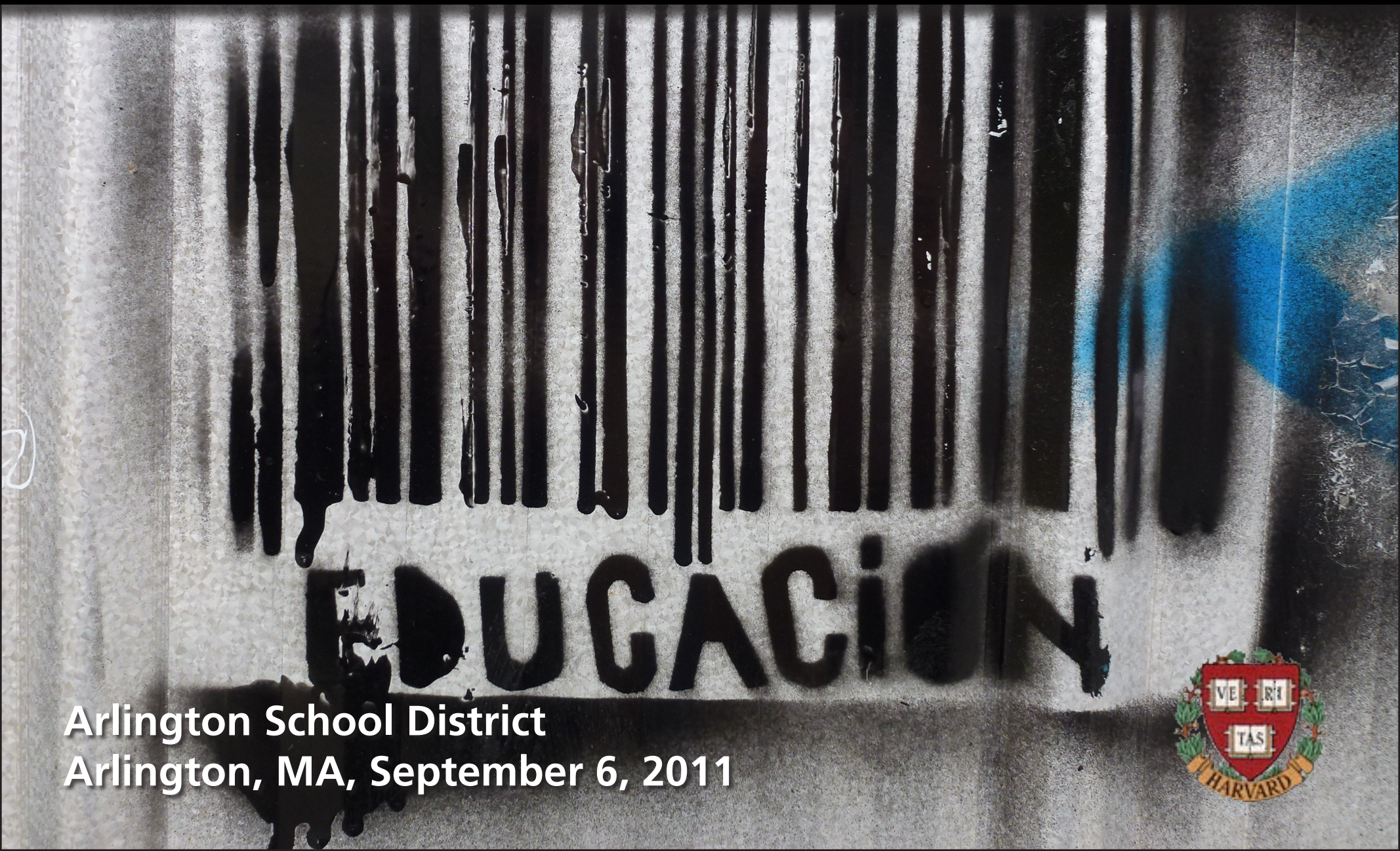


# Catalyzing learning



Arlington School District  
Arlington, MA, September 6, 2011





# Catalyzing learning





# Catalyzing learning



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# Catalyzing learning



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# Catalyzing learning



@eric\_mazur



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EDUCACION



**Think of something you are really good at**

**EDUCACION**



Think of something you are really good at



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Now think how you became good at it



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1 education

2 PI

3 PI 2.0





1 education

2 PI

3 PI 2.0
















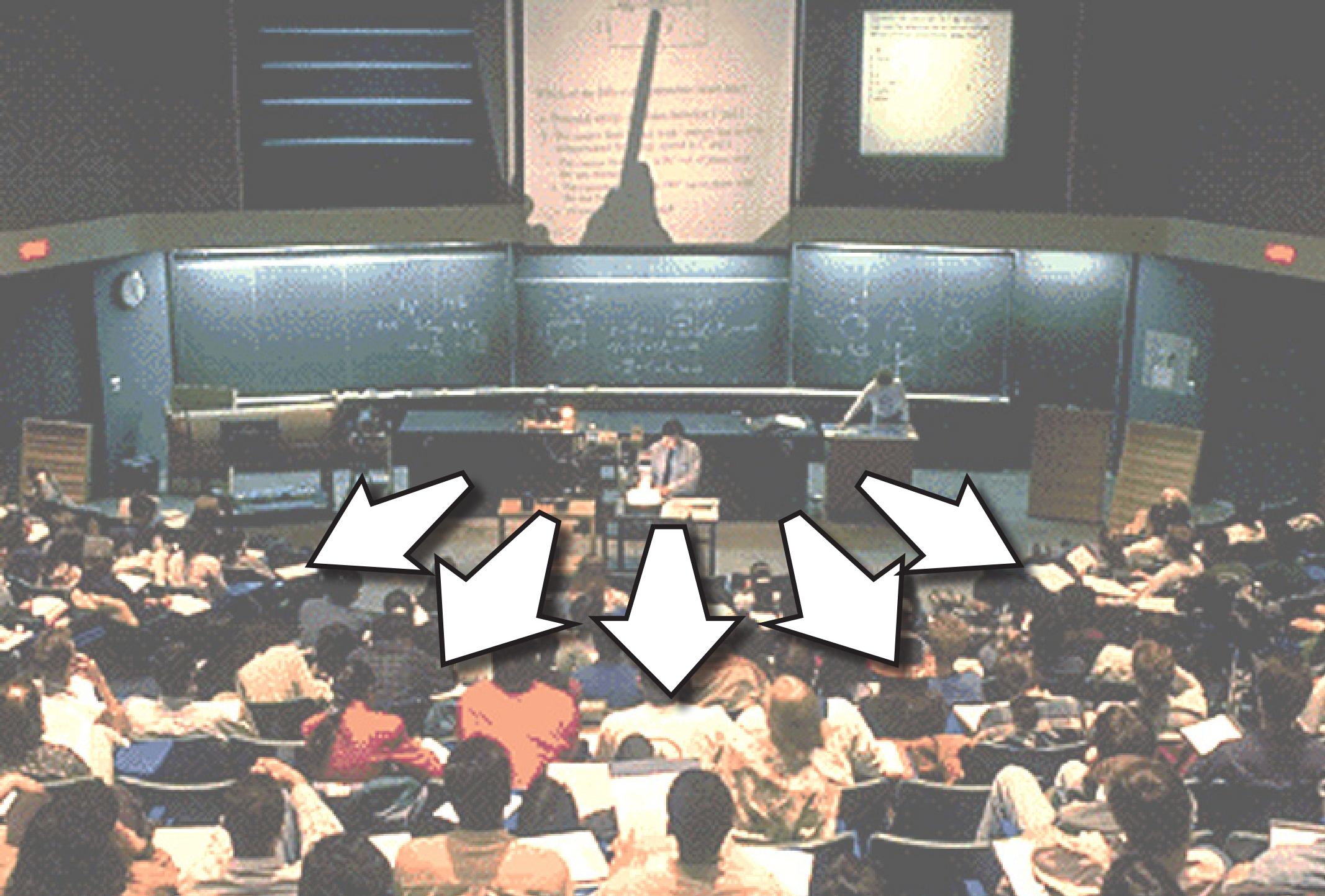


**What happens  
in a lecture?**











The result?

EDUCACION



**Lack of learning**

**EDUCACION**



**Lack of learning**

**Lack of retention**









# 1. transfer of information





**1. transfer of information**

**2. assimilation of that information**





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

**2. assimilation of that information**

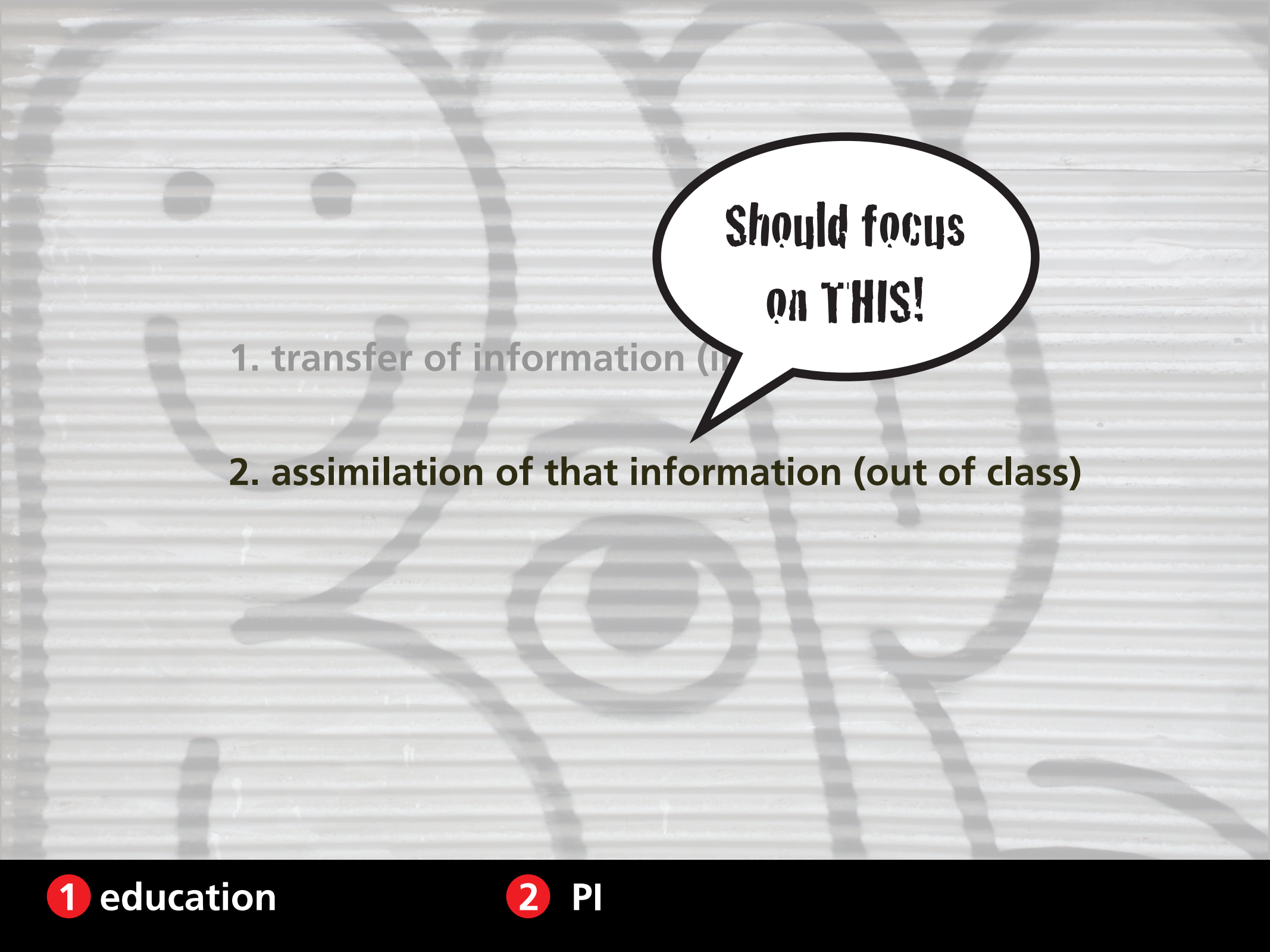




1. transfer of information (in class)

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)





# Peer

1. transfer of information (out of class)

2. assimilation of that information (in class)



question

1 education

2 PI



**question**



**think**



**question**



**think**



**poll**



**question**



**think**



**poll**



**discuss**



**question**



**think**



**poll**



**discuss**



**repoll**



**question**



**think**



**poll**



**discuss**

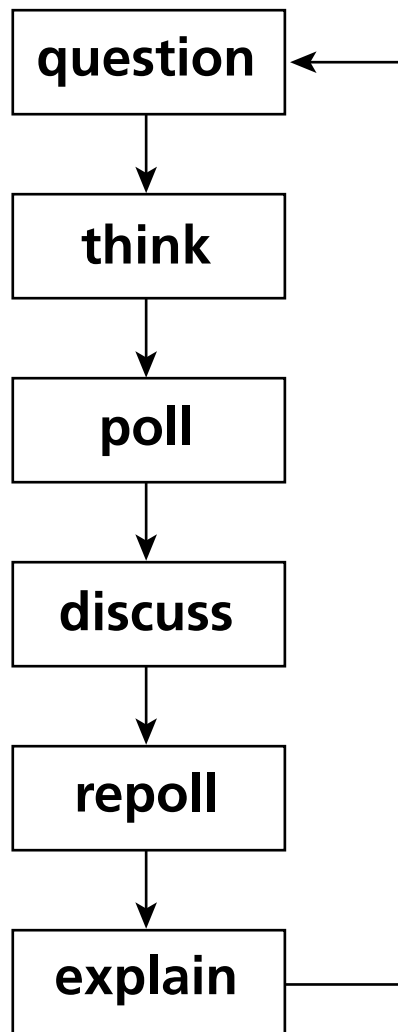


**repoll**

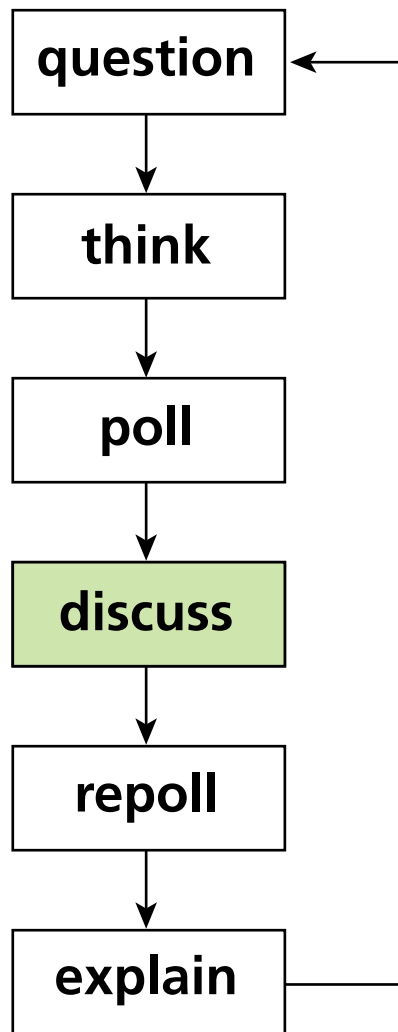


**explain**











**1** education

**2** PI





1 education

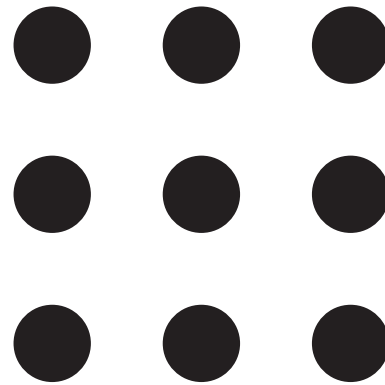
2 PI



An aerial photograph showing a long, wavy metal track, possibly a rail or a drainage channel, laid out on a bed of dark gravel. The track is made of several connected sections, and its wavy shape is a visual metaphor for thermal expansion. The surrounding area is green grass. The text "thermal expansion" is overlaid in the center of the image.

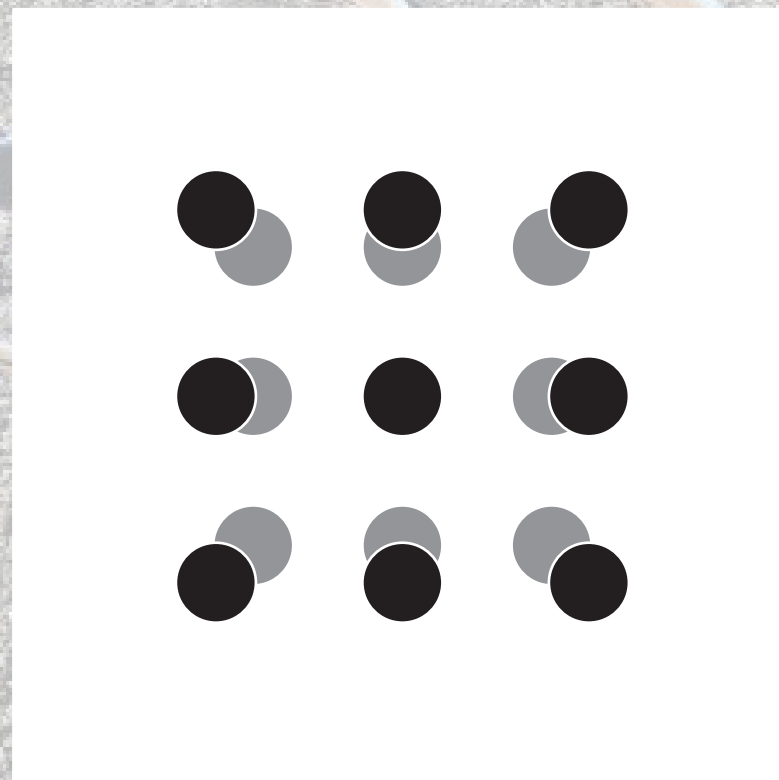
**thermal expansion**





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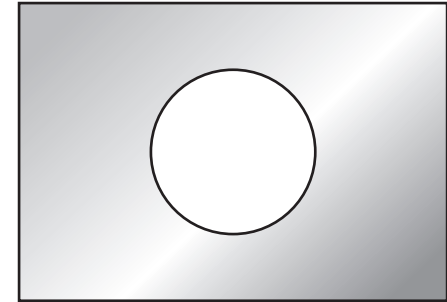
**all of them**



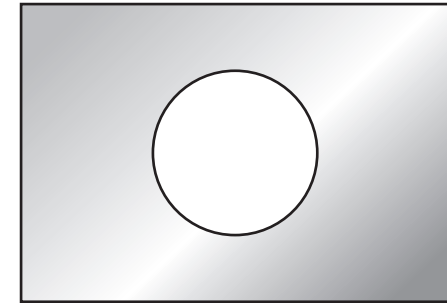
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**Consider a rectangular metal plate  
with a circular hole in it.**



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

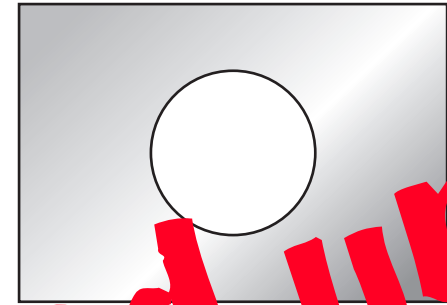


**When the plate is uniformly heated, the diameter of the hole**

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



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

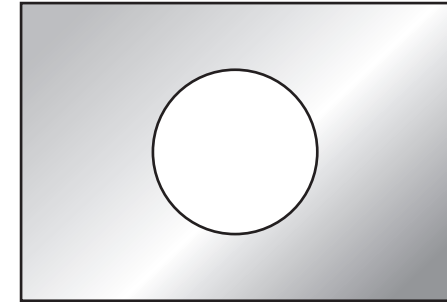


When the plate is uniformly heated, the diameter of the hole

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

**you got all fired up!**

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

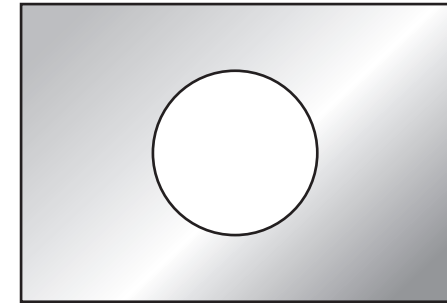


**When the plate is uniformly heated, the diameter of the hole**

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



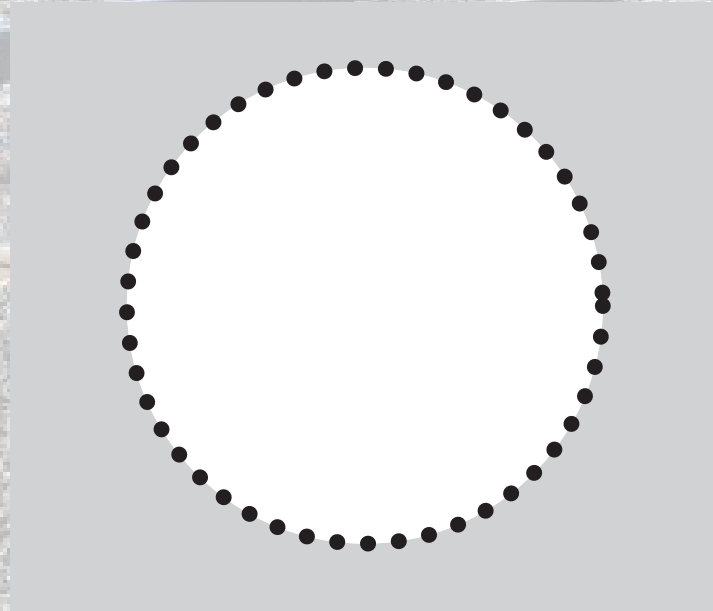
**Consider a rectangular metal plate with a circular hole in it.**



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

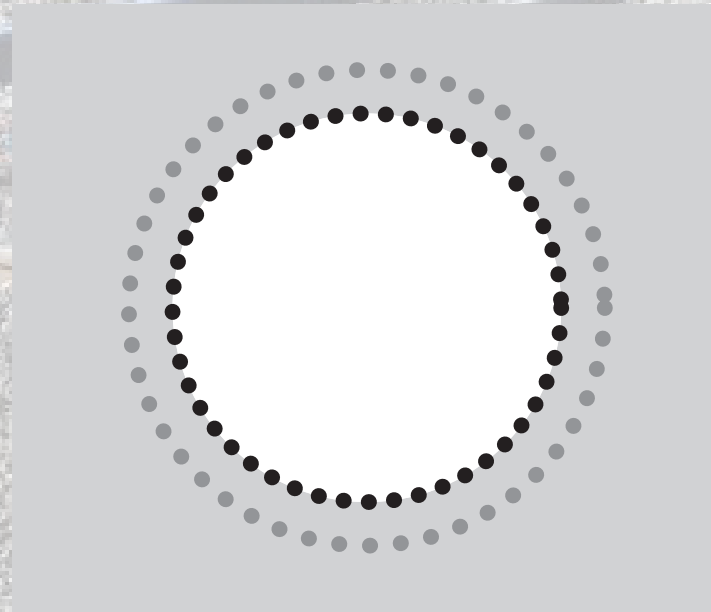
- 1. increases. ✓**
- 2. stays the same.
- 3. decreases.

consider atoms at rim of hole

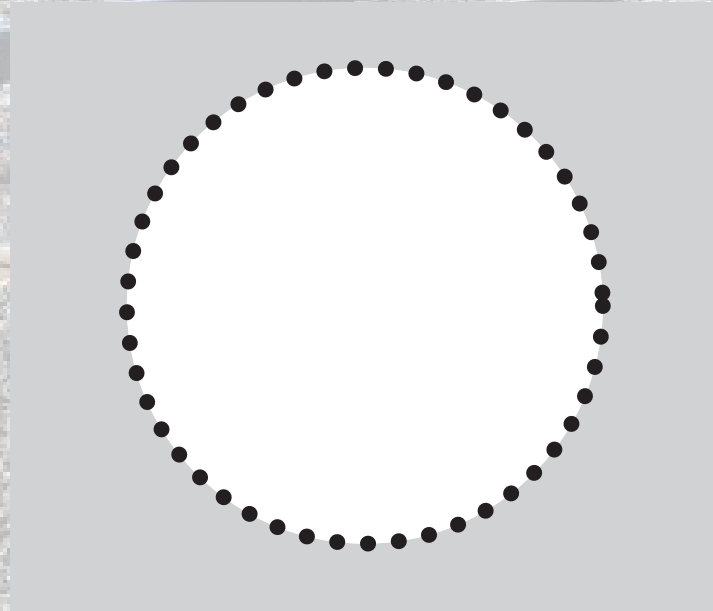




consider atoms at rim of hole

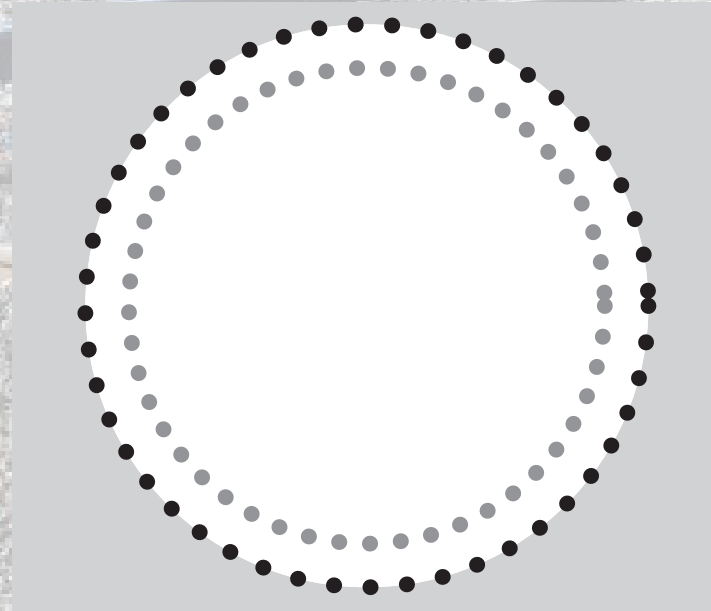


consider atoms at rim of hole





consider atoms at rim of hole



consider atoms at rim of hole

you won't forget this

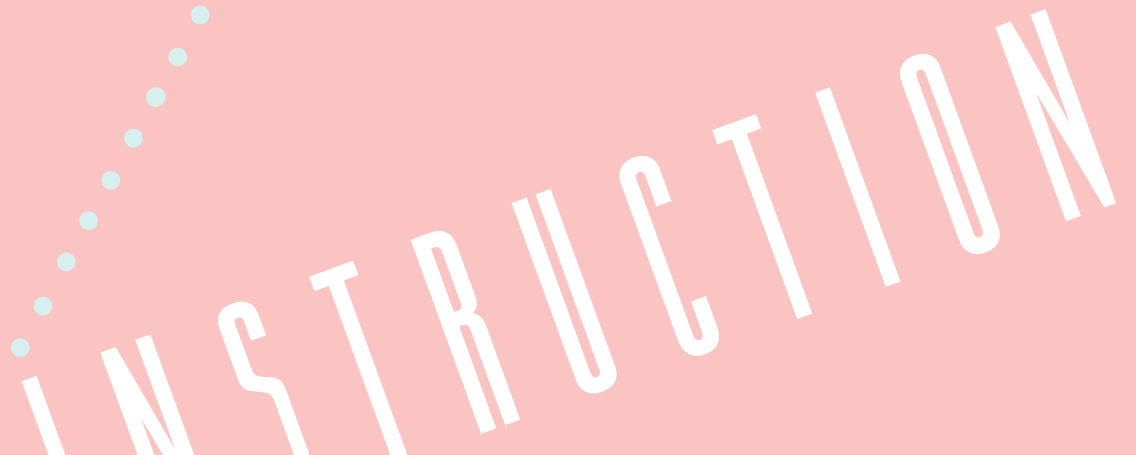




Peer



back to PI



INSTRUCTION

1 education

2 PI



Peer

INSTRUCTION

1 education

2 PI



Peer  
Higher learning gains



1 education

2 PI

The background features a large, light blue word 'Peer' with a dashed yellow line and arrows forming a circular path around it. Below this, the words 'Higher learning gains' and 'Better retention' are written in a bold, red, sans-serif font, slanted upwards from left to right. At the bottom, the word 'INSTRUCTION' is written in a large, white, sans-serif font, also slanted upwards. The overall background is a solid light red color.

**Higher learning gains**

**Better retention**

**INSTRUCTION**





**1** education

**2** PI

**3** PI 2.0



**feedback**

**1** education

**2** PI

**3** PI 2.0





1991

1 education

2 PI

3 PI 2.0



1 education

2 PI

3 PI 2.0





1998

1 education

2 PI

3 PI 2.0



1 education

2 PI

3 PI 2.0





1 education

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**
- 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 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, an individual would need all but which of the following:
- a. business model
  - b. depreciation?



## extensible plug-in architecture for question types

## 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



## Sample question types:

- direction
- expression
- long answer, short answer, word cloud (fill in text)
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- ranking
- region (select point on image)
- sketch



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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 &amp; support

**1** education**2** PI**3** PI 2.0

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pendicular mirrors as shown below.

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

Light enters horizontally into the combination of two perpendicular mirrors as shown below. Indicate the direction of the incident light after it reflects off of both mirrors.

[Submit response](#)[Switch to text response](#)[feedback & support](#)



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optics i

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6 7 8 9 10 11 12 13 14 15



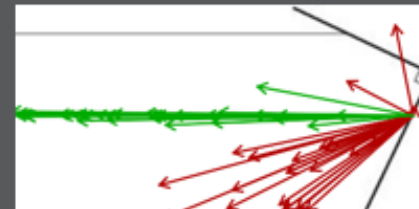
perpendicular mirrors as shown below.

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

Round 1



57 responses, 58% correct



feedback &amp; support

1 educa

3 PI 2.0

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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

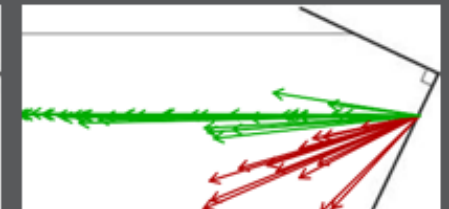
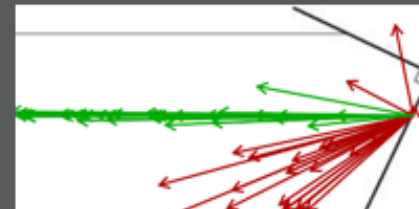


57 responses, 58% correct

Round 2



51 responses, 73% correct



✓ 8 get it now

✗ 0 still don't get it



feedback &amp; support



## 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

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**5.** region Where is Tanzania?[✖ Stop delivery](#) [🔄 Deliver again](#) [👥 Assign groups](#) [📊 Show all results](#)

feedback &amp; support

**1** education**2** PI**3** PI 2.0



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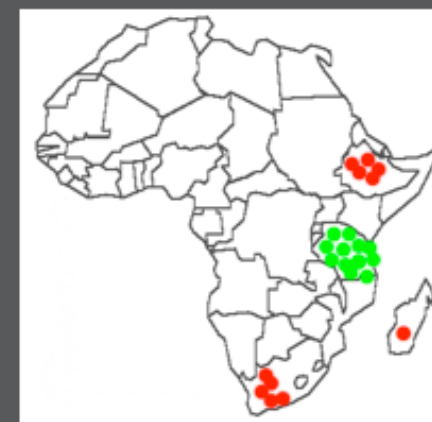


5. region Where is Tanzania?

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

Round 1

24 responses, 75% correct



feedback &amp; support

1 education

2 PI

3 PI 2.0

## 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



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1

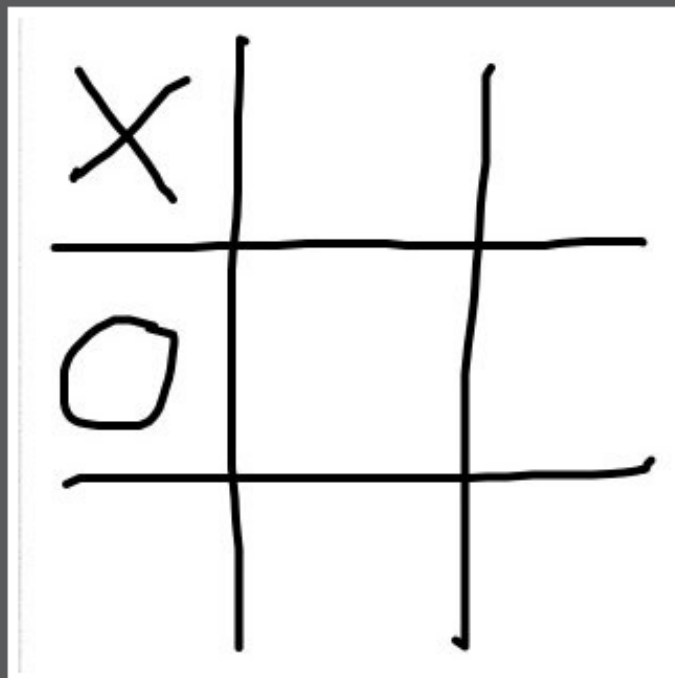
2

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4. region It's X's turn -- what's the best next move?

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feedback &amp; support

**1** education**2** PI**3** PI 2.0

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1

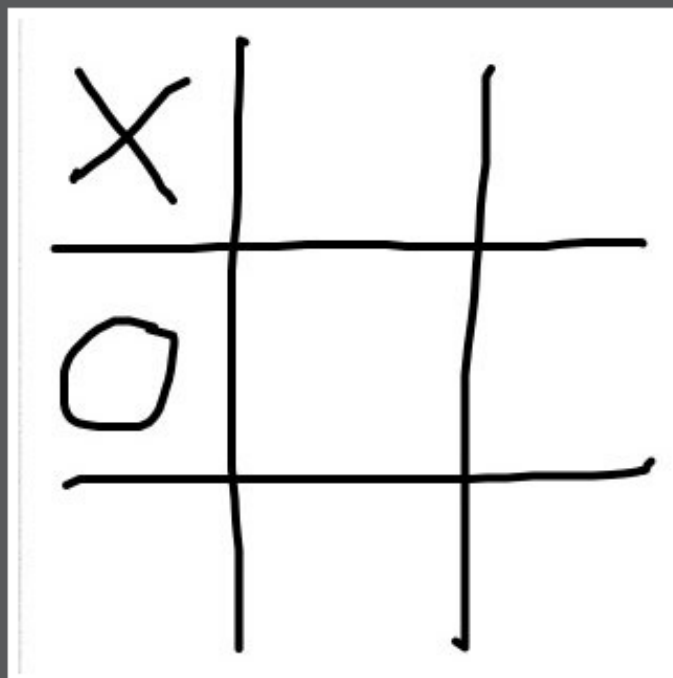
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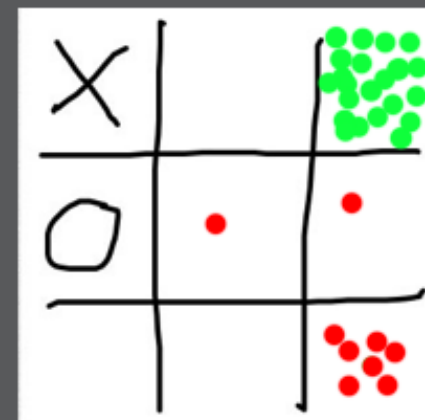


4. region It's X's turn -- what's the best next move?

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

Round 1

31 responses, 71% correct



feedback &amp; support

1 education

2 PI

3 PI 2.0



## Sample question types:

- direction
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- long answer, short answer, word cloud (fill in text)
- multiple-choice, many-choice
- numerical (enter a number)
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6. numerical 7 + 13 = ?

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**1** education**2** PI**3** PI 2.0



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6. numerical  $7 + 13 = ?$



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6. numerical 7 + 13 = ?

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6

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## Round 1

28 responses, 50% correct

6: 7%

13: 29%

20: 50%

21: 14%

[feedback & support](#)



## 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

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## transformations of parabolas

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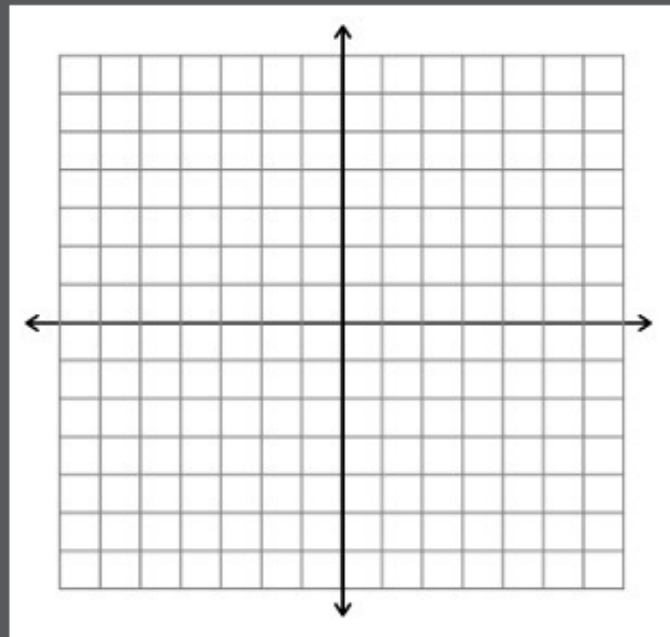
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**4.** sketch Sketch a graph of the function  $f(x) = (x - 3)^2 + 2$ .[✖ Stop delivery](#) [🔄 Deliver again](#) [👥 Assign groups](#) [📊 Show all results](#)**1** education**2** PI**3** PI 2.0



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## transformations of parabolas

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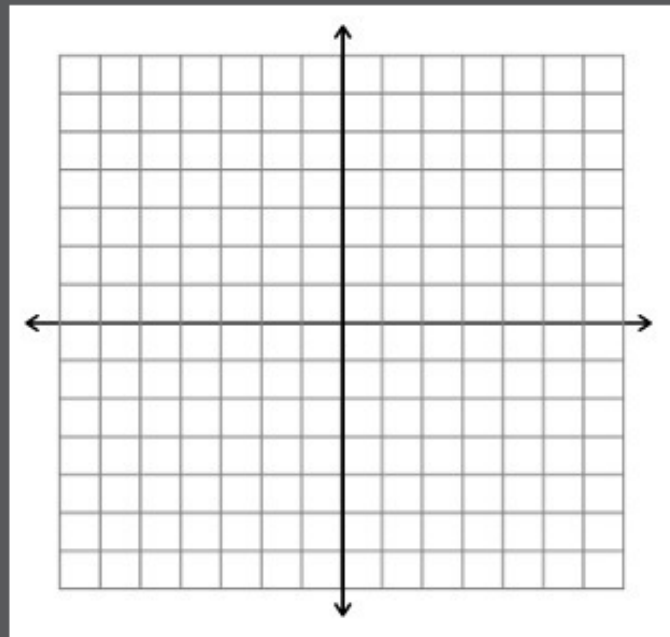
Jump to ▼

1

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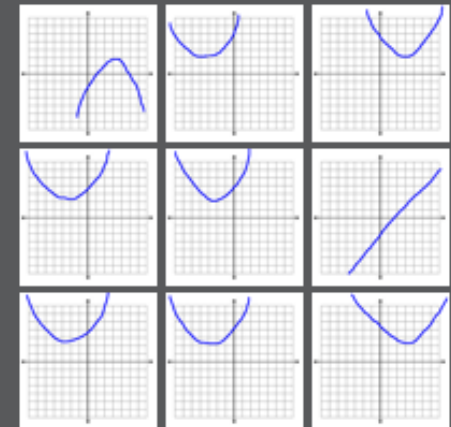
3

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

## Sample question types:

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





**1** education

**2** PI

**3** PI 2.0





**the future is here!**

**1** education

**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**

**1** education

**2** PI

**3** PI 2.0

**Funding:**

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