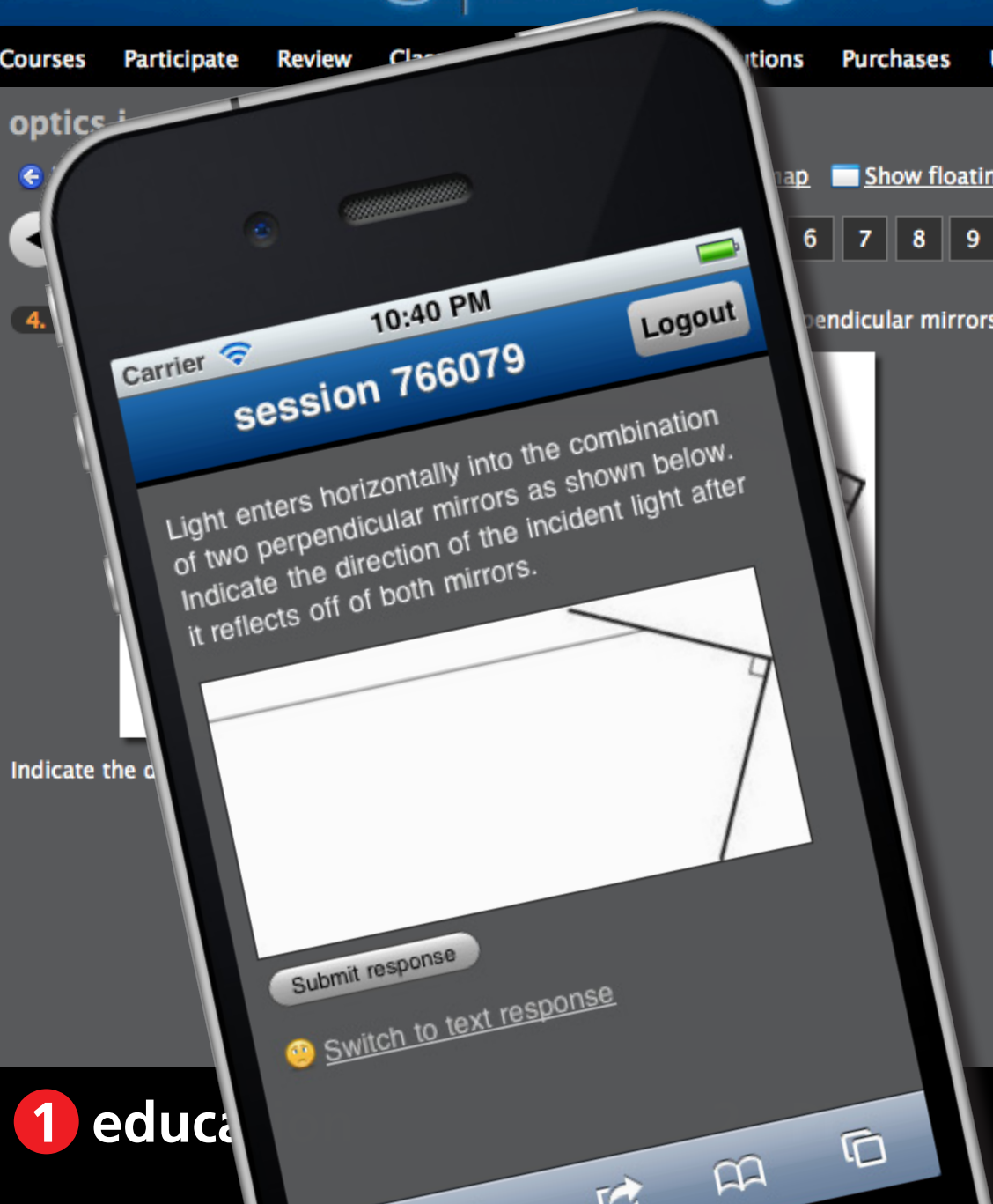
[Map](#) [Show floating session ID](#) [Edit](#) [Delete](#)

6 7 8 9 10 11 12 13 14 15

perpendicular mirrors as shown below.

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

[feedback & support](#)



# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classifications](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

current session: **766079** | 69 students

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

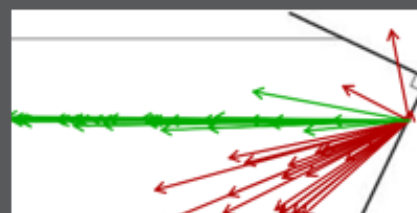
6 7 8 9 10 11 12 13 14 15



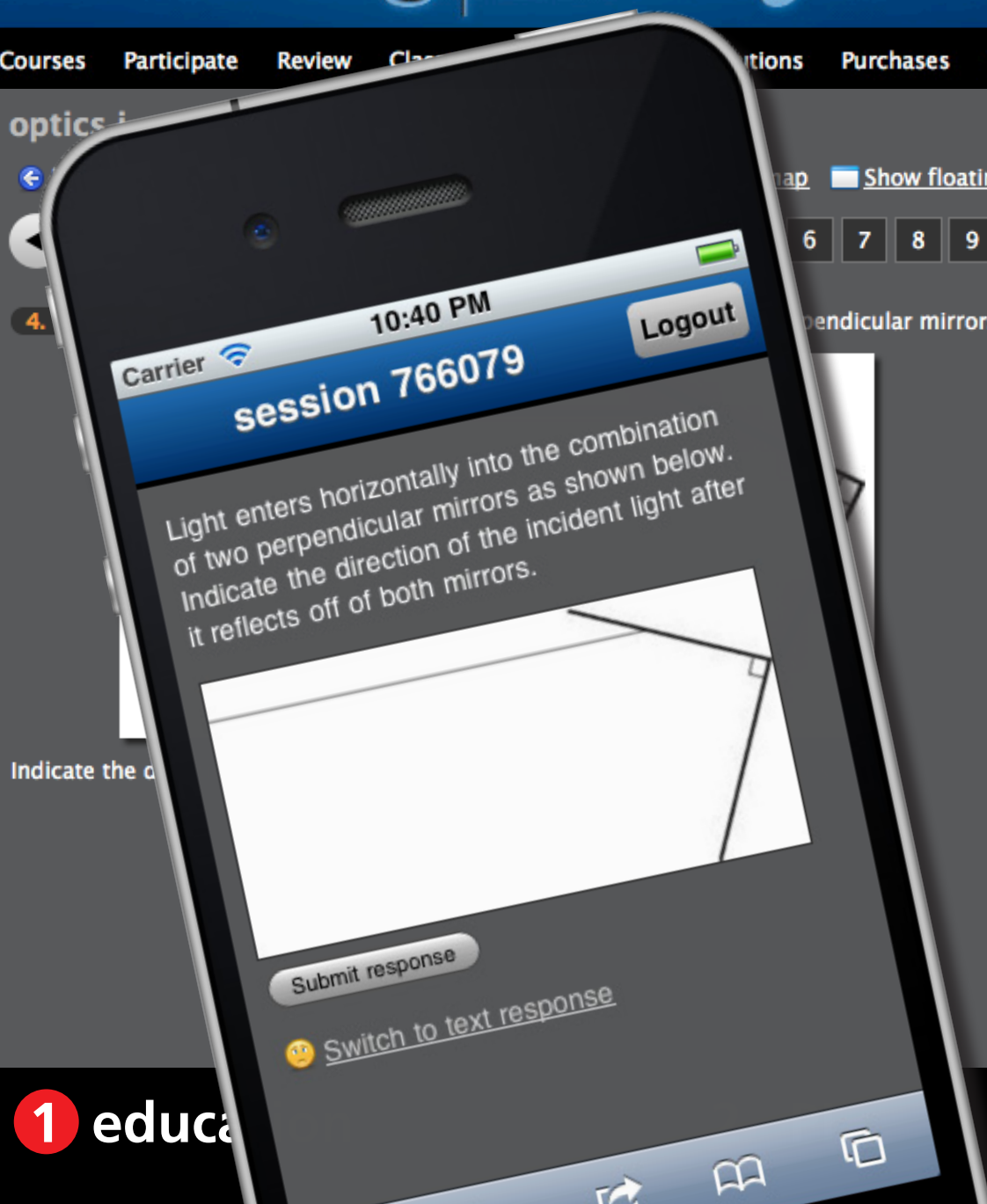
perpendicular mirrors as shown below.

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

Round 1   
● 57 responses, 58% correct



[feedback & support](#)



# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classifications](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

current session: **766079** | 69 students

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

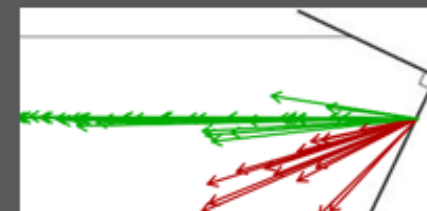
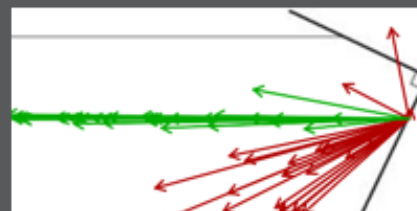
6 7 8 9 10 11 12 13 14 15

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](#)



# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classrooms](#) [Account](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

## transformations of parabolas

current session: **773885** | 9 students

[← Back to all lectures](#) [■ Stop session](#) [📊 Review results](#) [📄 Show floating session ID](#) [⚙ Edit](#) [📄 PDF](#) [✖ Delete](#)



Jump to ▾

1

2

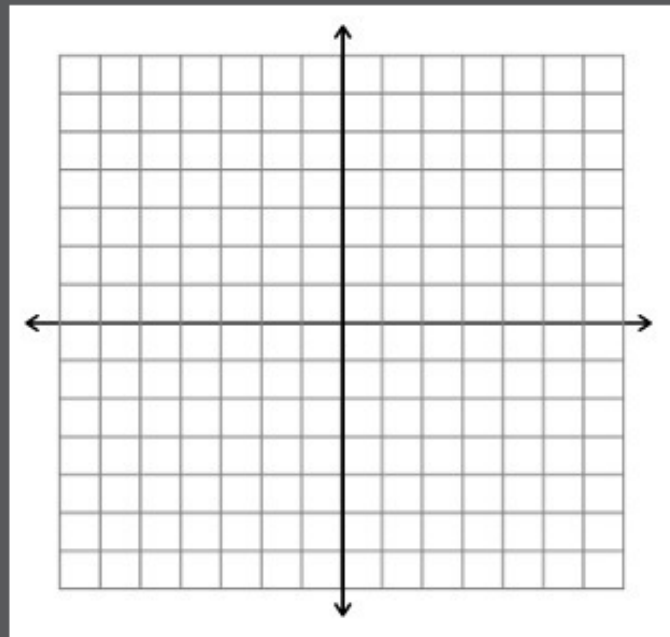
3

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

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classrooms](#) [Account](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

## transformations of parabolas

current session: **773885** | 9 students

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



Jump to ▾

1

2

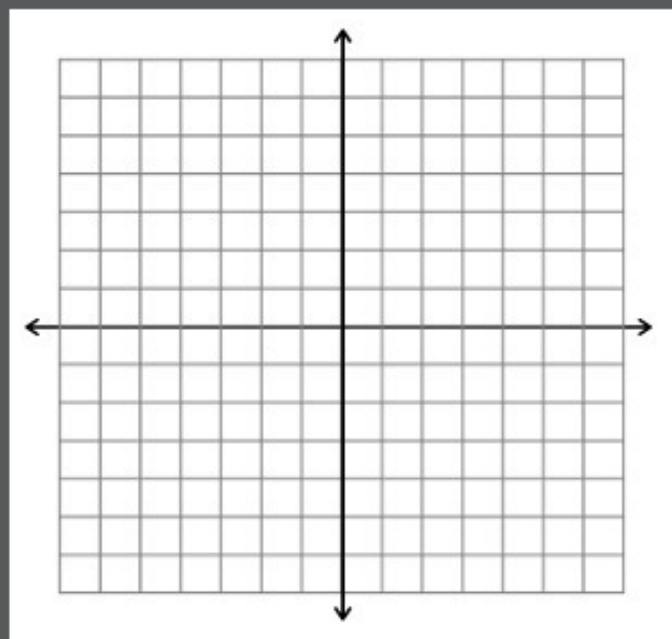
3

4



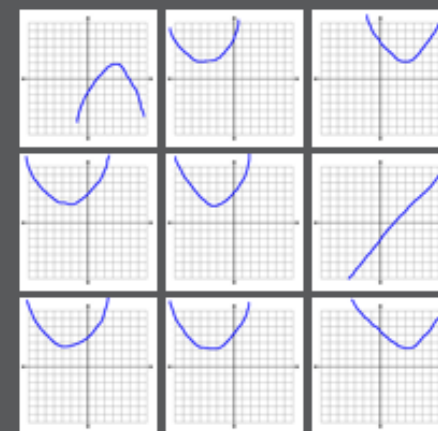
4. sketch Sketch a graph of the function  $f(x) = (x - 3)^2 + 2$ .

[Stop delivery](#) [Deliver again](#) [Assign groups](#) [Show all results](#)



Round 1

9 responses



1 education

2 PI

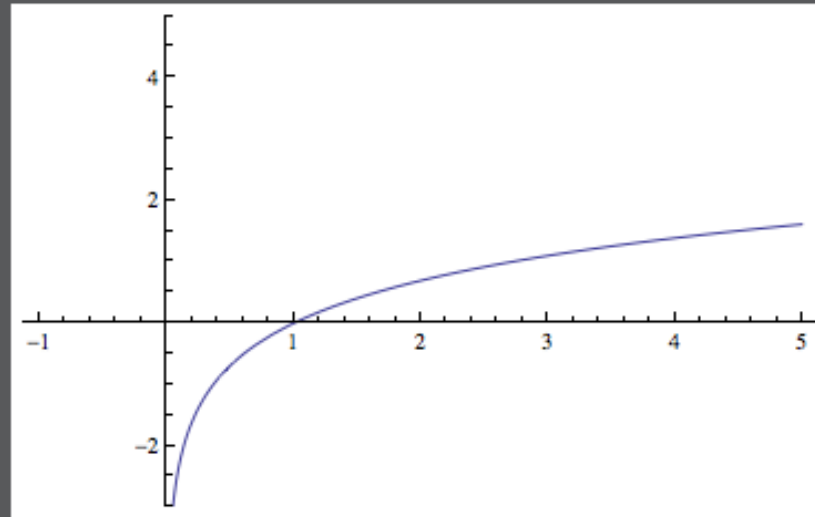
3 PI 2.0



# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classrooms](#) [Account](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

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



1 education

2 PI

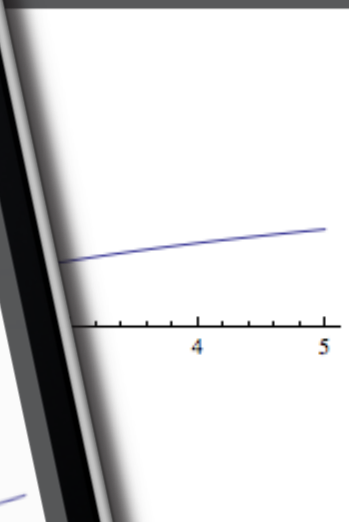
3 PI 2.0

# learning | catalytics

Courses Participate

ases Users Tour Help

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



**1** education

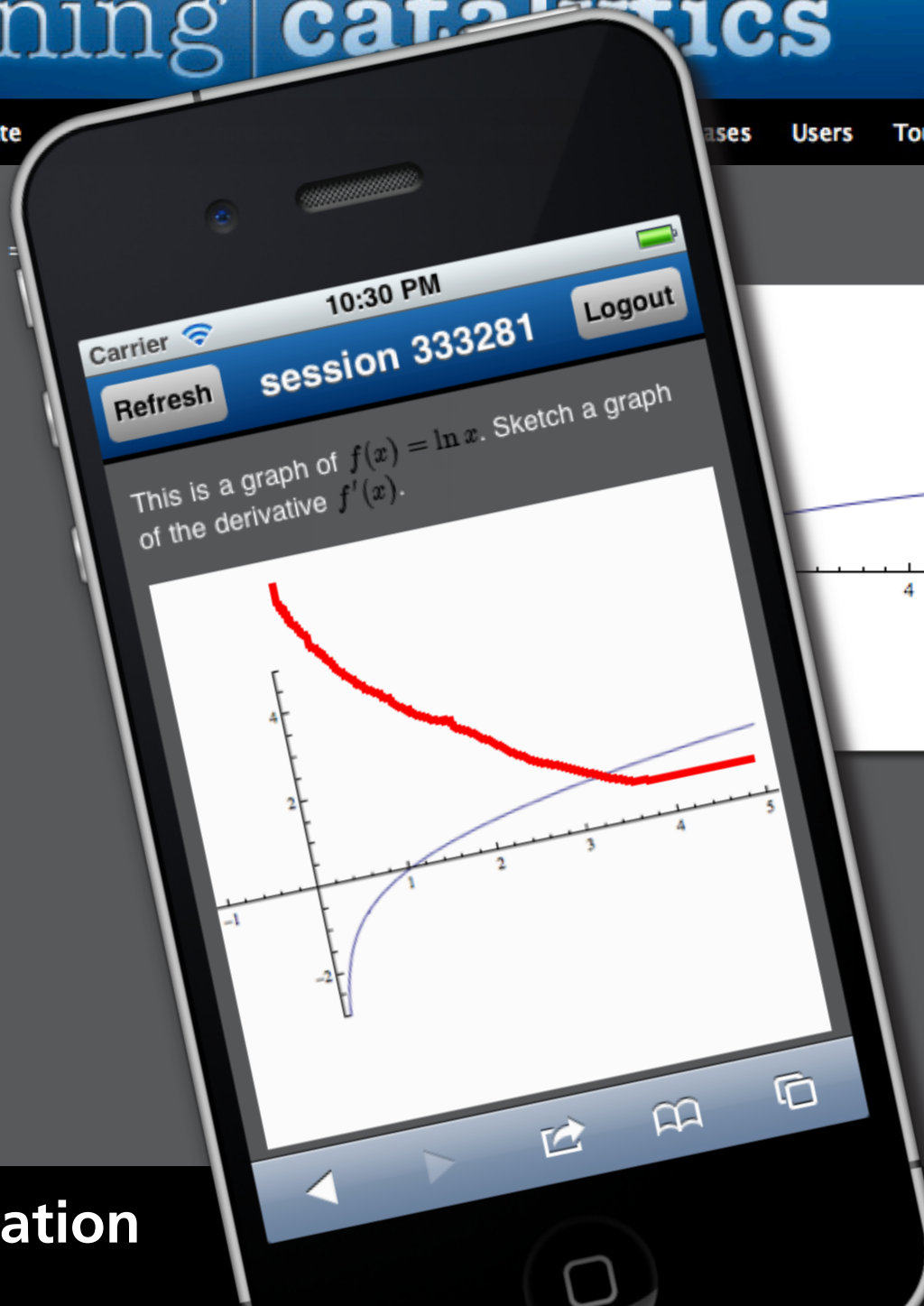
**3** PI 2.0

# learning | catalytics

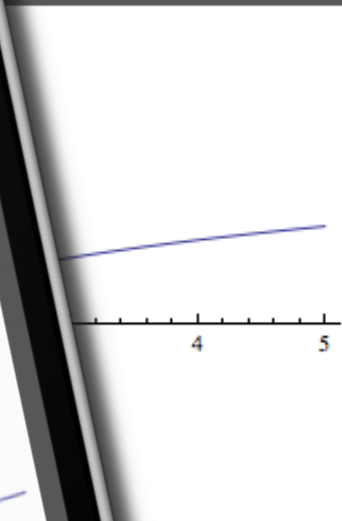
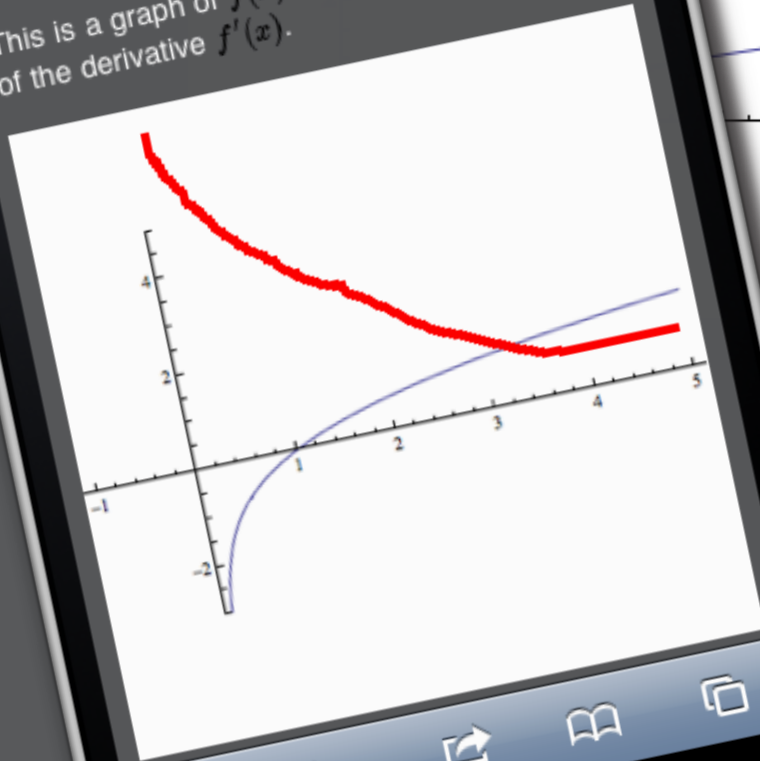
Courses Participate

ases Users Tour Help

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

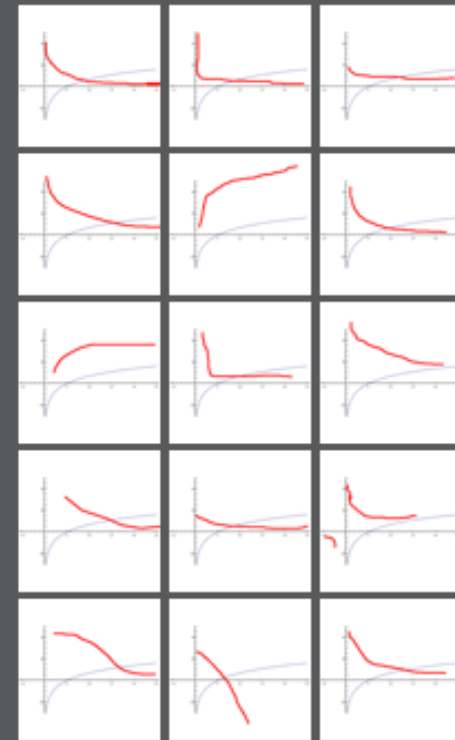


This is a graph of  $f(x) = \ln x$ . Sketch a graph of the derivative  $f'(x)$ .



Round 1

15 responses



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

1 education

3 PI 2.0

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classrooms](#) [Account](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

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

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classroom](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

1. highlighting  
sonnet?

[his Shakespeare](#) [Stop delivery](#) [Deliver again](#) [Assign groups](#) [Show all results](#)



1 educa

3 PI 2.0

# learning | catalytics

[Courses](#) [Participate](#) [Review](#) [Classroom](#) [Institutions](#) [Purchases](#) [Users](#) [Tour](#) [Help](#)

1. highlighting  
sonnet?

[his Shakespeare](#) [Stop delivery](#) [Deliver again](#) [Assign groups](#) [Show all results](#)



## 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,

## 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

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

# learning | catalytics

Courses Participate Review Classrooms Account Institutions Users About

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

Back to all lectures Download all results 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

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

# 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 as illustrated below.



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

# learning | catalytics

Courses Participate Review Classrooms Account Institutions Users About

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

Back to all lectures Download all results 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

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

# 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 as illustrated below.



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%

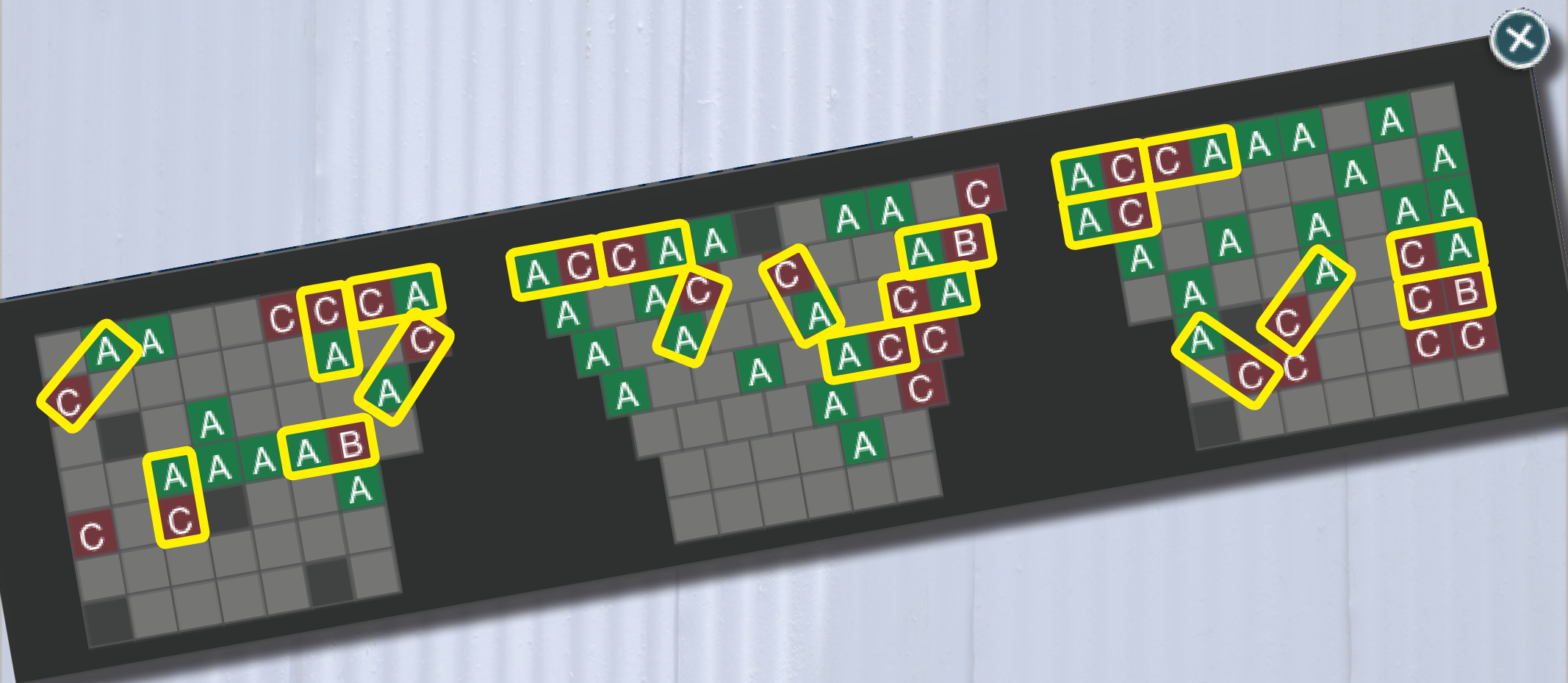
Search: \_\_\_\_\_

1 lecture

2 PI

3 PI 2.0

let system manage pairing



1 lecture

2 PI

3 PI 2.0

Leave

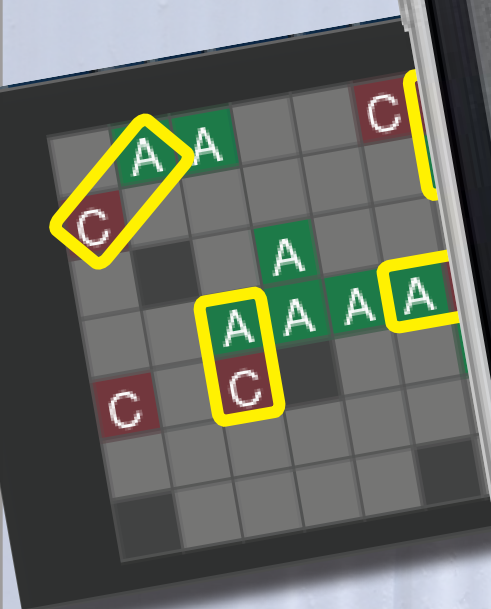
A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B at constant speed. The mechanical work required to cause this motion is



Please discuss your response with:

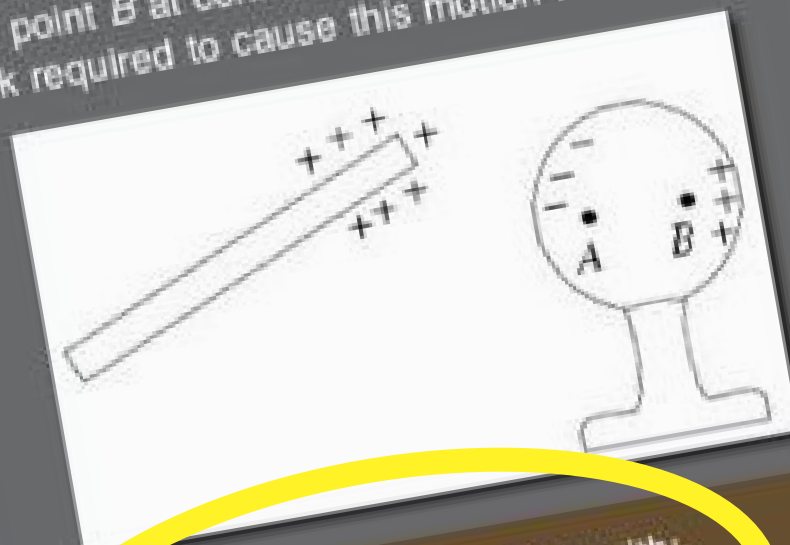
- Brian Lukoff (to your left)

[I am talking to this person/people](#)

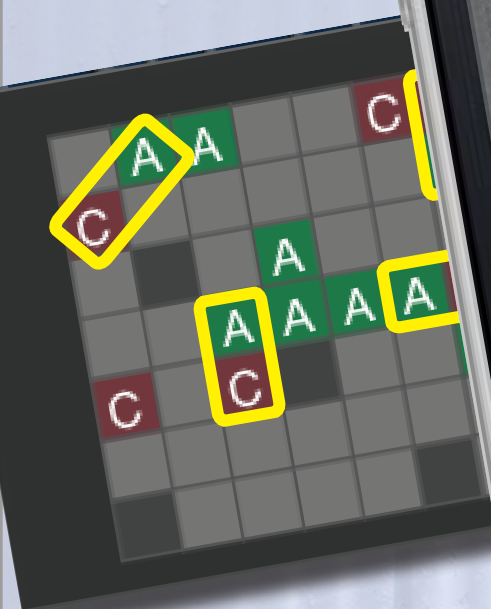


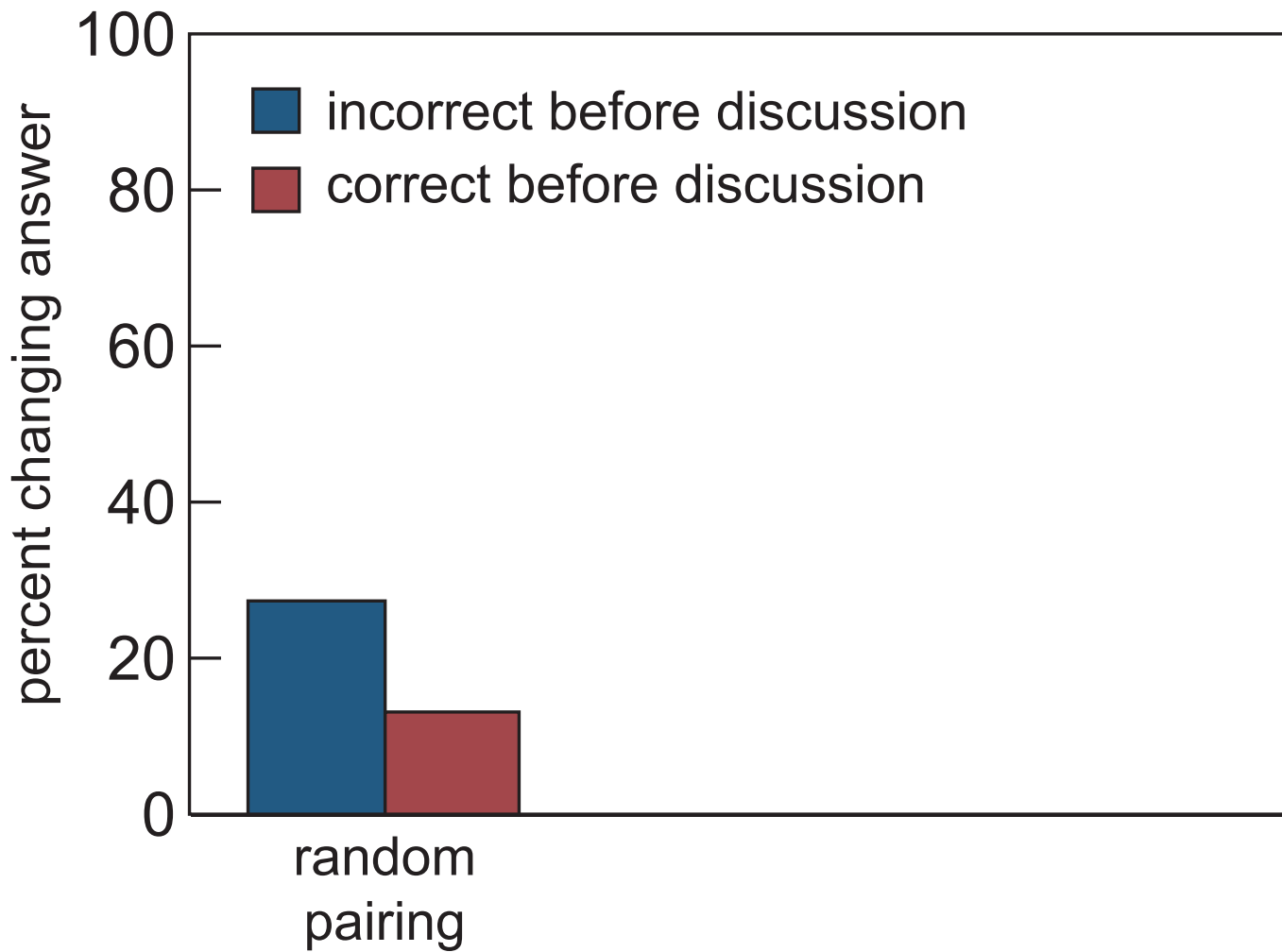


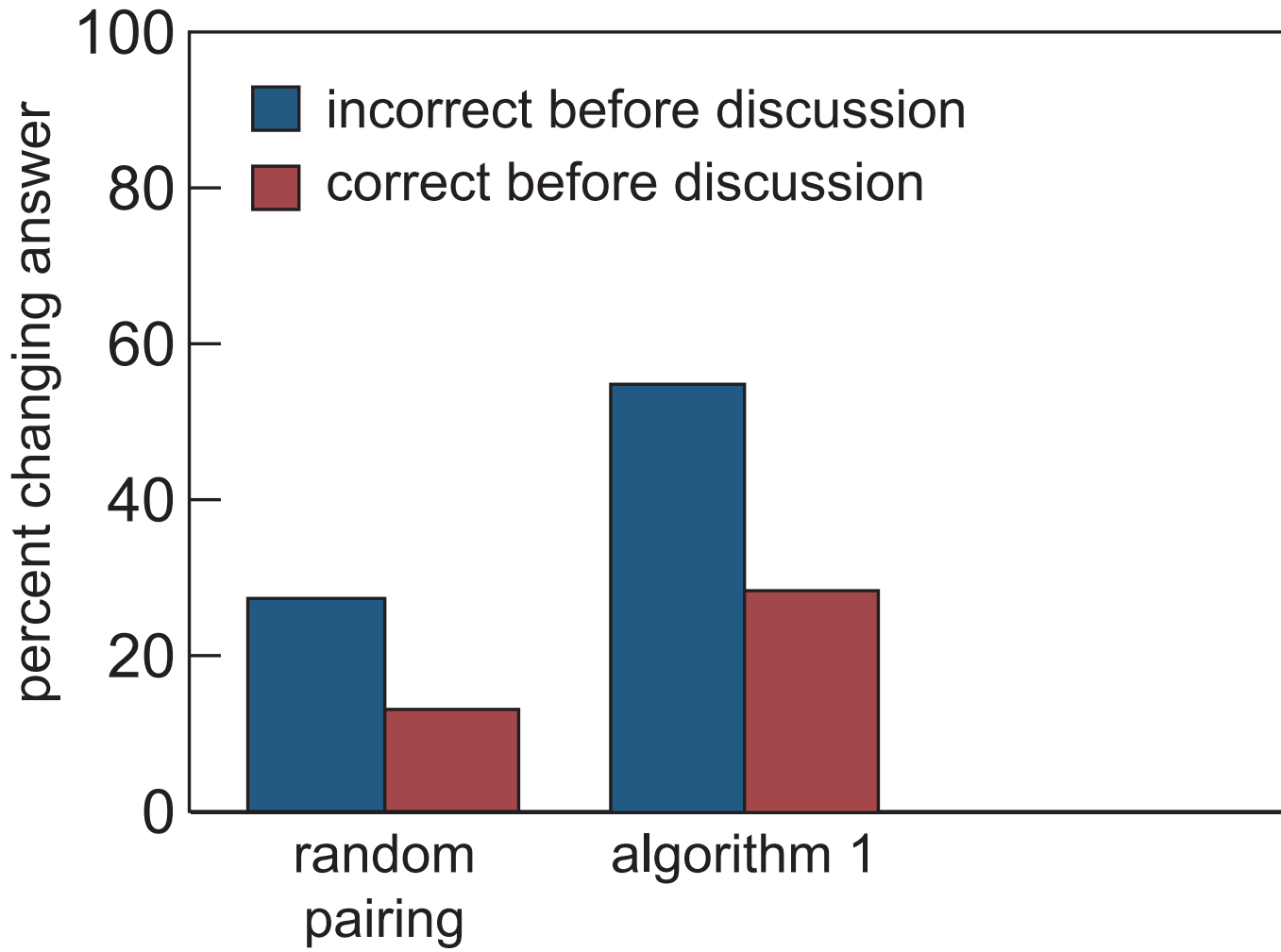
A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point A to point B at constant speed. The mechanical work required to cause this motion is

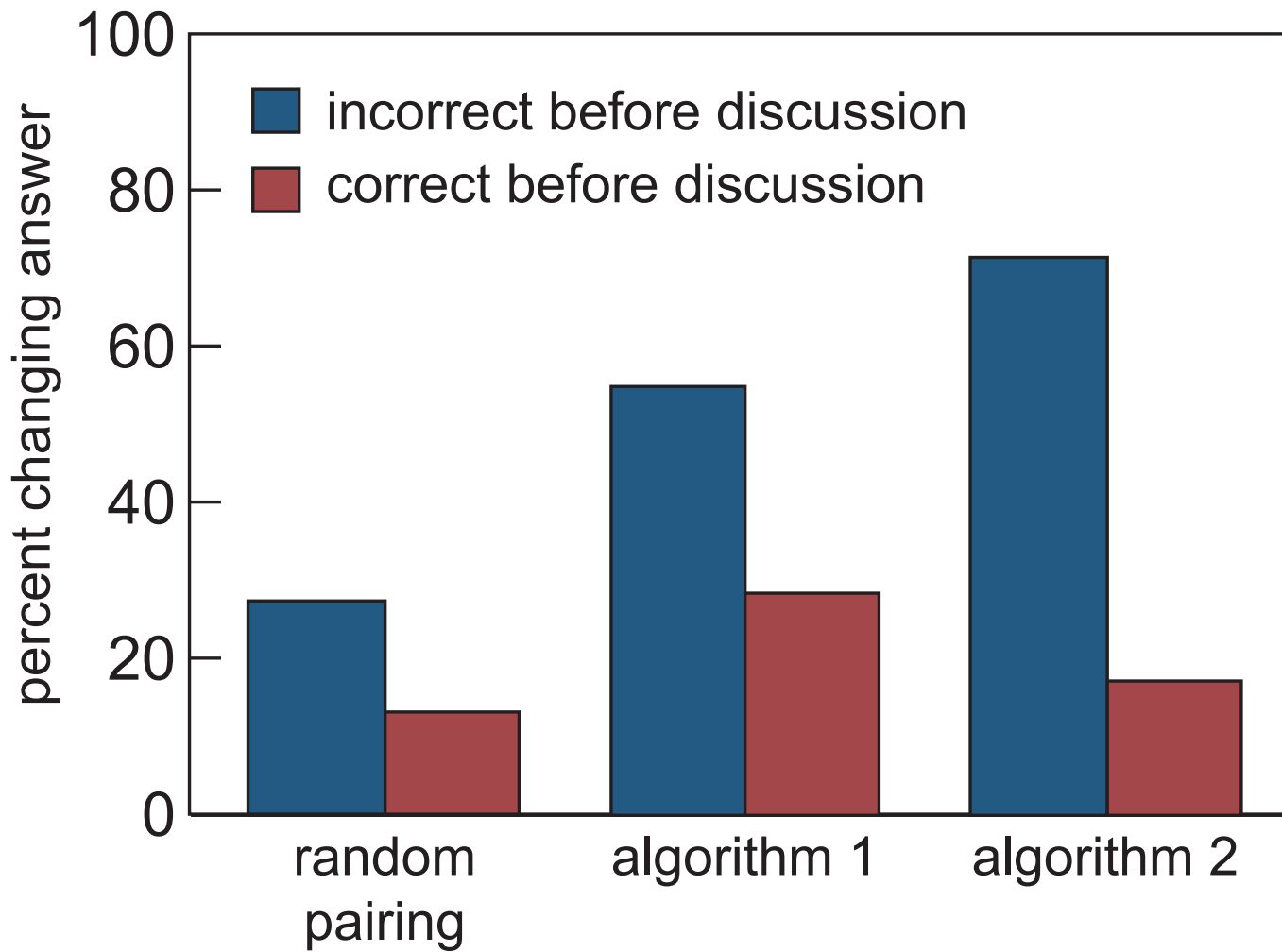


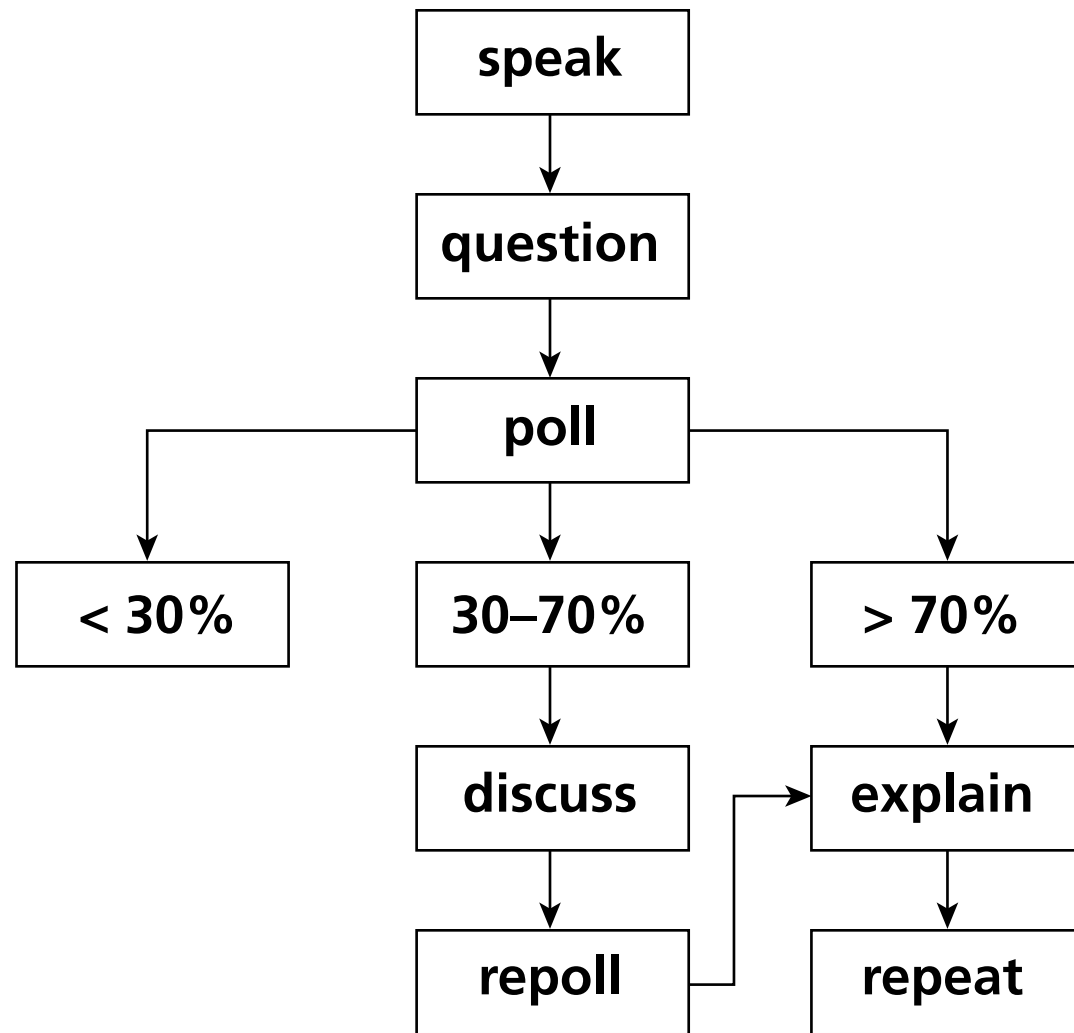
Please discuss your response with:  
• Brian Lukoff (to your left)

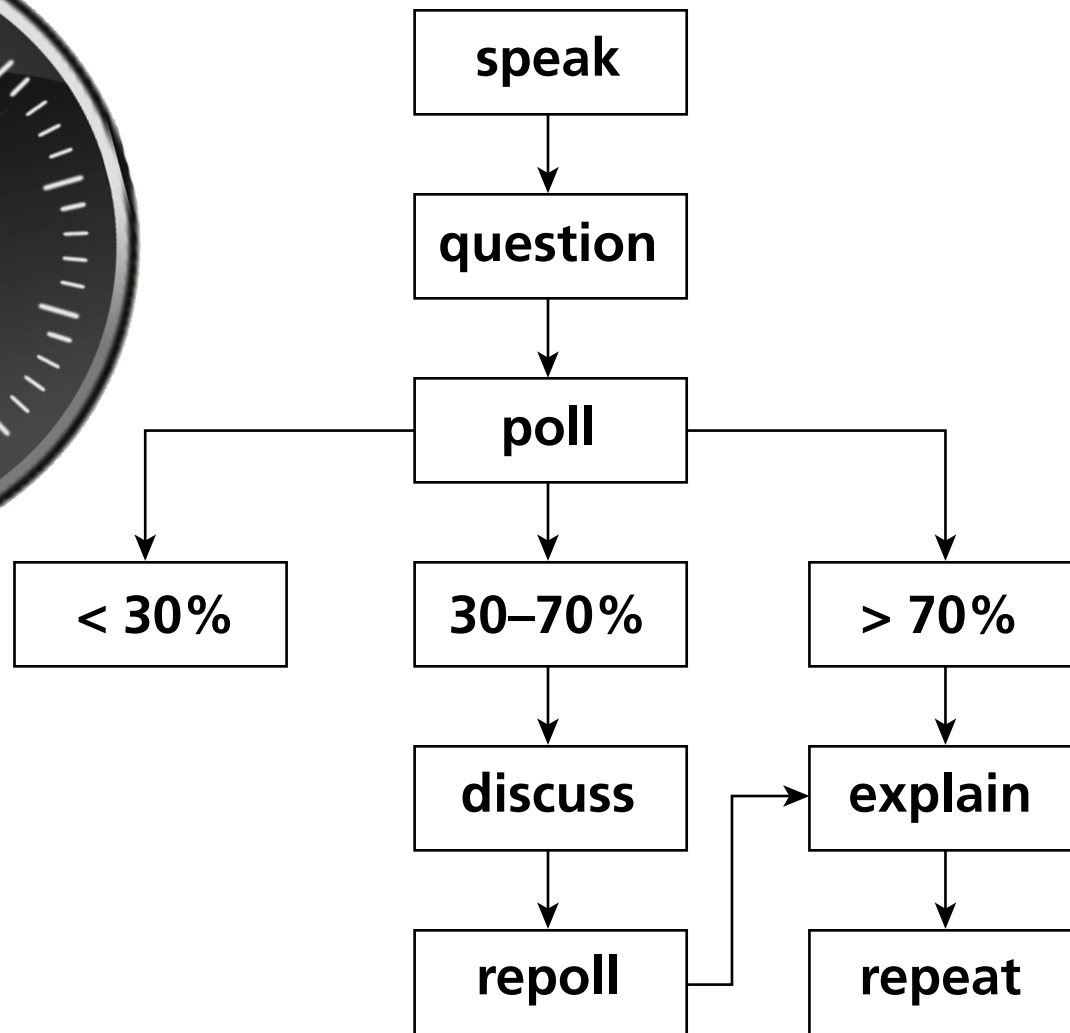














**1** lecture

**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*

**Funding:**

**National Science Foundation**

**for a copy of this presentation:**

**[mazur.harvard.edu](http://mazur.harvard.edu)**

**[learningcatalytics.com](http://learningcatalytics.com)**

**Follow me!**



**[eric\\_mazur](https://twitter.com/eric_mazur)**