Interactive Learning:
Technology in the Classroom

Symposium on Education and Technology
Harvard University
Cambridge, MA, 17 June 2013

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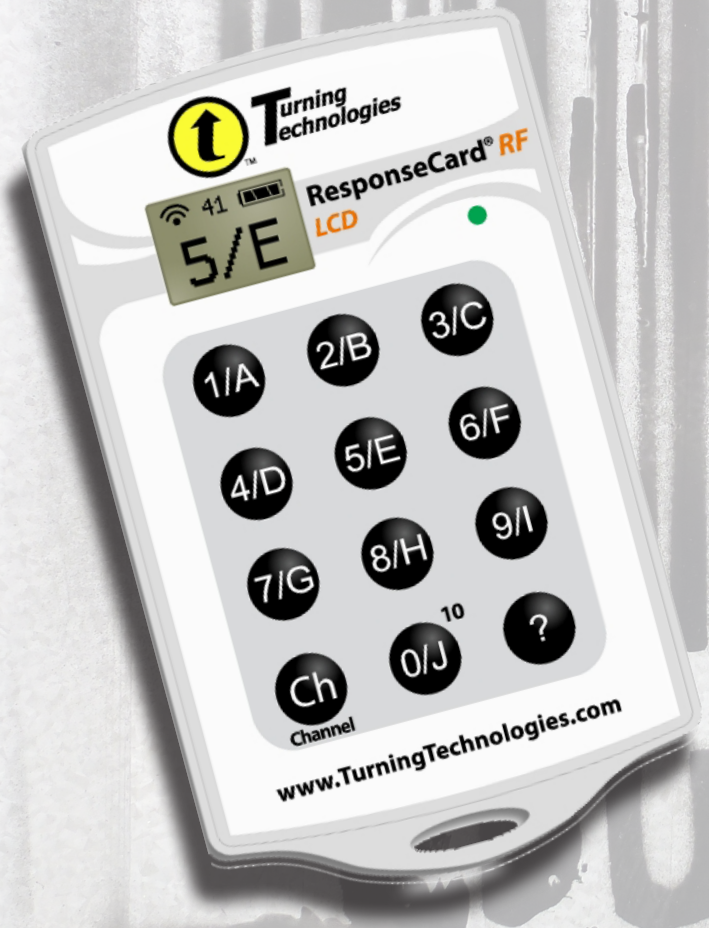
EDUCACiON



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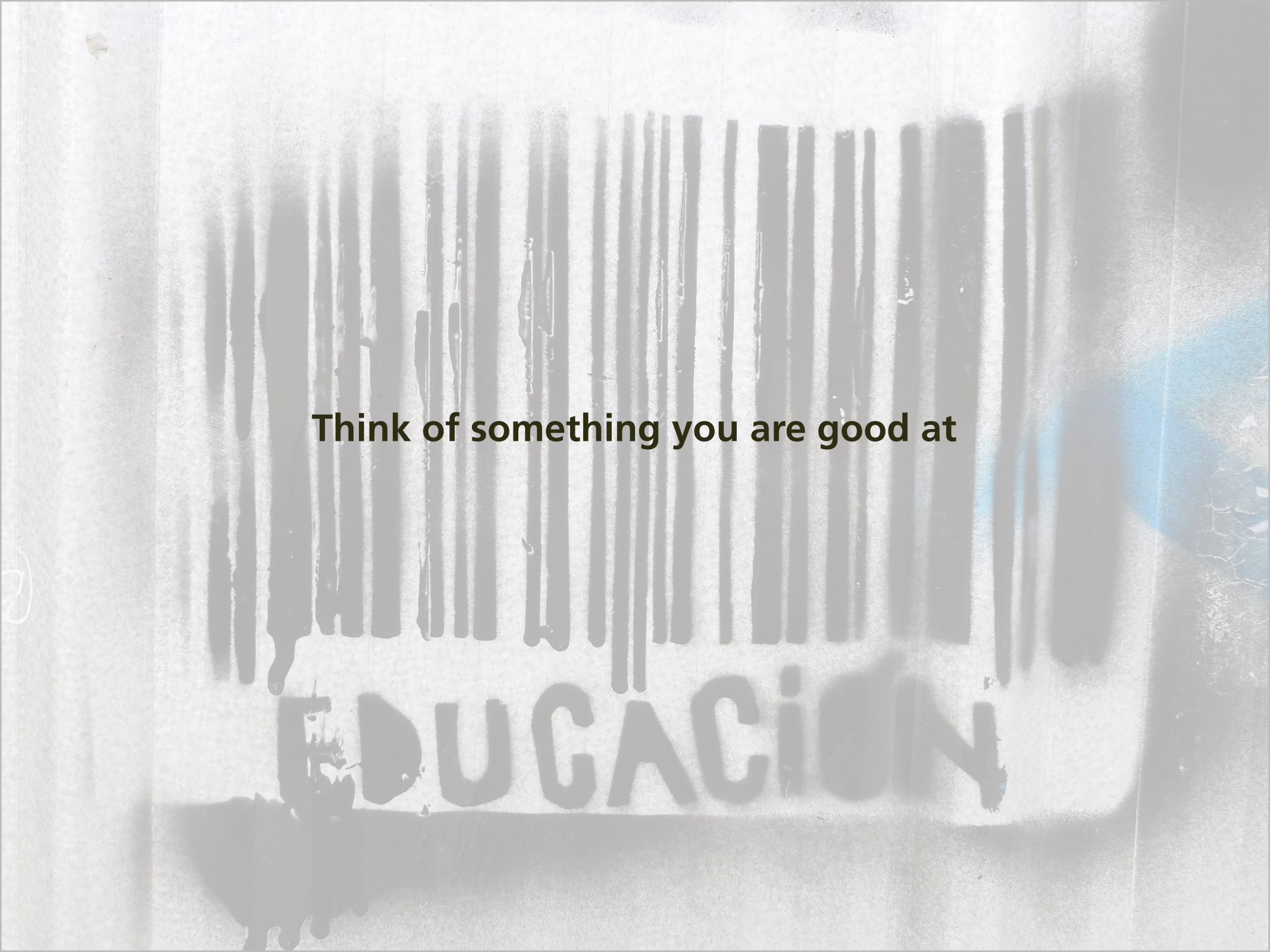
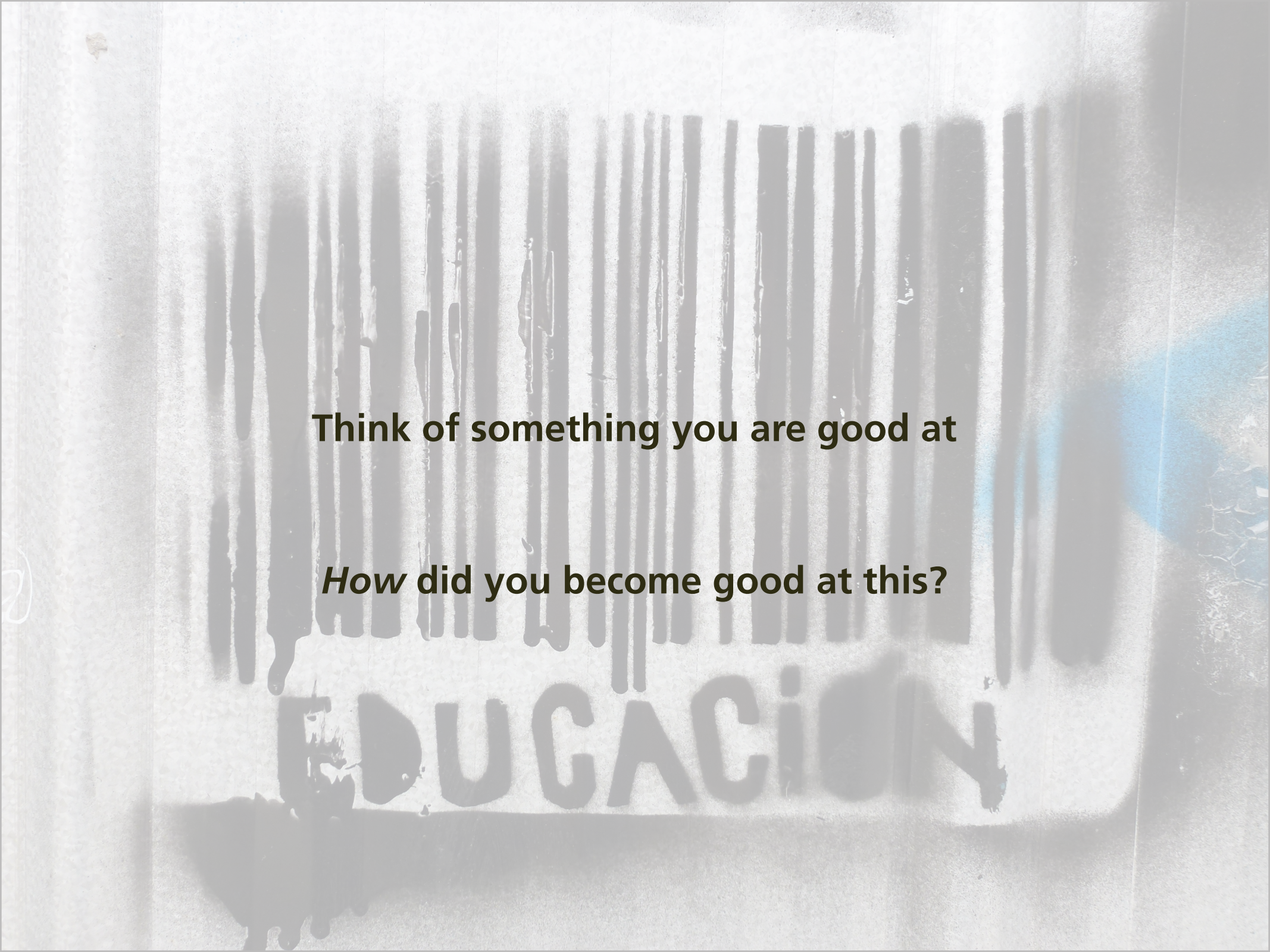

Think of something you are good at
EDUCACION



Think of something you are good at

How did you become good at this?

Became good at it by:

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

1 lecture

1 lecture

2 PI

1 lecture

2 PI

3 PI 2.0

1 lecture

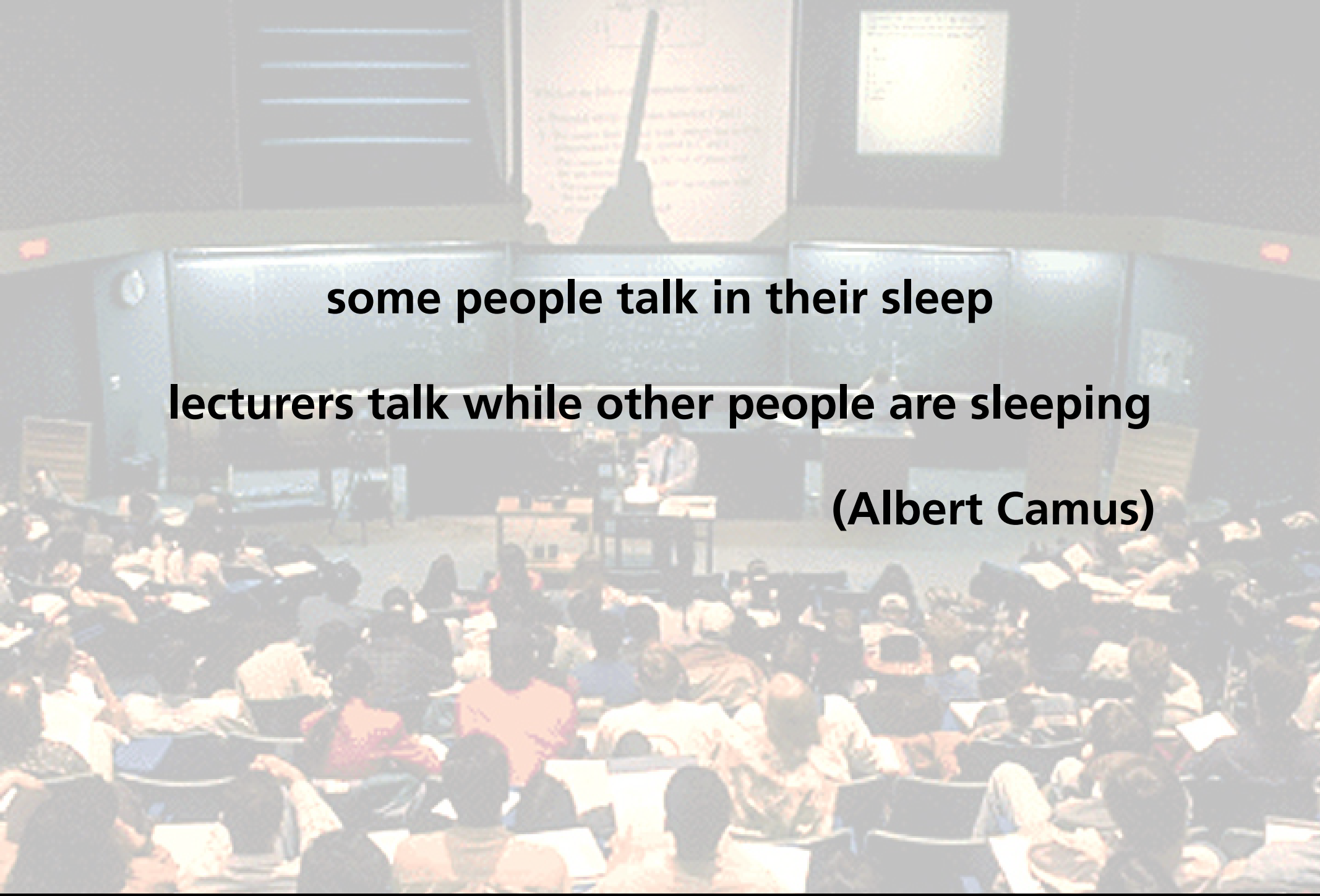
2 PI

3 PI 2.0


What happens
in a lecture?

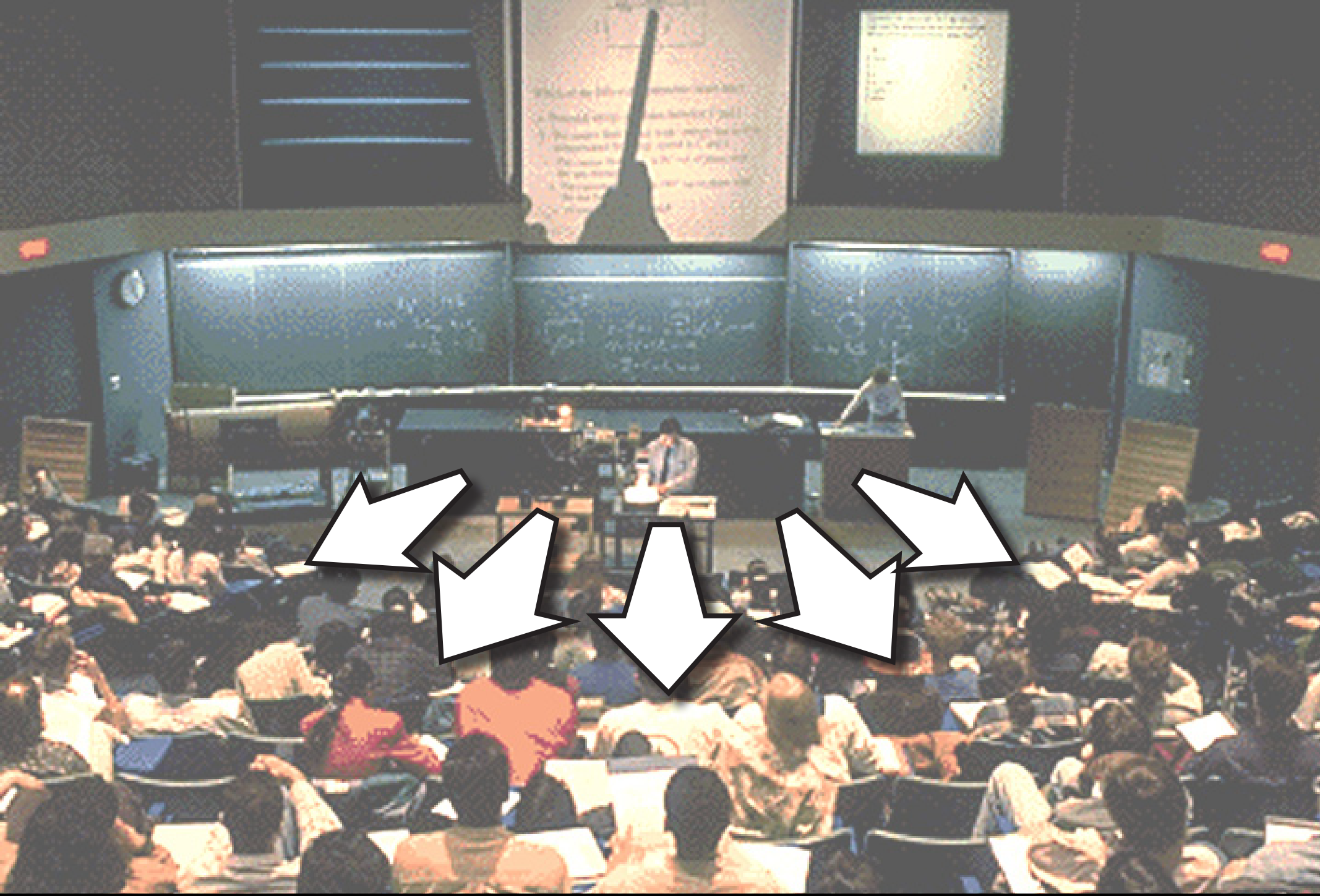
1 lecture

1 lecture

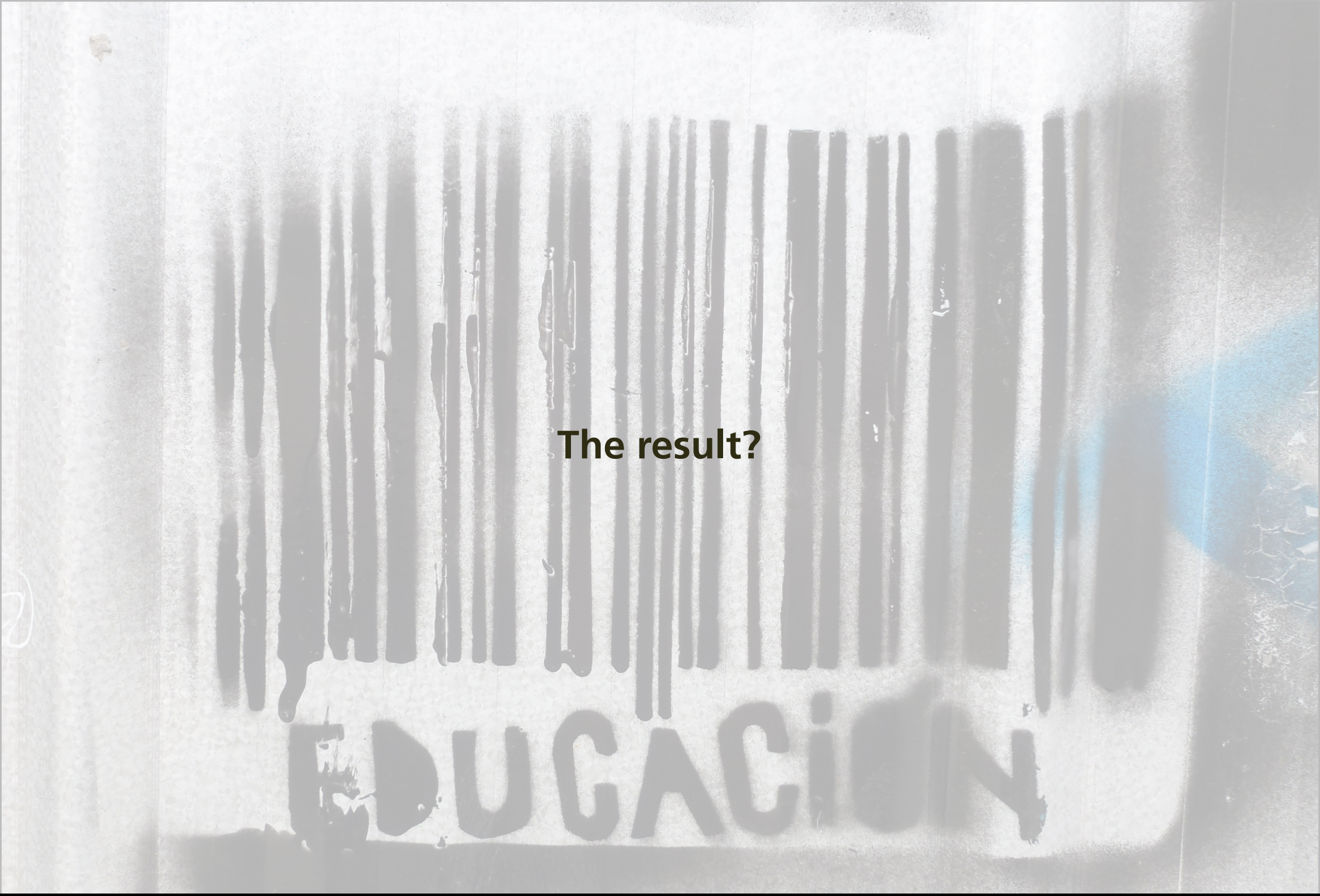

some people talk in their sleep
lecturers talk while other people are sleeping
(Albert Camus)

1 lecture

1 lecture

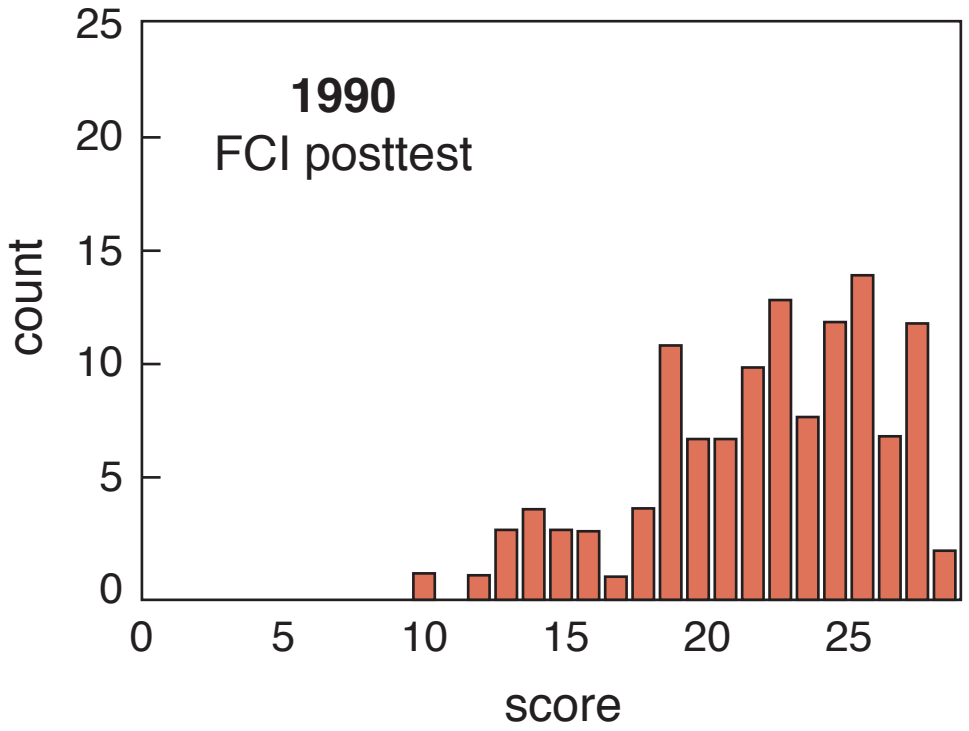


1 lecture

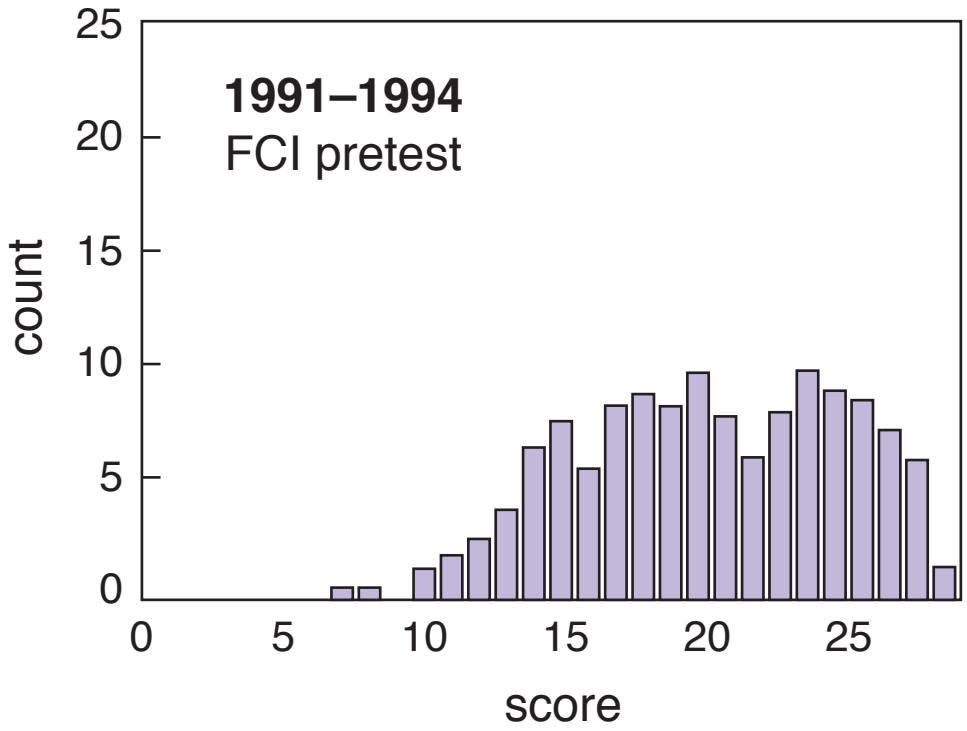


1 lecture

education is not just information transfer

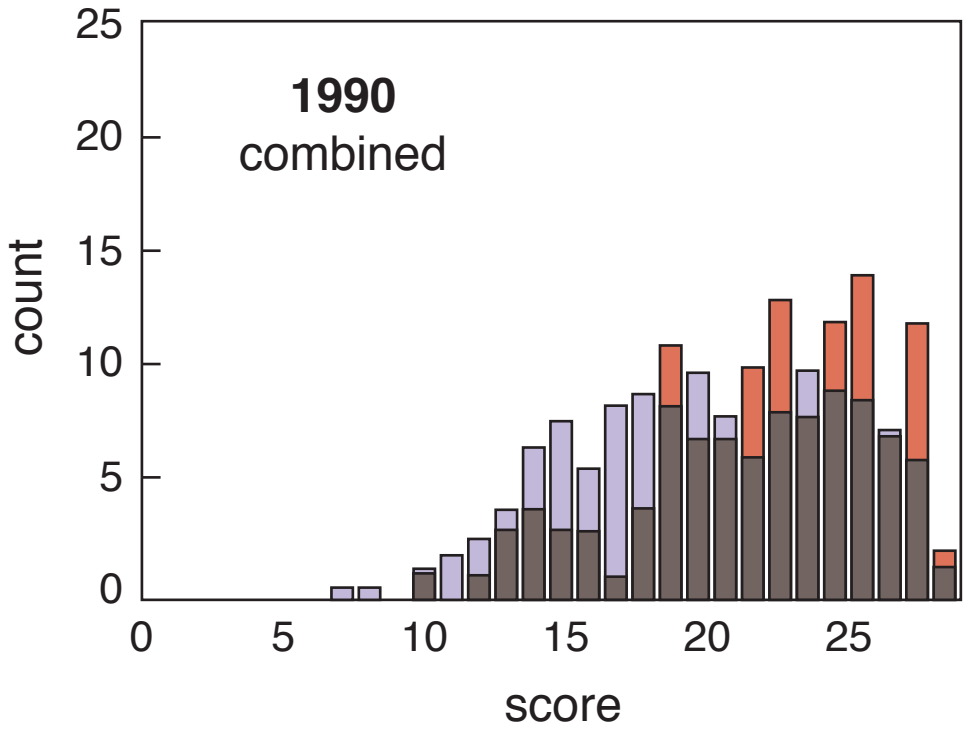


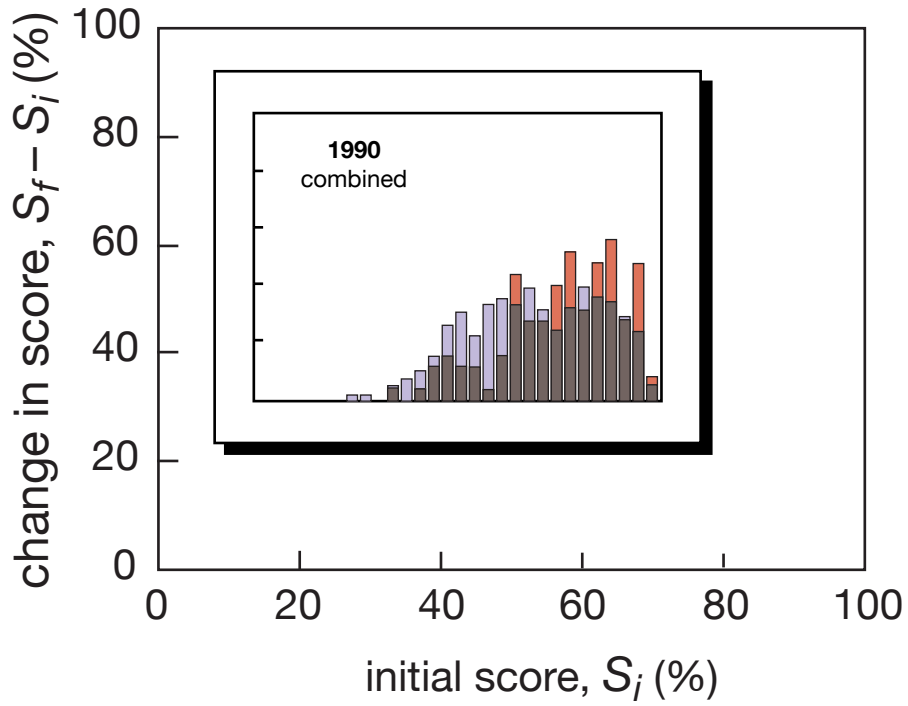
education is not just information transfer



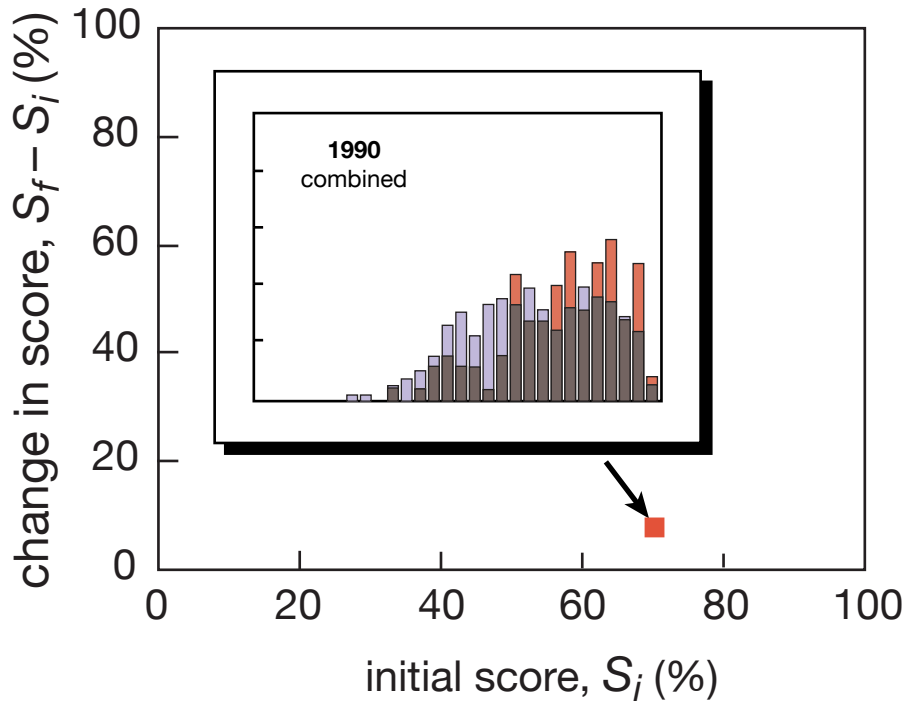
1 lecture

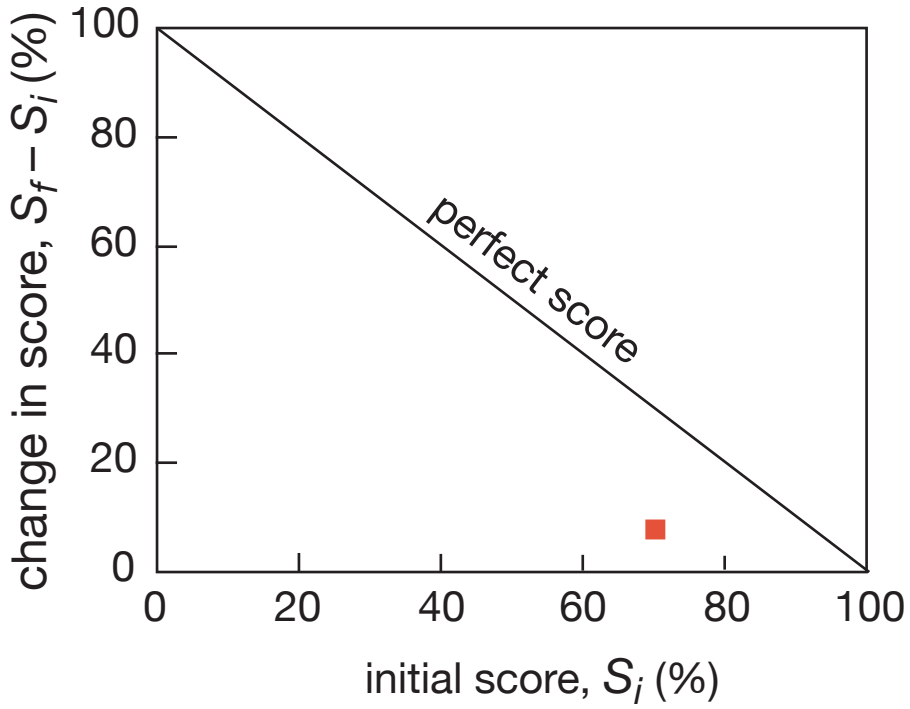
education is not just information transfer



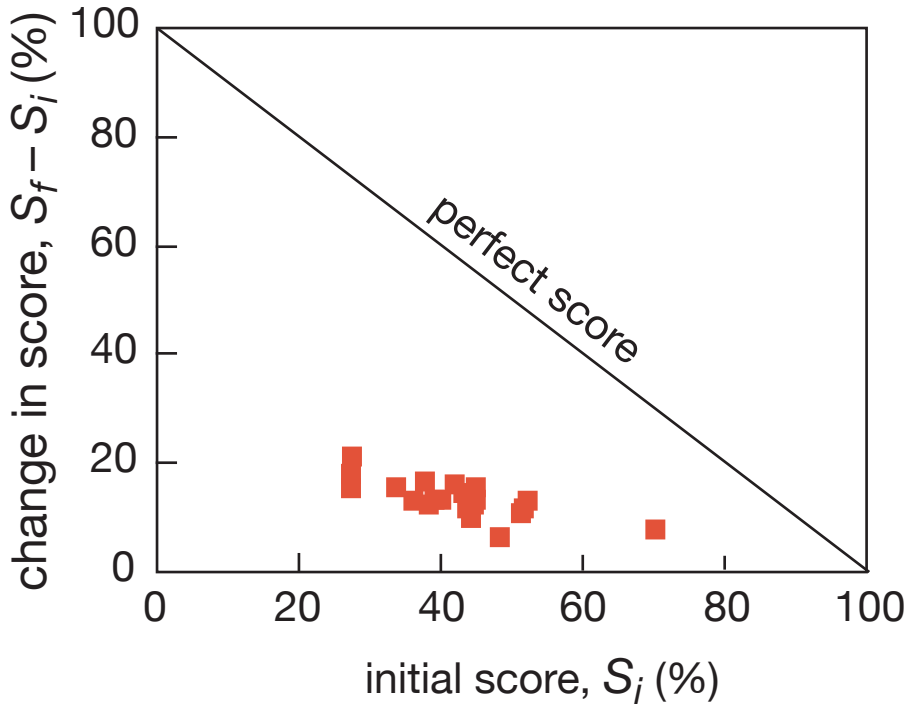

1990
combined
change in score, $S_f - S_i$ (%)
initial score, S_i (%)
0
20
40
60
80
100

1 lecture


1990
combined
change in score, $S_f - S_i$ (%)
initial score, S_i (%)
0
20
40
60
80
100

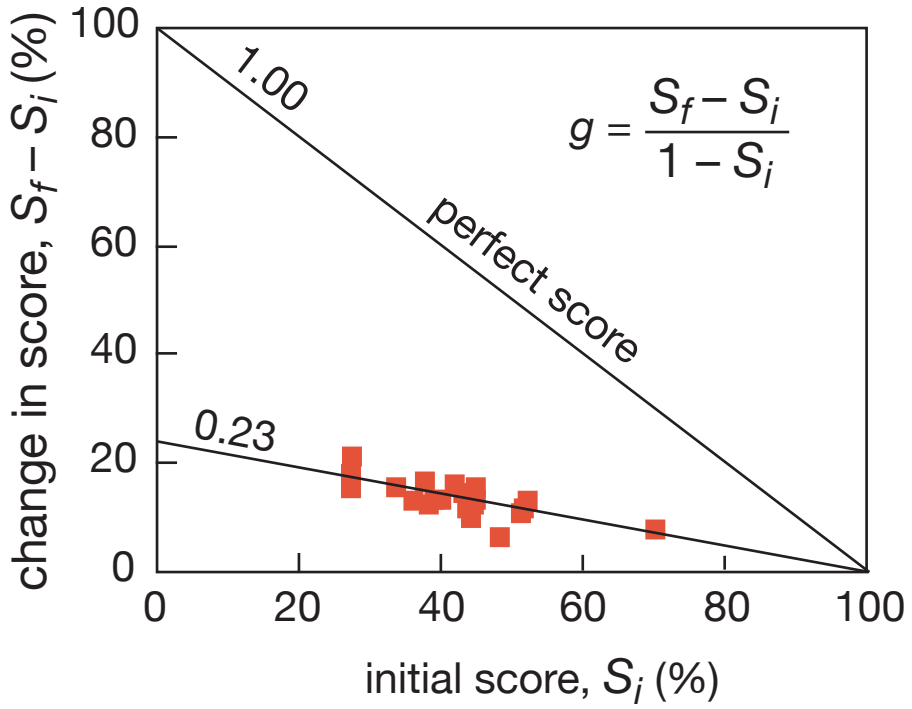

change in score, $S_f - S_i$ (%)
100
80
60
40
20
0
0
20
40
60
80
100
perfect score
initial score, S_i (%)

1 lecture

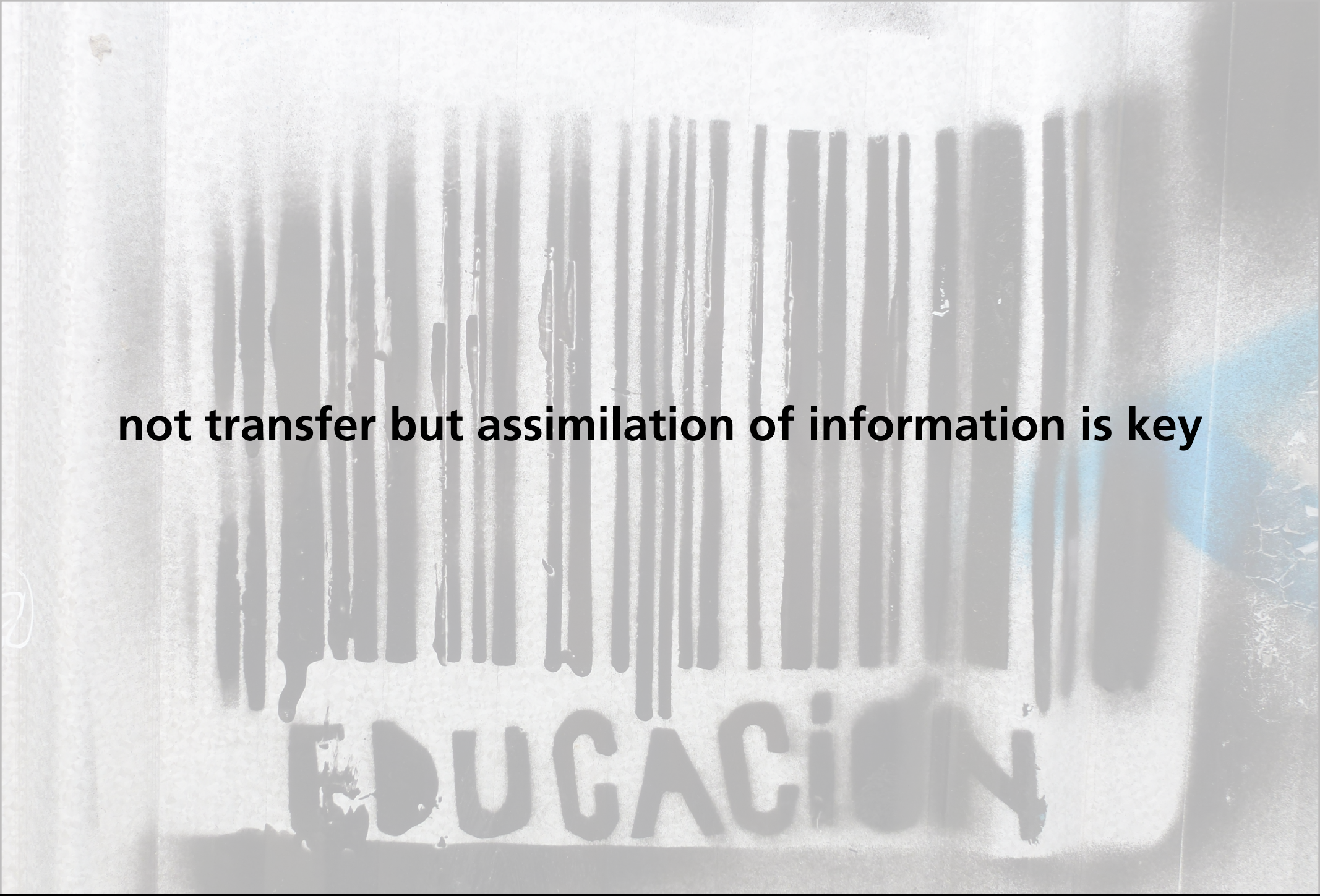


R.R. Hake, *Am. J. Phys.* 66, 64 (1998)

only one quarter of maximum gain realized



R.R. Hake, *Am. J. Phys.* 66, 64 (1998)


not transfer but assimilation of information is key
EDUCACION

1 lecture

1 lecture

1 lecture

1 lecture

2 PI


1. transfer of information

1. transfer of information

2. assimilation of that information

1 lecture

2 PI

1. transfer of information (in class)

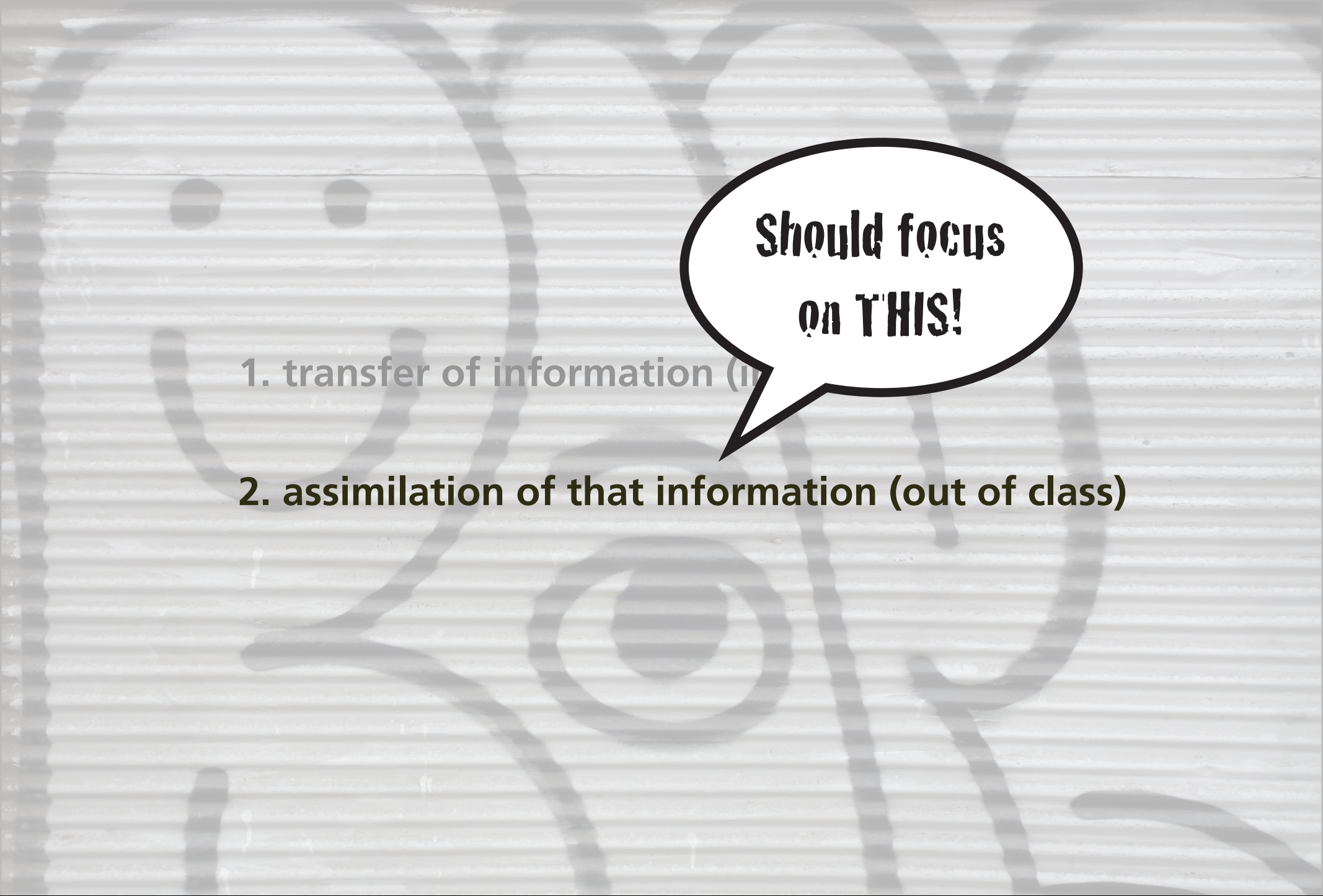
2. assimilation of that information

1 lecture

2 PI

1. transfer of information (in class)

2. assimilation of that information (out of class)



1 lecture 2 PI

1. transfer of information (in class)

2. assimilation of that information (out of class)

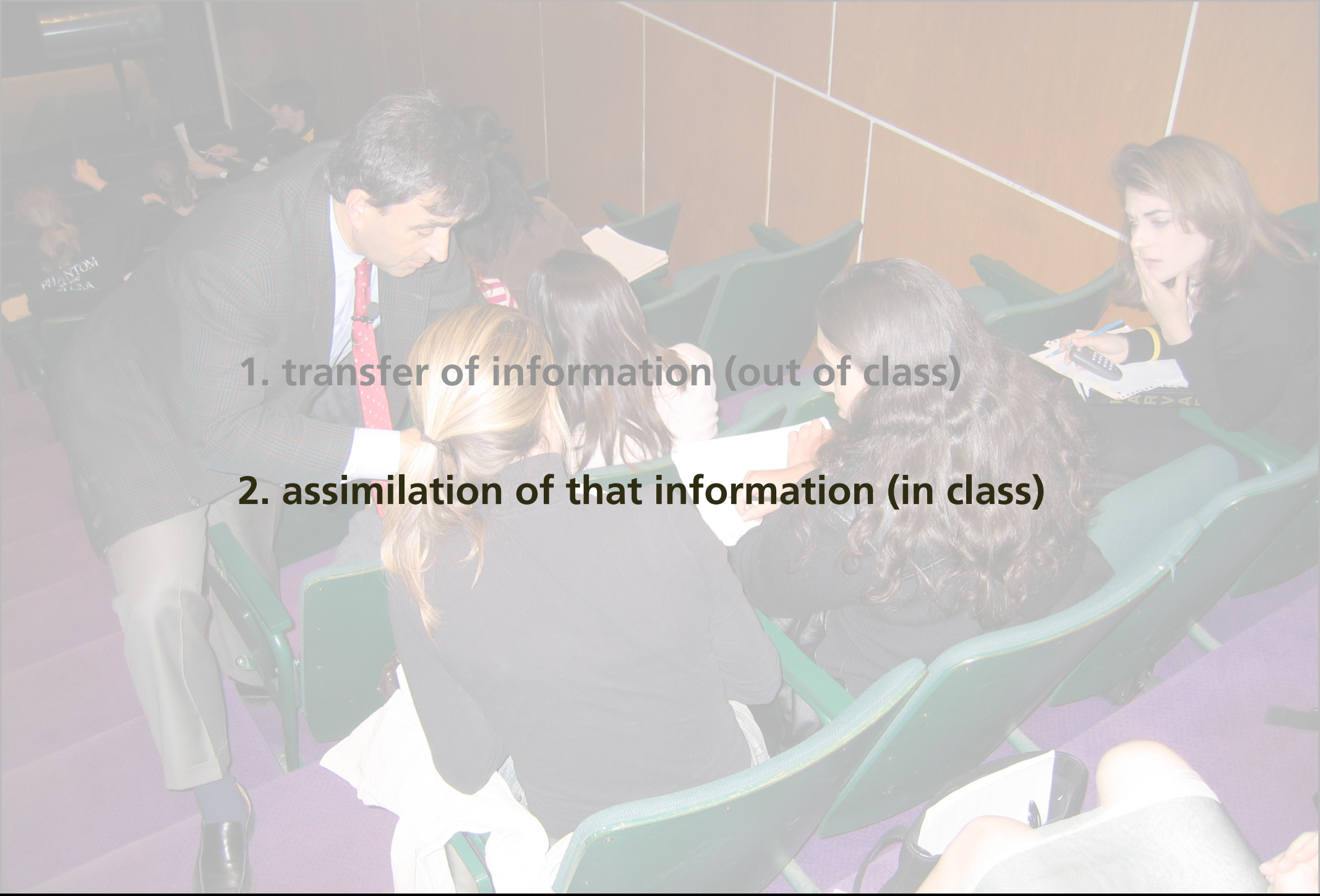
1 lecture 2 PI

1. transfer of information (out of class)

2. assimilation of that information (in class)

1 lecture

2 PI

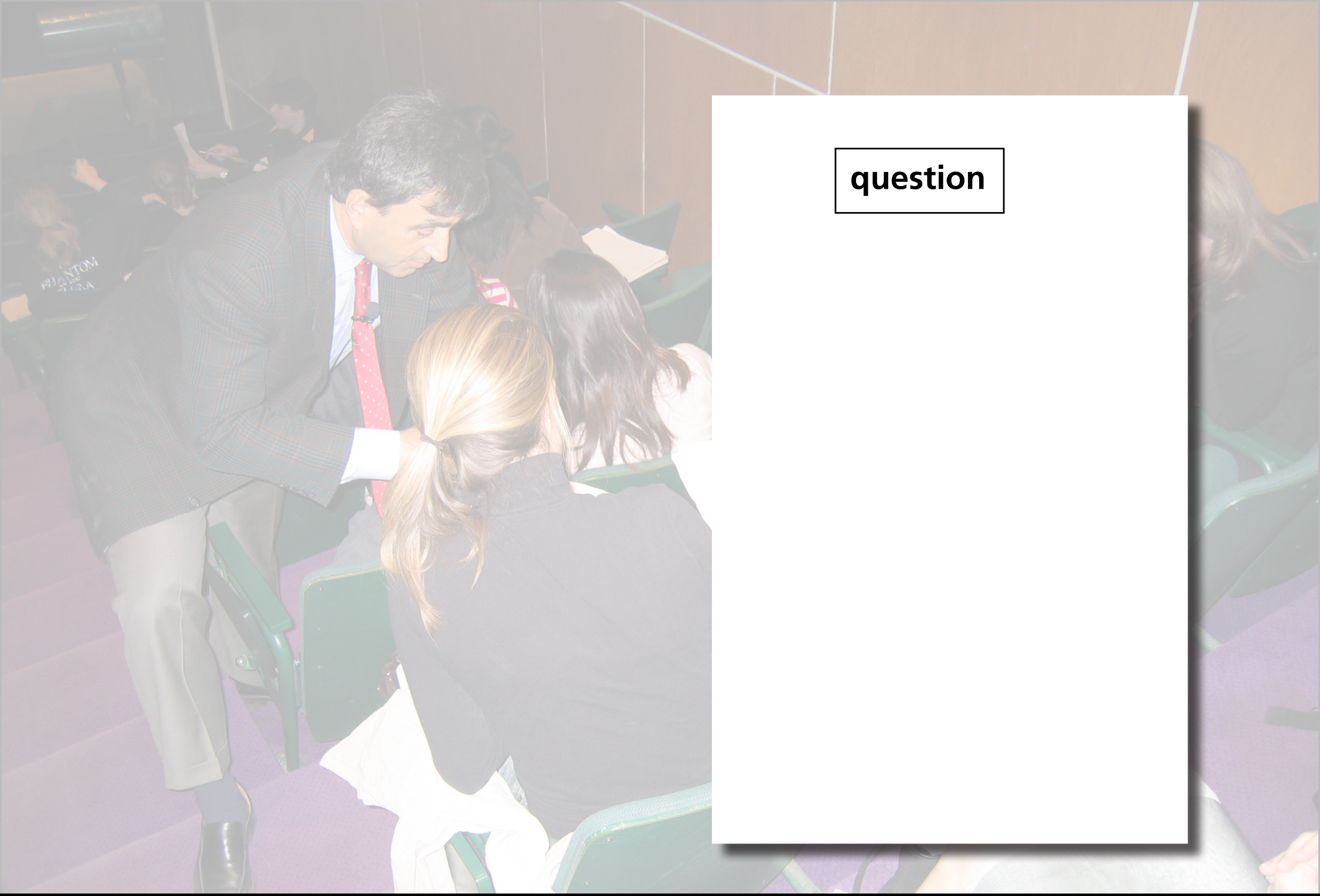


1. transfer of information (out of class)

2. assimilation of that information (in class)

1 lecture

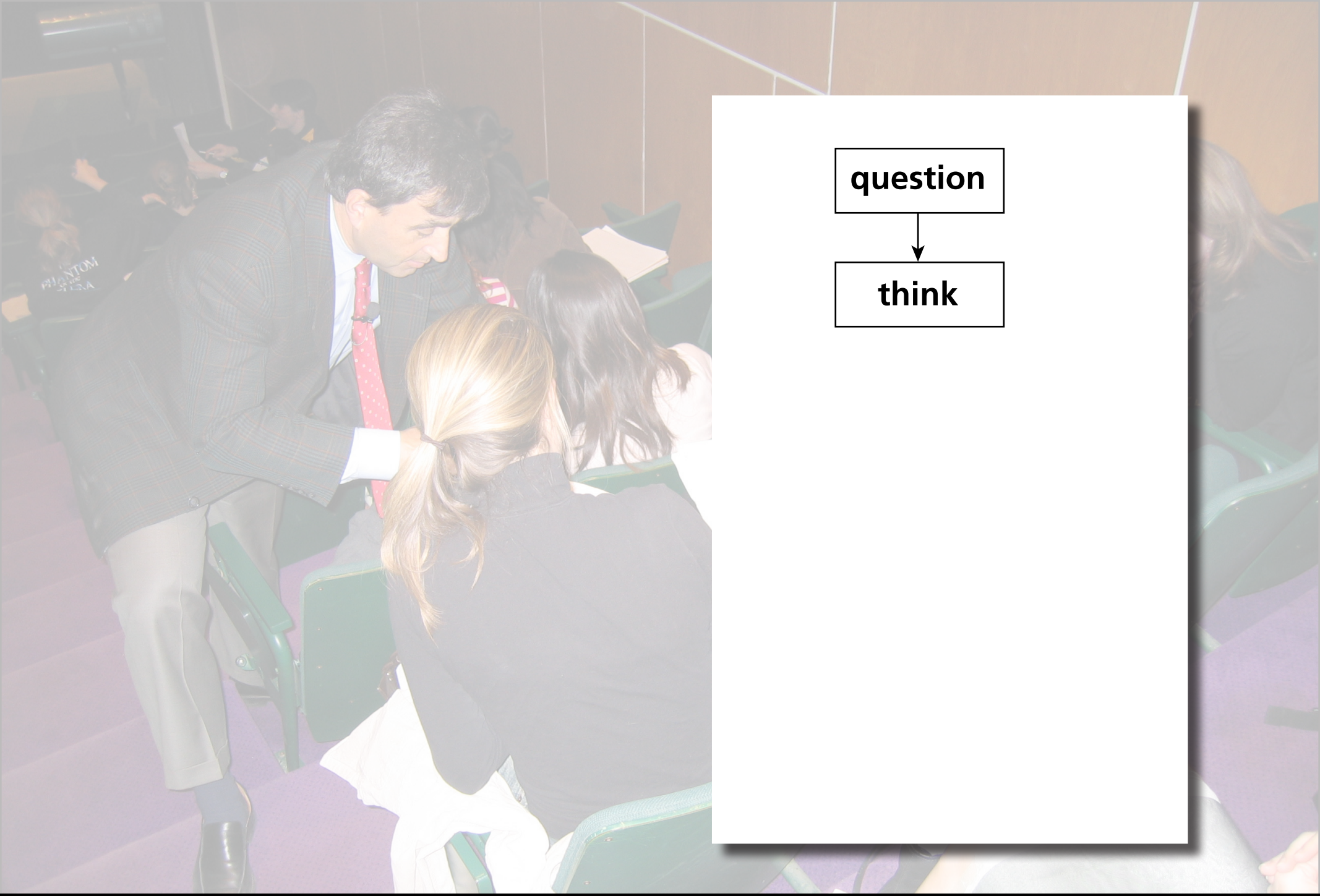
2 PI



question

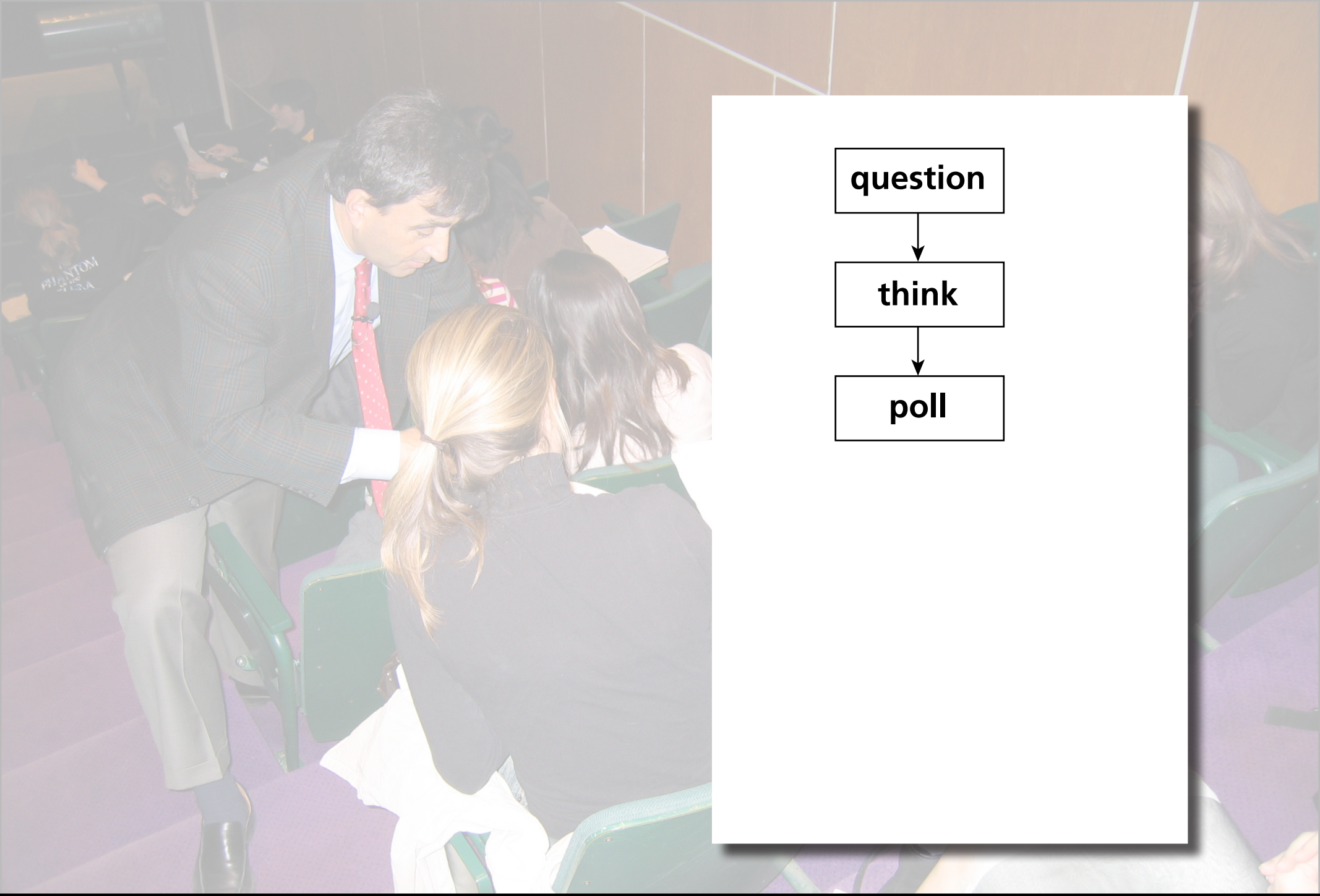
1 lecture

2 PI



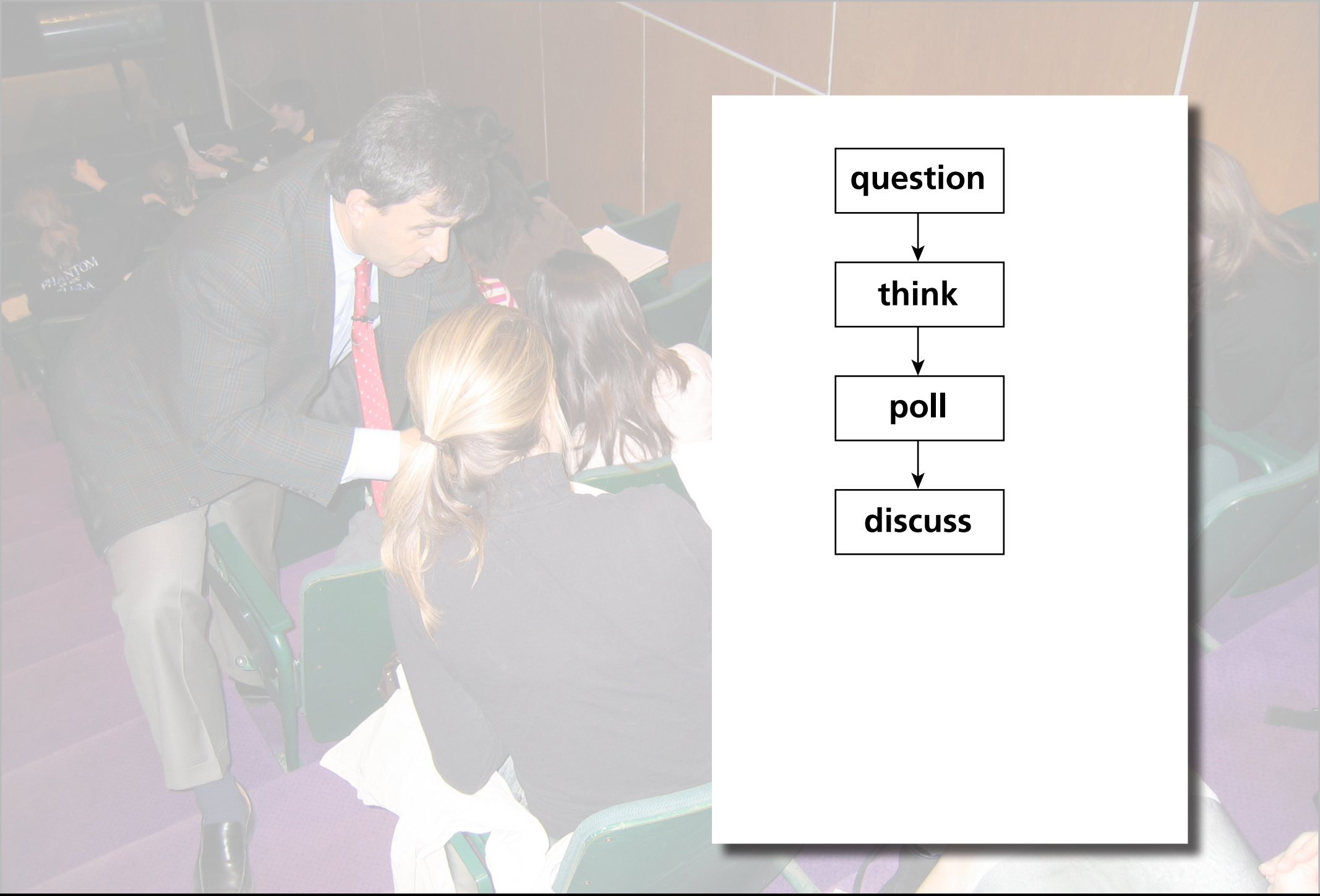
1 lecture

2 PI



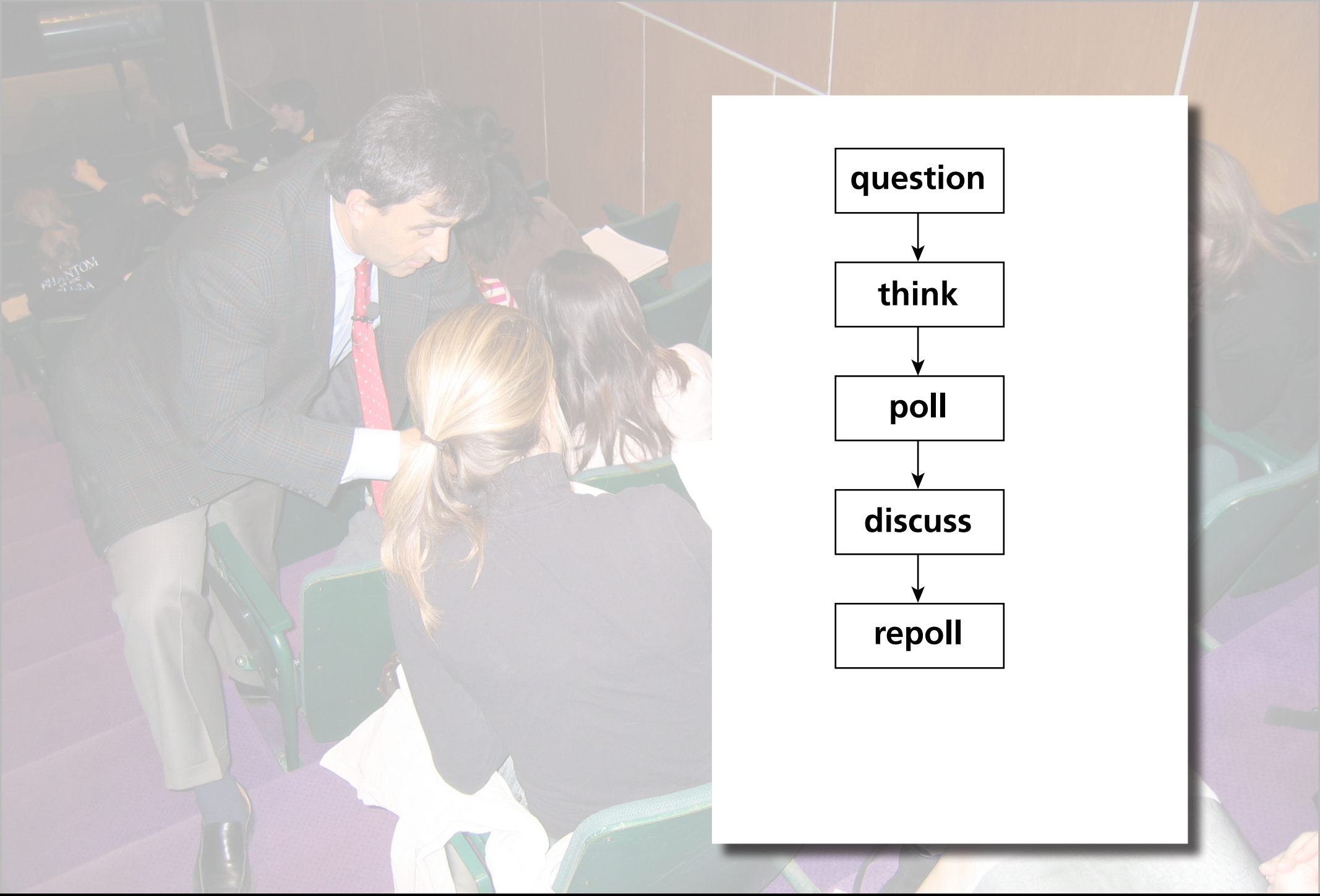
1 lecture

2 PI



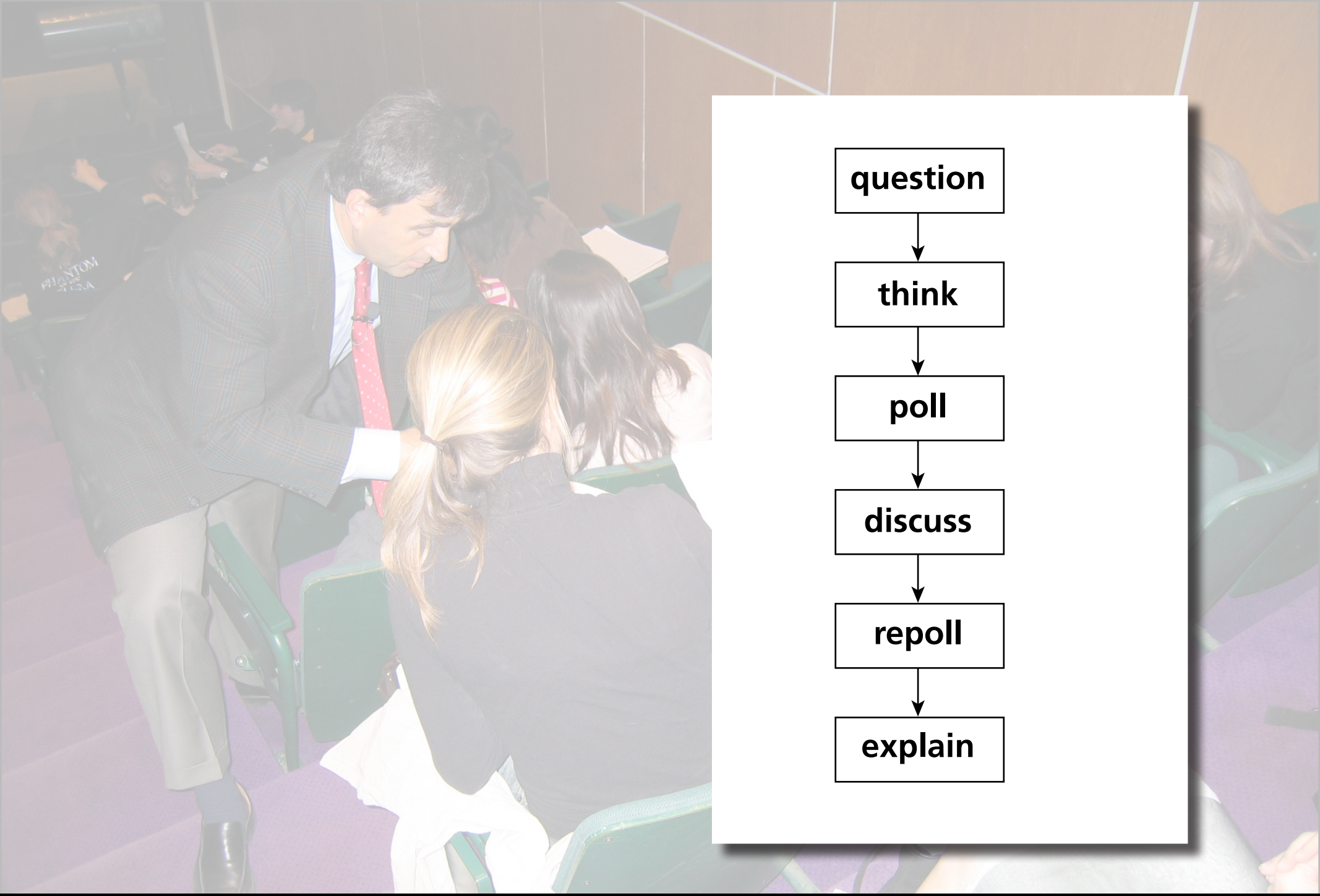
1 lecture

2 PI



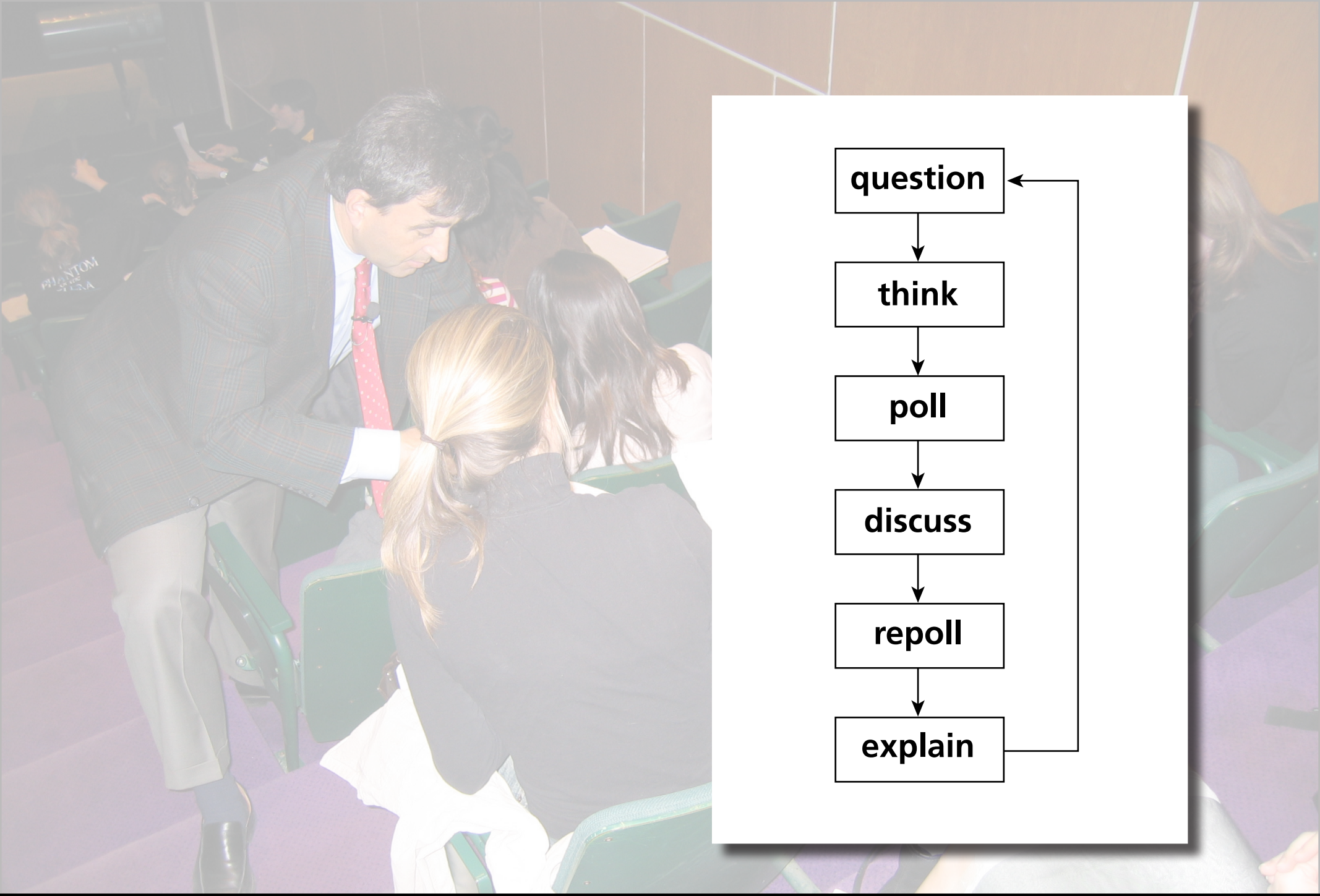
1 lecture

2 PI



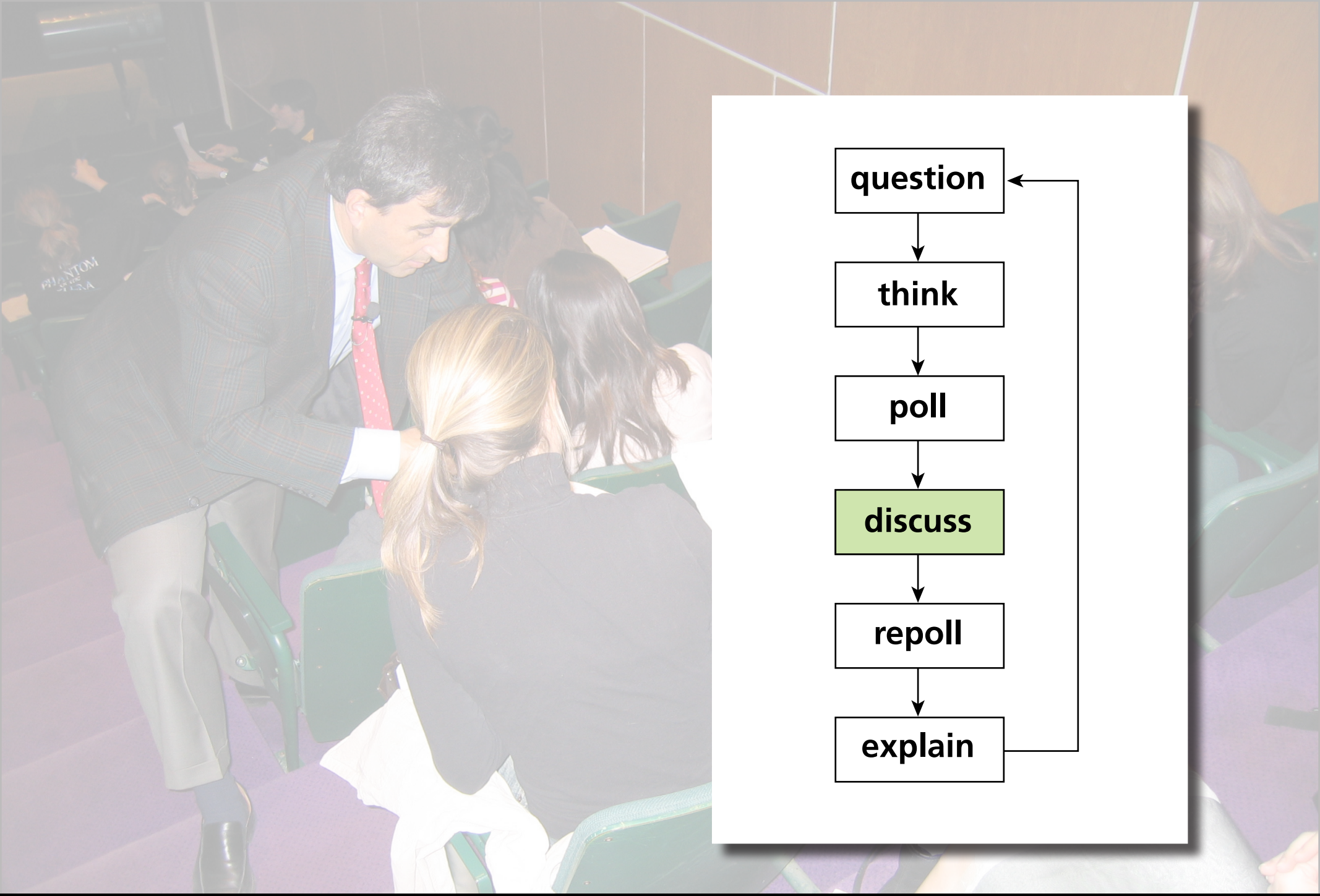
1 lecture

2 PI



1 lecture

2 PI



1 lecture

2 PI

1 education

2 PI

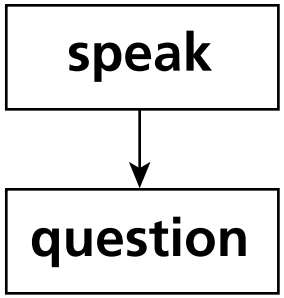
1 lecture

2 PI

speak

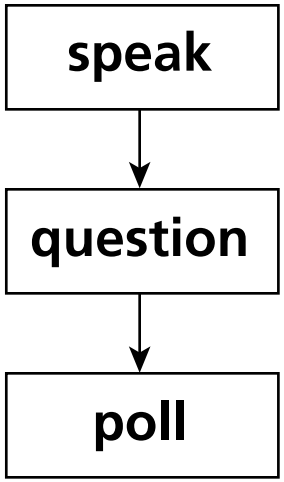
1 lecture

2 PI

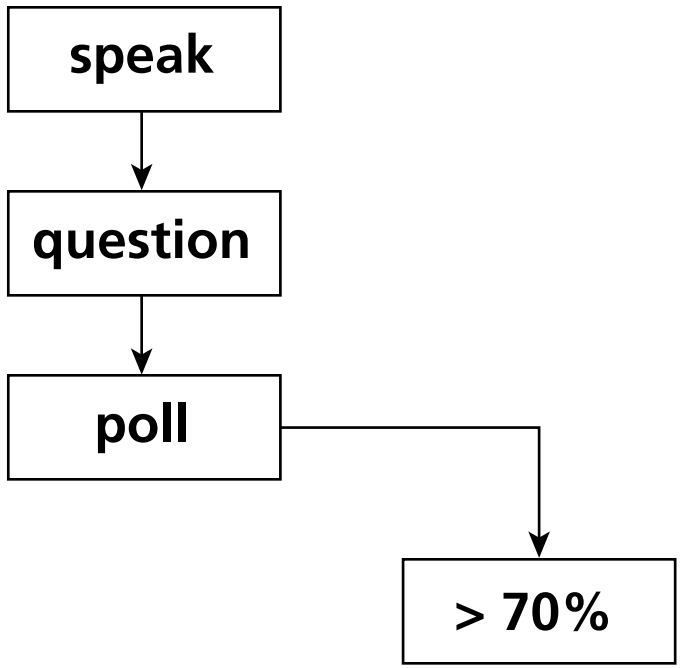


1 lecture

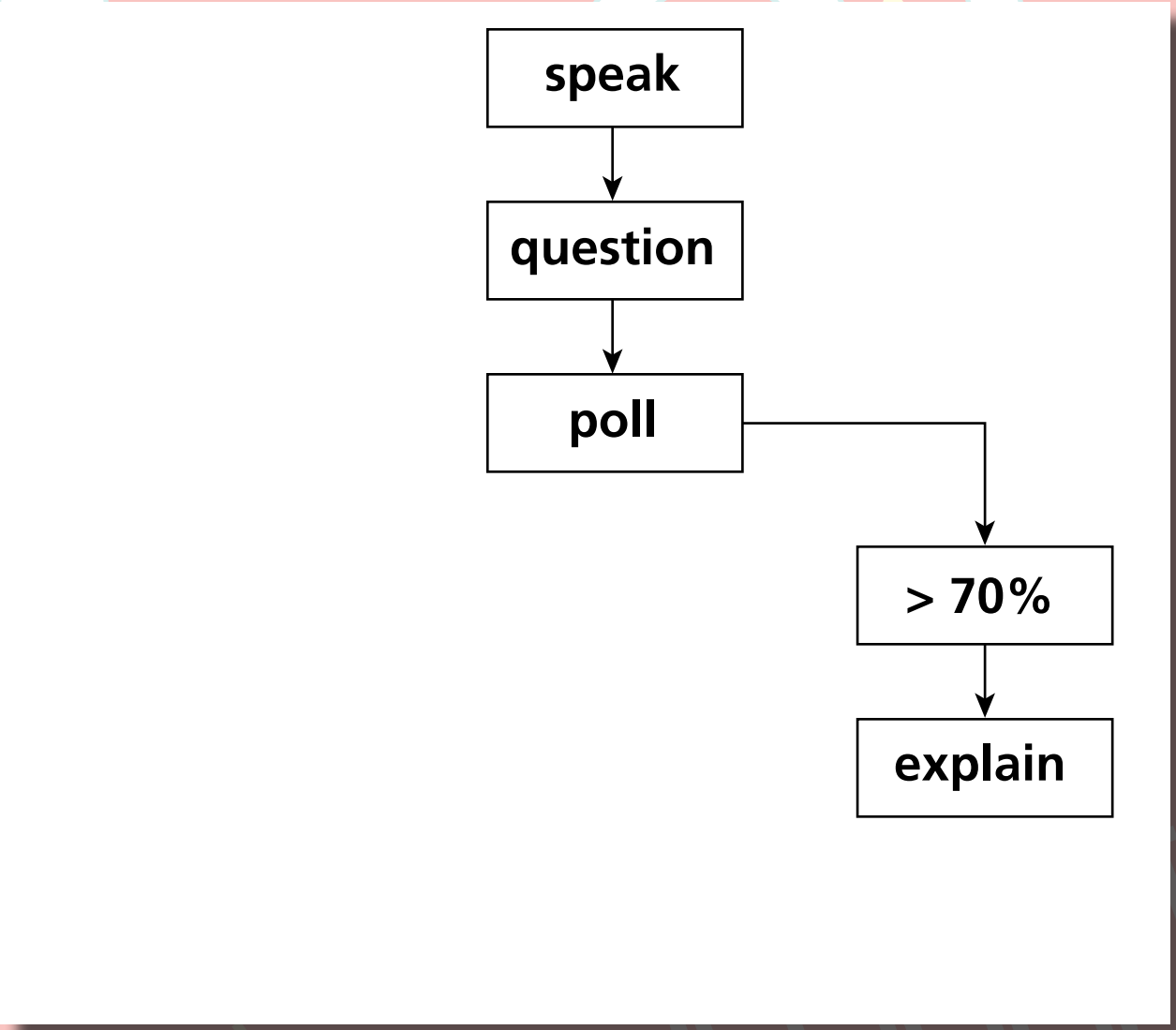
2 PI



1 lecture 2 PI

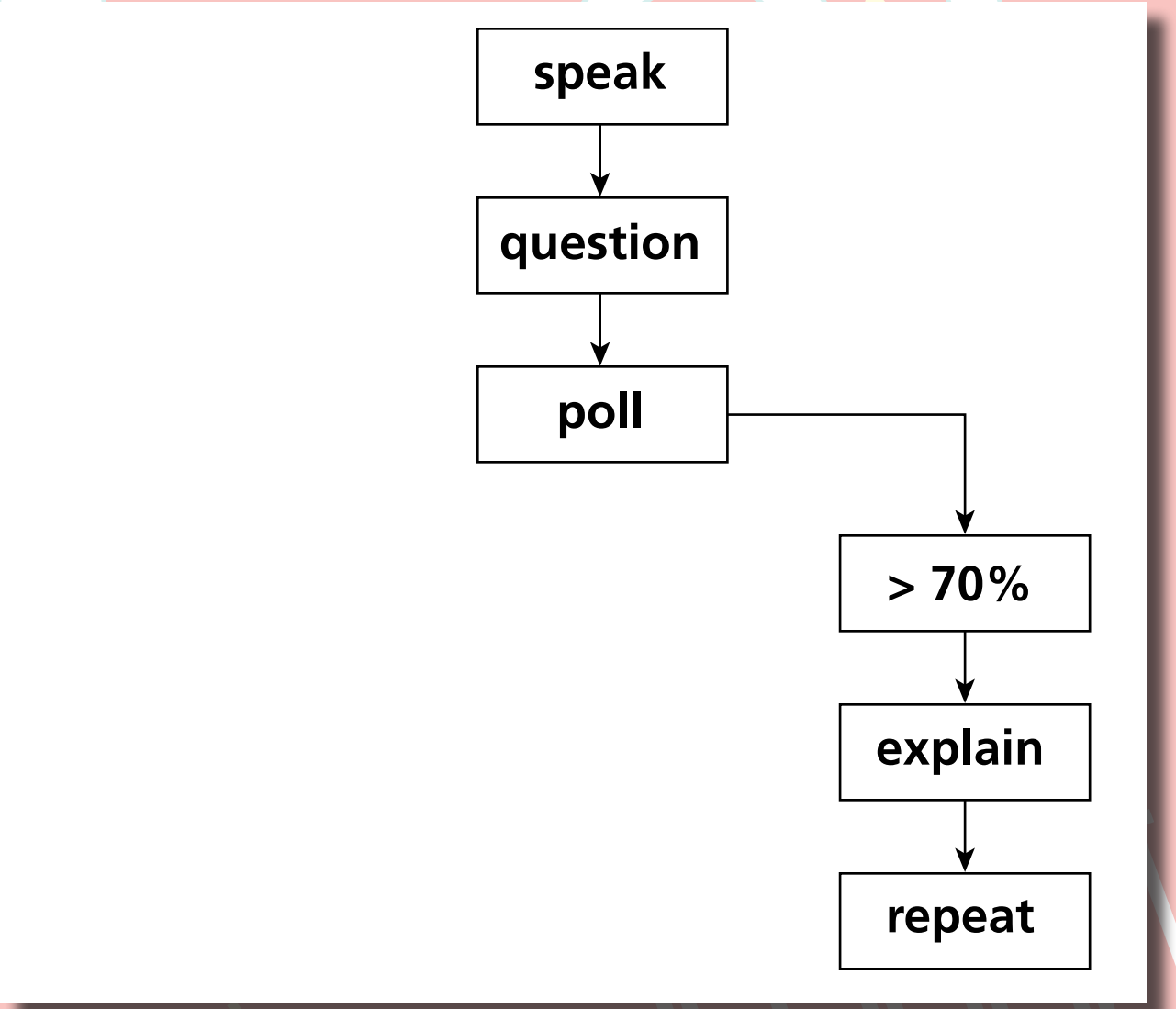


1 lecture 2 PI



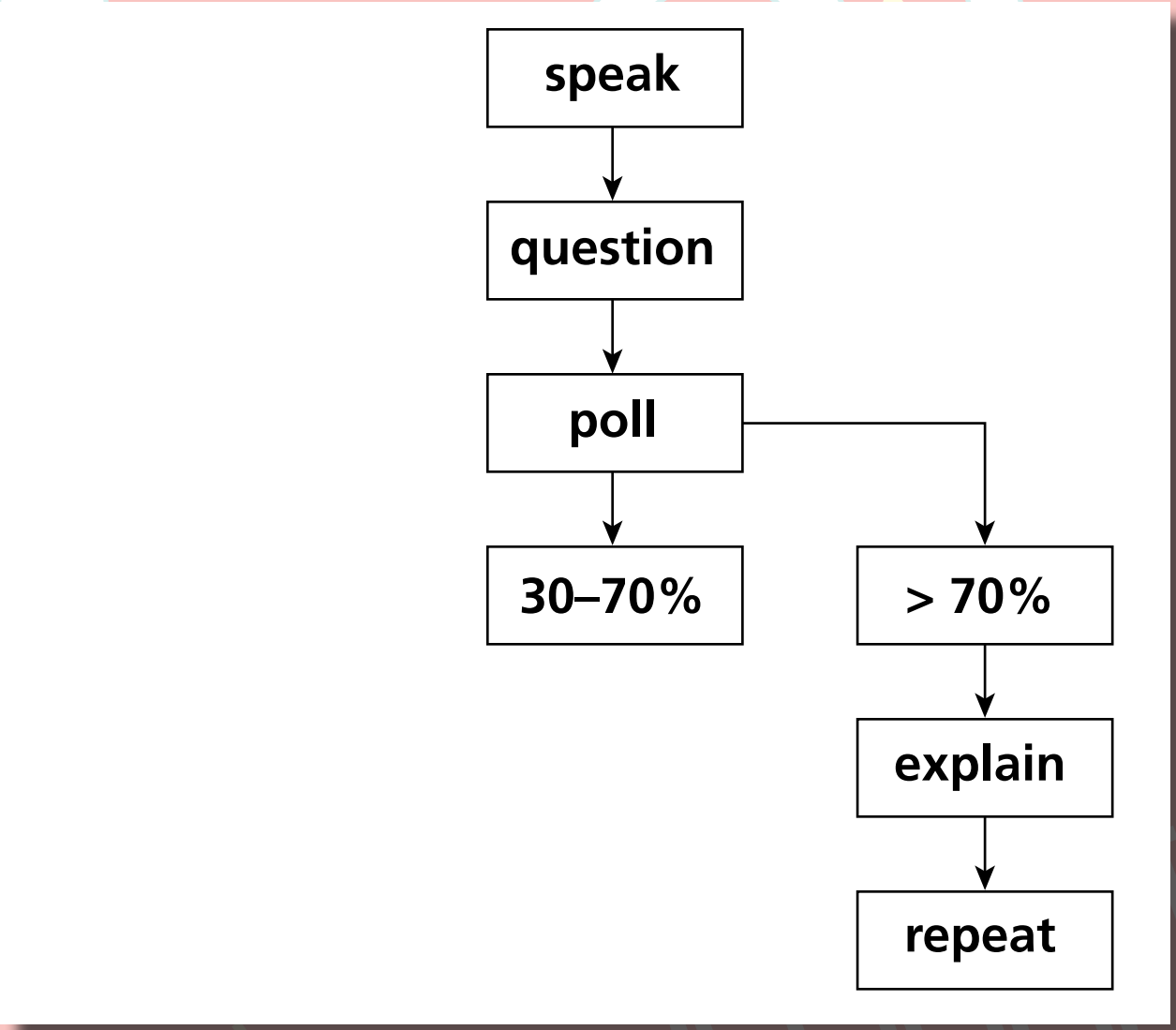
1 lecture

2 PI



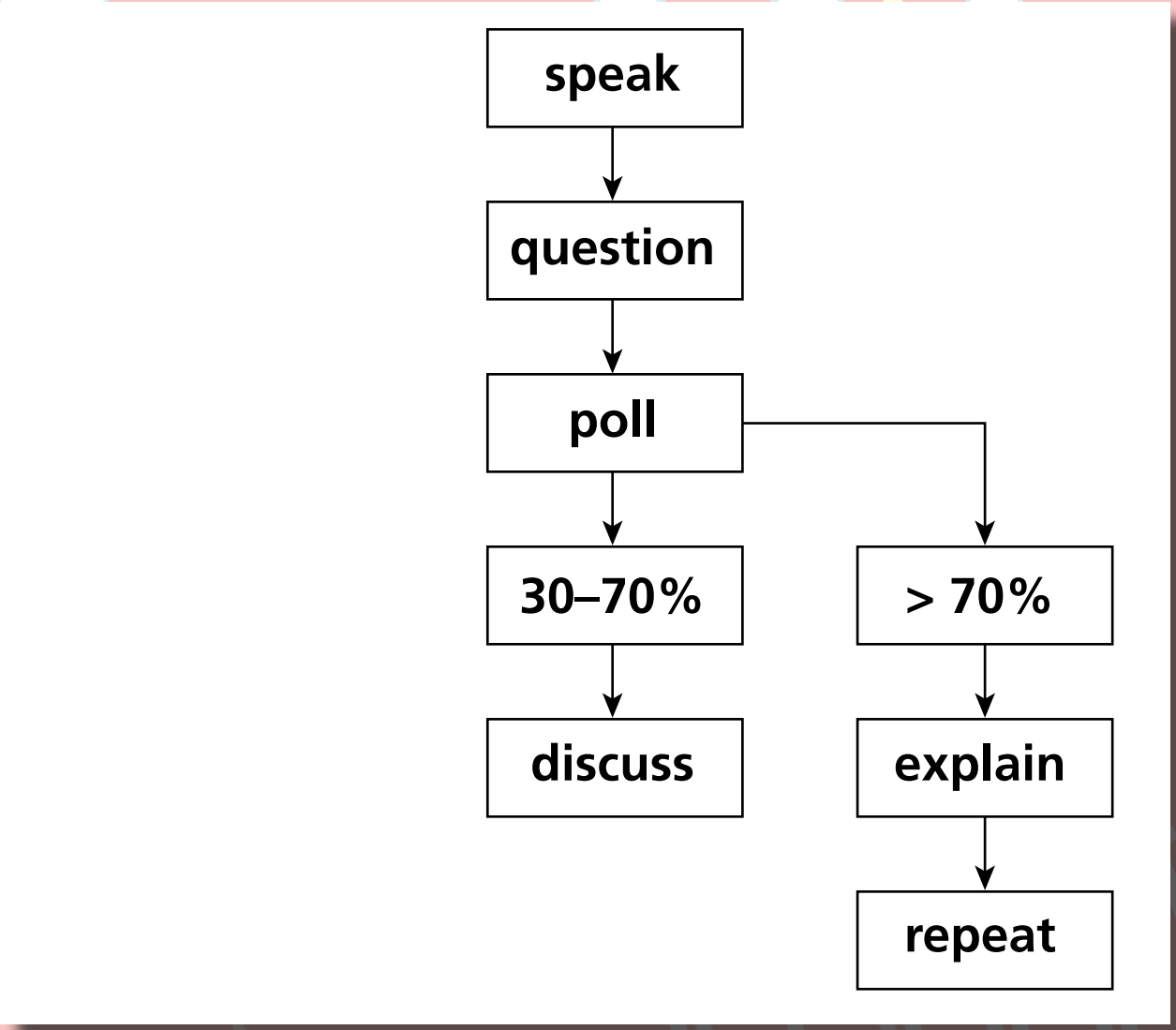
1 lecture

2 PI



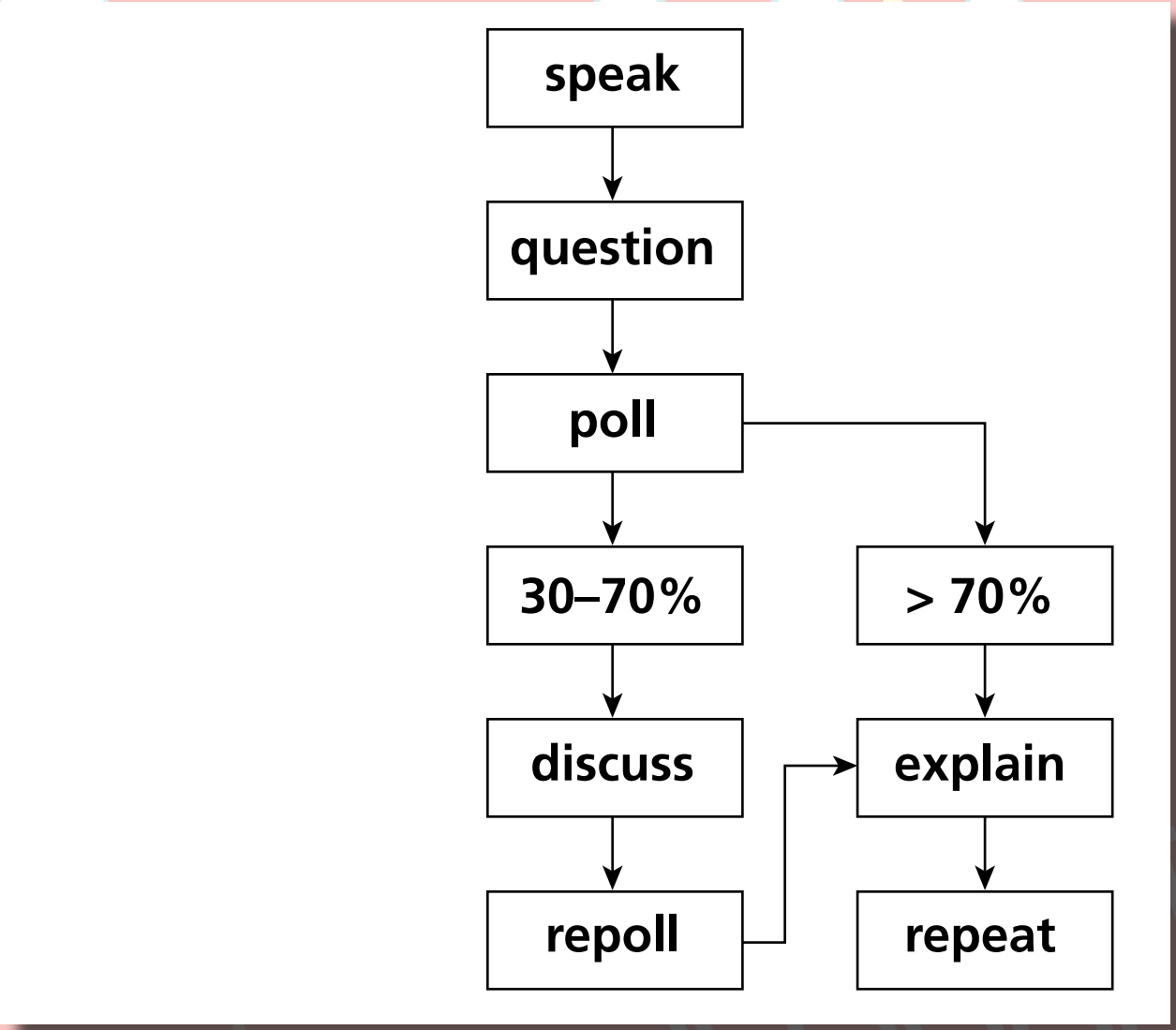
1 lecture

2 PI



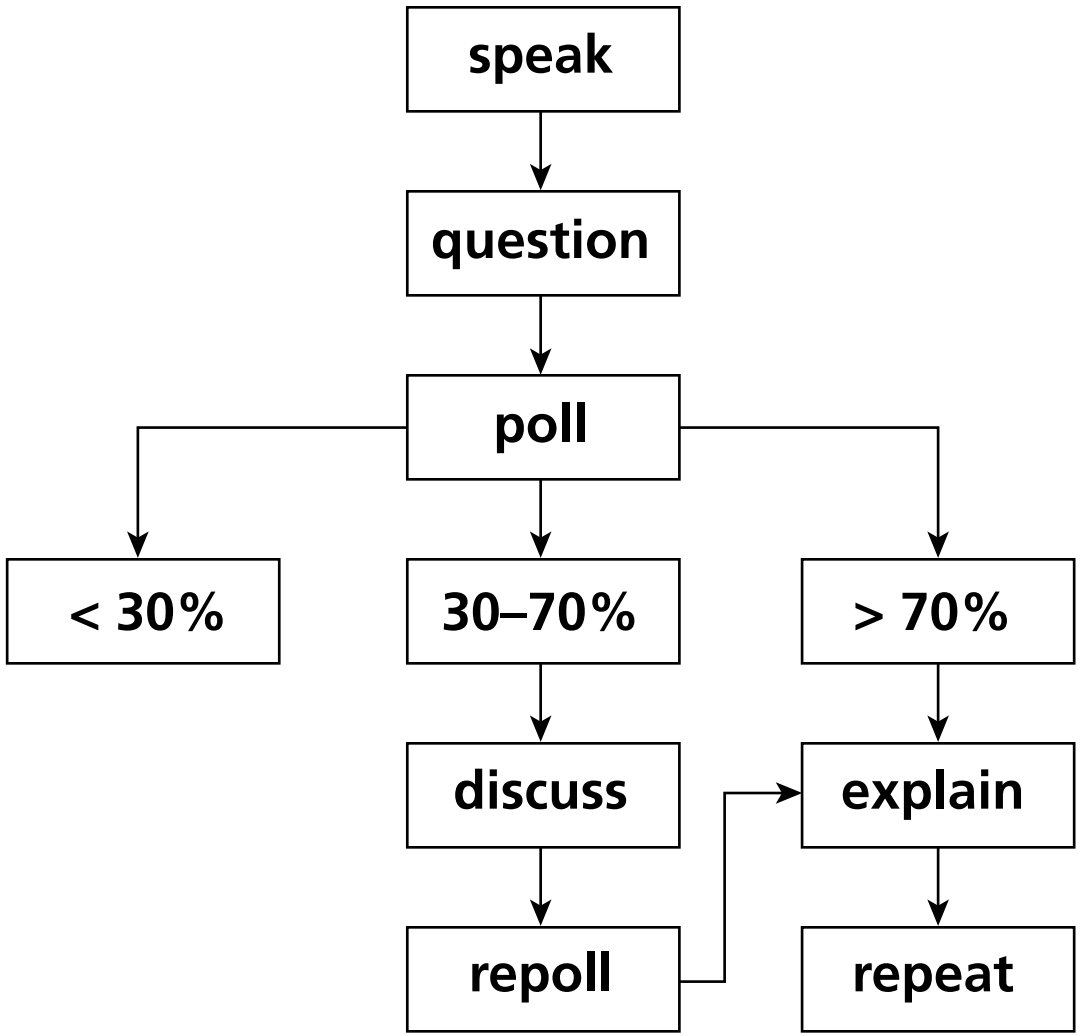
1 lecture

2 PI



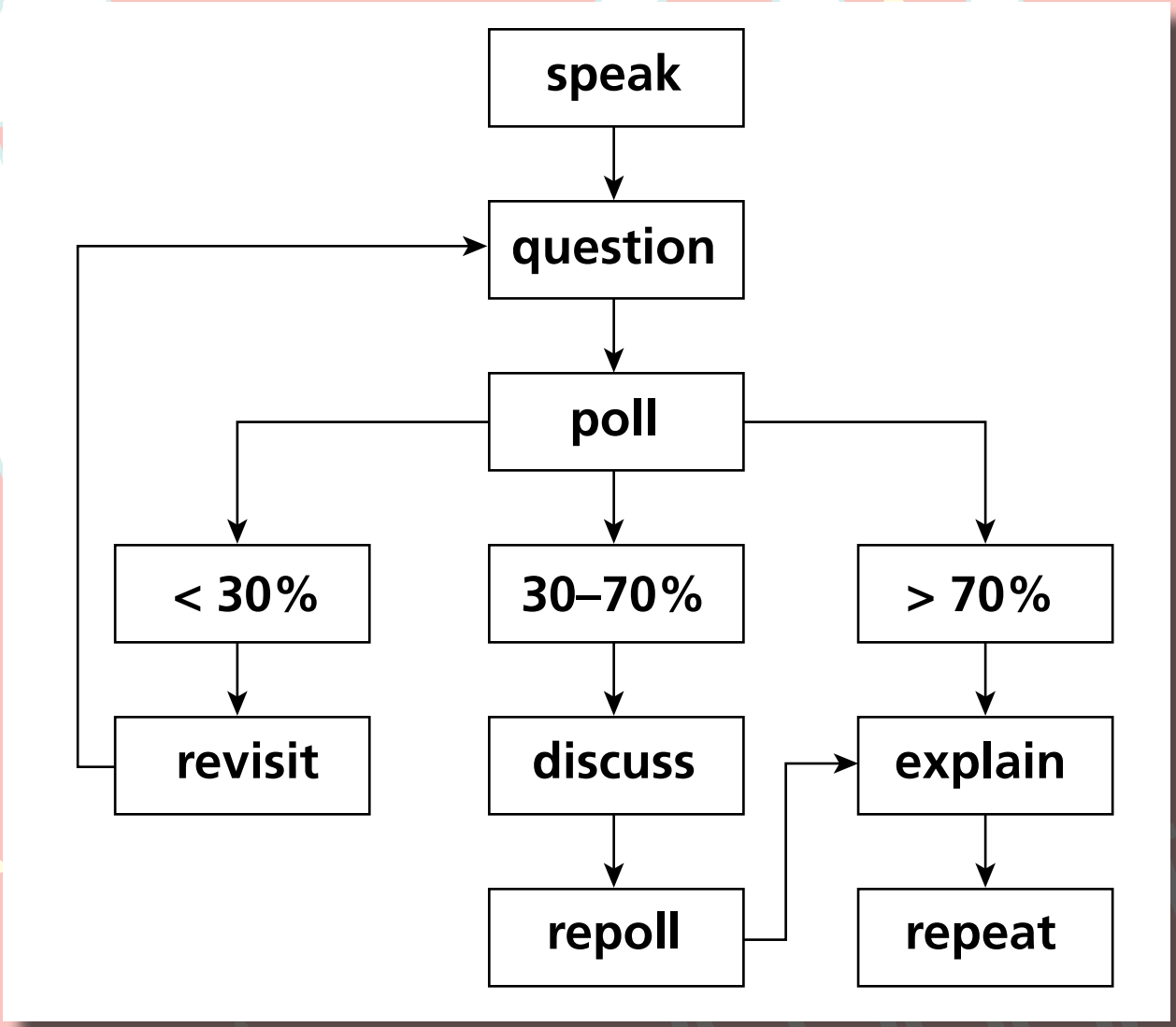
1 lecture

2 PI



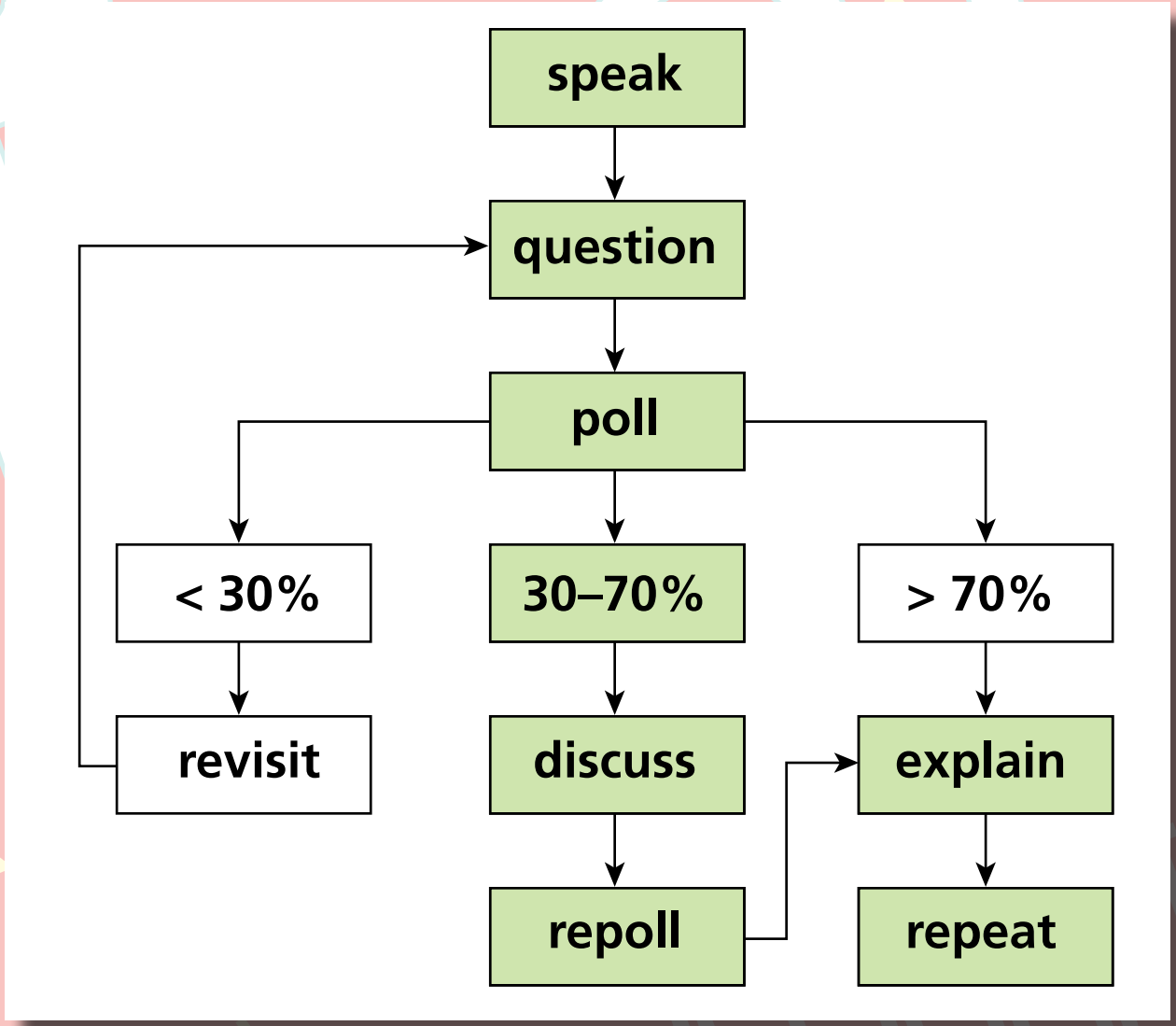
1 lecture

2 PI



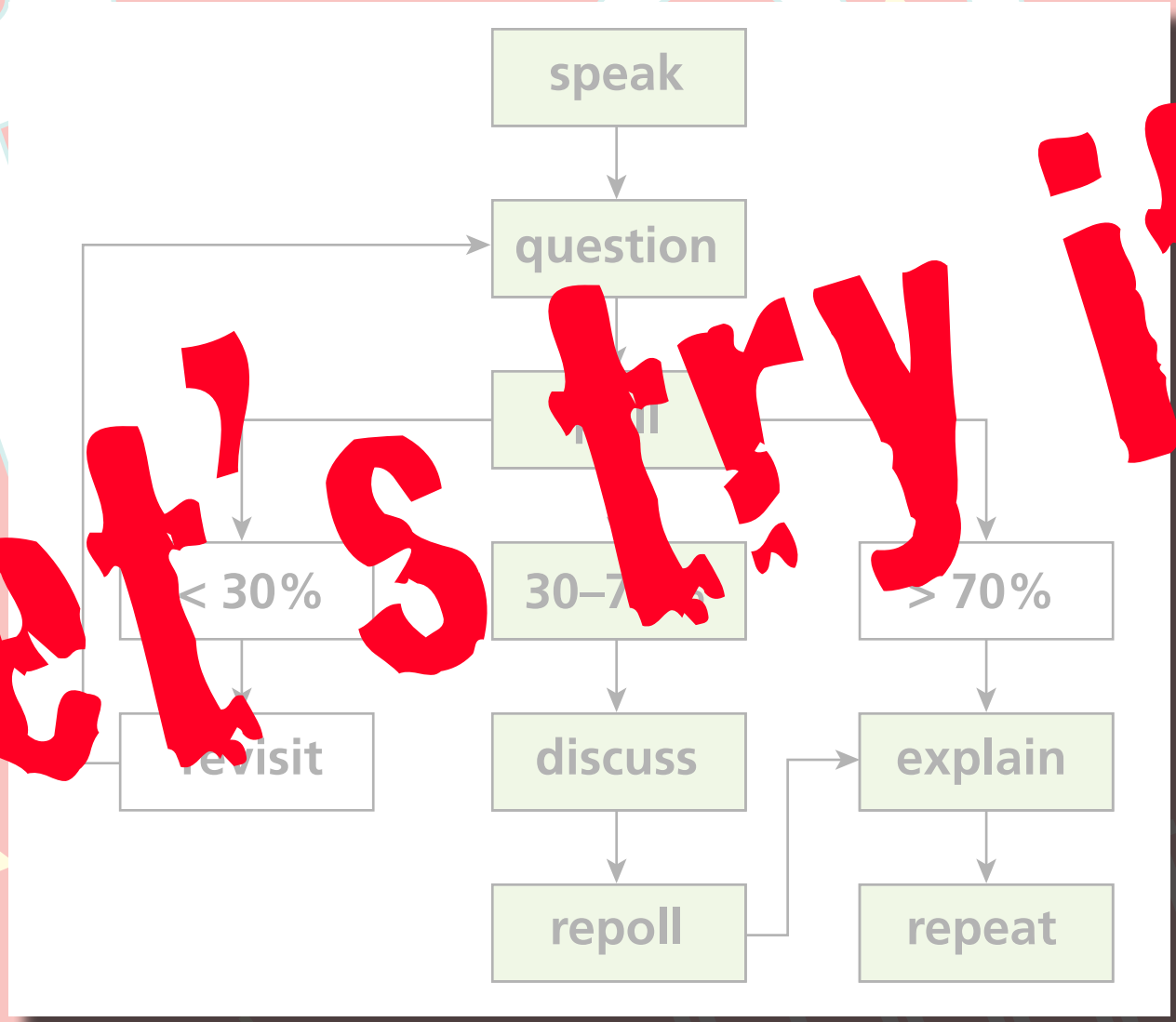
1 lecture

2 PI



1 lecture

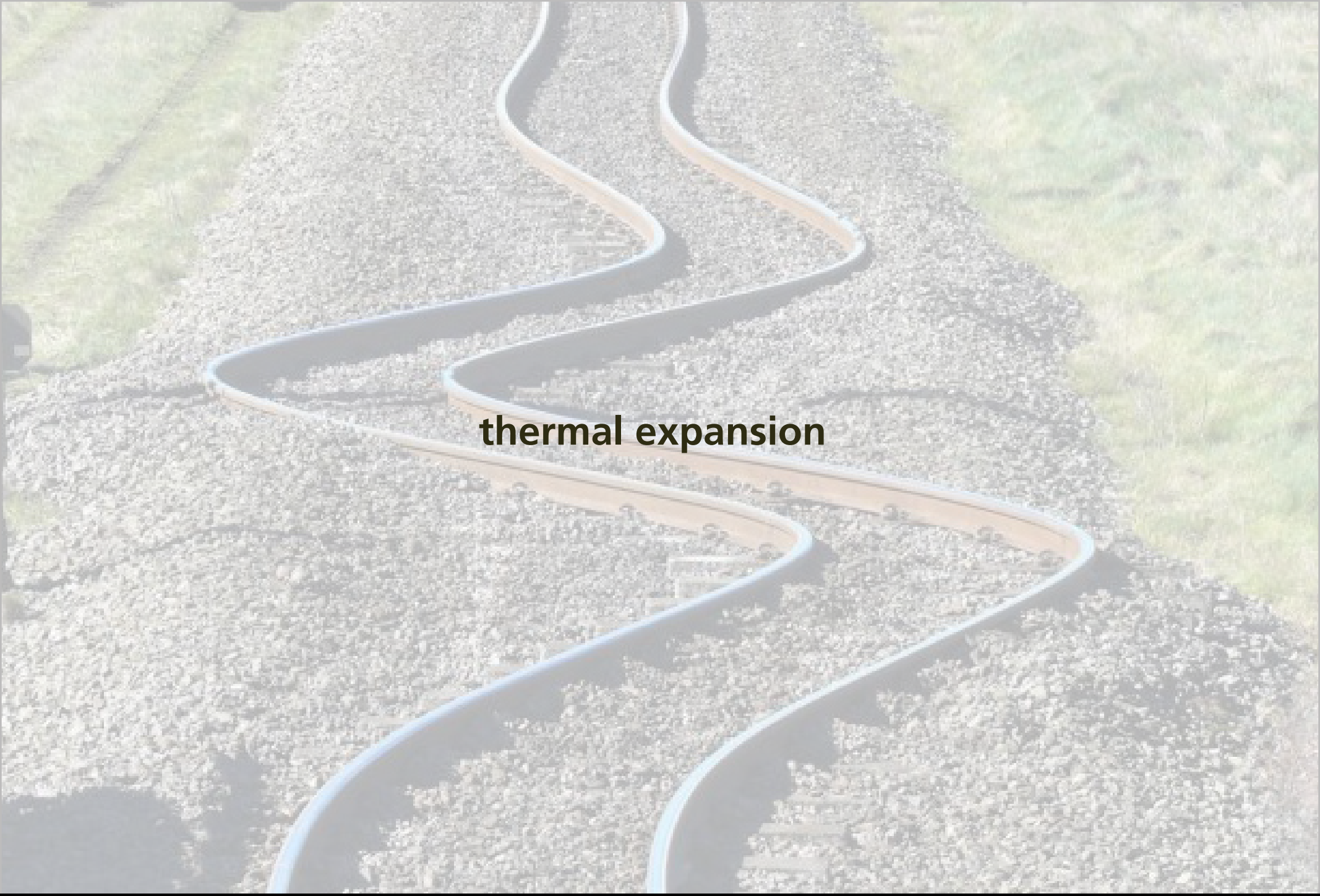
2 PI



Let's try it!

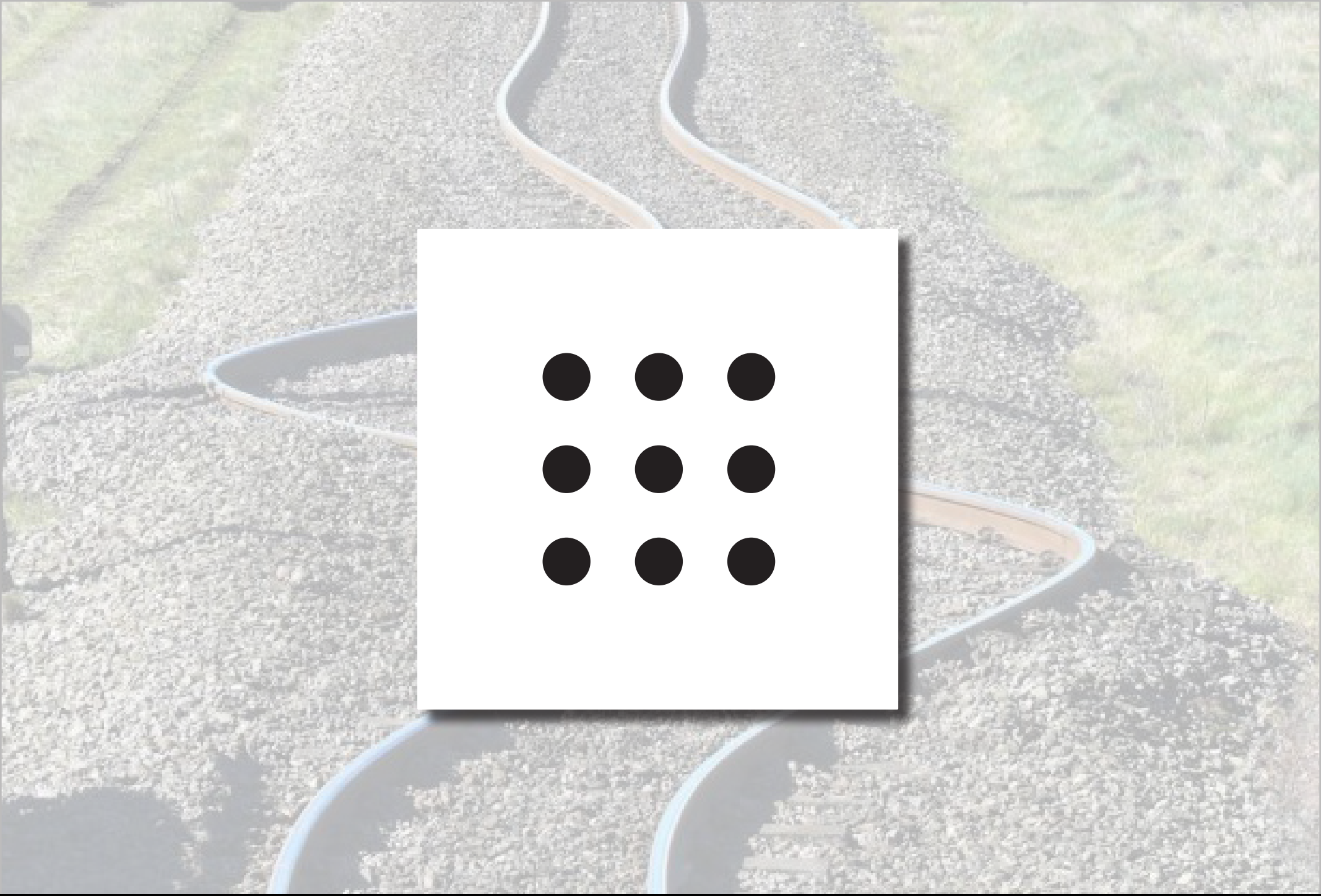
1 lecture

2 PI



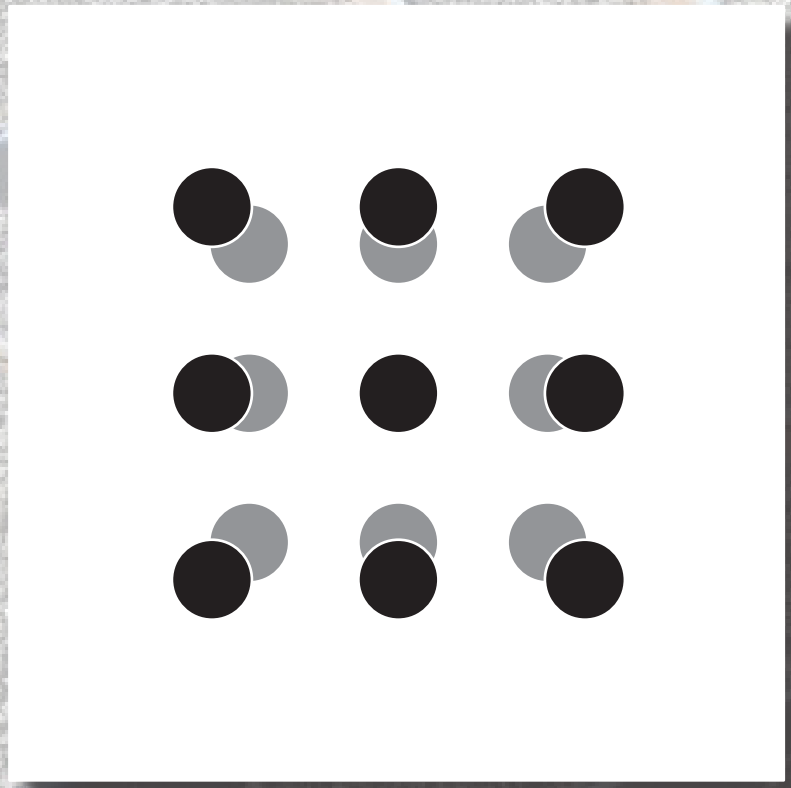
1 lecture

2 PI



1 lecture

2 PI



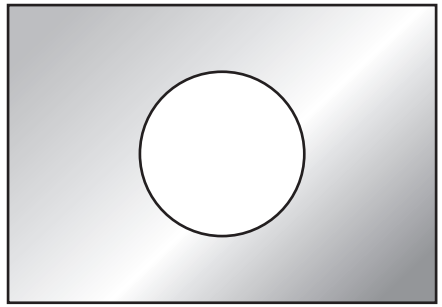
1 lecture

2 PI

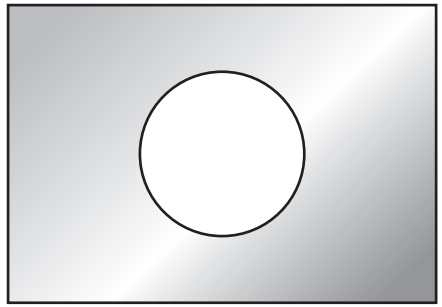
1 lecture

2 PI

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



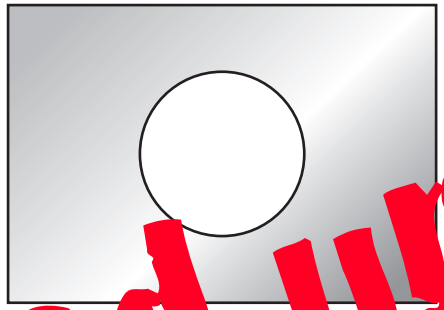
Consider a rectangular metal plate with a circular hole in it.



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.

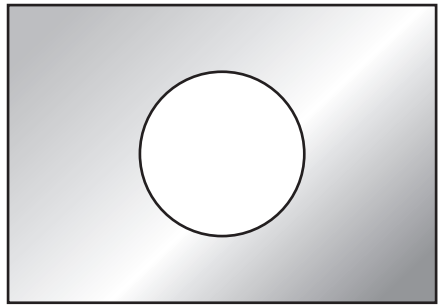


When the plate is uniformly heated, the diameter of the hole

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…

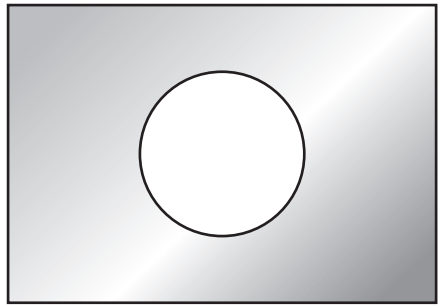
1. made a commitment
2. externalized your answer
3. moved from the answer/fact to reasoning

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.



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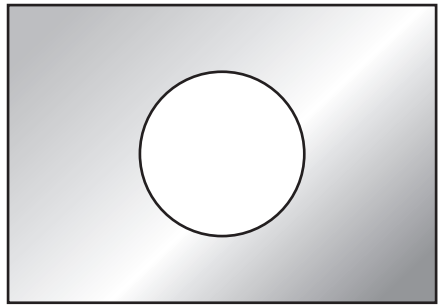
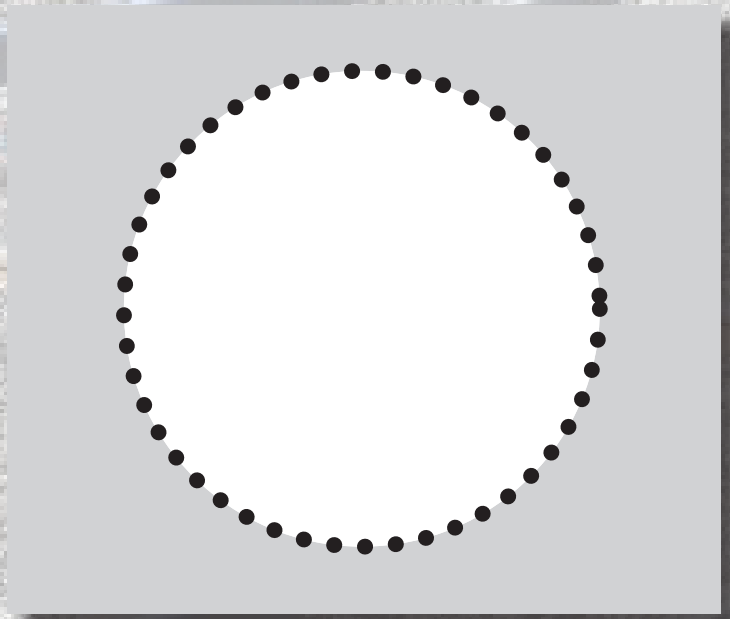
Consider a rectangular metal plate with a circular hole in it.



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

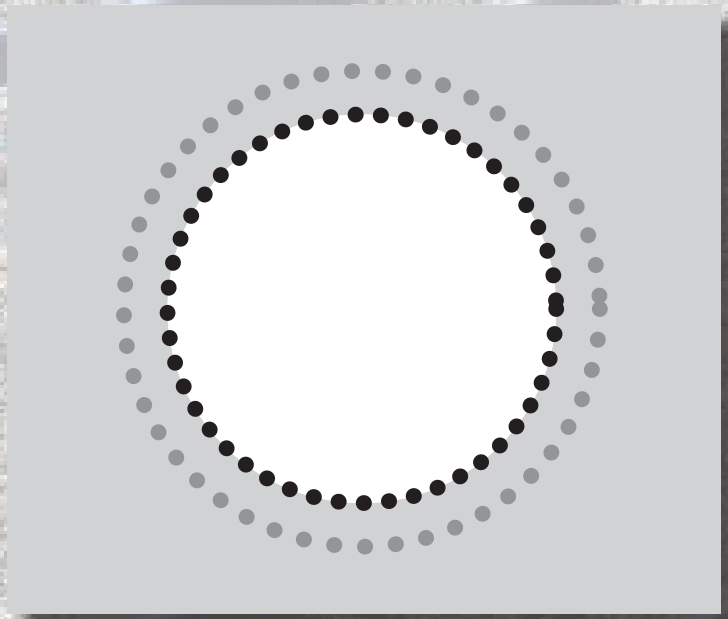
1. increases. ✔
2. stays the same.
3. decreases.

consider atoms at rim of hole



1 lecture 2 PI

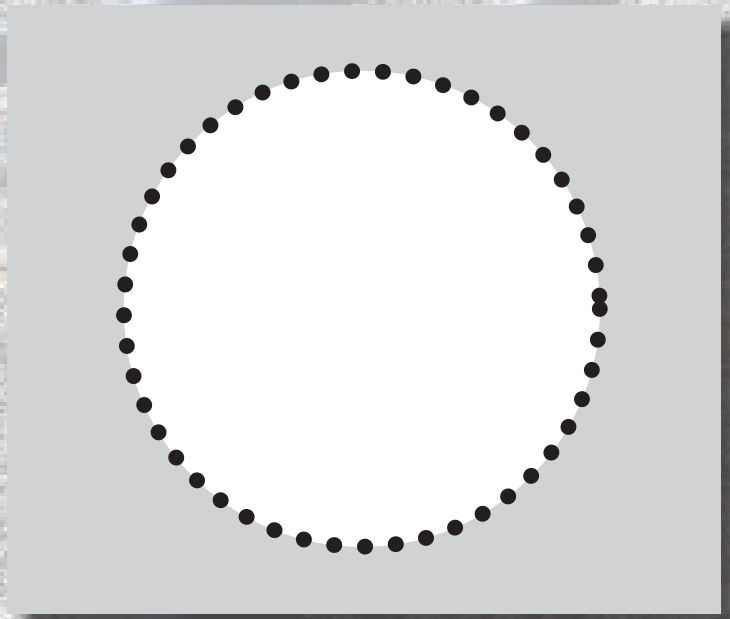
consider atoms at rim of hole



1 lecture

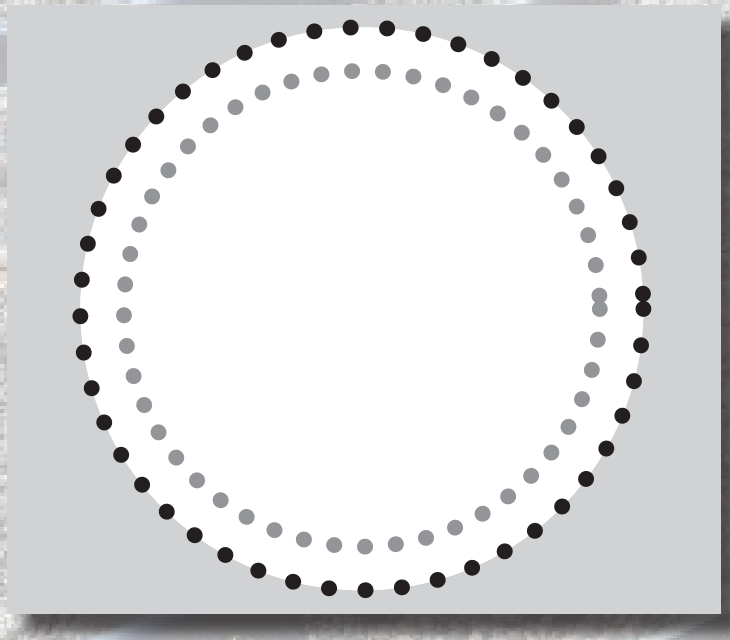
2 PI

consider atoms at rim of hole



1 lecture 2 PI

consider atoms at rim of hole



1 lecture 2 PI

consider atoms at rim of hole

you won't forget this

1 lecture

2 PI


peer
back to pI
INSTRUCTION
1 lecture
2 PI

1 lecture

2 PI


Peer
Higher learning gains
INSTRUCTION
1 lecture
2 PI


Peer
Higher learning gains
Better retention
INSTRUCTION
1 lecture
2 PI


Join now!
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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

1 lecture

2 PI

3 PI 2.0

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1 lecture

2 PI

3 PI 2.0

1 lecture 2 PI 3 PI 2.0

How do I…

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

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Gary King

Brian Lukoff

Eric Mazur

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Use intelligent algorithms and data analytics to…

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

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a. A 30-year fixed rate
b. A 15-year fixed rate mortgage at
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 ov
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 would most likely use which

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:

business model

preciation?

extensible plug-in architecture for question types

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

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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.

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4.

endicular mirrors as shown below.

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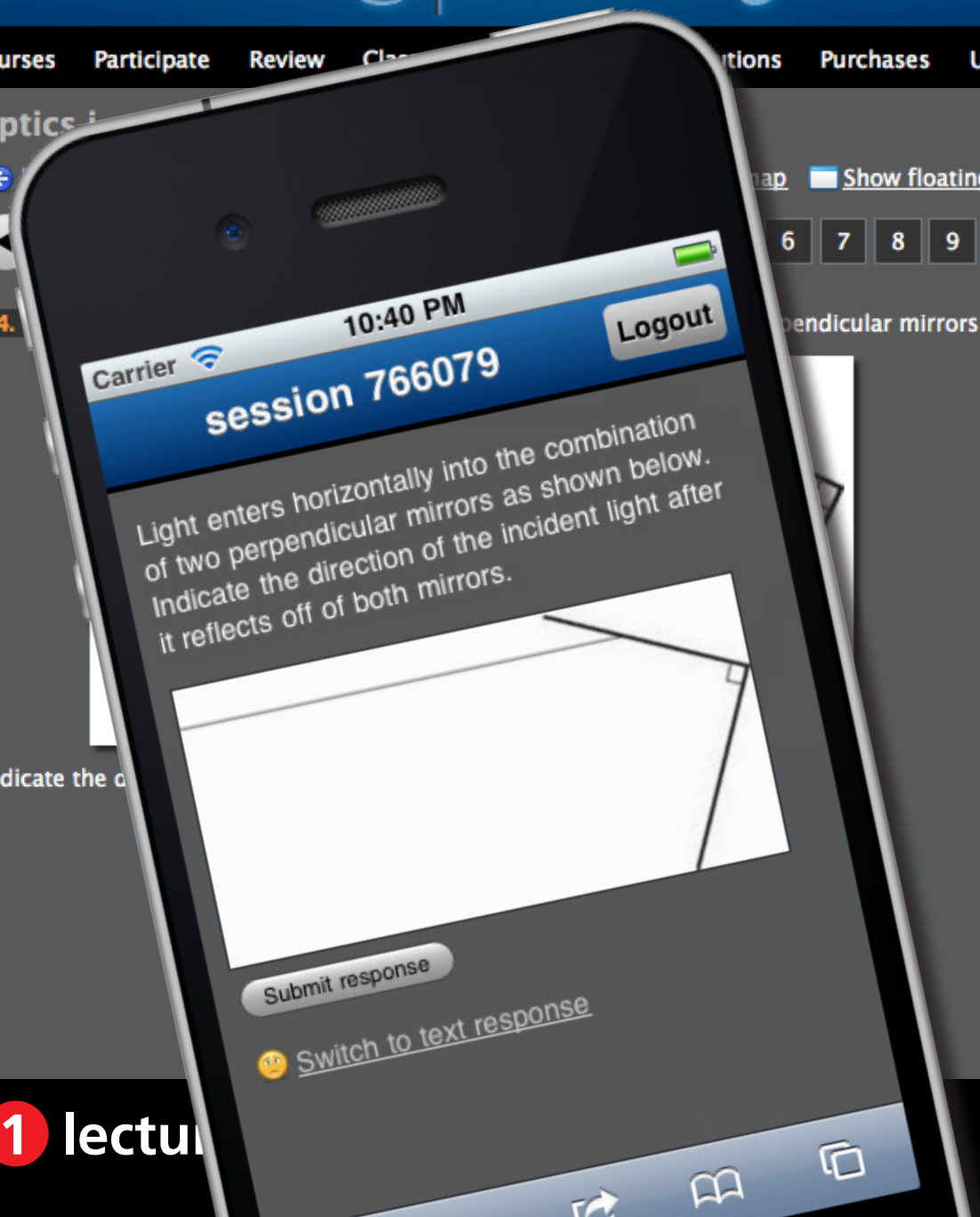

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4.

endicular mirrors as shown below.

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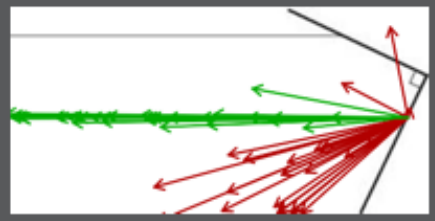
Round 1

57 responses, 58% correct



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6 7 8 9 10 11 12 13 14 15

4.

endicular 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

Indicate the d

feedback & support

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

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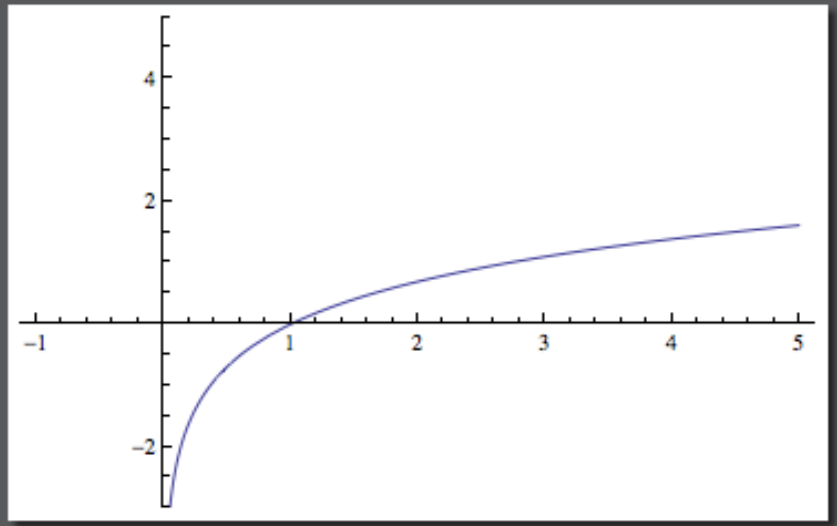
This is a graph of $f(x) = \ln x$. Sketch a graph of the derivative $f'(x)$.



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

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This is a graph of $f(x)$ =
Round 1
15 responses
6 get it now
0 still don't get it
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transformations of parabolas

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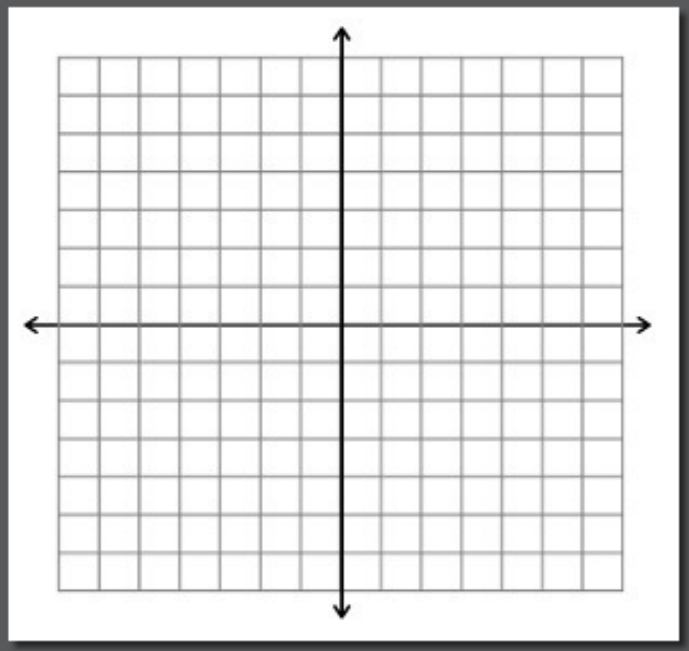
4. sketch Sketch a graph of the function $f(x) = (x-3)^2 + 2$.

Stop delivery | Deliver again | Assign groups | Show all results



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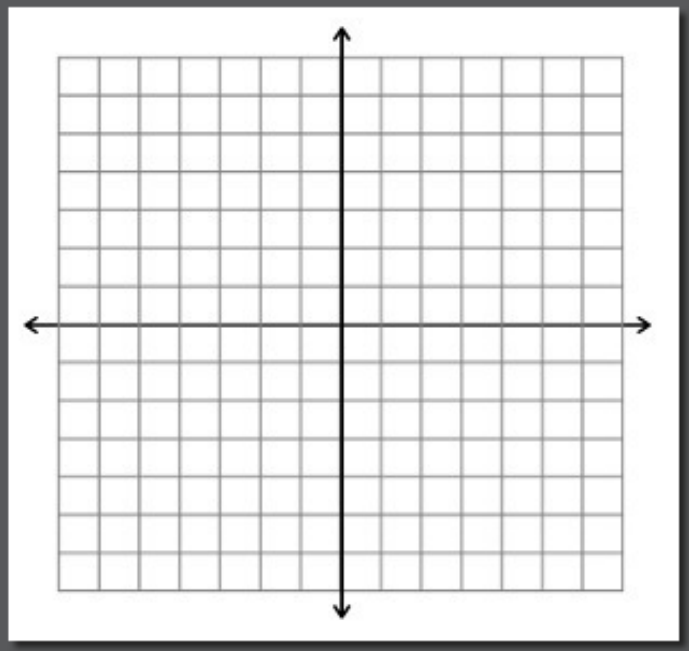
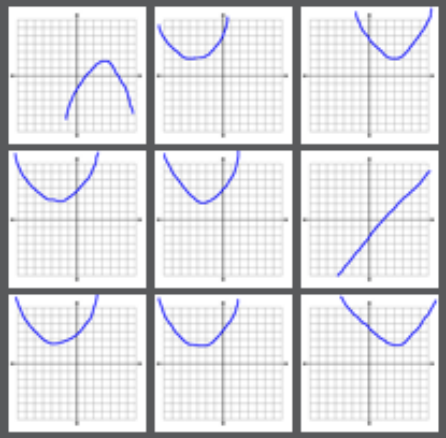


Round 1

9 responses



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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.

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1. highlighting ... ...is Shakespeare sonnet?

Stop delivery Deliver again Assign groups Show all results

For sham
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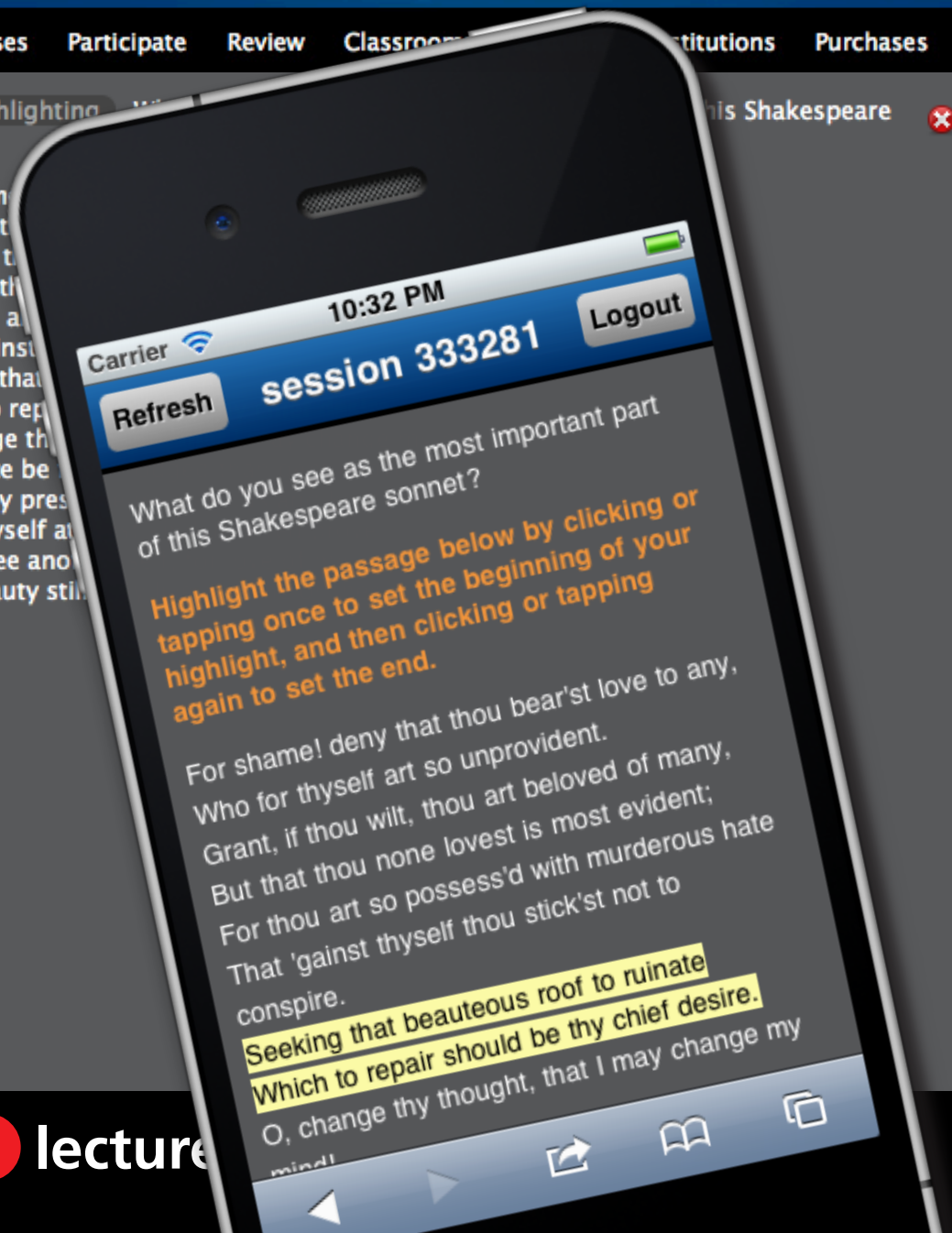

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1. highlighting ... ...is Shakespeare sonnet?

Stop delivery | Deliver again | Assign groups | Show all results

For sham...
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But that th...
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That 'gainst...
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Which to rep...
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Or to thyself a...
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Round 1

3 responses

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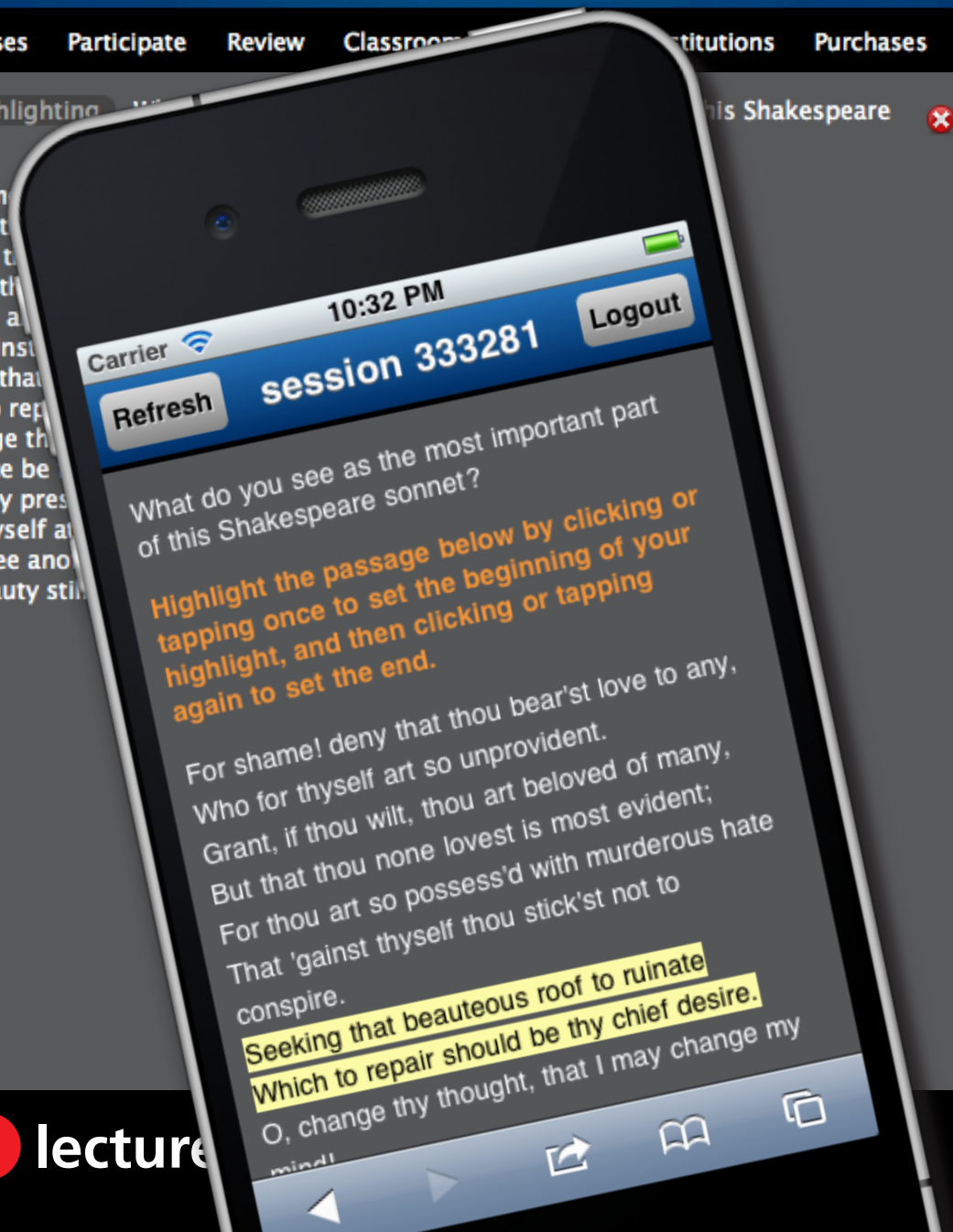

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Sample question types:

- 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

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human interaction

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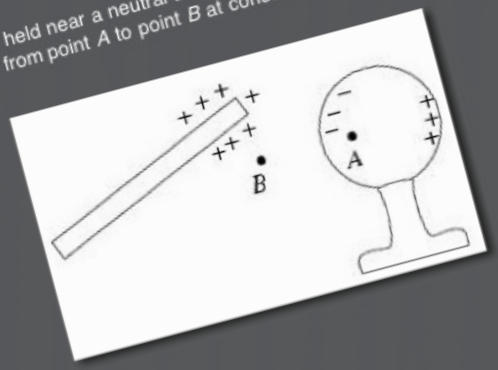
A positively charged rod is held near a neutral conducting sphere as illustrated below. A positively charged particle is moved from point *A* to point *B* at constant speed. The potential difference from *A* to *B* is



A. positive
B. zero
C. negative
D. depends on the path taken from *A* to *B*
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%

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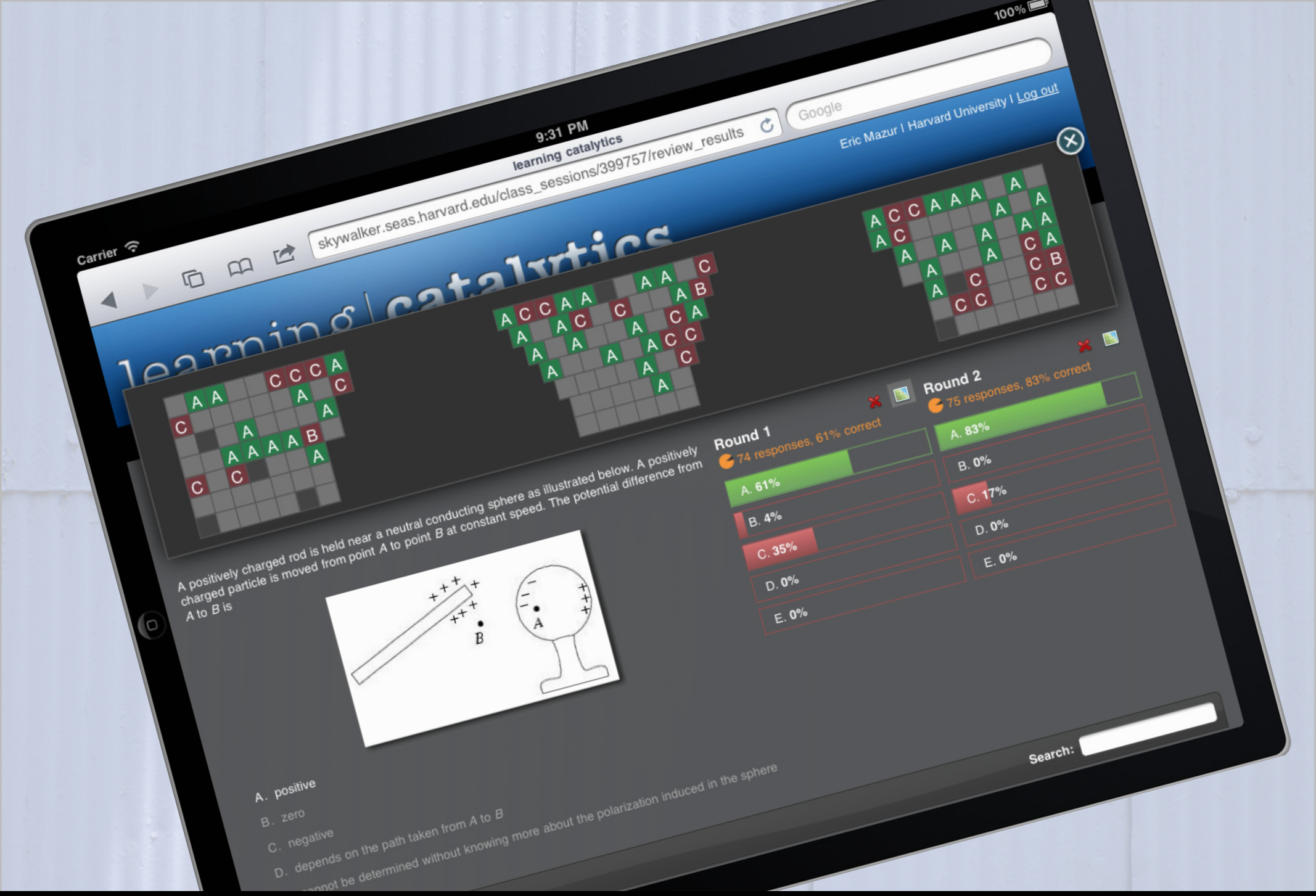

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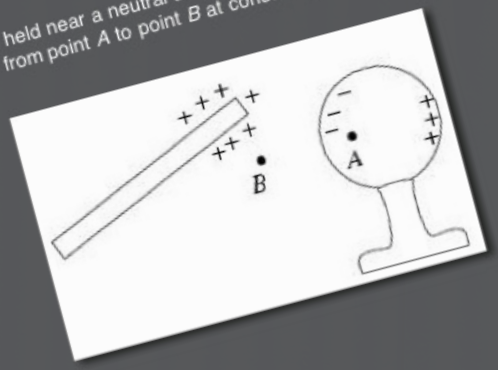

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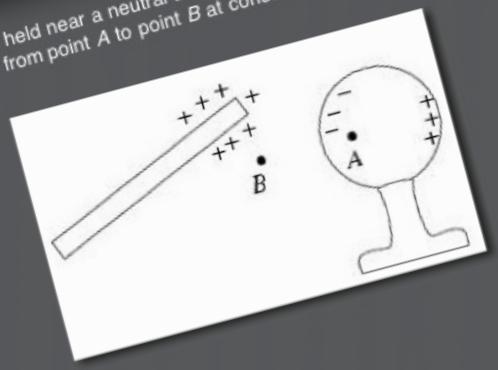

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let system manage pairing

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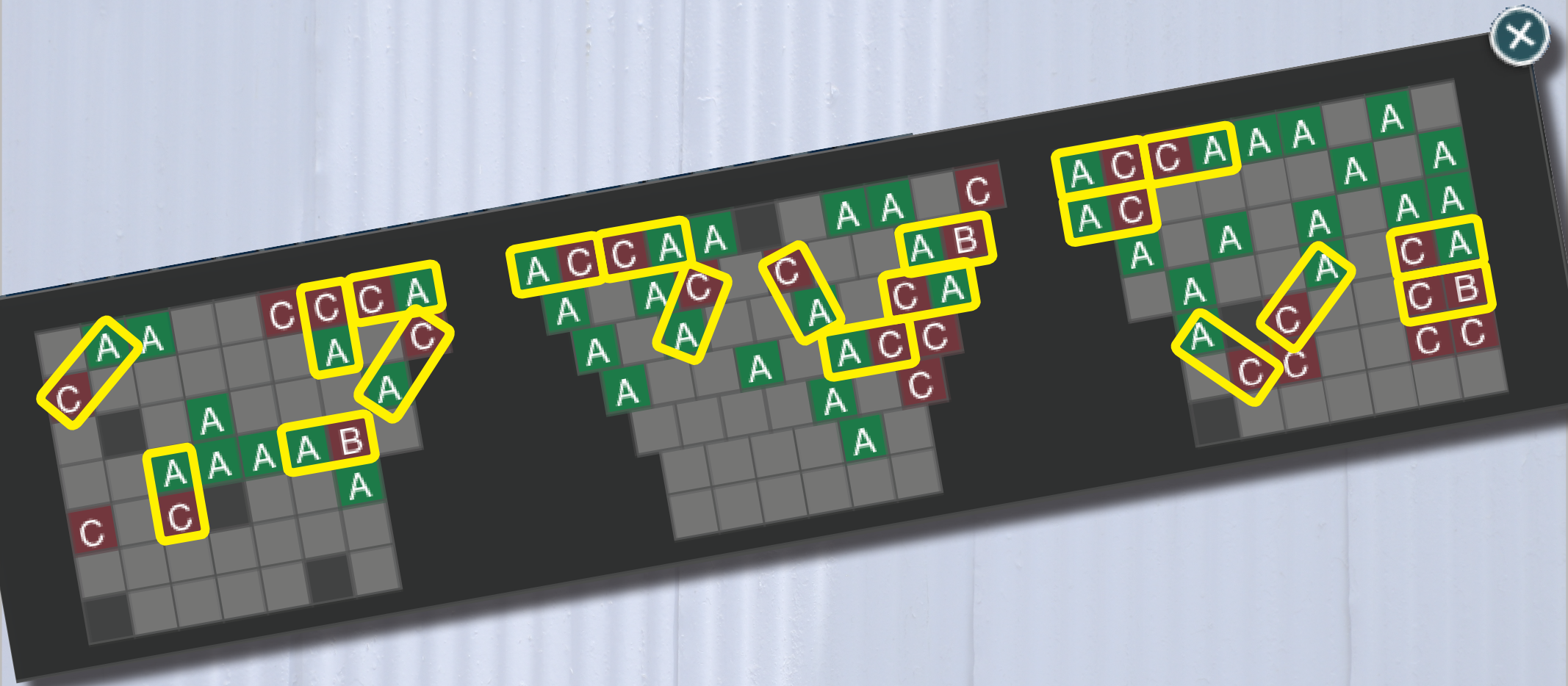

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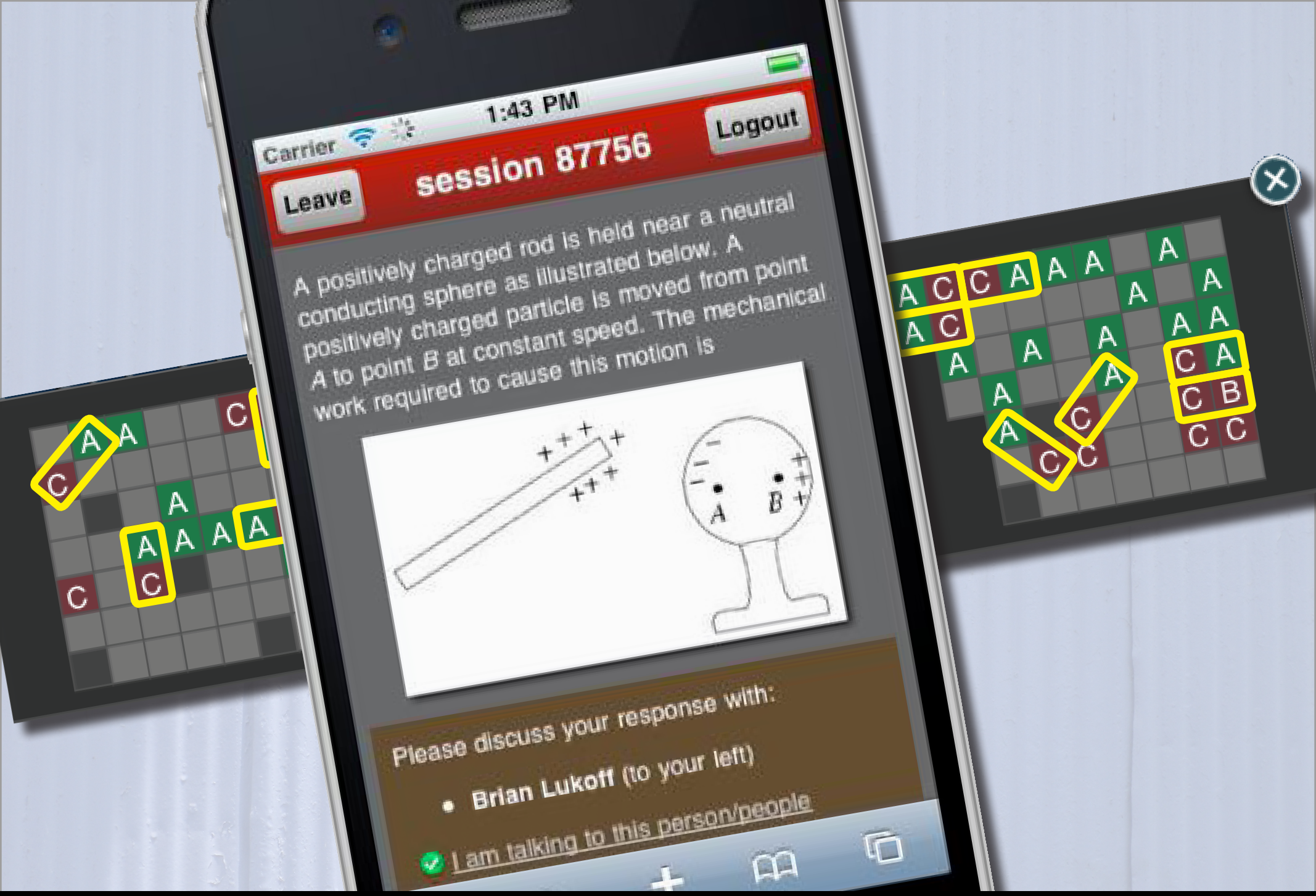

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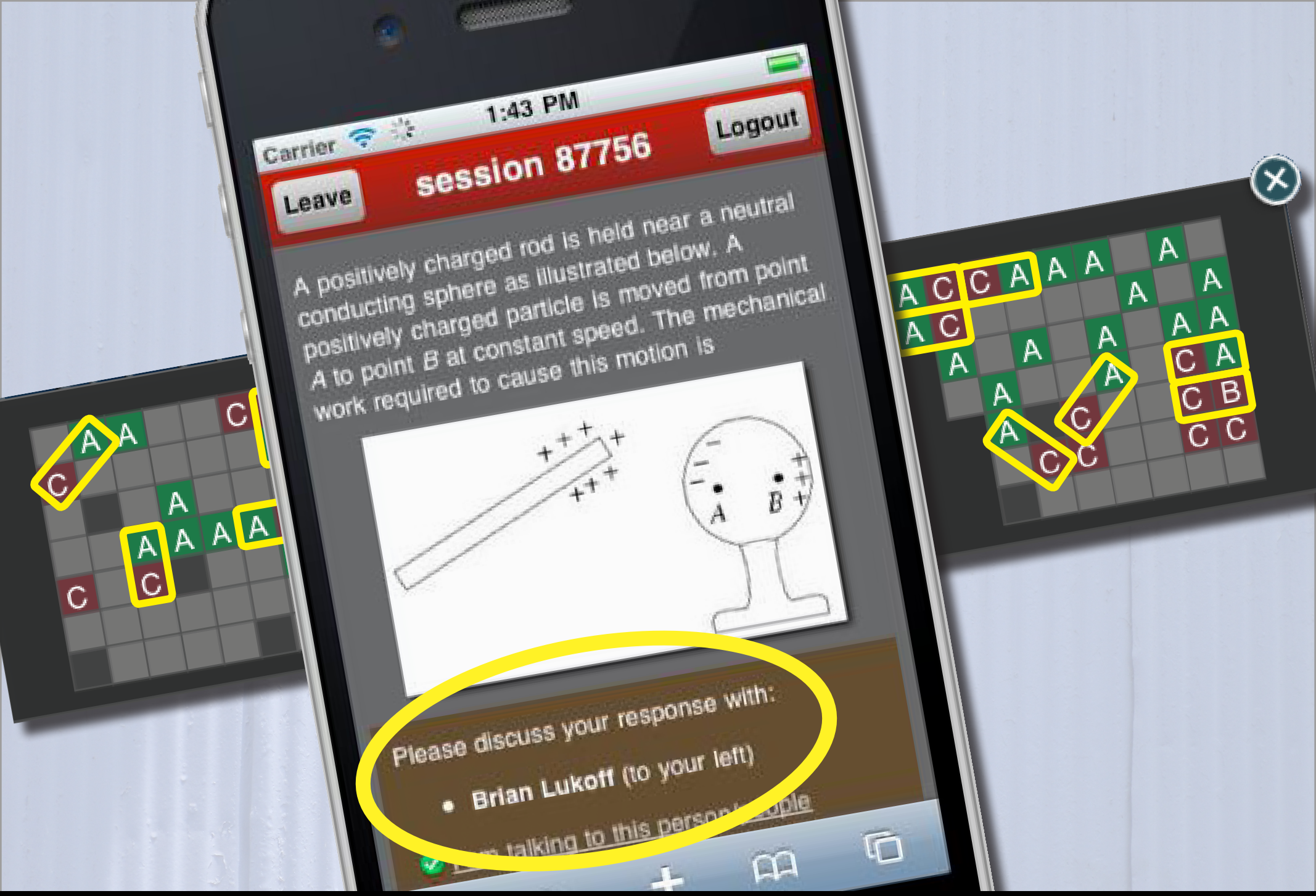

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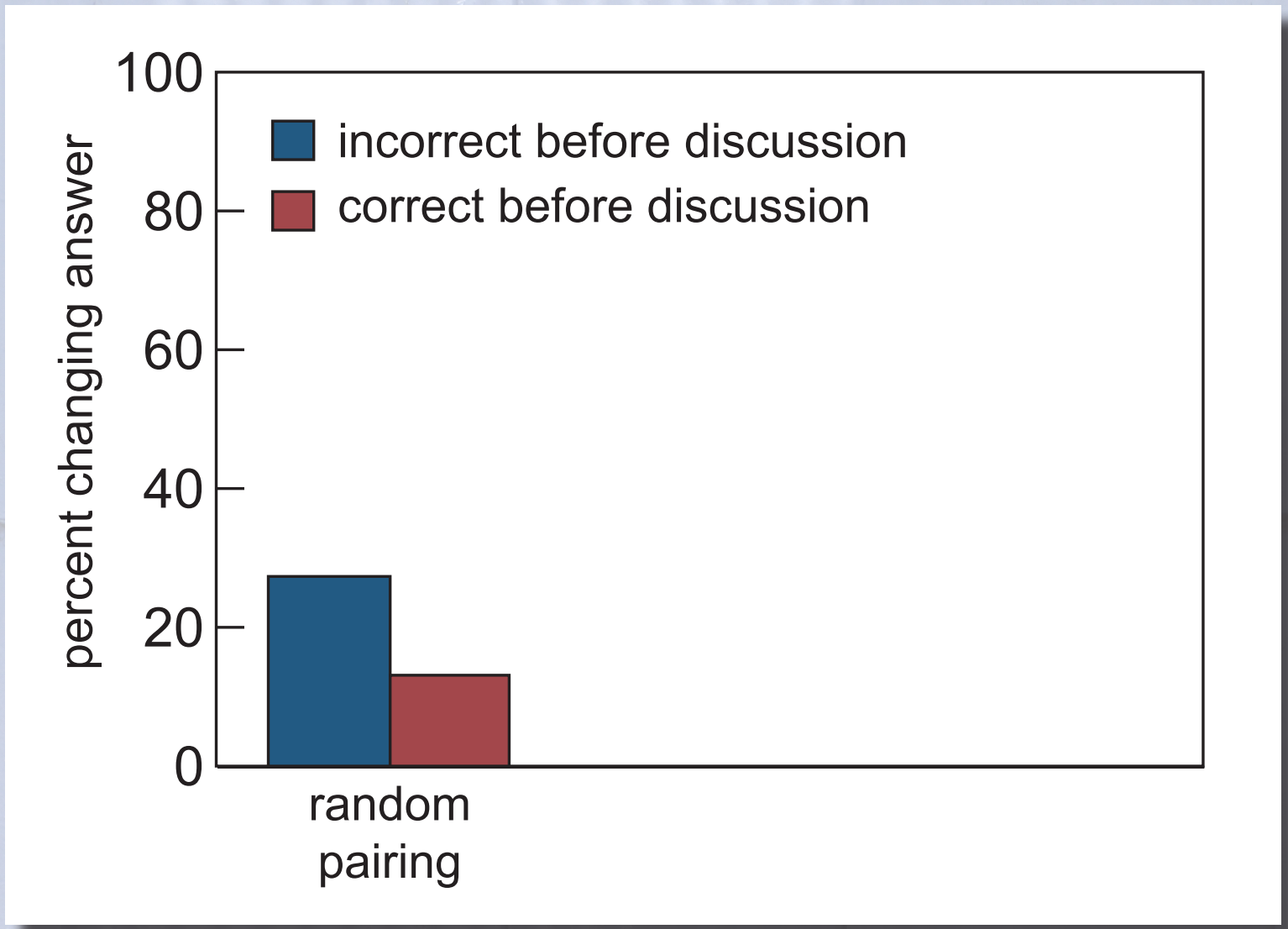

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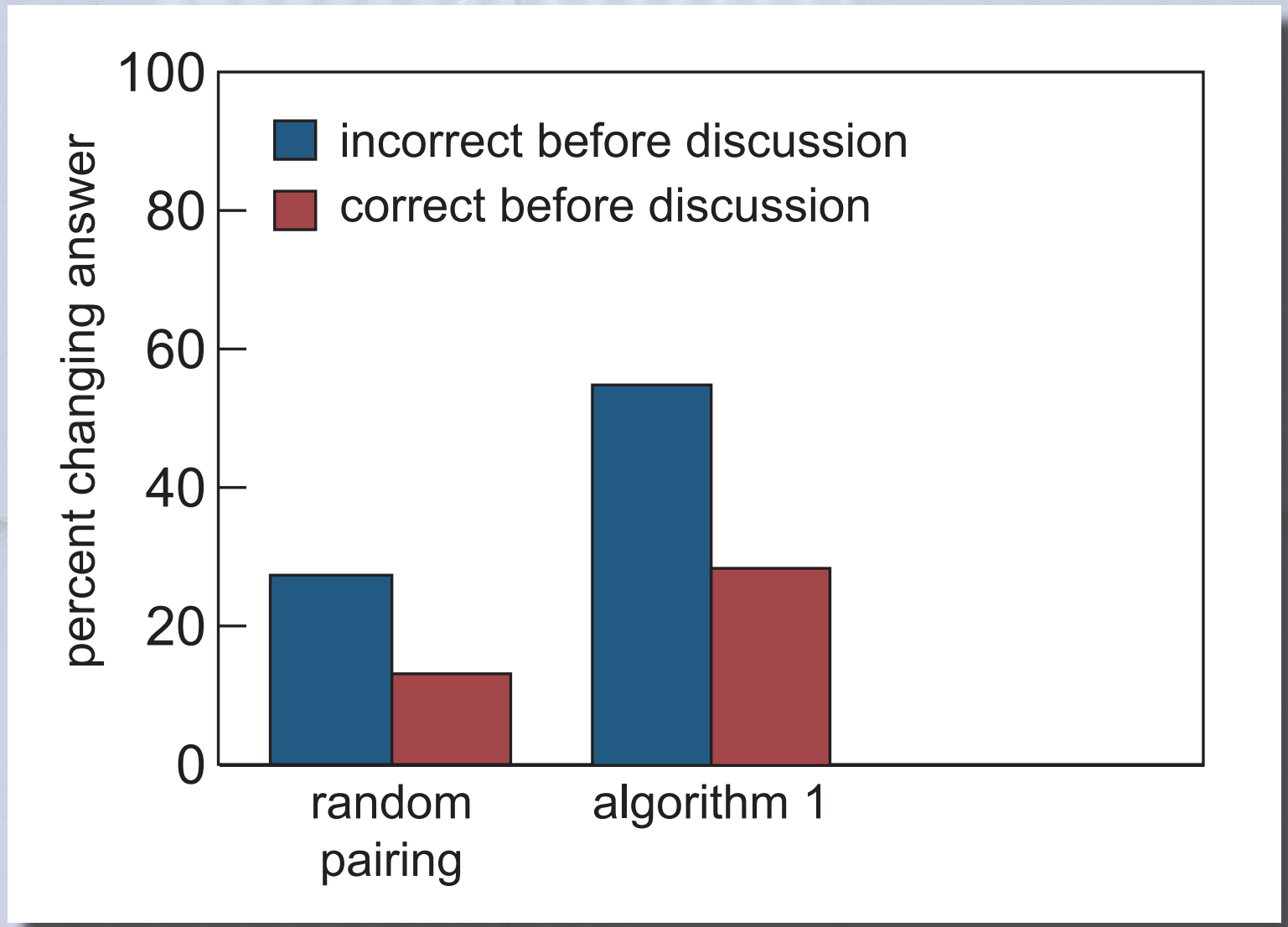

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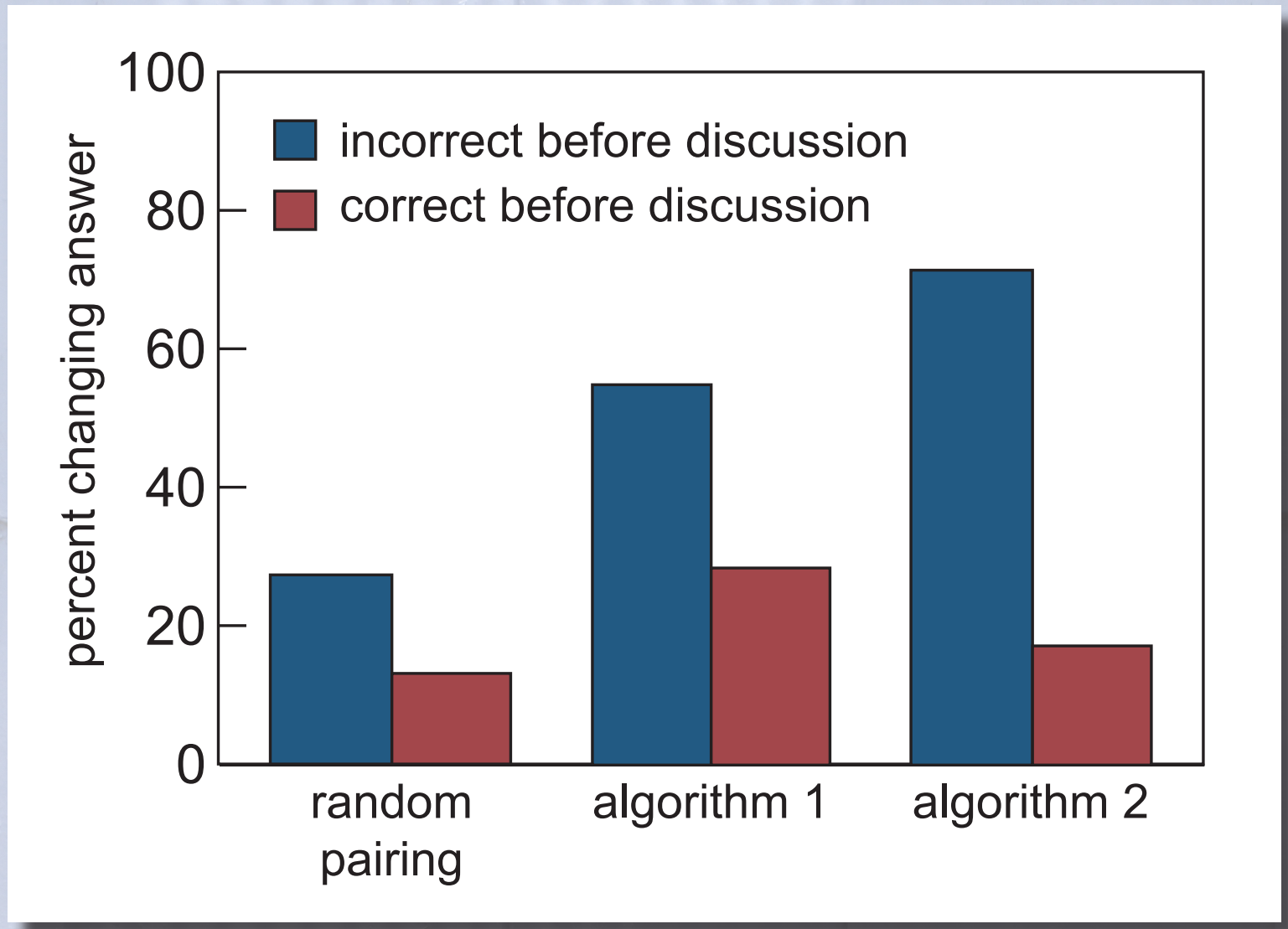

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1 lecture

2 PI

3 PI 2.0

in a lecture, students…

1 lecture

2 PI

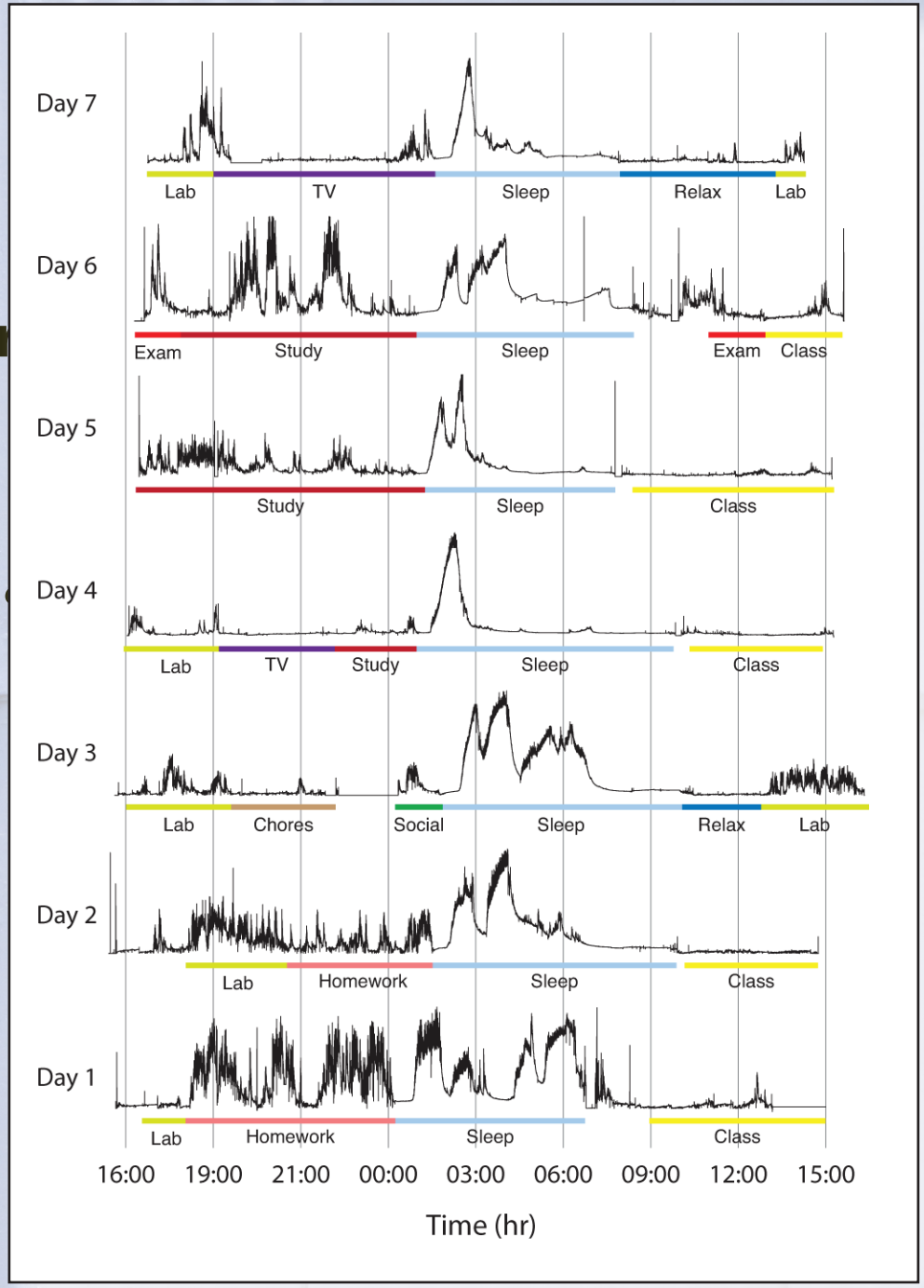
3 PI 2.0

in a lecture, students…

1. don’t pay utmost attention

in a lectur

1. don’t pay utmost



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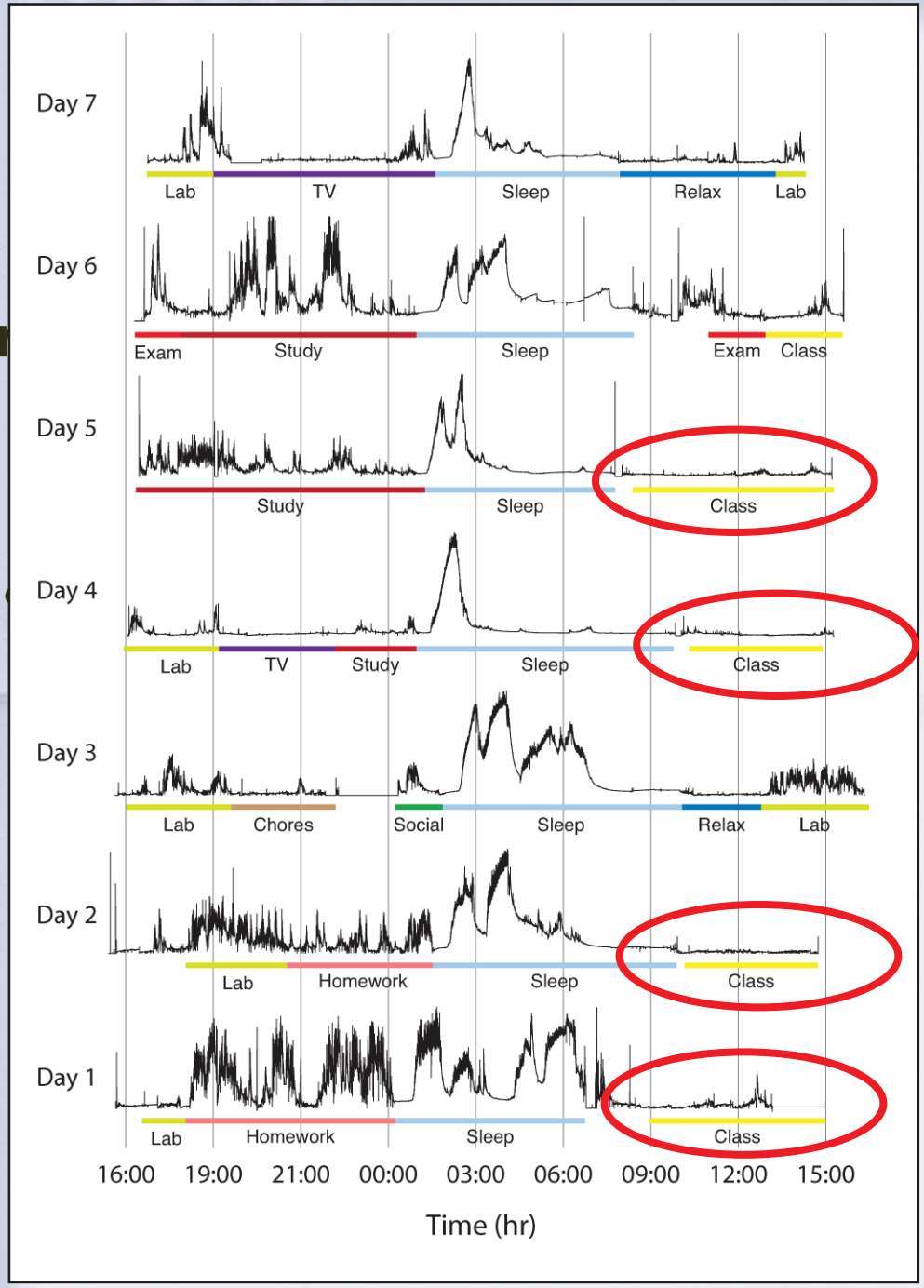
1. don’t pay utmost



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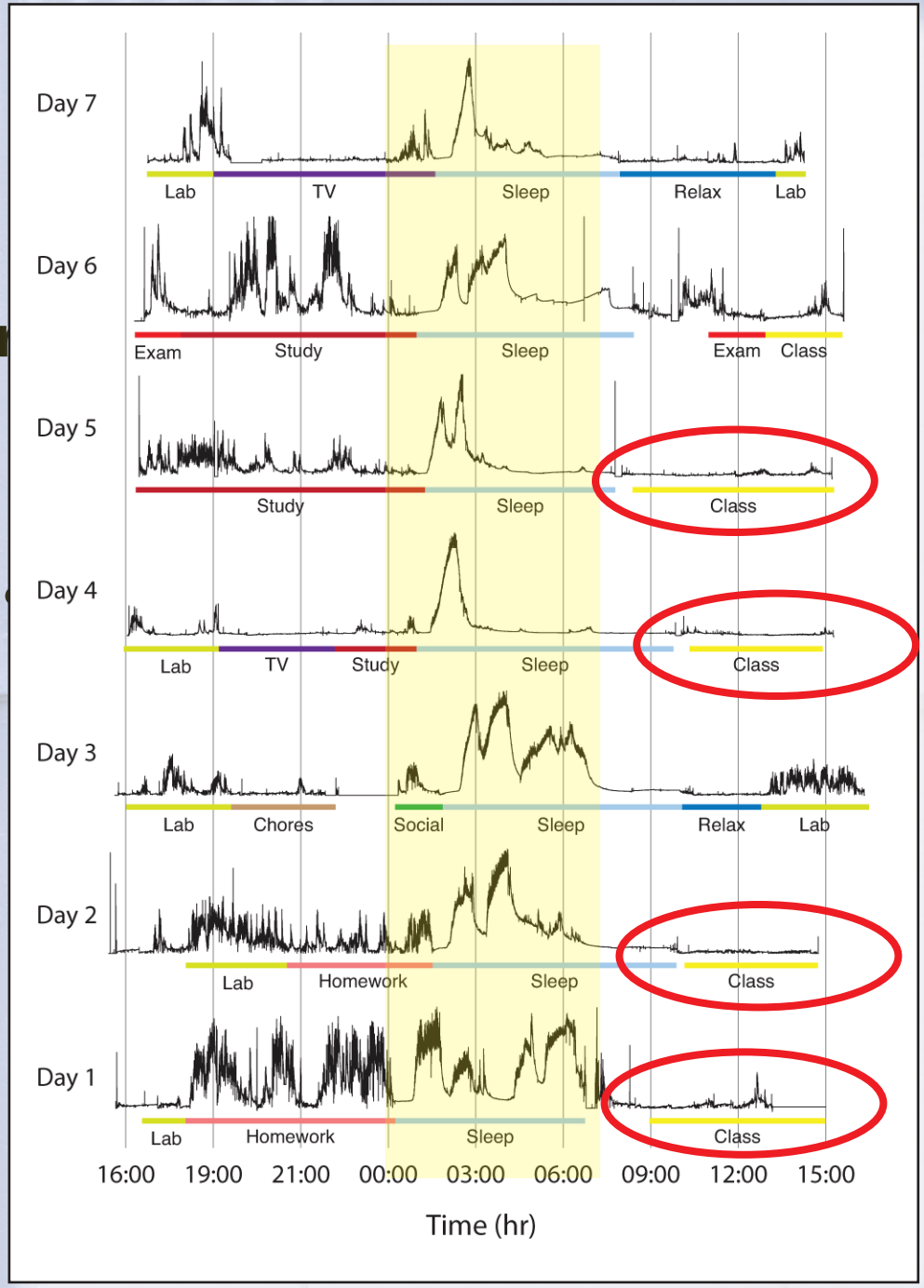

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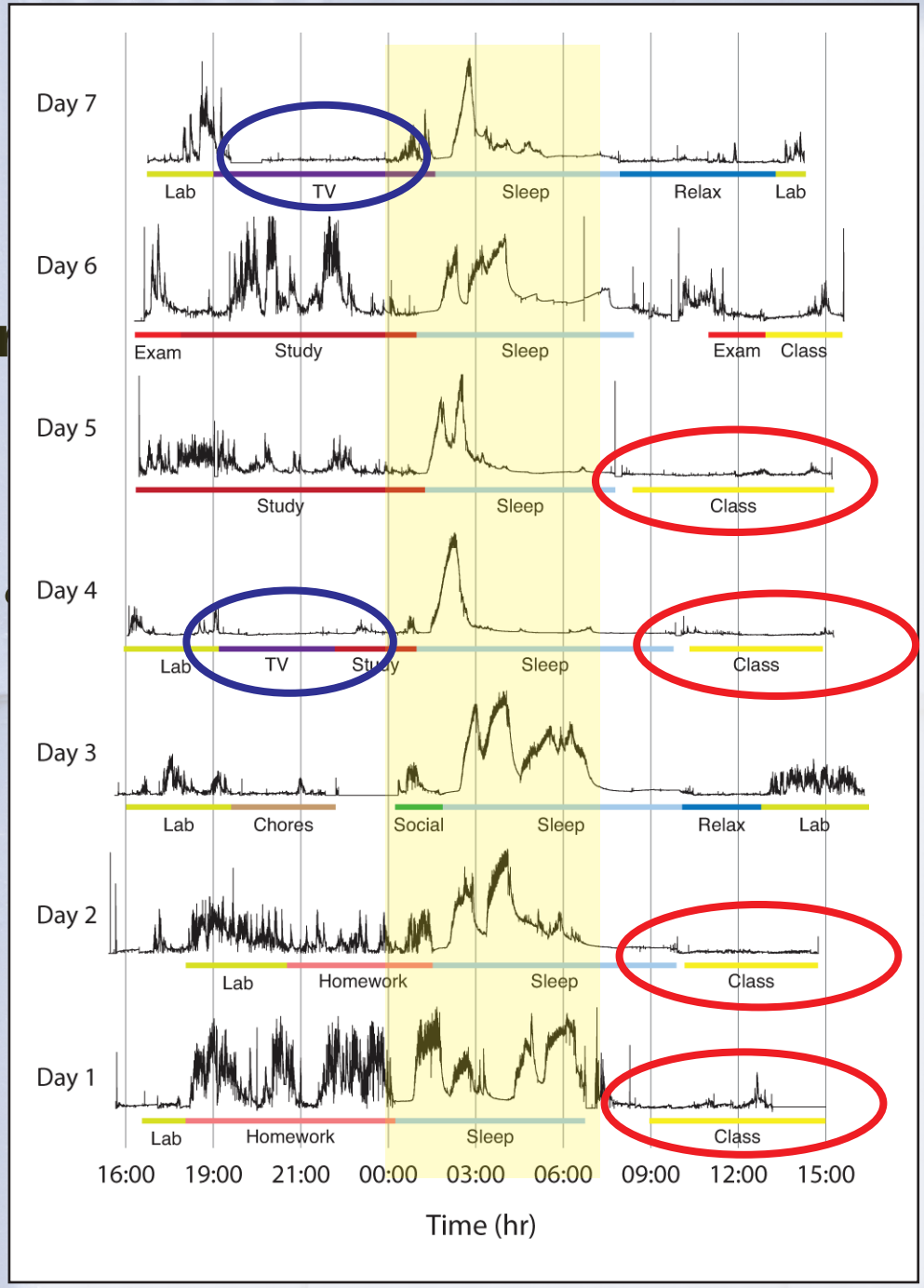
in a lectur

1. don’t pay utmost



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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 lecture 2 PI 3 PI 2.0

1 lecture

2 PI

3 PI 2.0

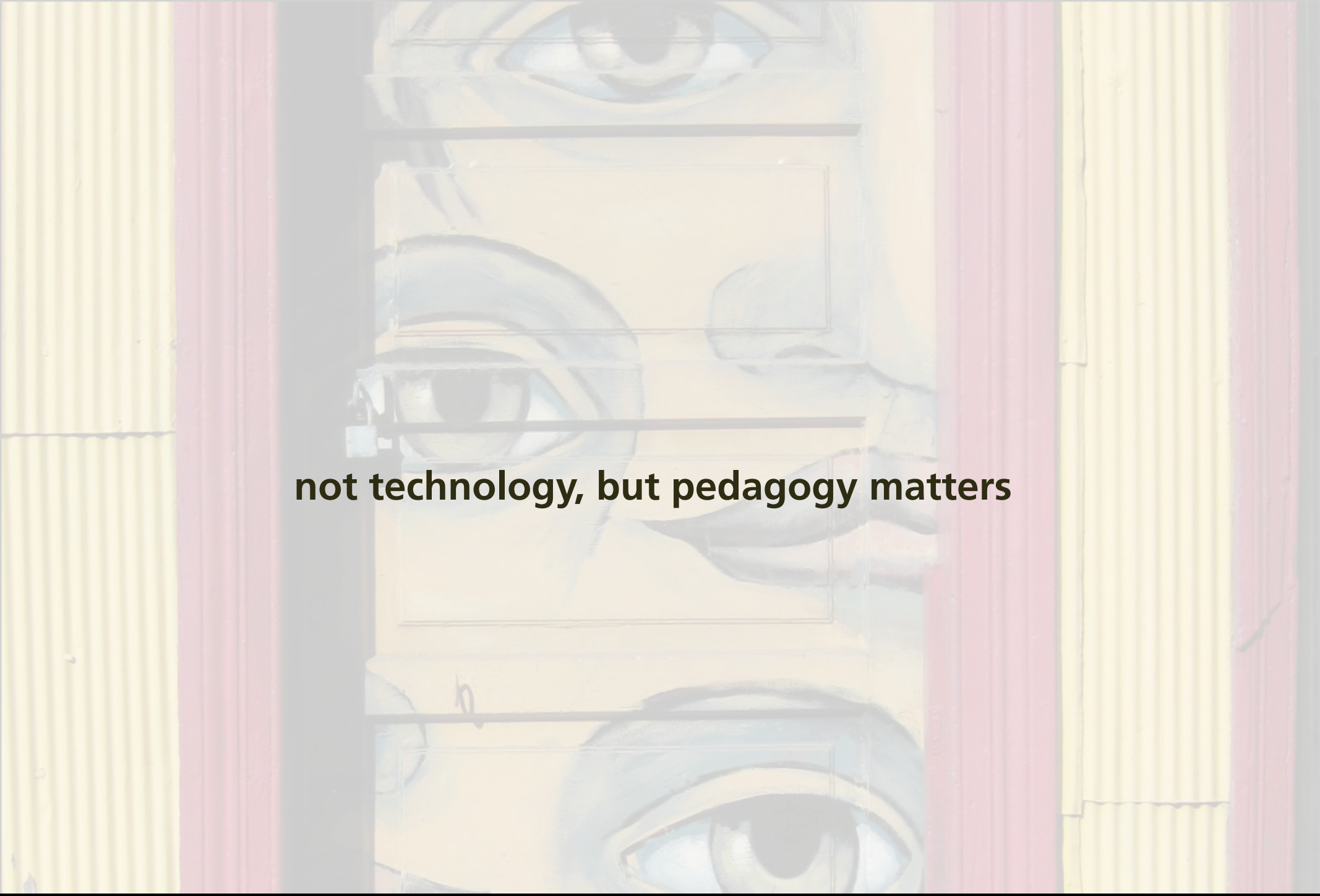
Education is not just about:

- transferring information
- getting students to do what we do

Education is not just about:

- transferring information
- getting students to do what we do

discovery & exploration a must!



not technology, but pedagogy matters

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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*

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