

Flipping the STEM Classroom: How to turn your students' worlds right side up



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5

4

3

2

1

After taking this workshop you will be able to explain the following to a colleague!

1. Why should I flip my class?
2. What is a flipped classroom?
3. What are innovative ways to engage my students outside of class?
4. What are innovative ways to engage my students in class?
5. What do I do next?

1

Why should I flip my class?

Think of something you are very good at, something you know you do well and write that down.

How did you get good at that
something?

Also jot that down.

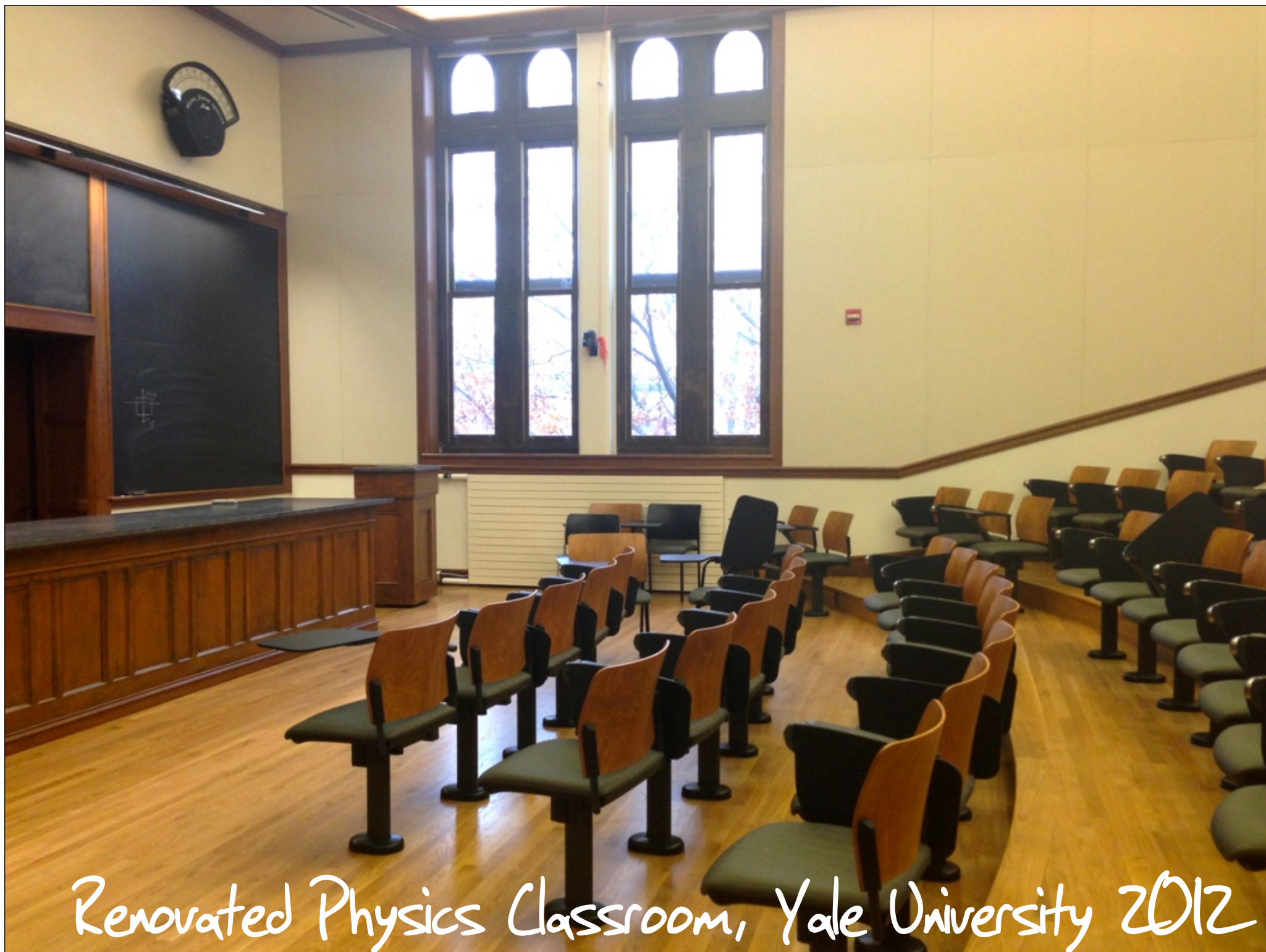
Which option best matches how you got good at it?

- A. listening to someone else talk
- B. practice or trial & error
- C. taught myself
- D. other

What is the model of education in most classrooms?

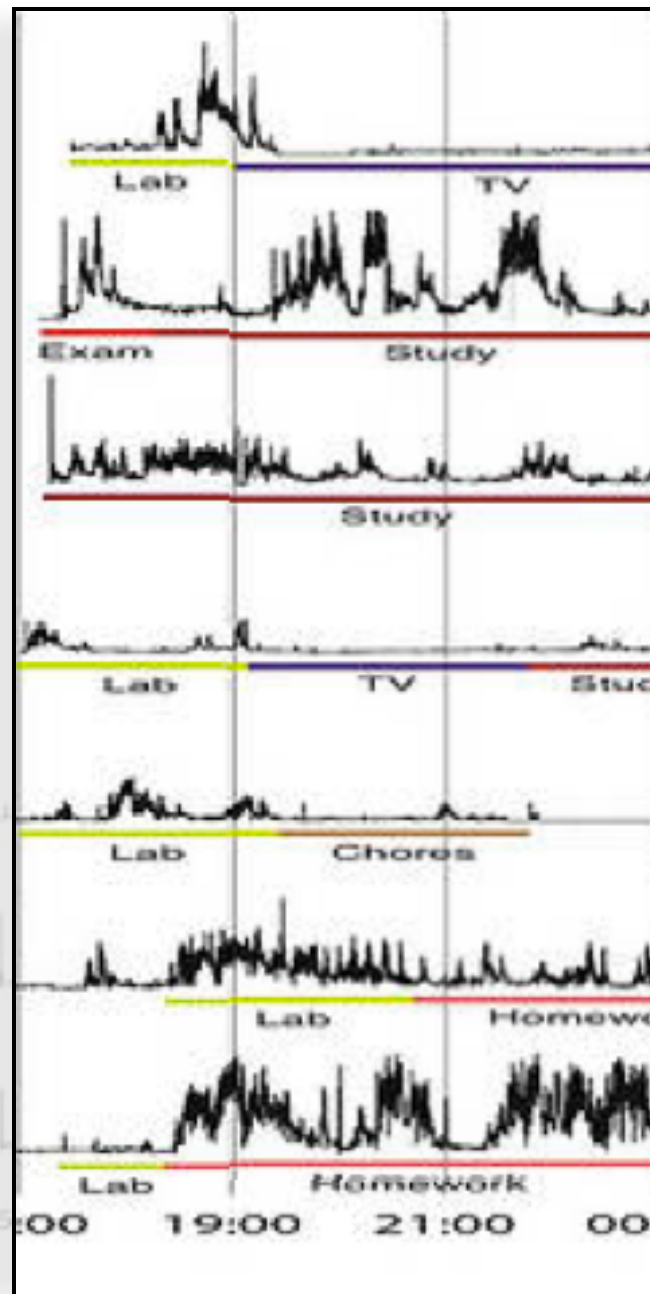
Greek amphitheater, 4th Century BC

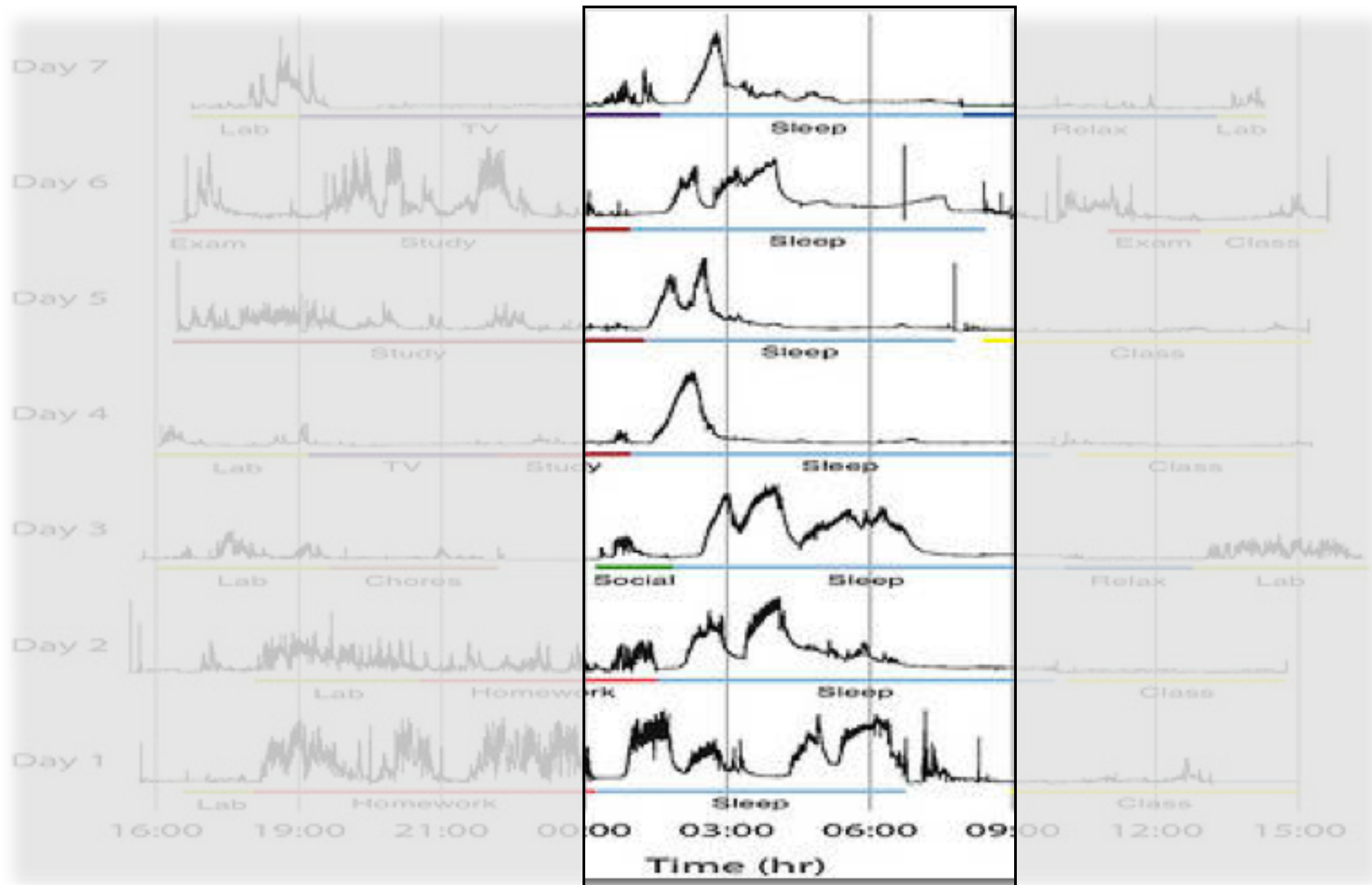


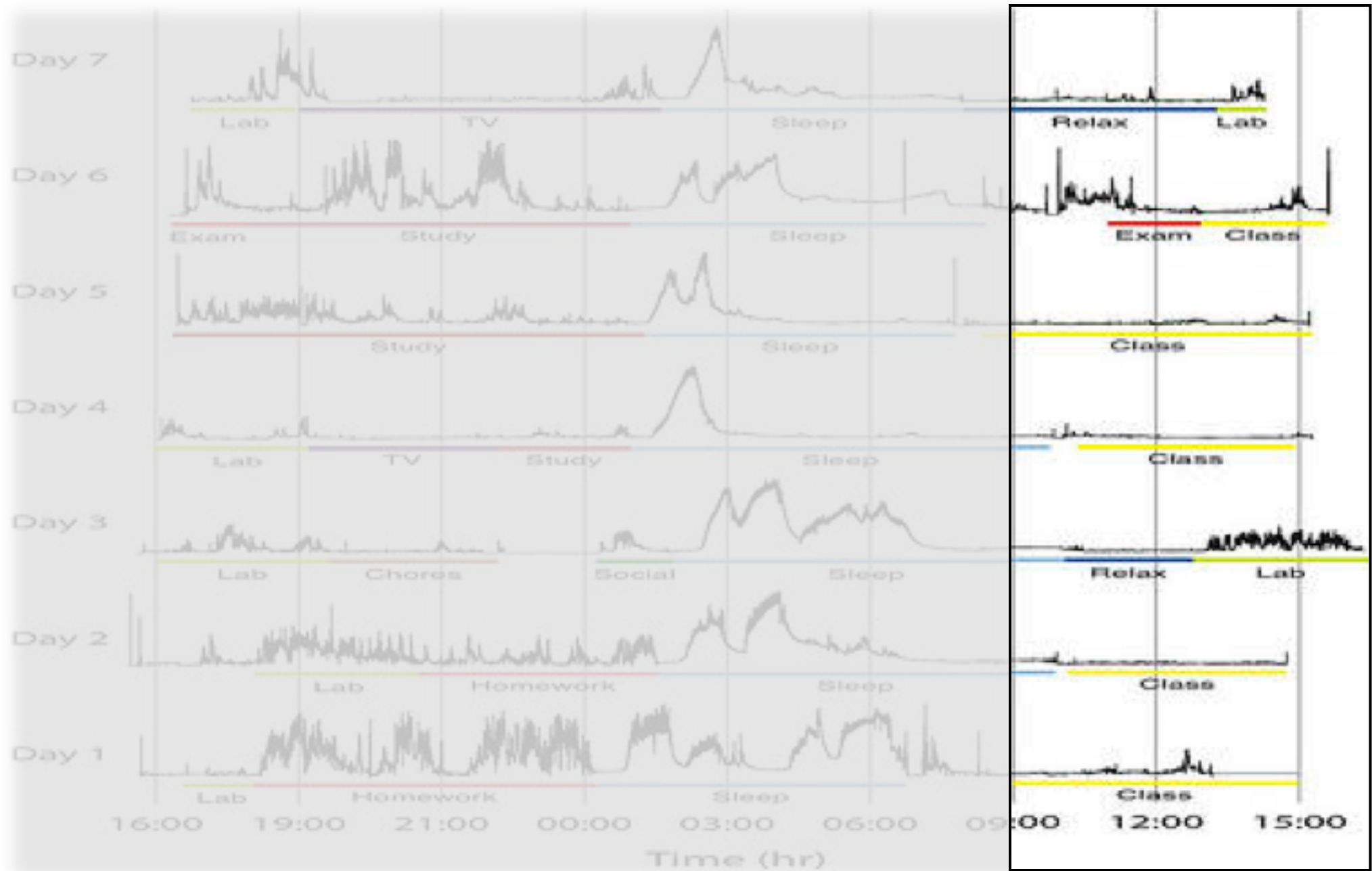


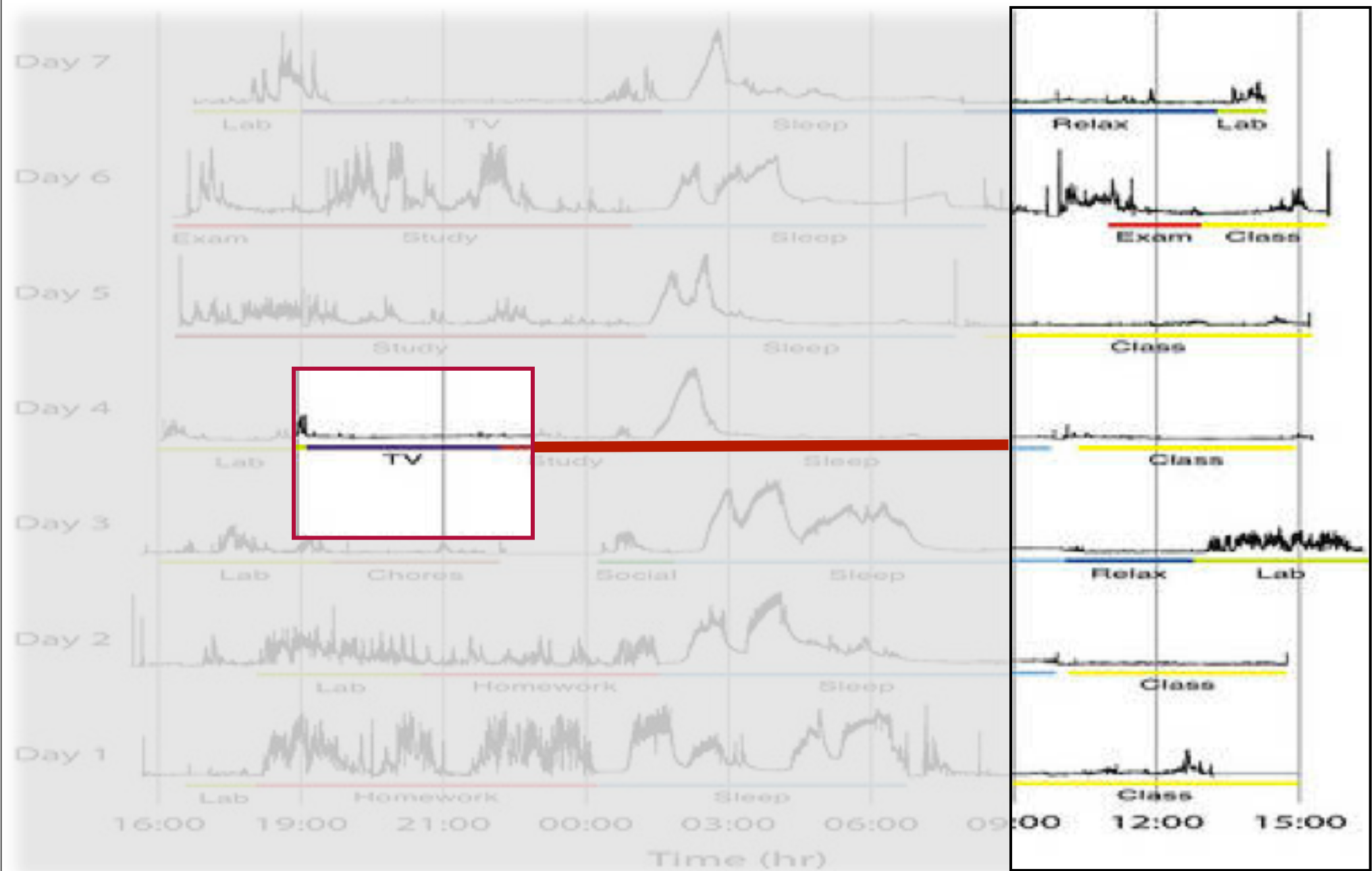
Renovated Physics Classroom, Yale University 2012

The primary model education is
knowledge delivery or information
transfer.

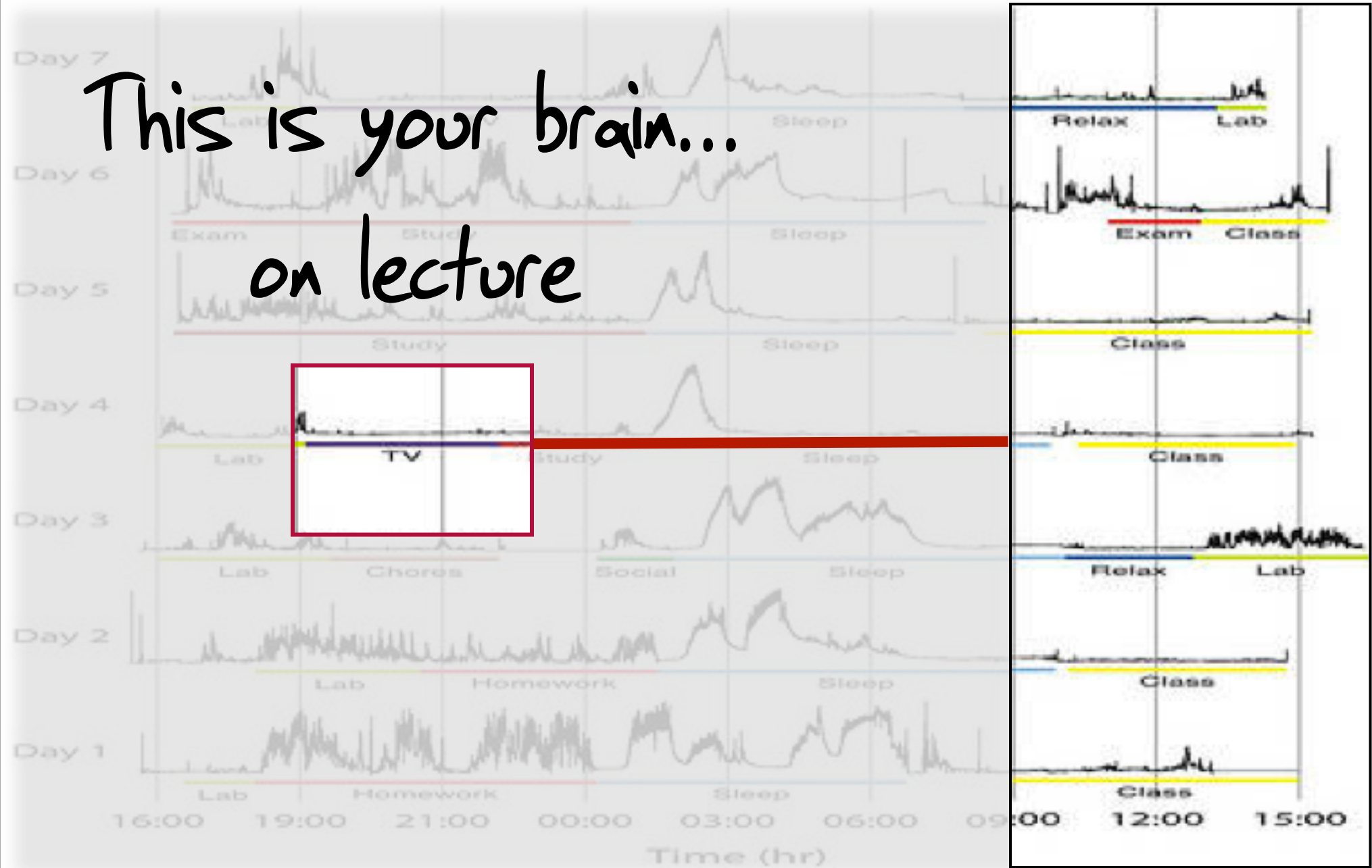


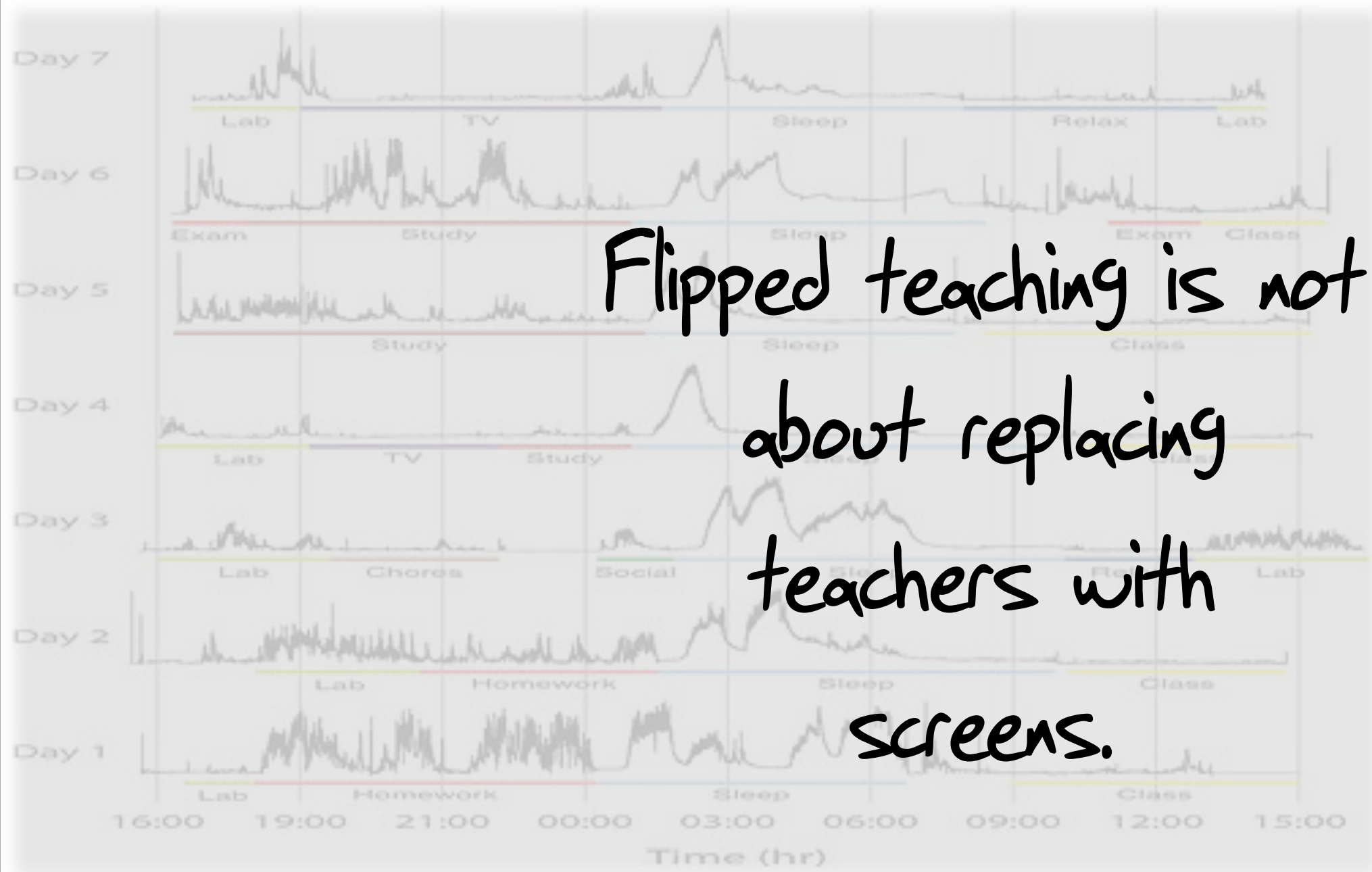




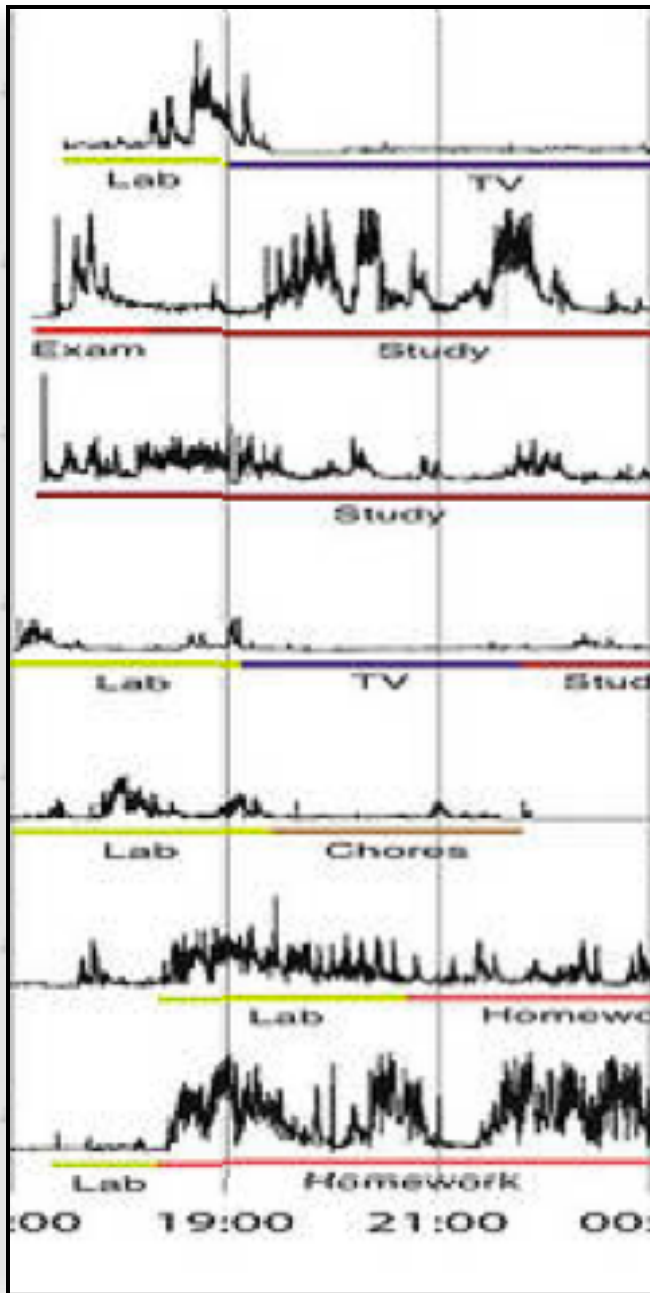


This is your brain...
on lecture





It's about creating
classroom
environments that can
engage students like
this...



What keeps you up at night?

"How boring I am and how little
will be retained by the student."

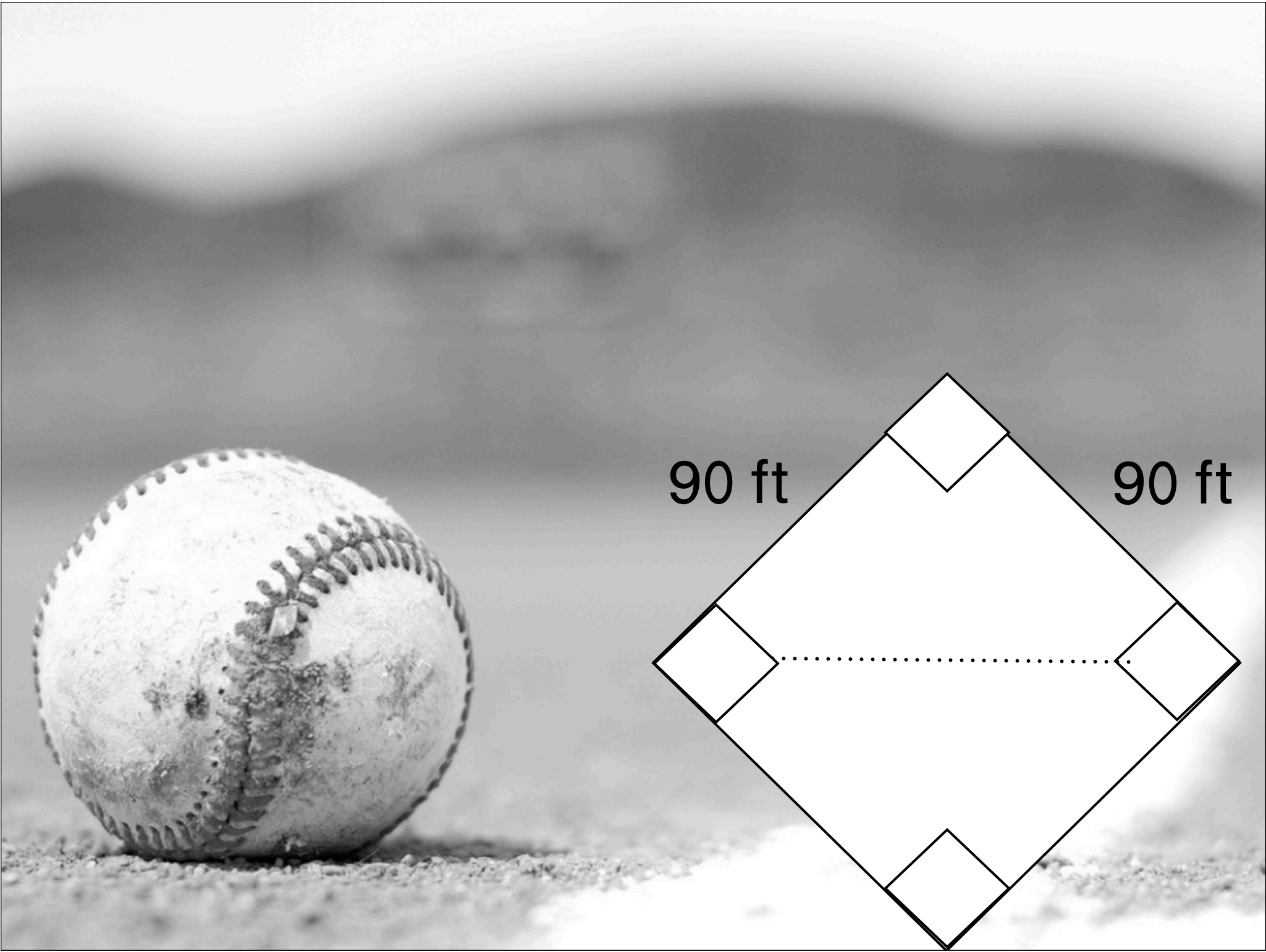
Estimate the shortest distance
between third & first base on a
professional baseball field, in feet?



Estimate the shortest distance
between third & first base on a
professional baseball field, in feet?



- A. 45 ft
- B. 90 ft
- C. 130 ft
- D. 180 ft



90 ft

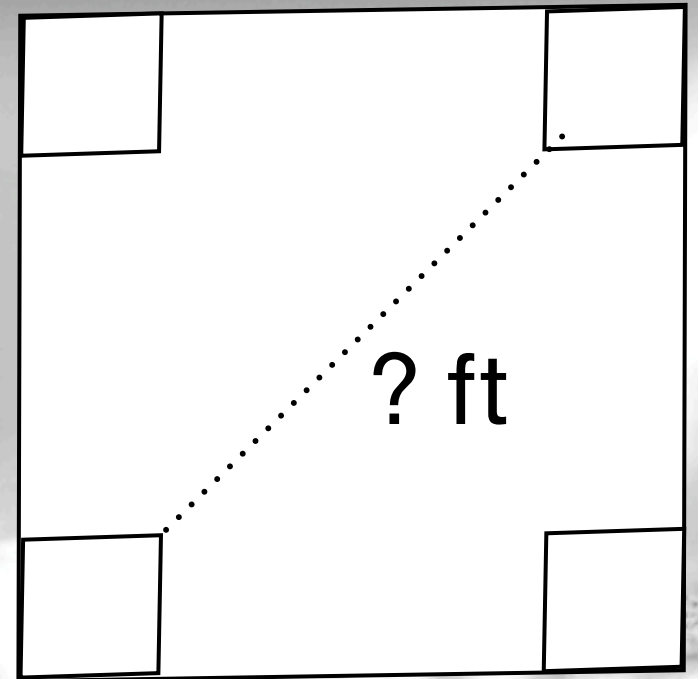
90 ft

$$a^2 + b^2 = c^2$$

90 ft

90 ft

? ft



Estimate the shortest distance
between third & first base on a
professional baseball field, in feet?



- A. 45 ft
- B. 90 ft
- C. 130 ft
- D. 180 ft

What percentage of 10th grade students get Pythagorean theorem problems right on standardized tests?

- A. 25%
- B. 33%
- C. 50%
- D. 66%

What percentage of 10th grade MA
students got this problem right?

33%

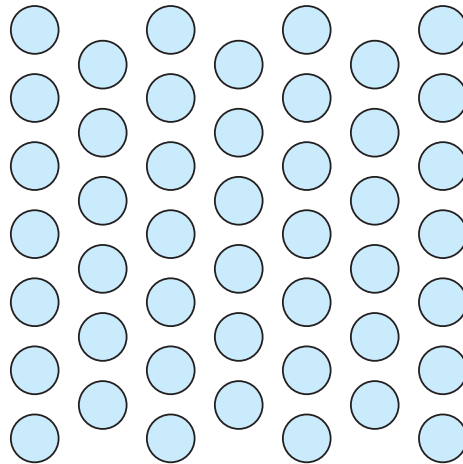
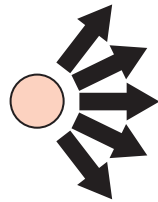
Students cannot transfer knowledge
across contexts.

The ultimate purpose of education
is knowledge transfer.

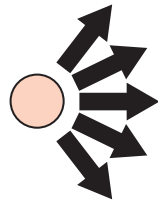
Something is very broken when after
18 years of education kids can't
transfer knowledge...

Why is this happening?

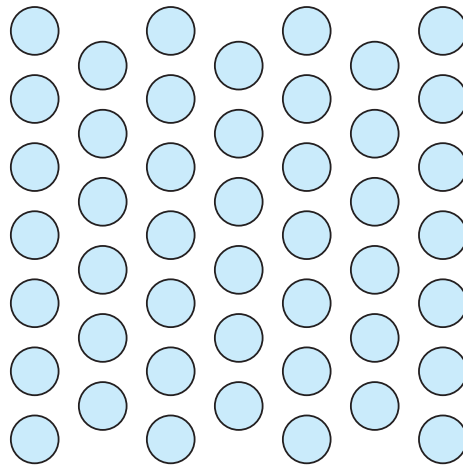
education focuses on knowledge
delivery

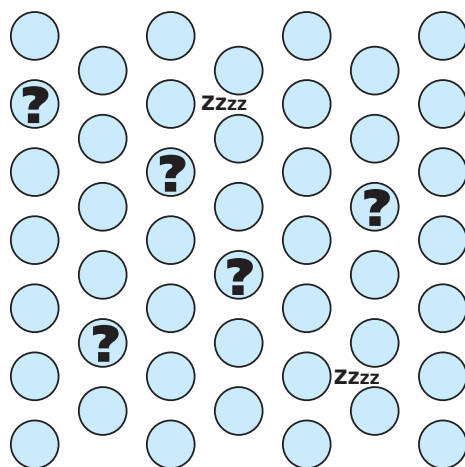
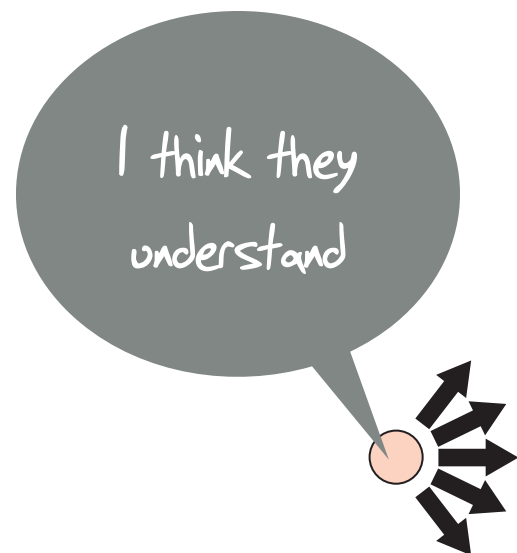


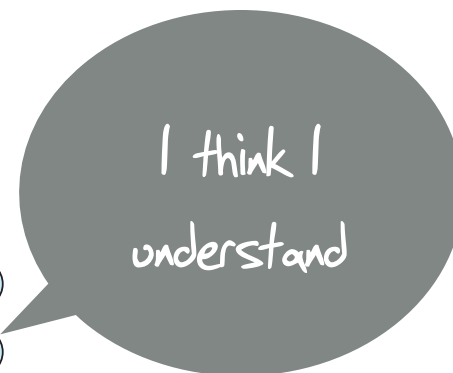
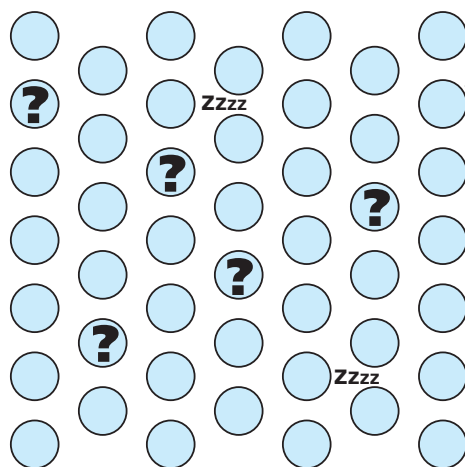
we tell

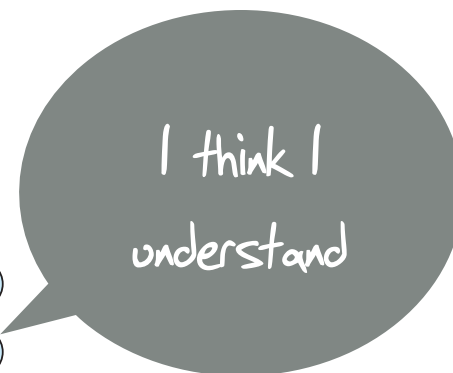
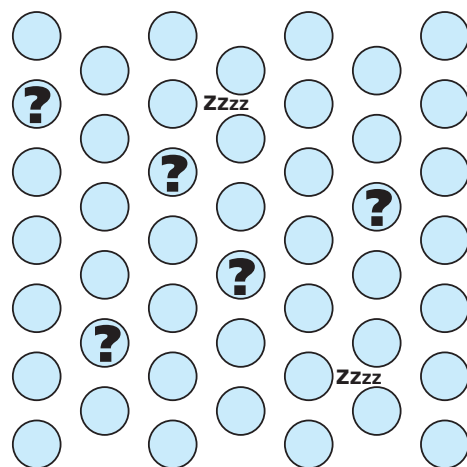
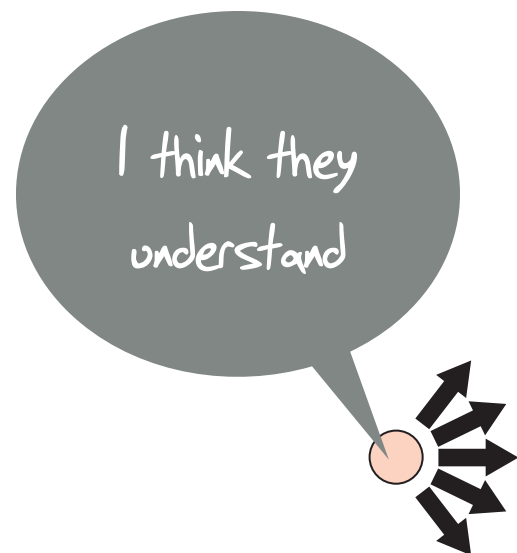


$$a^2 + b^2 = c^2$$



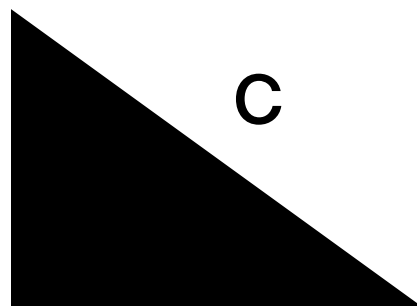






we test

90

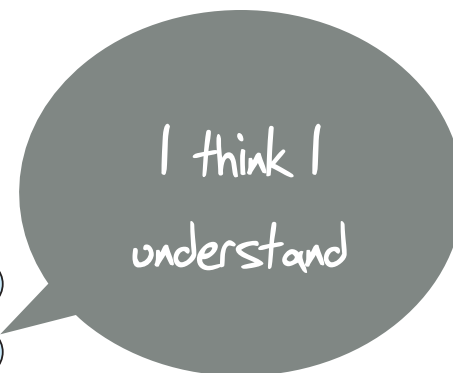
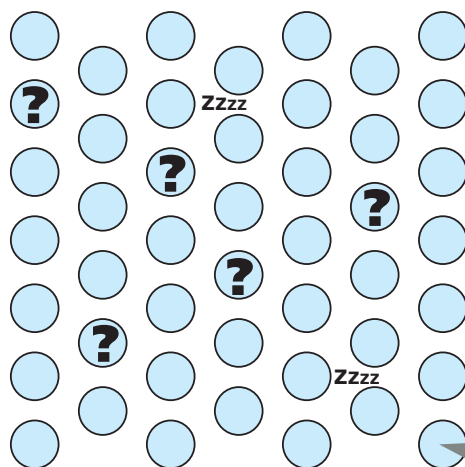


C

90



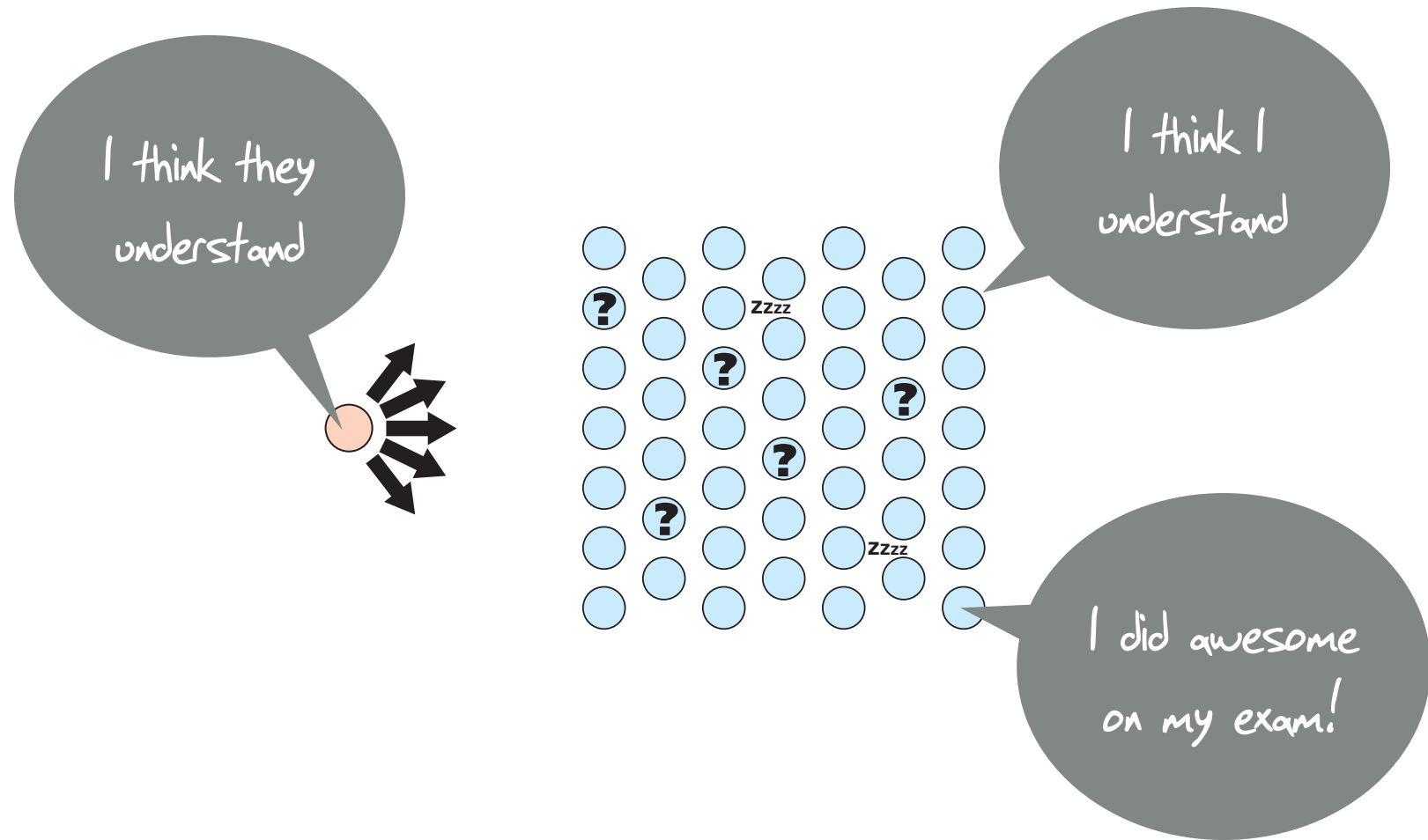
I think they understand



I think I understand



I did awesome on my exam!



Lecture's Lullaby

~~What keeps you up at night?~~

"Do the students really understand, or just pretend to?"

~~What keeps you up at night?~~
"Do the students really understand, or just pretend to?"

Do we measure their understanding
or their pretending to understand?

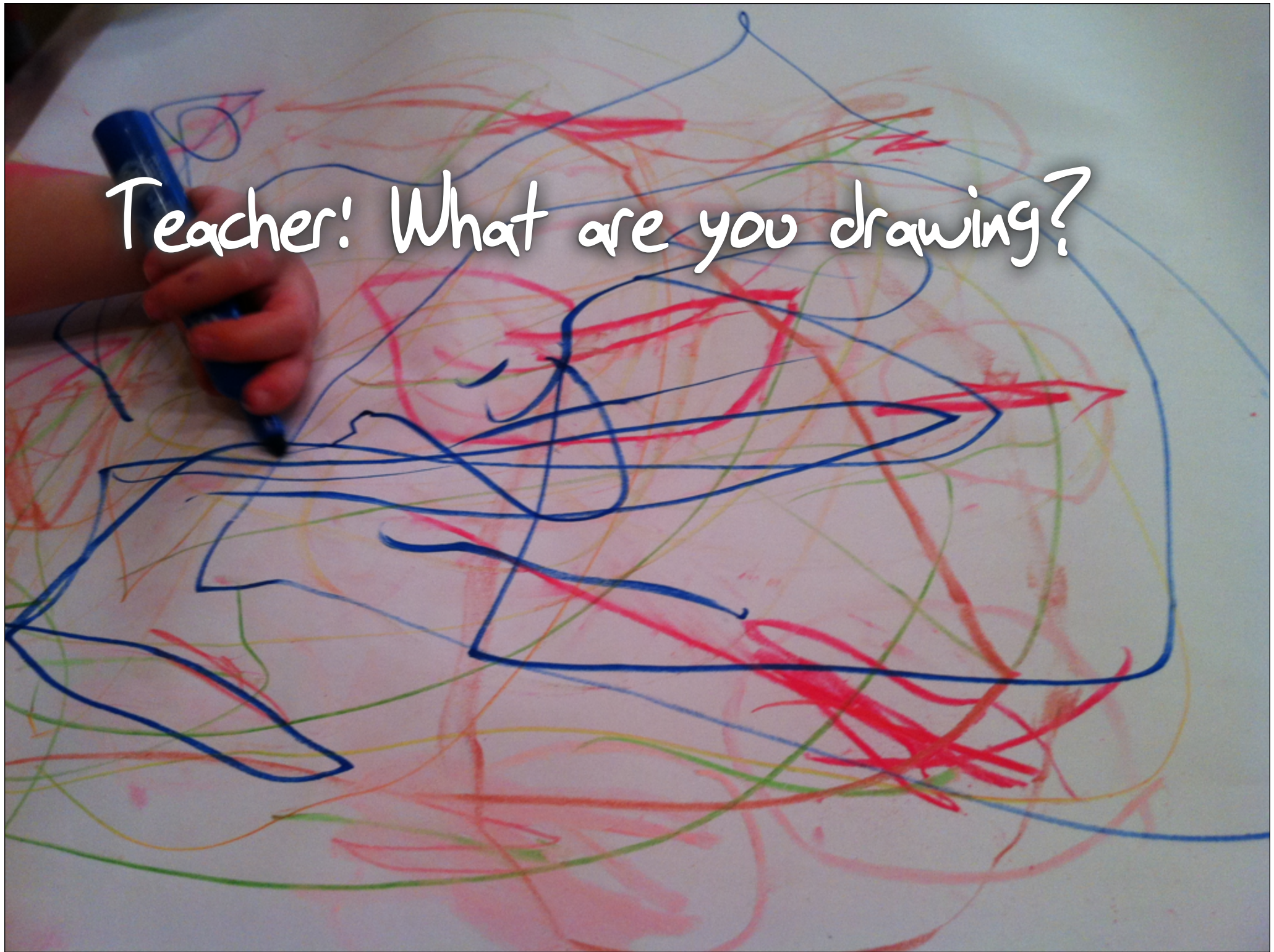
What is: 6 symptoms of an education pandemic

1. Students are resistant to learning on their own
2. Cannot tolerate not having all the variables given
3. Lack perseverance or "patient problem solving"
4. Cannot transfer knowledge across contexts
5. Unwilling or unable to risk failure
6. Don't retain what they learn

Adapted from Dan Meyer: http://www.ted.com/talks/dan_meyer_math_curriculum_makeover.html



Teacher! What are you drawing?



A hand holding a blue marker is drawing a picture of God on a whiteboard. The drawing consists of a large, irregular blue outline that resembles a long, horizontal, somewhat triangular shape with a pointed right side. Inside this shape, there are several horizontal blue lines. The background of the whiteboard is covered with numerous scribbles in red, green, and yellow. The text "Teacher! What are you drawing?" is written in white, and "Jane! A picture of God" is written in yellow, both in a casual, handwritten style.

Teacher! What are you drawing?

Jane! A picture of God

A hand holding a blue marker is shown in the upper left corner, actively drawing a chaotic scribble on a white surface. The scribble consists of numerous overlapping, swirling lines in blue, red, green, and yellow. The text is overlaid on the drawing.

Teacher: What are you drawing?

Jane: A picture of God

Teacher: But no one knows what
God looks like.

A hand holding a blue marker is shown in the upper left corner, actively drawing a chaotic scribble on a whiteboard. The scribble consists of numerous overlapping, swirling lines in blue, red, and green, filling most of the frame. The text is overlaid on this background.

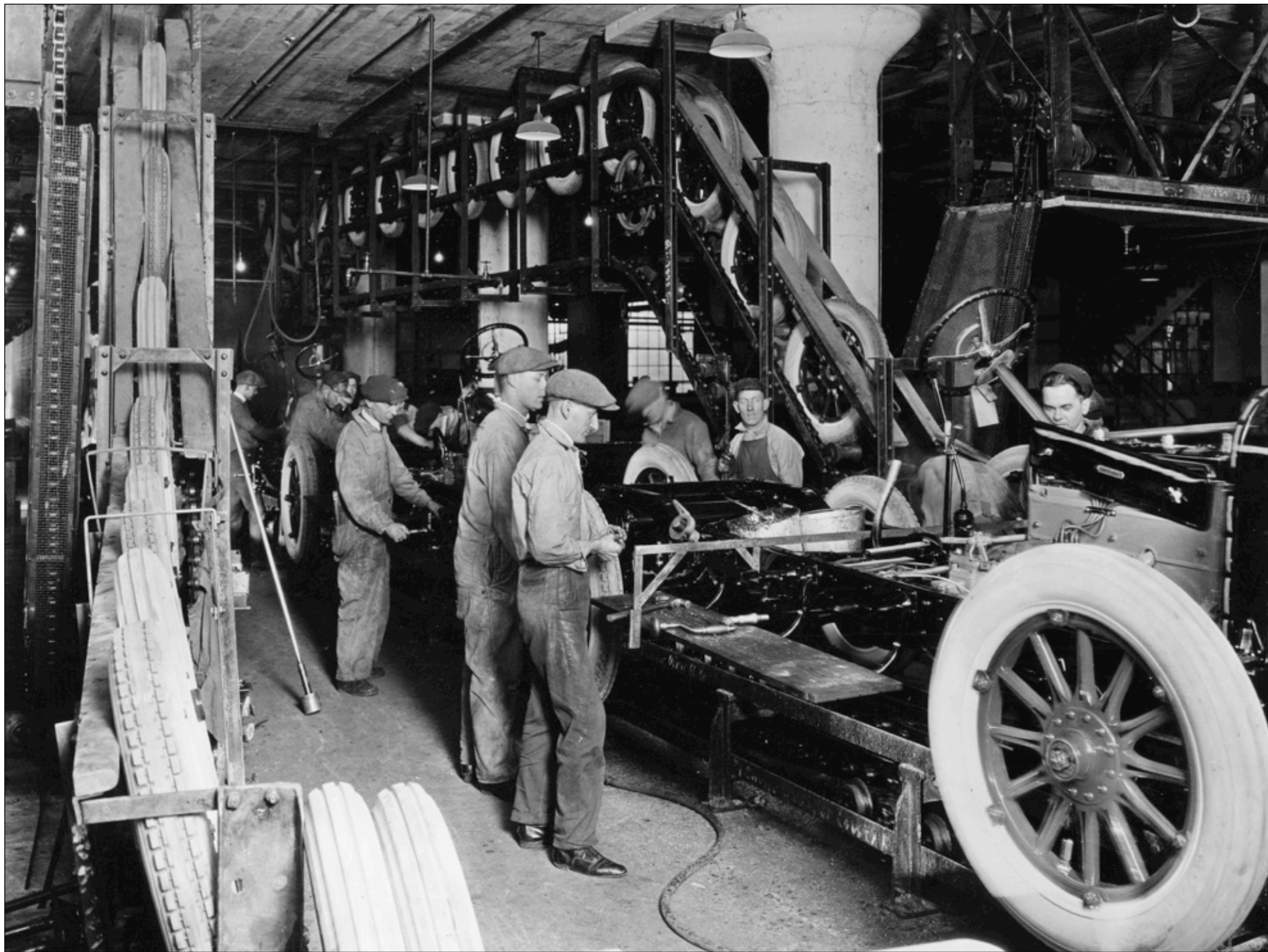
Teacher: What are you drawing?

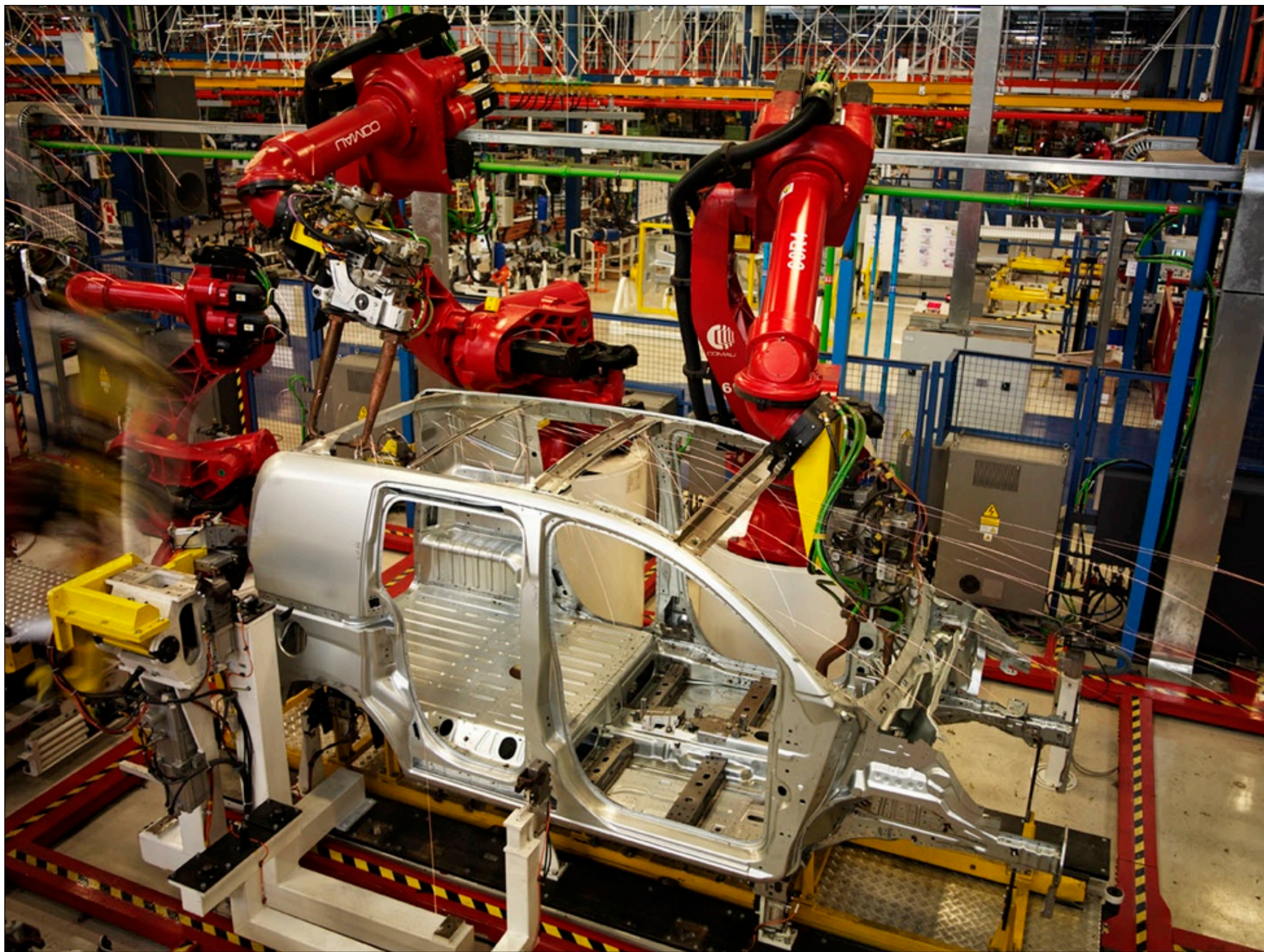
Jane: A picture of God

Teacher: But no one knows what
God looks like.

Jane: Well, they will in a minute!

*Sir Ken Robinson, Ted Talk on Creativity





Why should I flip my classroom?

"Our classroom models are doing
an incredible job of preparing
students for the 21st Century!"

My Message



Education
doesn't have to
be this way!

What can be...

1. Students are motivated to learn on their own
2. Succeed on problems that require approximation/estimation
3. Persevere in the face of setbacks
4. Apply knowledge in new, foreign contexts
5. Willing or able to risk failure
6. Students retain what they learn

My Message



Flipped teaching
offers one way
to change the
education
experience.

2

What is a flipped classroom?

Flipped classrooms are mostly about putting lectures online...

A. True

B. False

Flipped classrooms replace faculty
with computers...

- A. True
- B. False

There are many ways to flip a
class...

- A. True
- B. False

Flipped teaching follows a
prescriptive technique...

- A. True
- B. False

You can't flip just a few concepts...

A. True

B. False

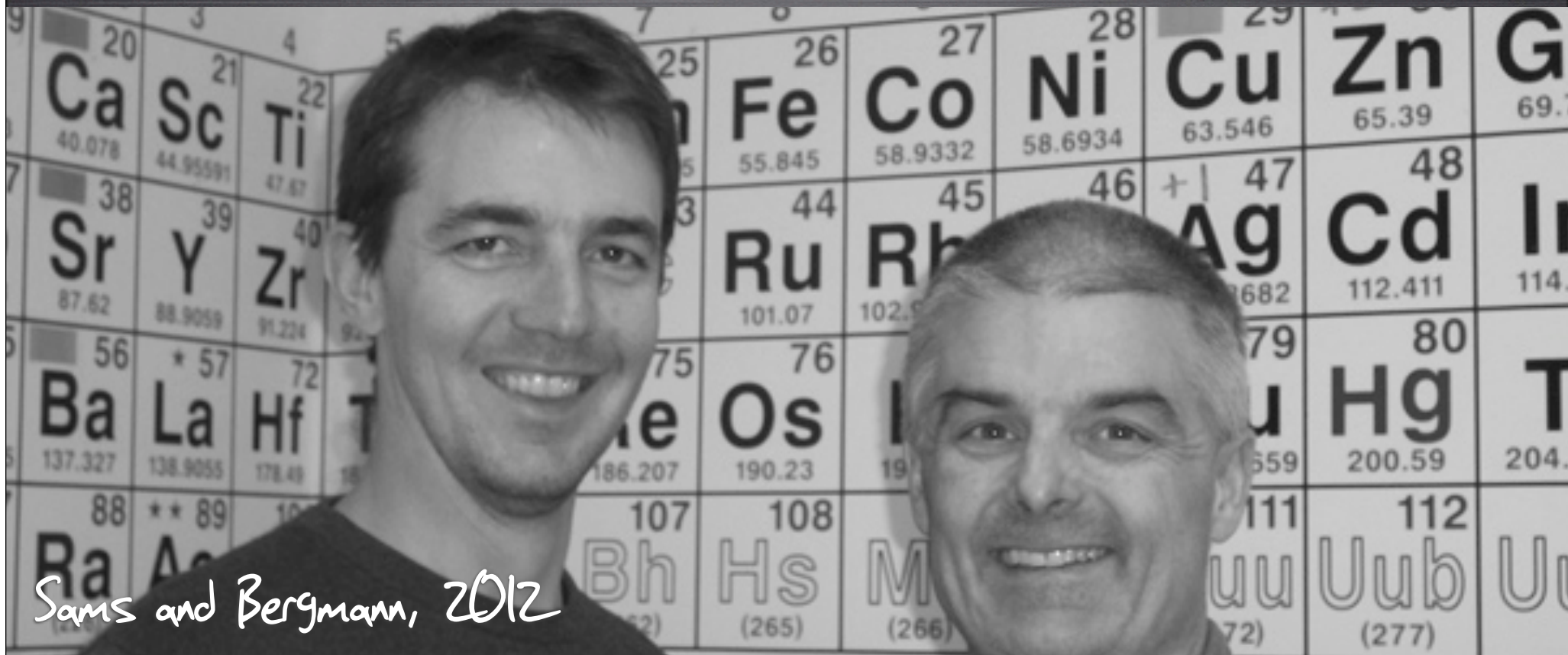
Flipped teaching is a mindset...

- A. True
- B. False

Flipped teaching is the latest
edutrend...

- A. True
- B. False

"Flipping the classroom is...[a] mindset
redirecting attention away from the teacher and
putting attention on the learner and the learning."



4 key characteristics of a flipped classroom

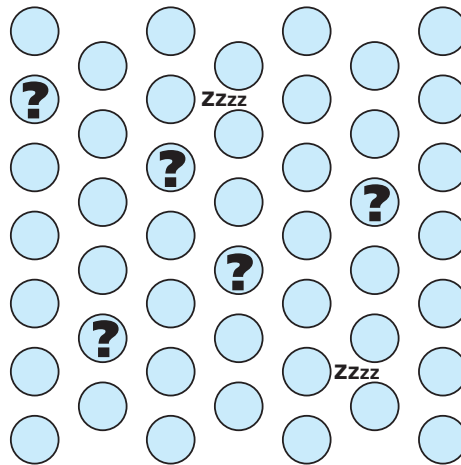
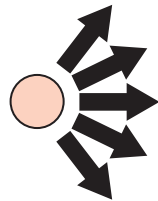
1. Bulk of direct instruction happens out of class
2. Attention is directed at students versus faculty in class
3. Guided practice or assimilation happens in class
4. Teacher is guide on the side versus sage on the stage

2 protocols for flipped teaching...

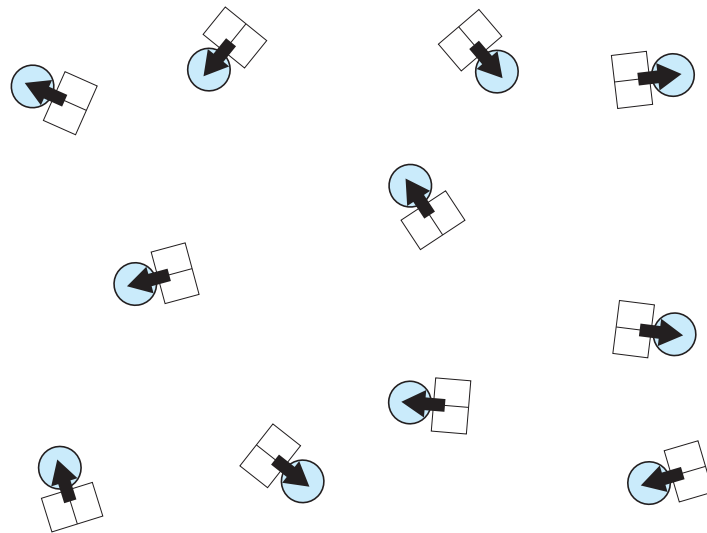
1. Flipped IOI Model

2. JiTT + Peer Instruction

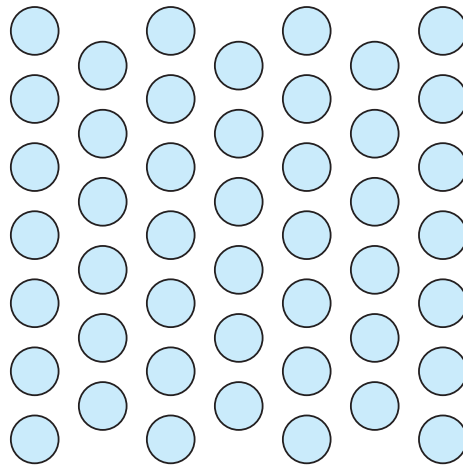
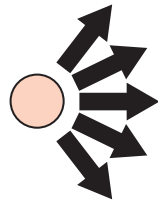
Flipped classrooms moves coverage out



students do coverage before class

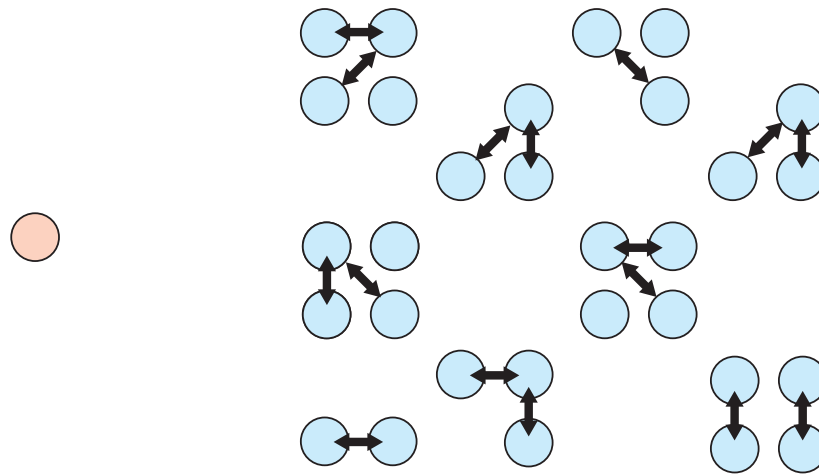


In class



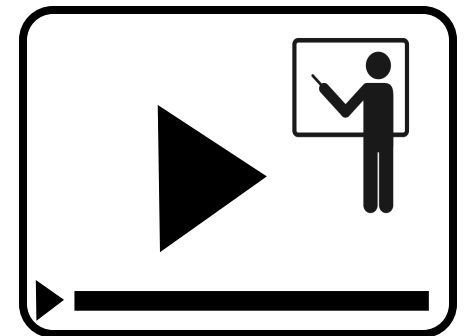
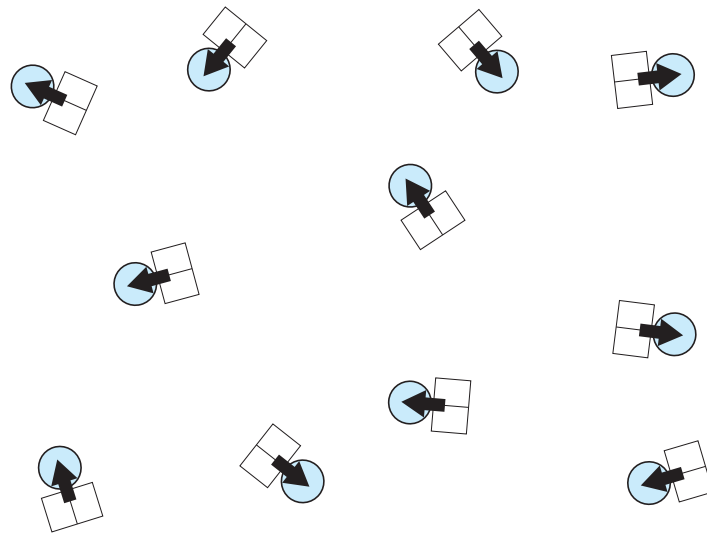
you, lecture a little

in class, you help students



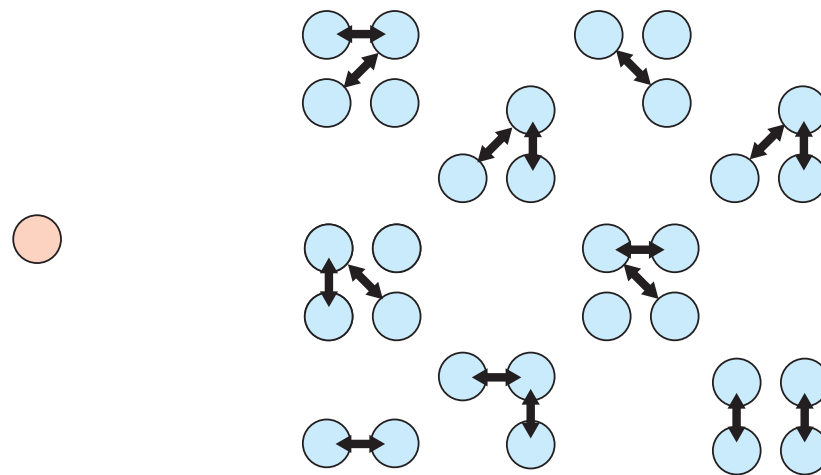
uncover meaning a lot

Flipped IOI Model



Coverage activity is lecture video

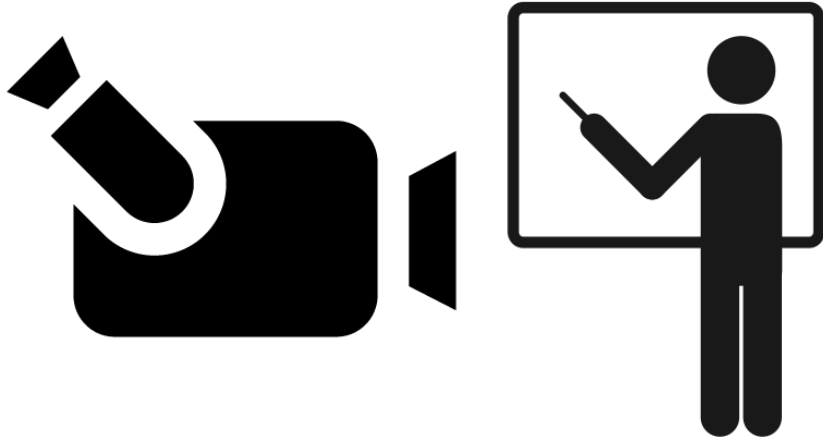
Flipped IOI Model



Homework problems in class

How do I put my lectures online?

Screencasting



1 Record Lesson



2 Provide Access

Screencasting

Tips for making videos!



1. Keep videos short - 7 min chunks
2. Give students lesson on how to effectively watch
3. Write a script
4. Practice editing
5. Embed or include assessments

Screencasting

My quick start guide for flipping your
classroom with screencasting!



blog.peerinstruction.net



Flipped classrooms can be just putting videos online and doing homework in class, but they can and should be much more than that...

What are innovative tools for engaging students outside of class?

~~What keeps you up at night?~~

Student engagement

Thinking of new ways of actively engaging learners. Moving them away from a preoccupation with outcome (grade) to process (learning).

Zinnovative flipped methods

- Out of Class - Just-in-Time Teaching
- In Class - Peer Instruction

Out of Class Tools
Just-in-Time Teaching

My students do at least 30 mins
of reading before coming to class...

a. true

b. false

c. depends

I would like my students to do at least 30 mins of reading before coming to class...

a. true

b. false

c. depends

Arteries

- a. Carry blood away from the heart
- b. Carry blood that is pumped to the heart
- c. Are less elastic than veins
- d. Both a and b

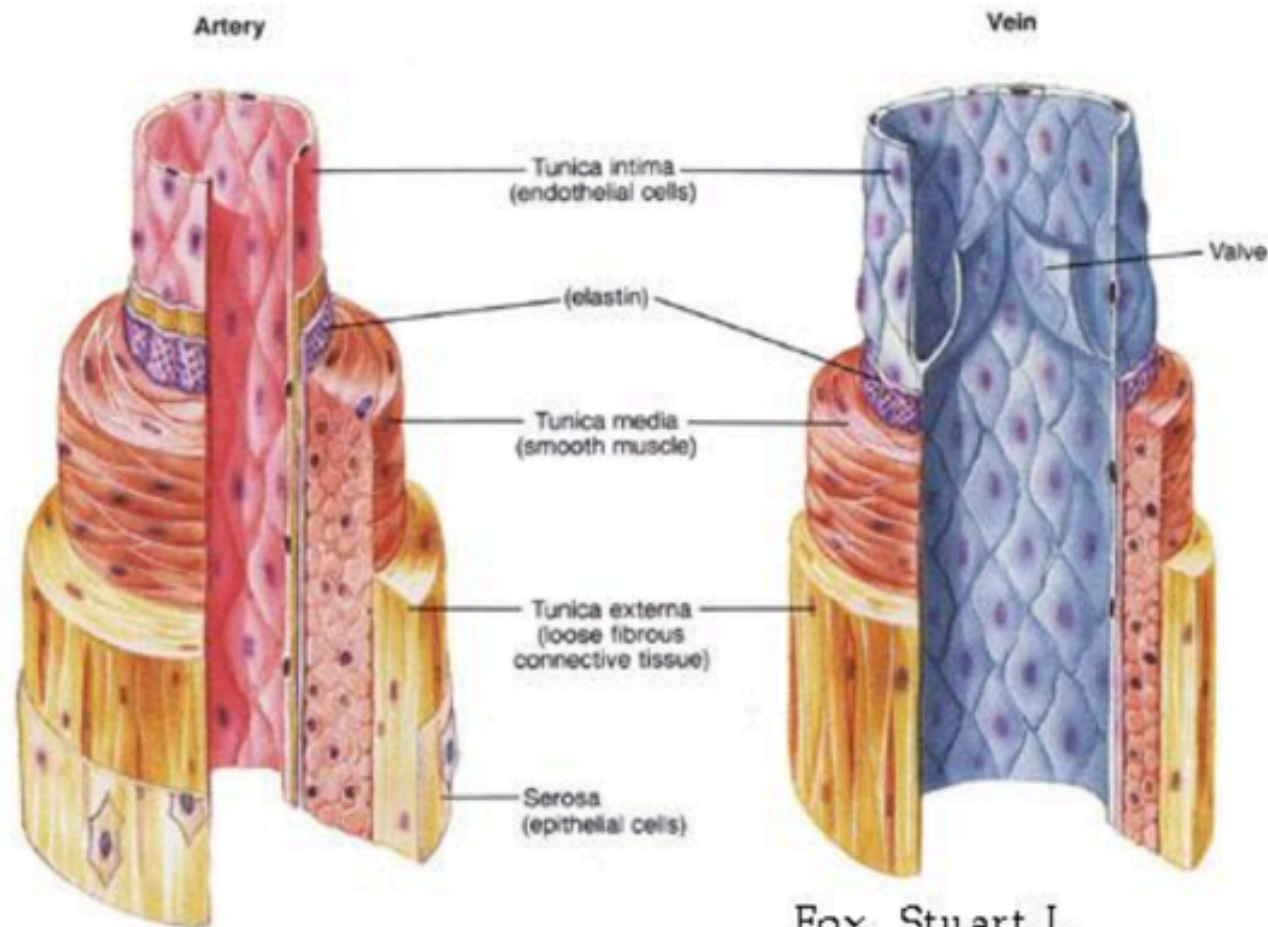
Does an artificial artery have to be elastic?

A. Yes

b. No

What do you wonder about veins and arteries?

Blood vessels (arteries and veins) are the transport conduits of the circulatory system. *Arteries* transport blood away from the heart whereas *veins* transport blood towards the heart.

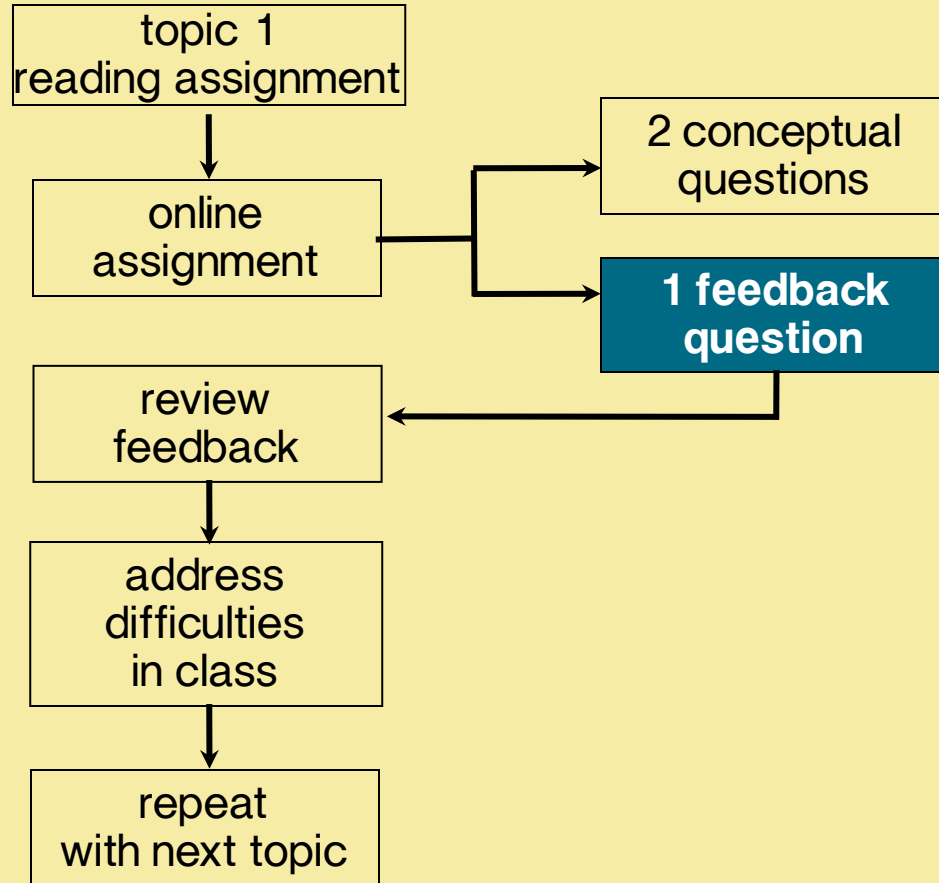


Fox, Stuart I.
Human Physiology 4th
Brown Publishers

Arteries are thicker than veins, more elastic, and carry blood from the heart; veins carry blood back to the heart.

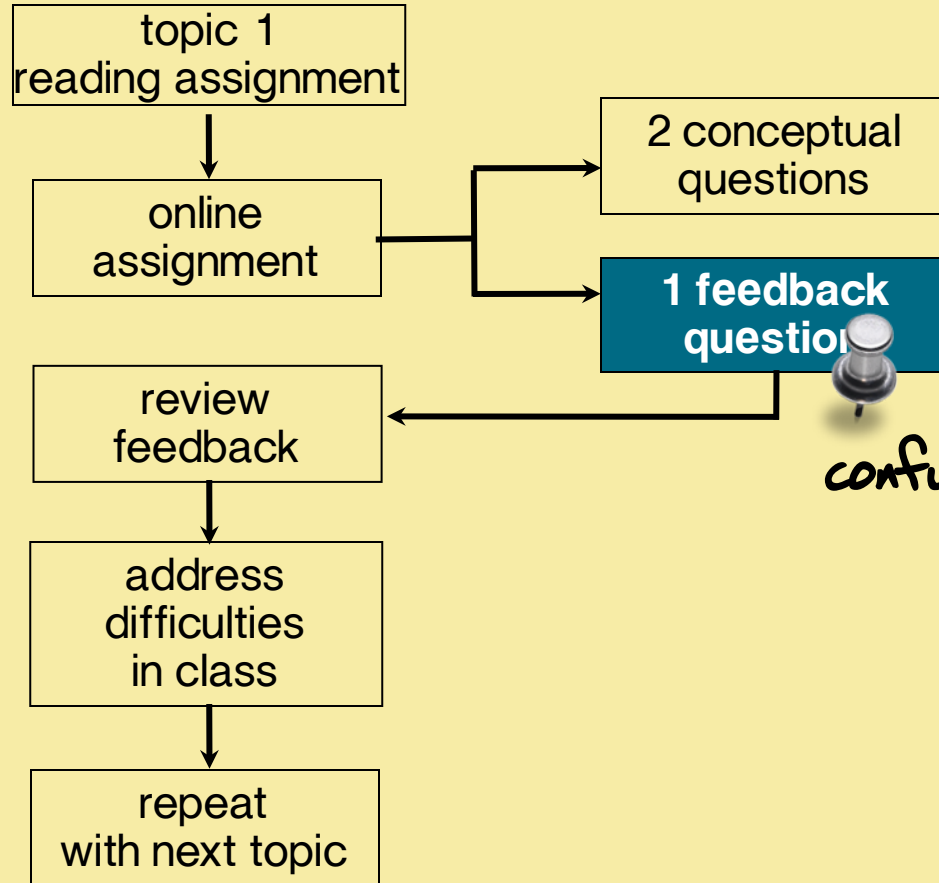
Out of Class Tools

Just-in-Time Teaching



Out of Class Tools

Just-in-Time Teaching

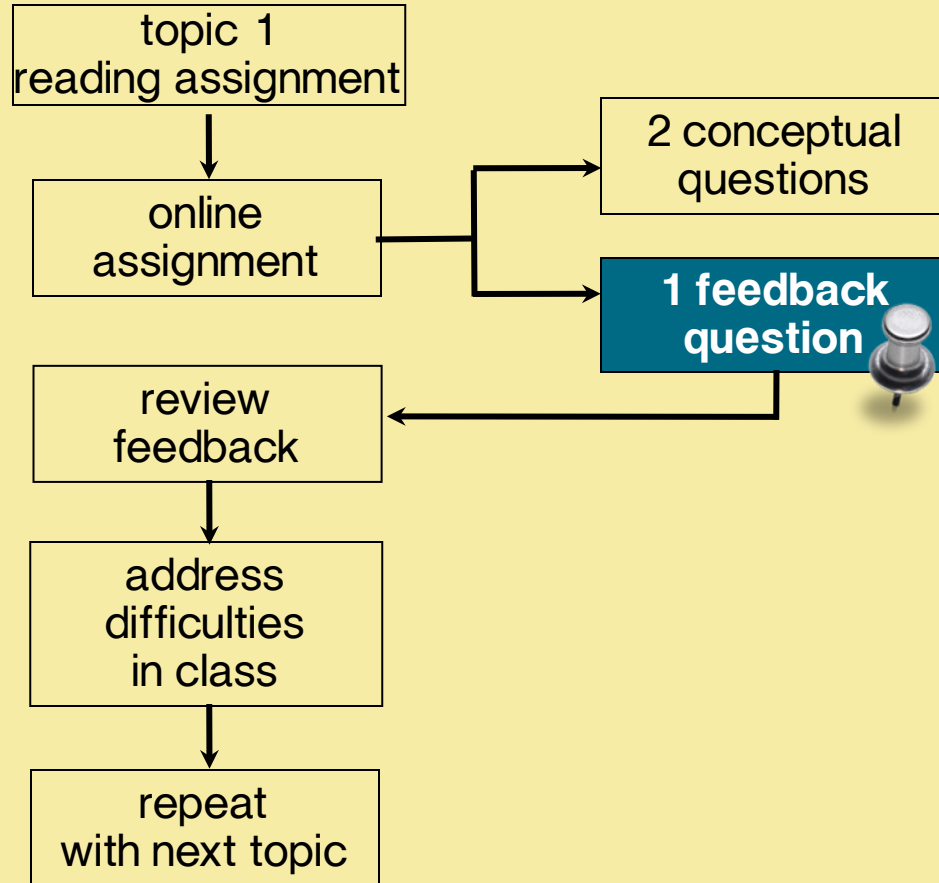


What do you find most
confusing about what you read?

Muddiest Point Technique

Out of Class Tools

Just-in-Time Teaching



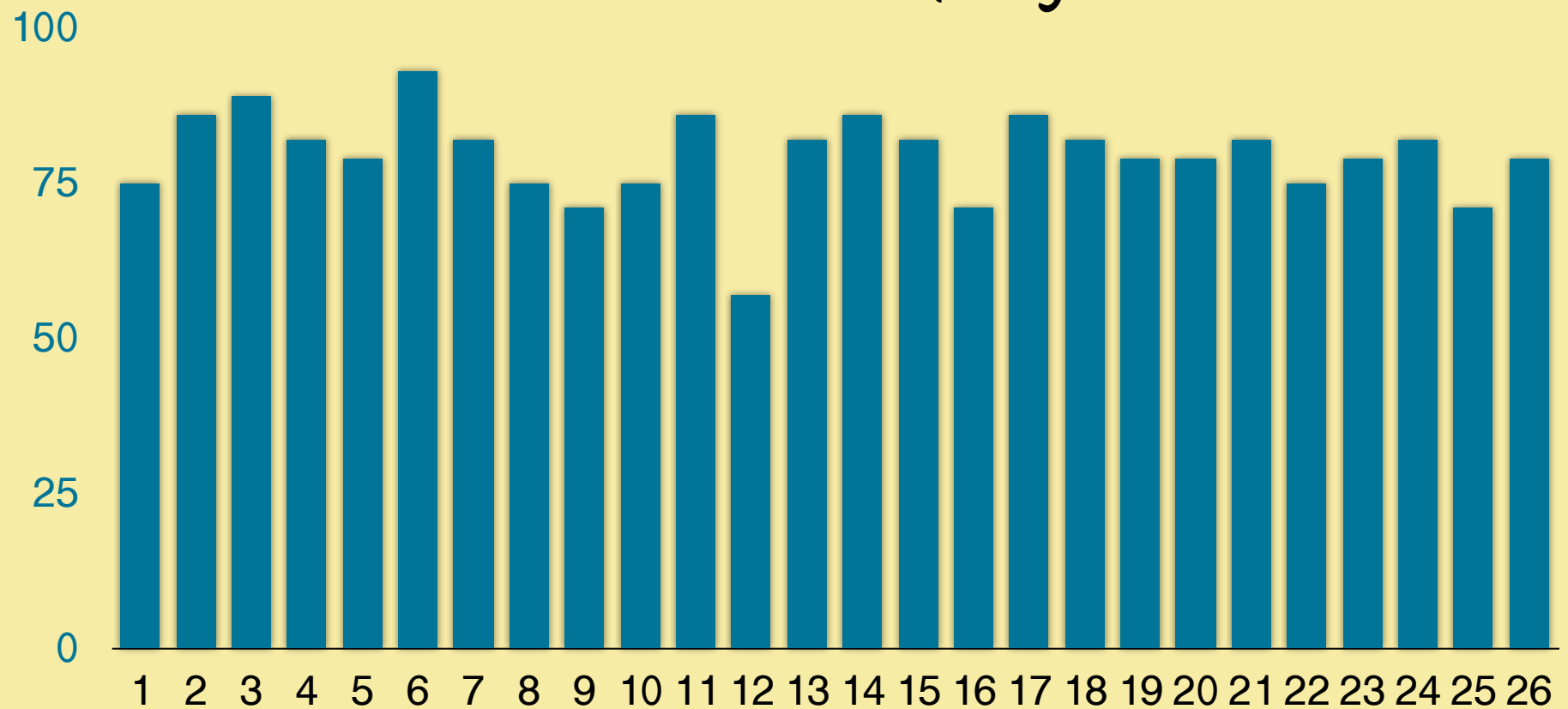
What do you wonder about this topic? *Wonder Question*

Out of Class Tools

Just-in-Time Teaching

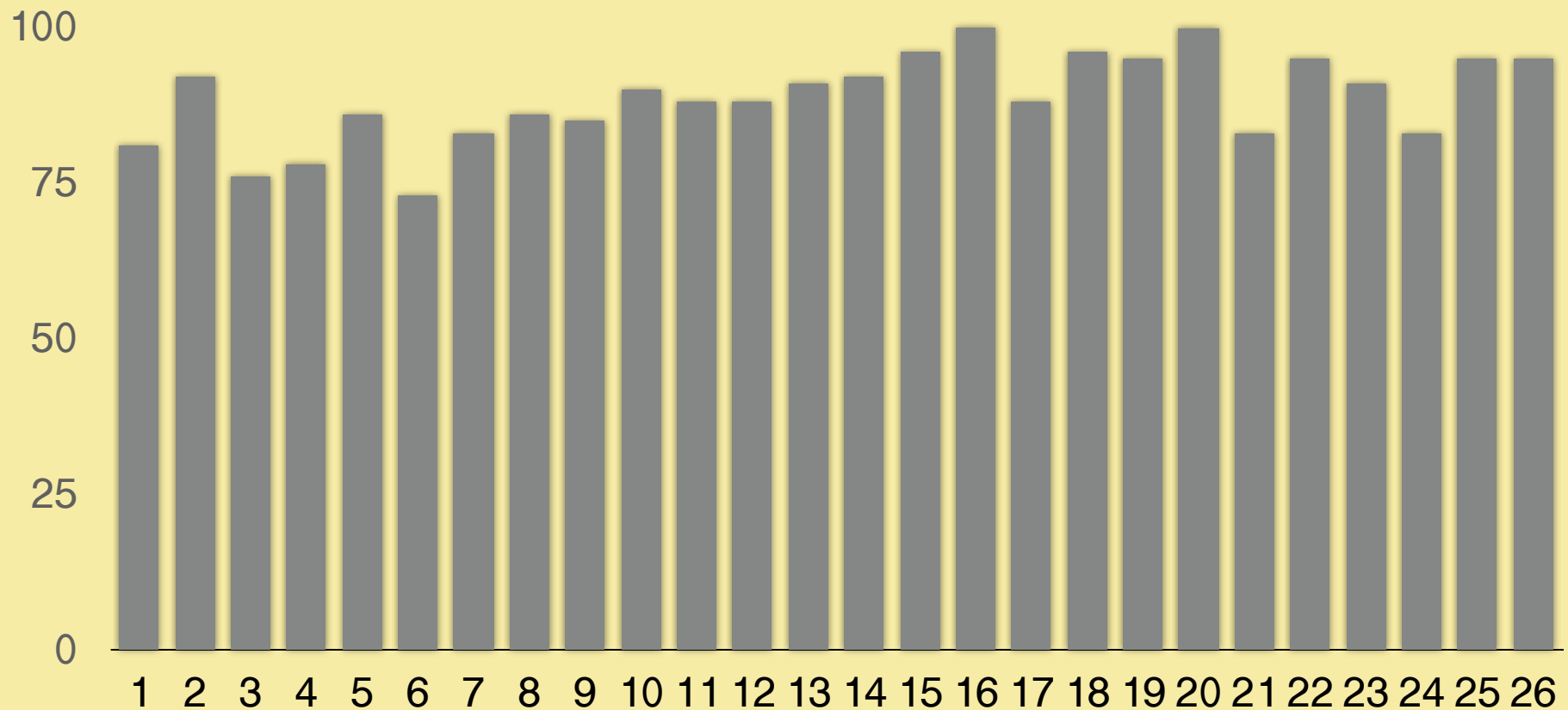
"It is important to cite achievement data & research about student engagement not just perceptions."

Out of Class Tools Just-in-Time Teaching



% of students (n=28) completing reading assignment (n=26)

Out of Class Tools Just-in-Time Teaching



% of students (n=28) reading assignment engagement (n=26)

Tips for JiTT

- give students points for doing reading assignments
- organize class time around results of feedback
- display their comments anonymously in class
 - find a colleague doing it on campus

What are innovative tools for engaging students in class?

In Class Tools

What keeps you up at night?

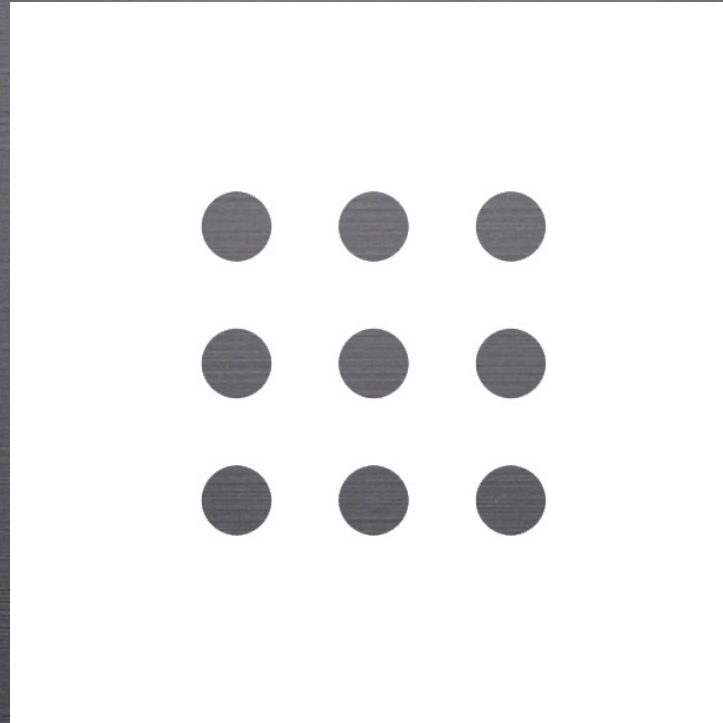
"How to make learning more interesting and enjoyable."

"Engaging my students."

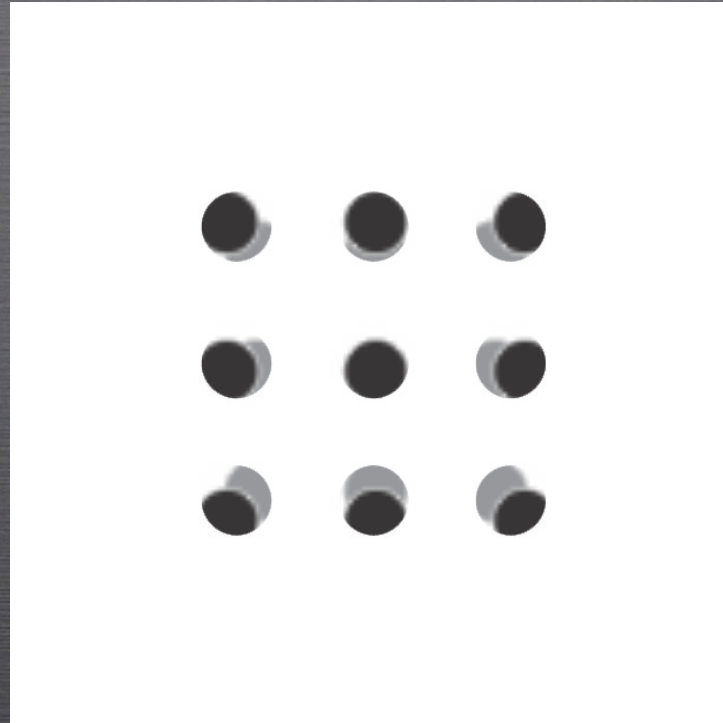
Thermal Expansion



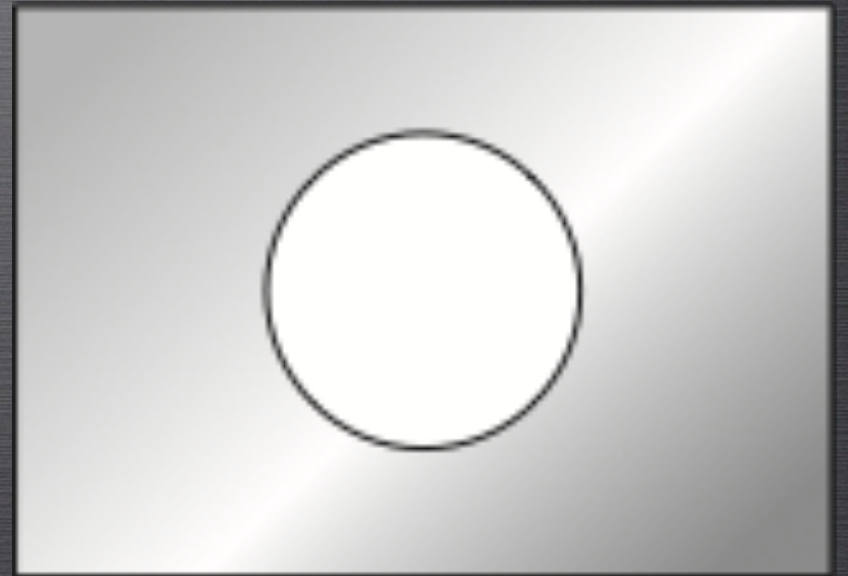
When metals heat up, they expand



When metals heat up, they expand

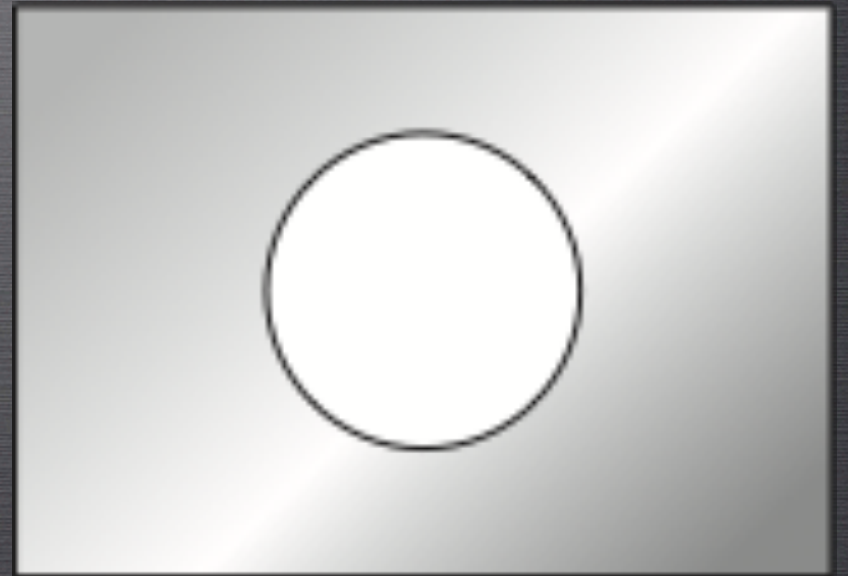


Consider a metal plate with a hole
in it



If you heat it uniformly, what happens to the hole?

- A. increases
- B. stays the same
- C. decreases

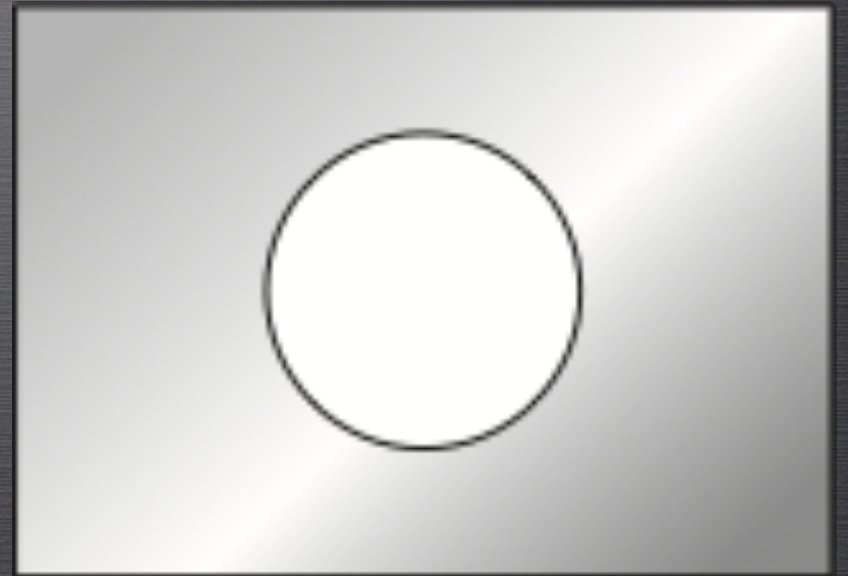


If you heat it uniformly, what happens to the hole?

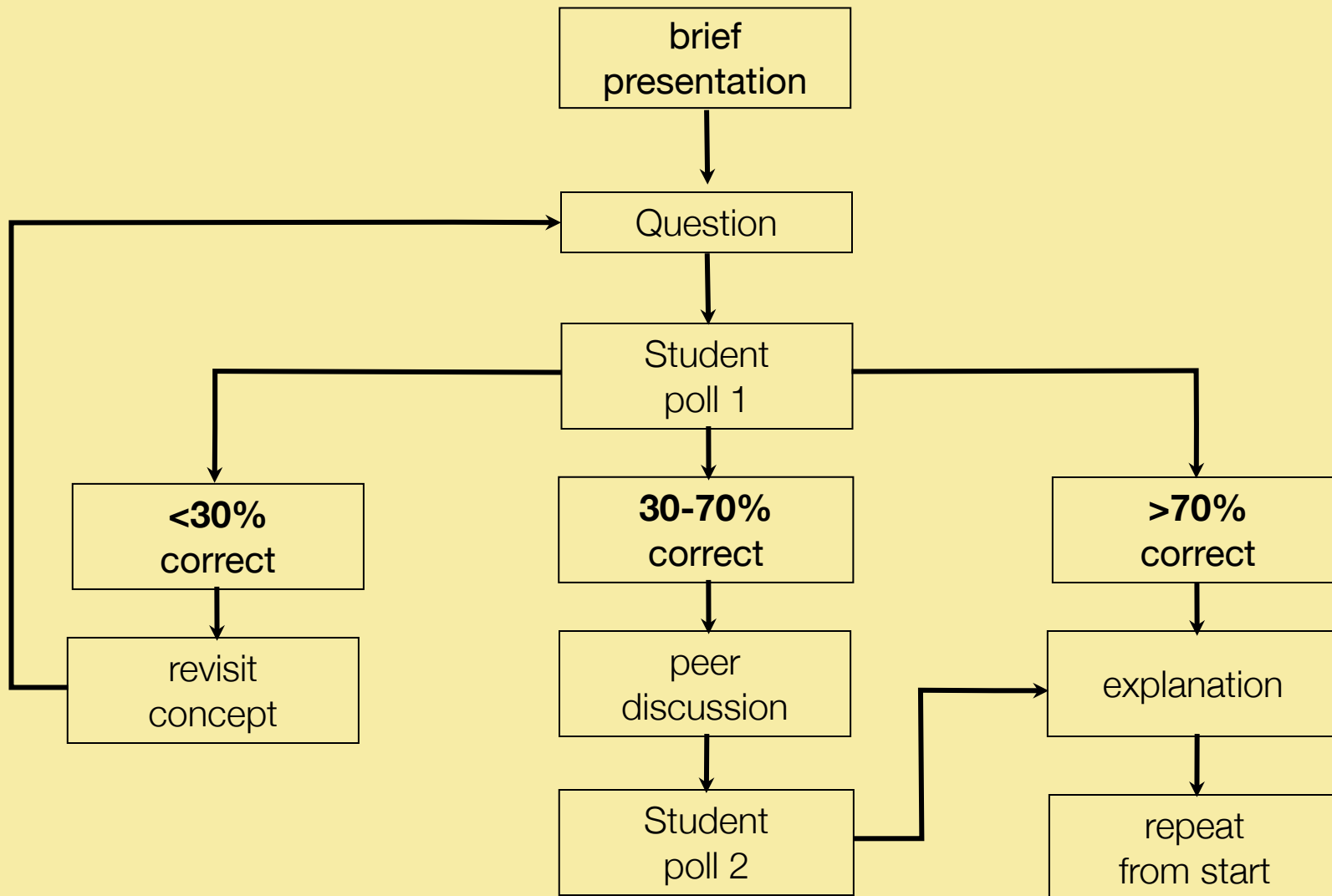
A. increases

B. stays the same

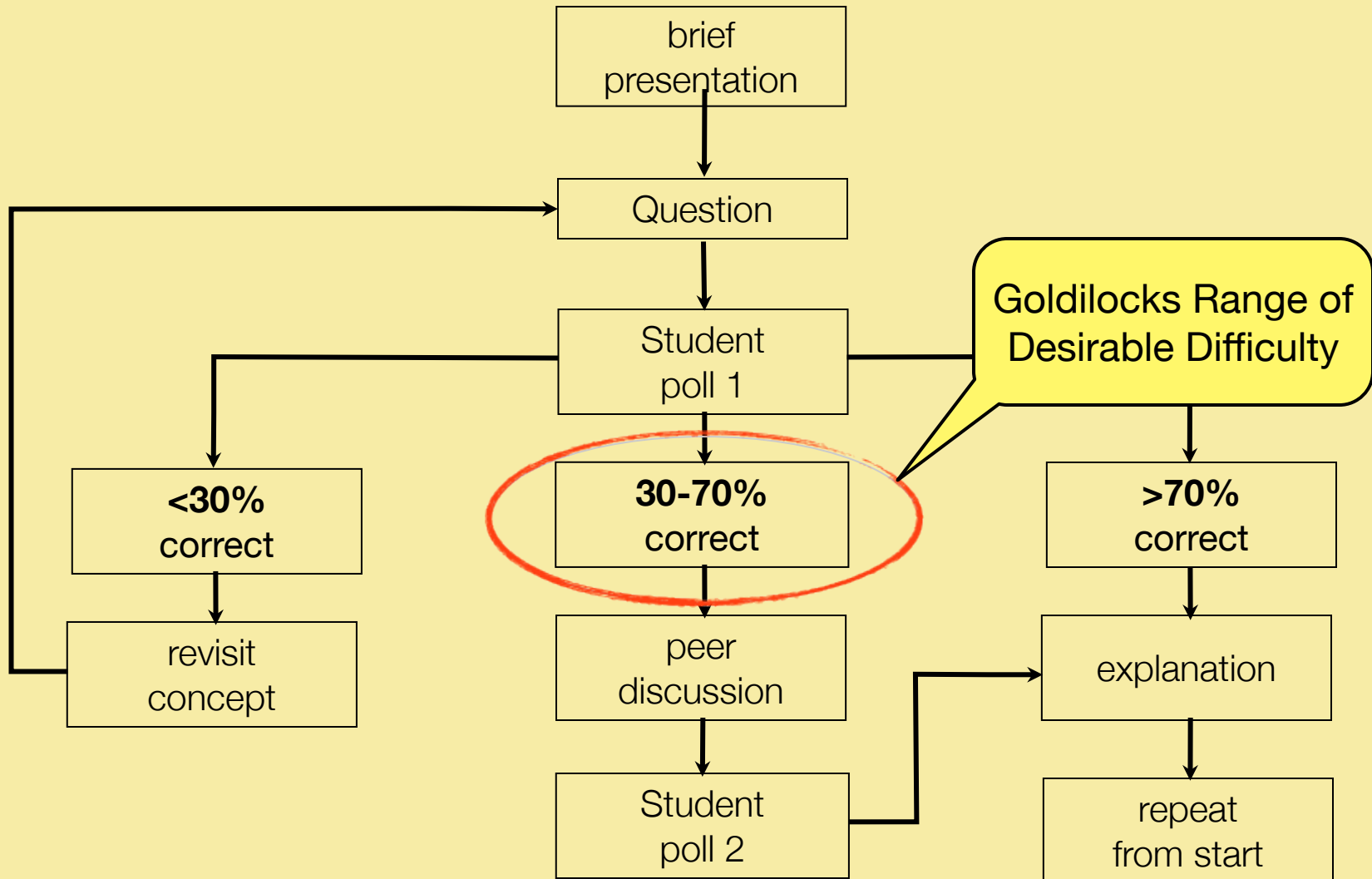
C. decreases



Peer Instruction



Peer Instruction



Systematic Moral Analysis



Gert's Moral Rules

1. Do not kill.
2. Do not cause pain.
3. Do not disable.
4. Do not deprive of freedom.
5. Do not deprive of pleasure.
6. Do not deceive.
7. Keep your promises
8. Do not cheat.
9. Obey the law.
10. Do your duty.

Heinz's wife was near death, and her only hope was a drug that had been discovered by a pharmacist who was selling it for an exorbitant price. The drug cost \$20,000 to make, and the pharmacist was selling it for \$200,000. Heinz could only raise \$50,000 and insurance wouldn't make up the difference. He offered what he had to the pharmacist, and when his offer was rejected, Heinz said he would pay the rest later. Still the pharmacist refused. In desperation, Heinz broke into the store and stole the drug.

Should Heinz have broken into the store to steal the drug for his wife?

- A. Yes
- B. No

In Peer Instruction – is it always necessary to give students time to answer on their own first?

A. Yes

B. No

C. It depends

Should I show the histogram to students before they vote?

A. Yes

B. No

C. It depends

In Class Tools

Peer Instruction



My quick start guide for flipping your
classroom with Peer Instruction!

blog.peerinstruction.net



What are alternatives to dickers?





A pink square containing the letter 'A' in a white, bold, sans-serif font with a black outline.

A

A green square containing the letter 'B' in a white, bold, sans-serif font with a black outline.

B

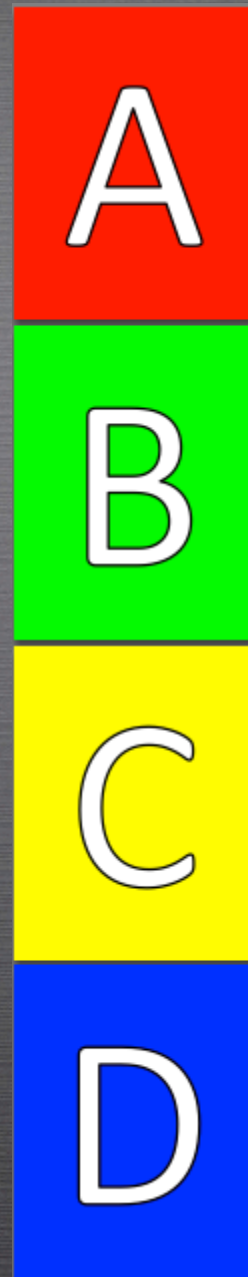
A yellow square containing the letter 'C' in a white, bold, sans-serif font with a black outline.

C

A blue square containing the letter 'D' in a white, bold, sans-serif font with a black outline.

D

<http://bit.ly/TgzlcQ>



<http://bit.ly/VnXtNS>

learning catalytics

https://learningcatalytics.com/courses/11/lectures/203

Brian Lukoff | Harvard University | [Log out](#)

learning | catalytics


Courses Participate Review Classrooms Account About

current session: 766079 | 69 students

[Stop session](#) [Review results](#) [Seat map](#) [Show floating session ID](#) [Edit](#) [PDF](#) [Delete](#)

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

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.



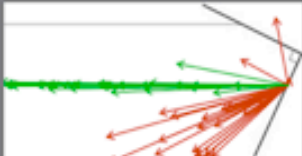
[Submit response](#)

[Switch to text response](#)

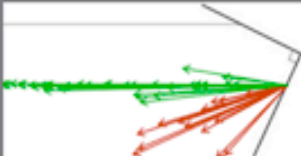
Current seat: A2 [Change seats](#)

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

Round 1 [X](#) [F](#) [G](#) 57 responses, 58% correct



Round 2 [X](#) [F](#) [G](#) 51 responses, 73% correct



8 get it now
0 still don't get it

[feedback & support](#)

Tips for PI

- can use with just one concept in a course
- always give students a chance to vote first
before discussion
- have students give explanations of different
responses as closure activity

5

What do I do next?

#1 Tip for Getting Started

Find a mentor

hero

mentor



Peer Instruction Network

Connect.Share.Learn.

www.peerinstruction.net

Peer Instruction Network

CONNECT. SHARE. LEARN.

Join

The Peer Instruction Network connects innovative educators from across the globe.



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One easy way to make readings come alive for your students

January 24, 2013

Want to make the subject matter come alive for your students? Most of us do. This is easier when we are in the classroom and can interact with students one on one and react to their blank stares when we are talking nonsense. But what about when they are at home? In a recent conversation [...]

Quick Start Guide to Flipping your Classroom with Peer Instruction

January 15, 2013

Ready to turn your students' worlds right side up? Flip your classroom with Peer Instruction. Peer Instruction is the first innovative teaching method I tried the second time teaching my "big girl" course – a graduate level seminar on educational theory at Teachers College, Columbia University. I had been working as a postdoc with Eric [...]

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Peer Instruction



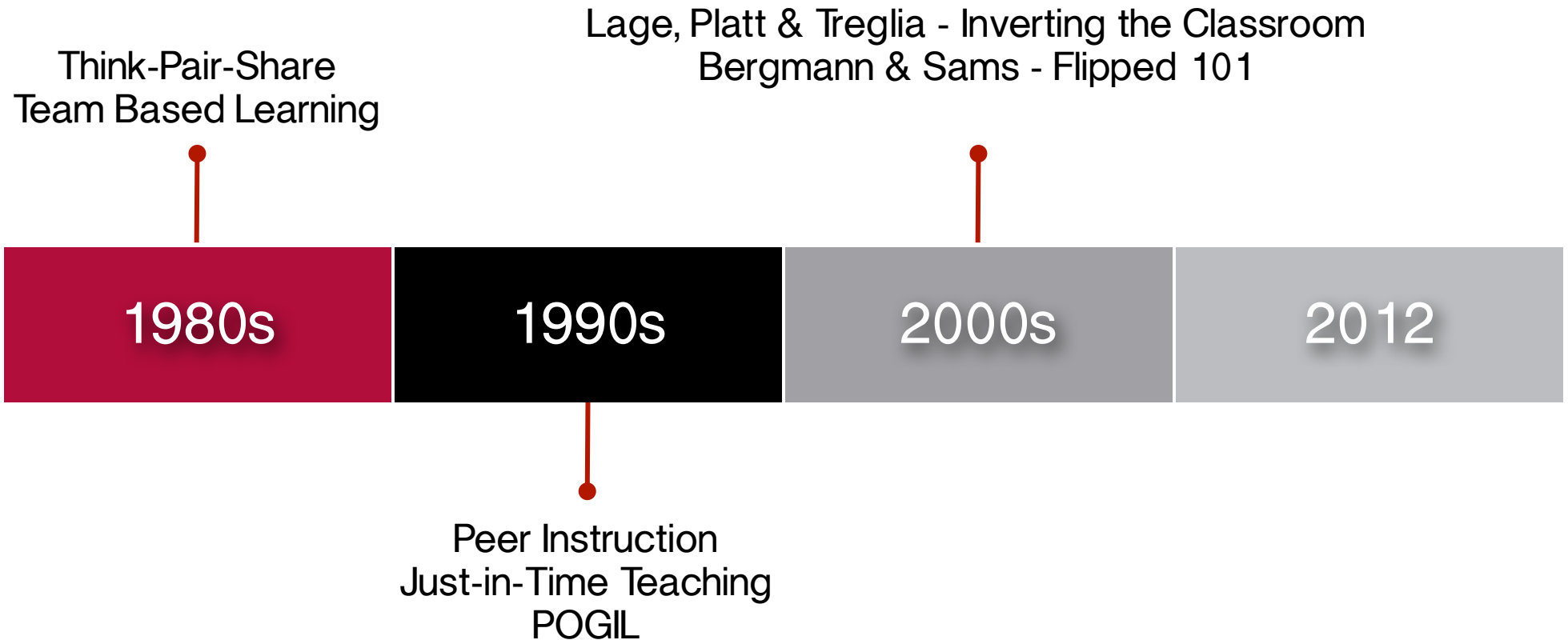
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"Given that students are asked to evaluate us as instructors, how do you avoid giving the impression that you are largely absent in a flipped class?"

When do you think we first
heard the modern call for
flipped classrooms?

One Possible Timeline of Calls for Flipped Classrooms



Moore Method

1910s

Discovery Learning
Problem-Based learning

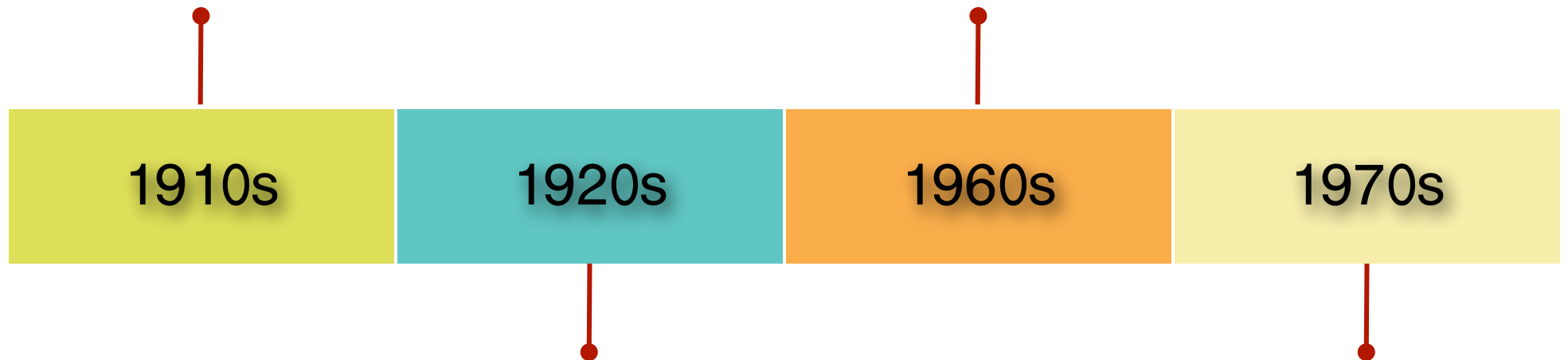
1960s

Experiential Learning

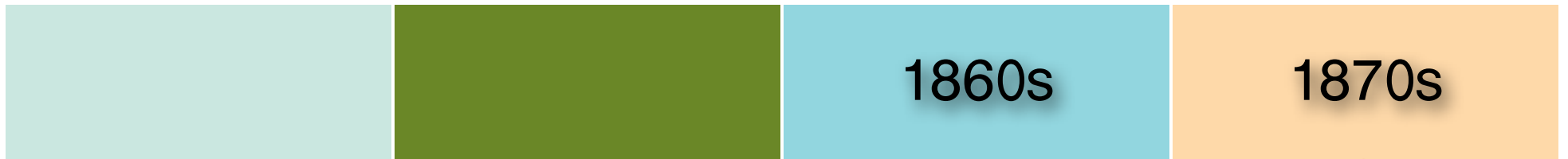
1920s

Pedagogy of
the Oppressed

1970s



Practical education



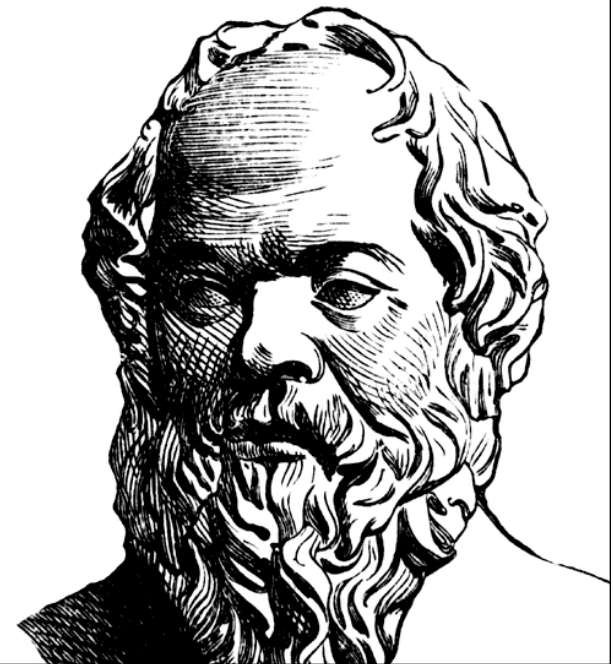
1860s

1870s

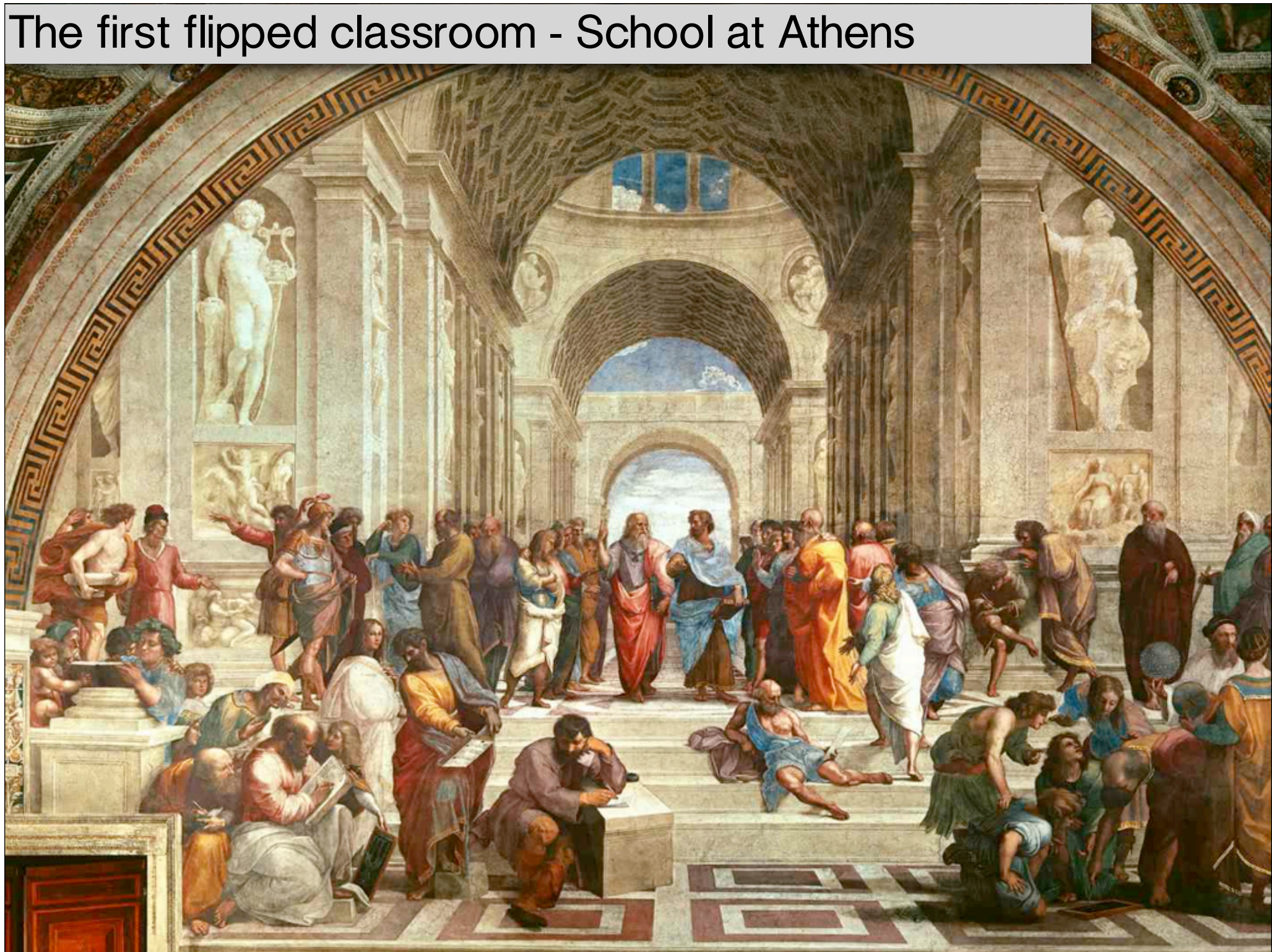
Casebook Method

~460 BC

Dialogue,
Questioning

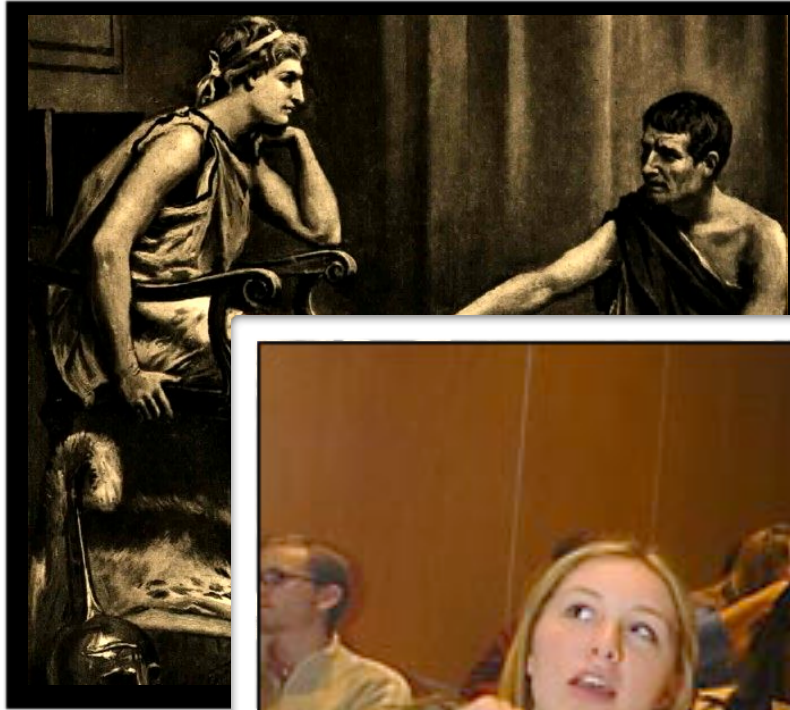


The first flipped classroom - School at Athens









Try flipping your classroom, it
may just turn your students'
worlds right side up.





Acknowledgements

PEOPLE

Eric Mazur

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Peter Newbury

Dan Meyer

Nancy Duarte

BOOKS

Flip Your Classroom

Peer Instruction a User's Manual

Just-in-Time Teaching

Slide:Dology



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