Masterclass Interactive Teaching

TU Delft
22 September, 2011

Get your clickers ready!

- no ON/OFF button
- only last “click” counts
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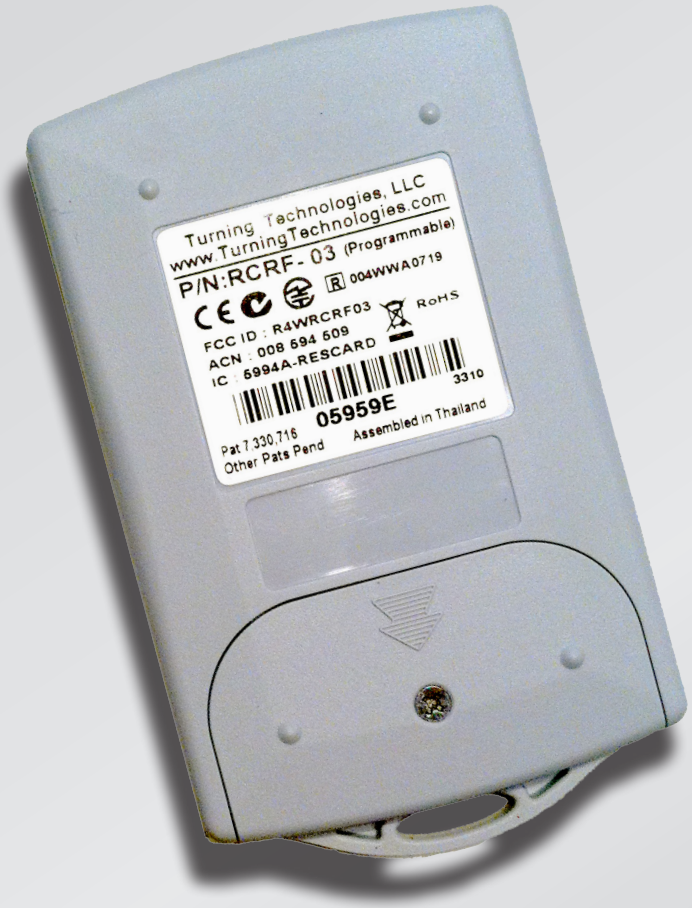

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How do we learn?

Think of something you are good at — something that you know you do well.

How do we learn?

Think of something you are good at — something that you know you do well.

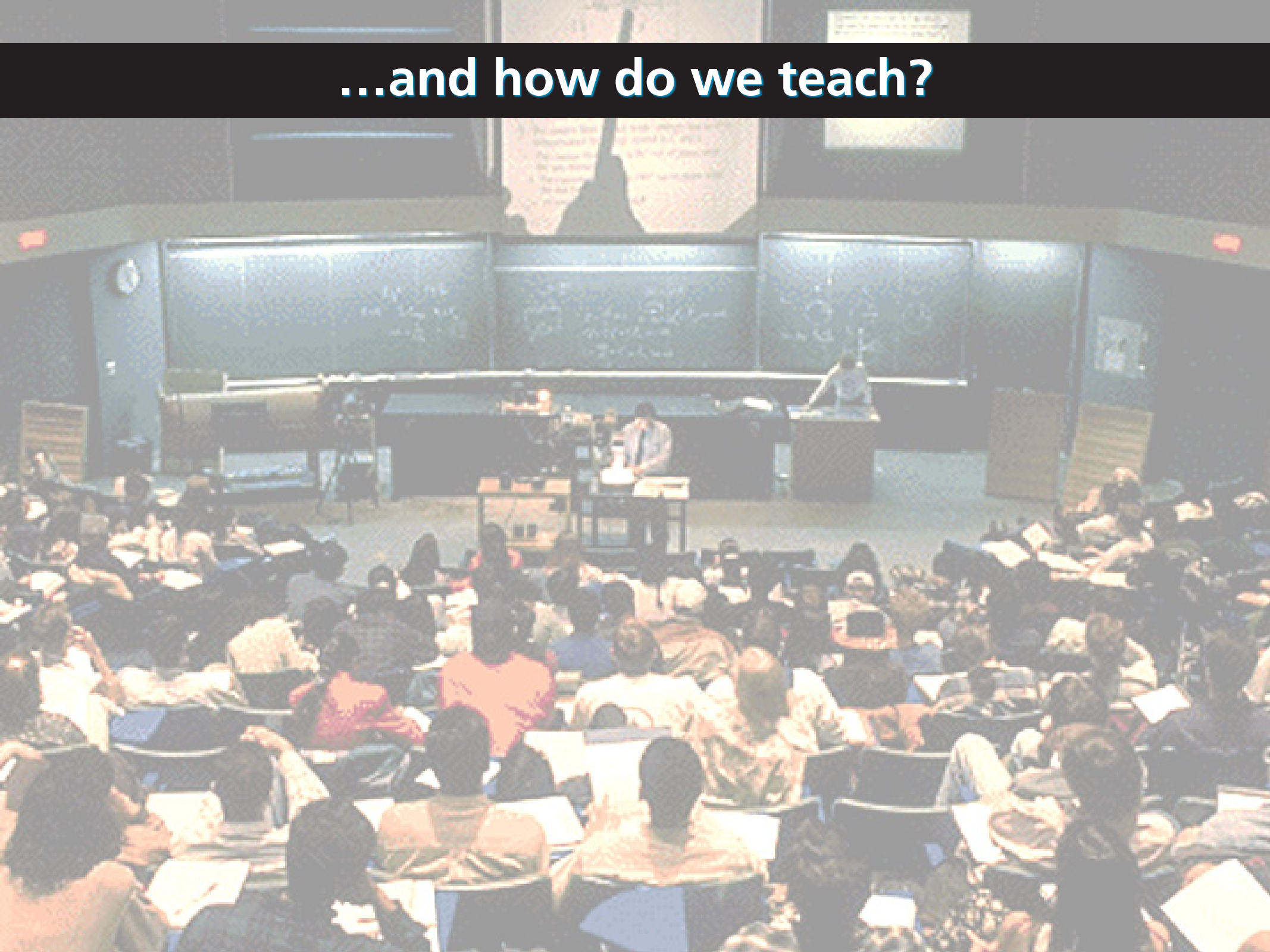
***How* did you become good at this?**

How do we learn?

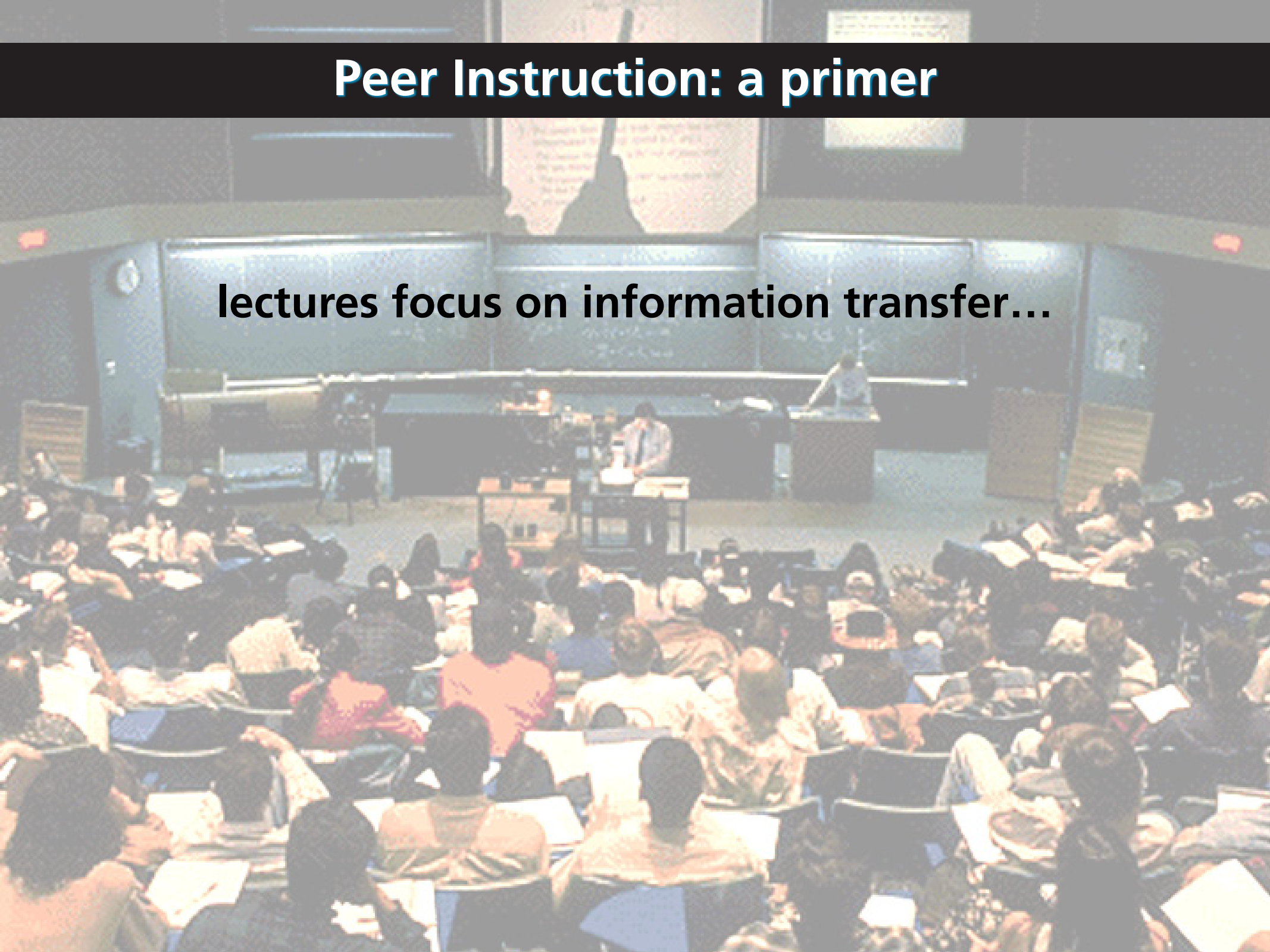
Became good at it by:

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

…and how do we teach?



Peer Instruction: a primer



lectures focus on information transfer…

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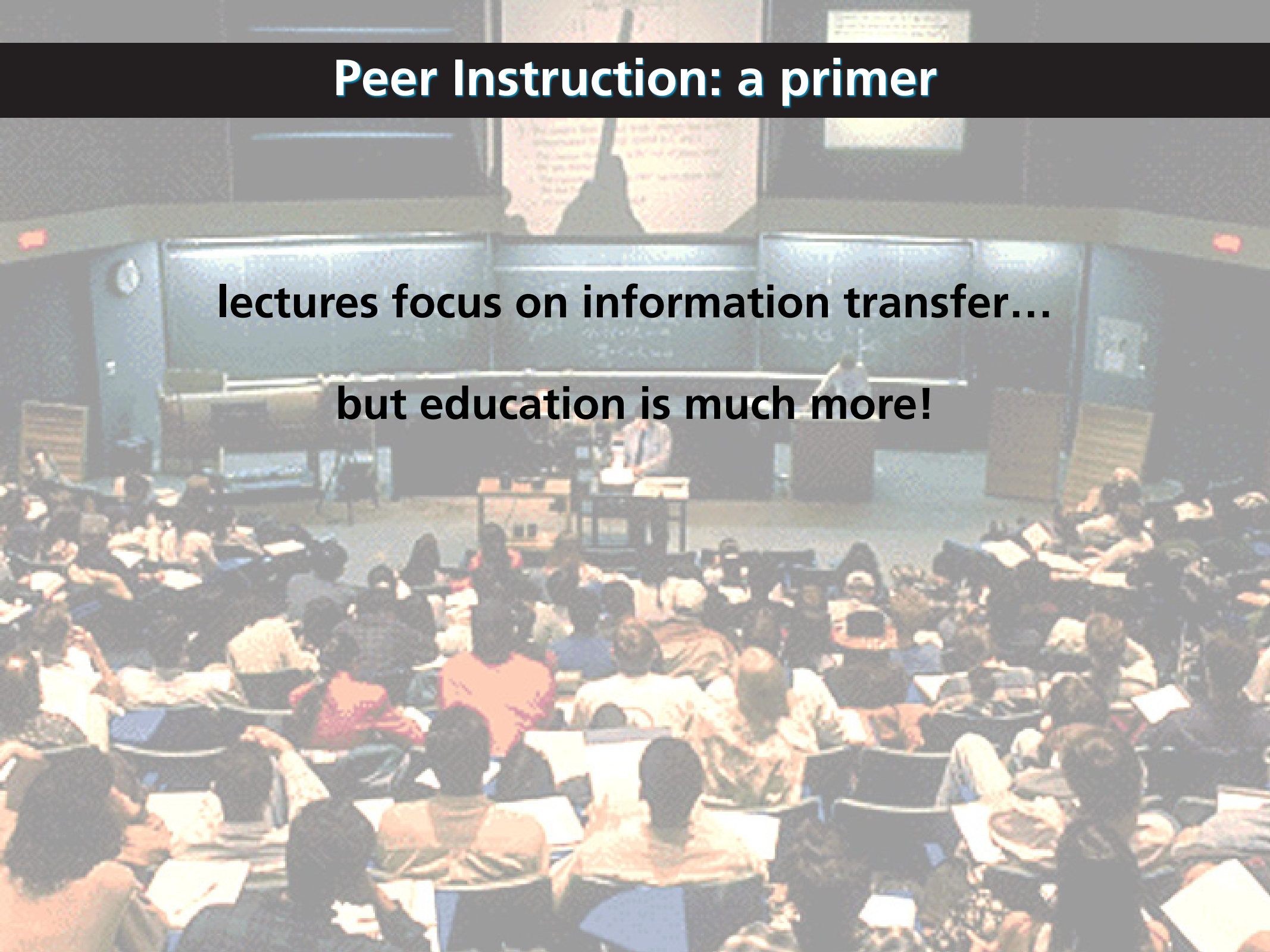
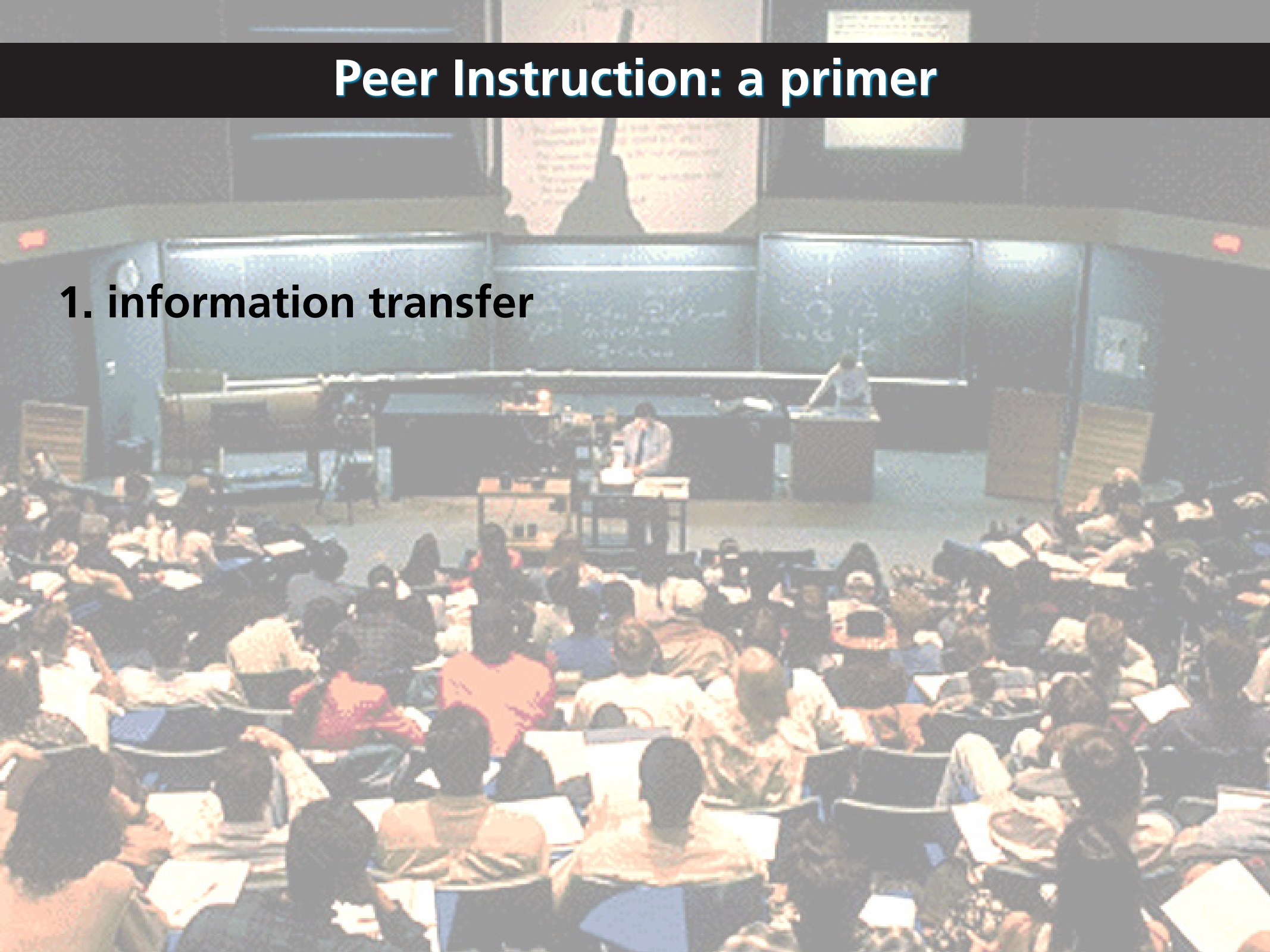


lectures focus on information transfer…

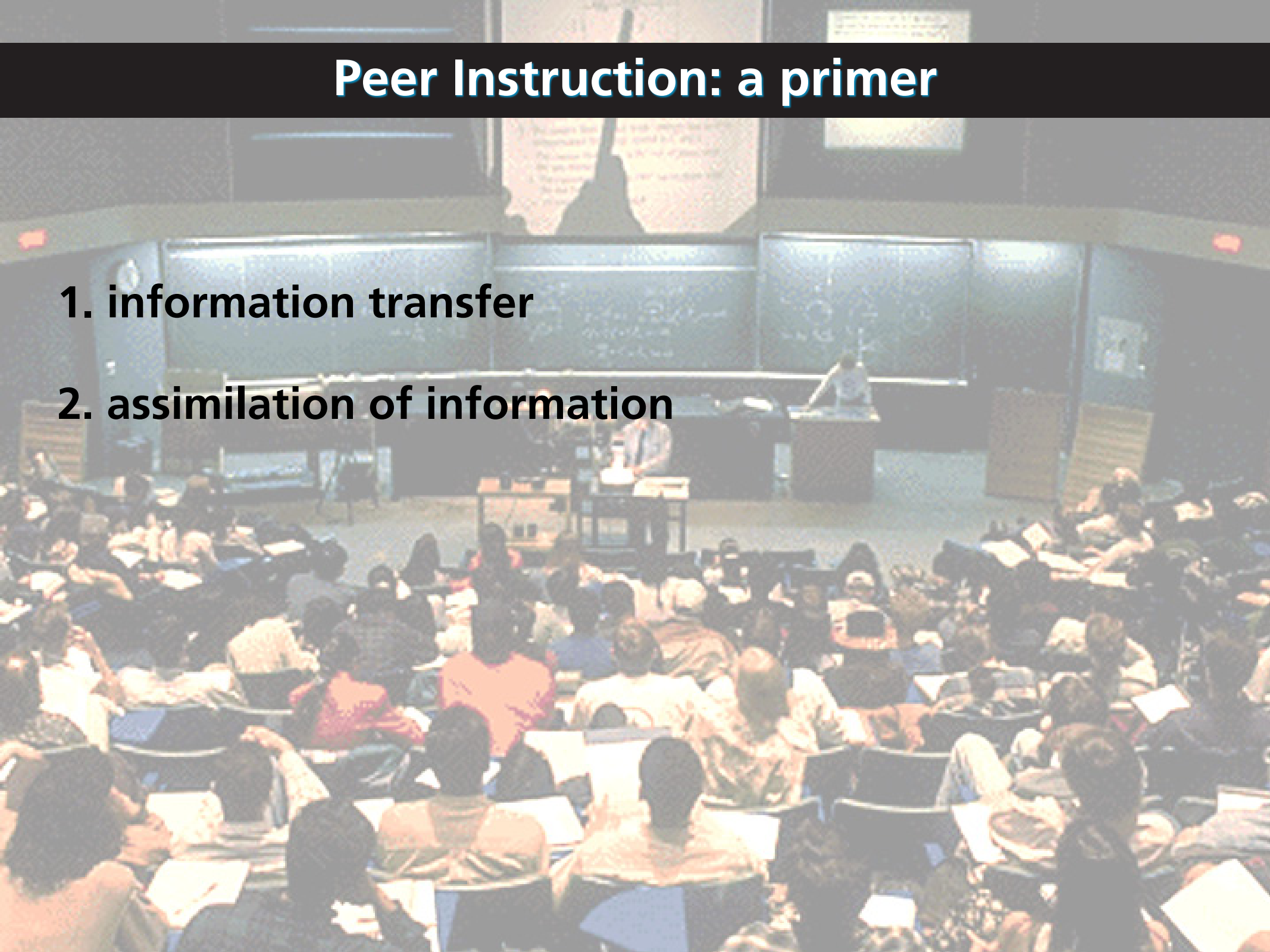
but education is much more!

Peer Instruction: a primer



1. information transfer

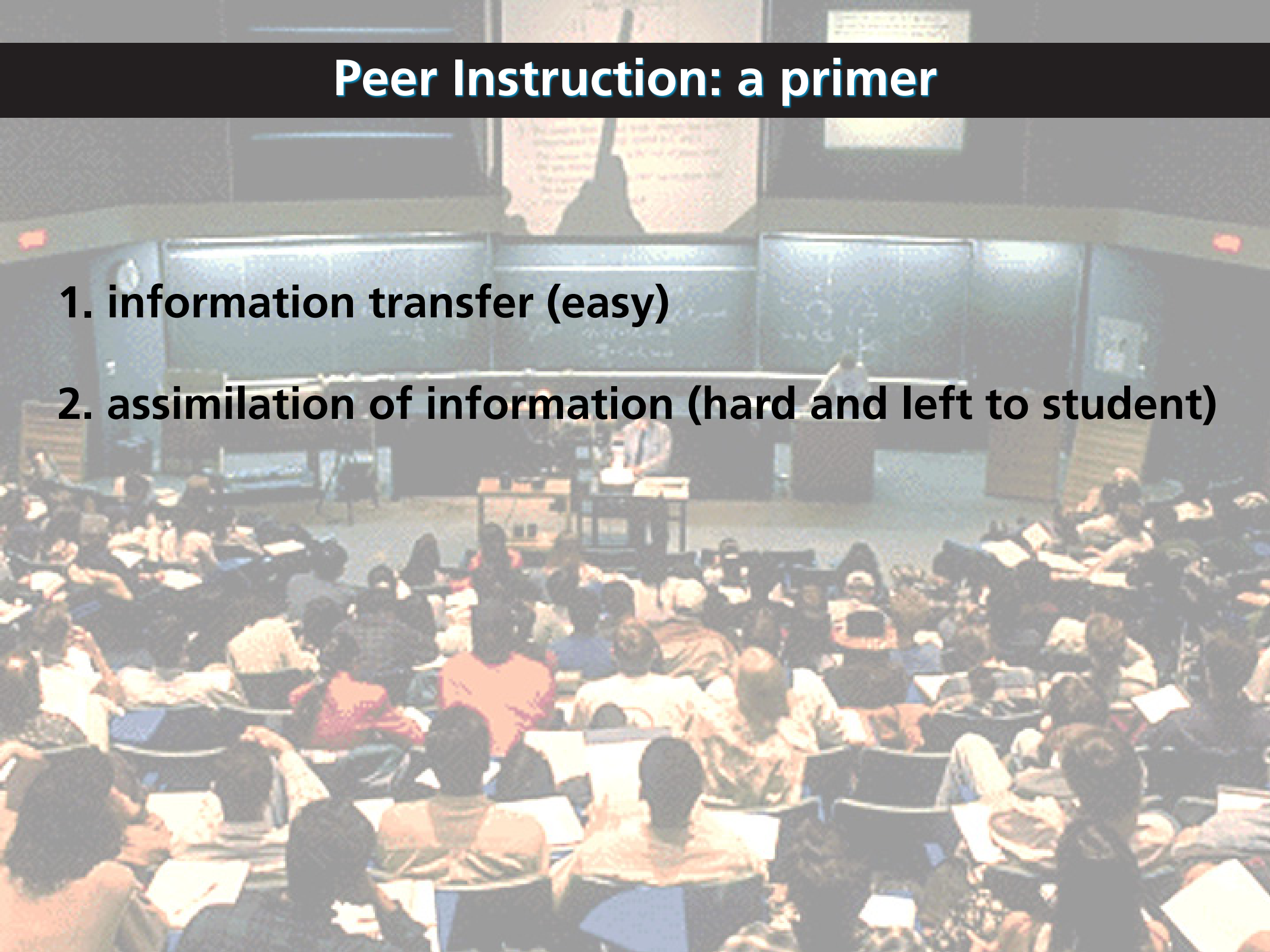
Peer Instruction: a primer



1. information transfer

2. assimilation of information

Peer Instruction: a primer



1. information transfer (easy)

2. assimilation of information (hard and left to student)

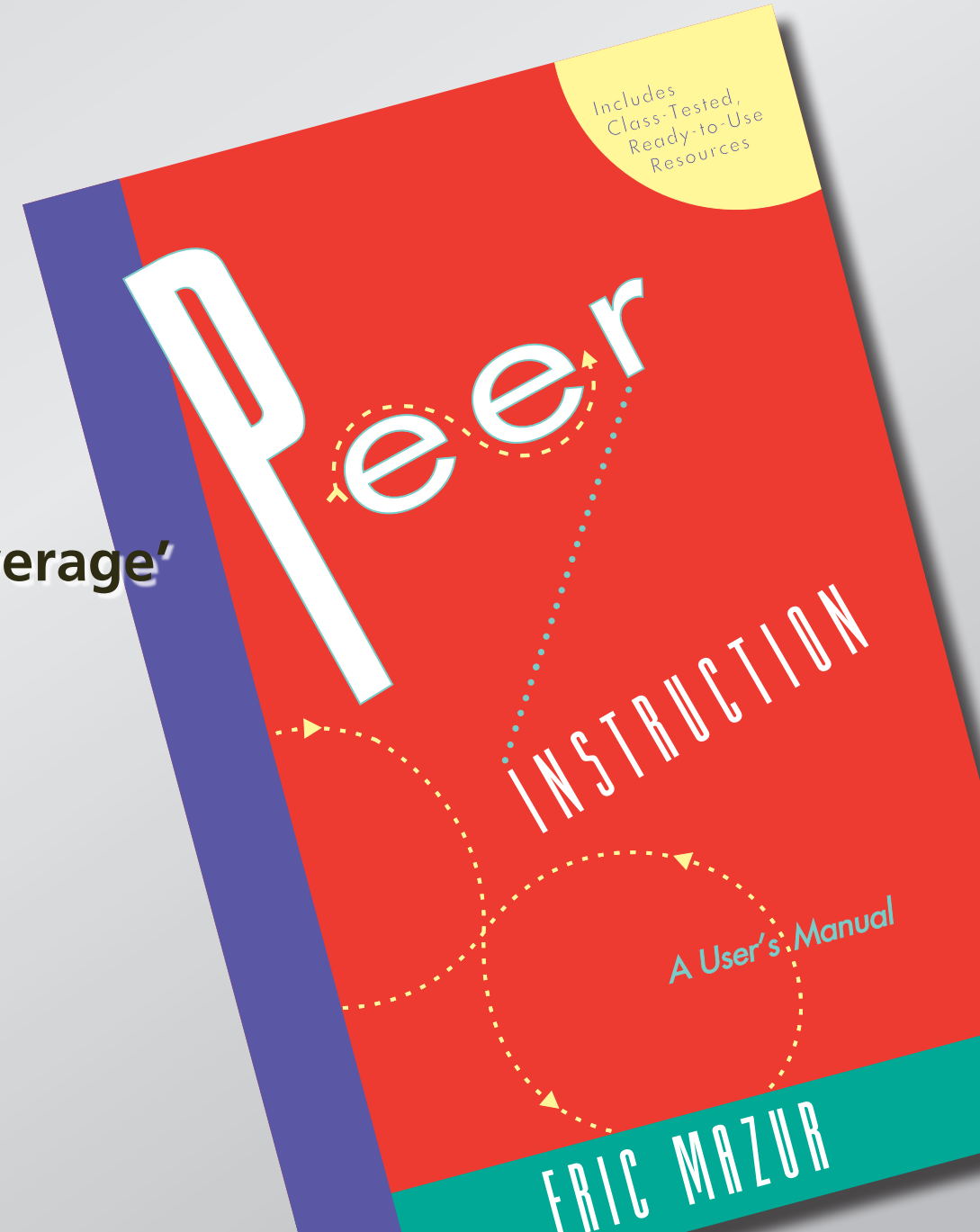
Peer Instruction: a primer

Solution: move information transfer out of classroom!

Peer Instruction: a primer

Main features:

- **pre-class reading**
- **in-class: depth, not 'coverage'**
- **ConcepTests**



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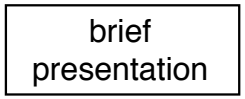

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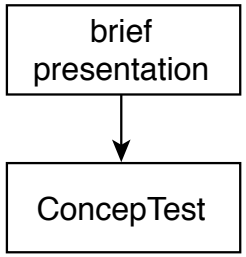

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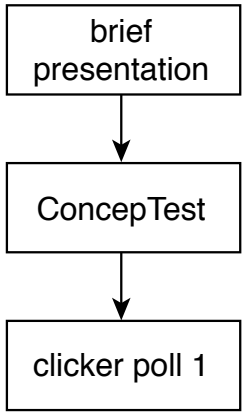

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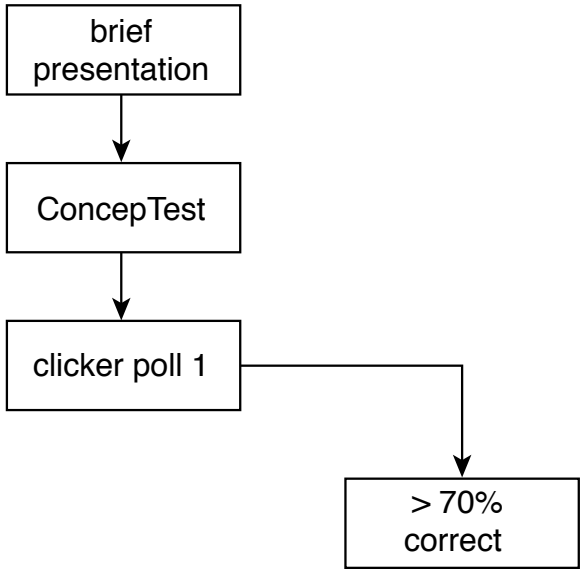

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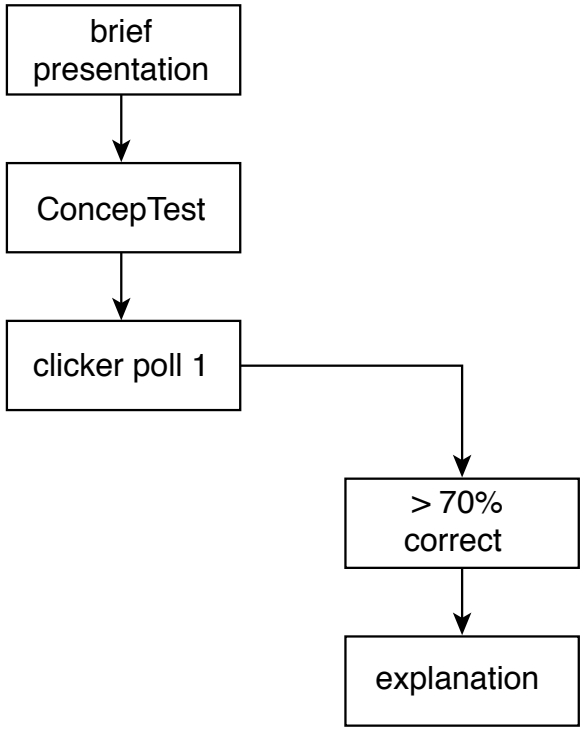

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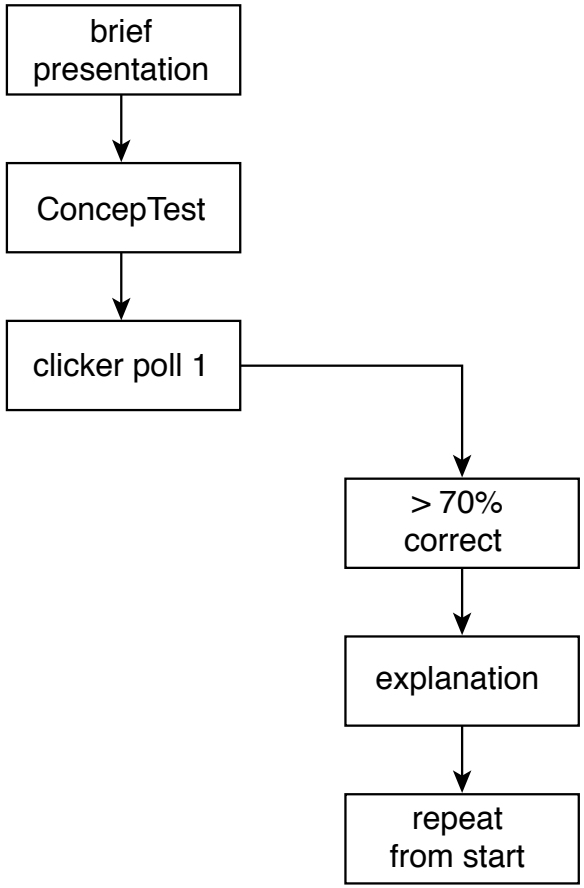

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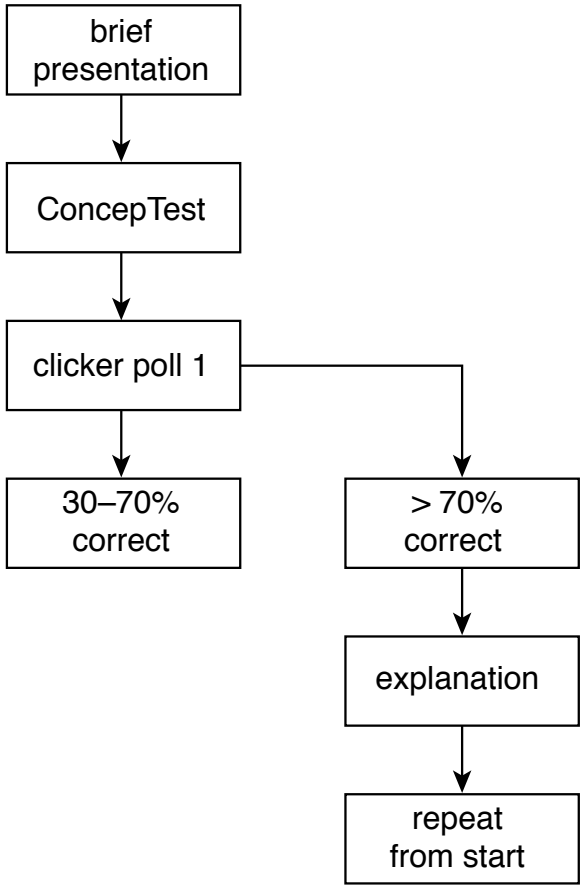

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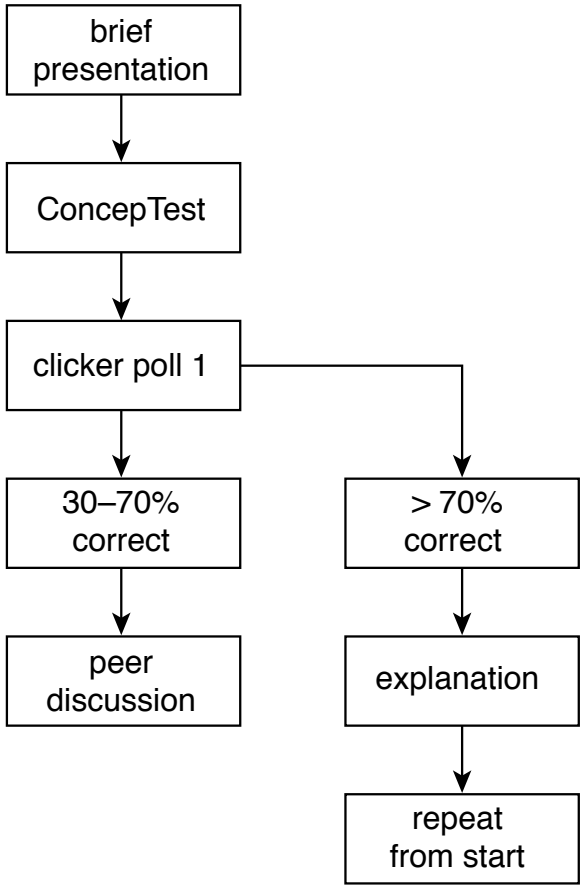

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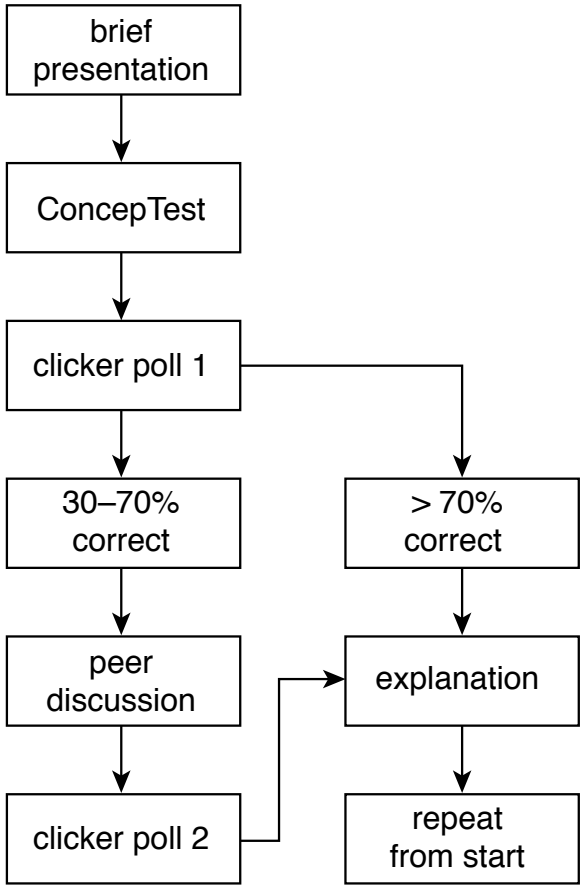

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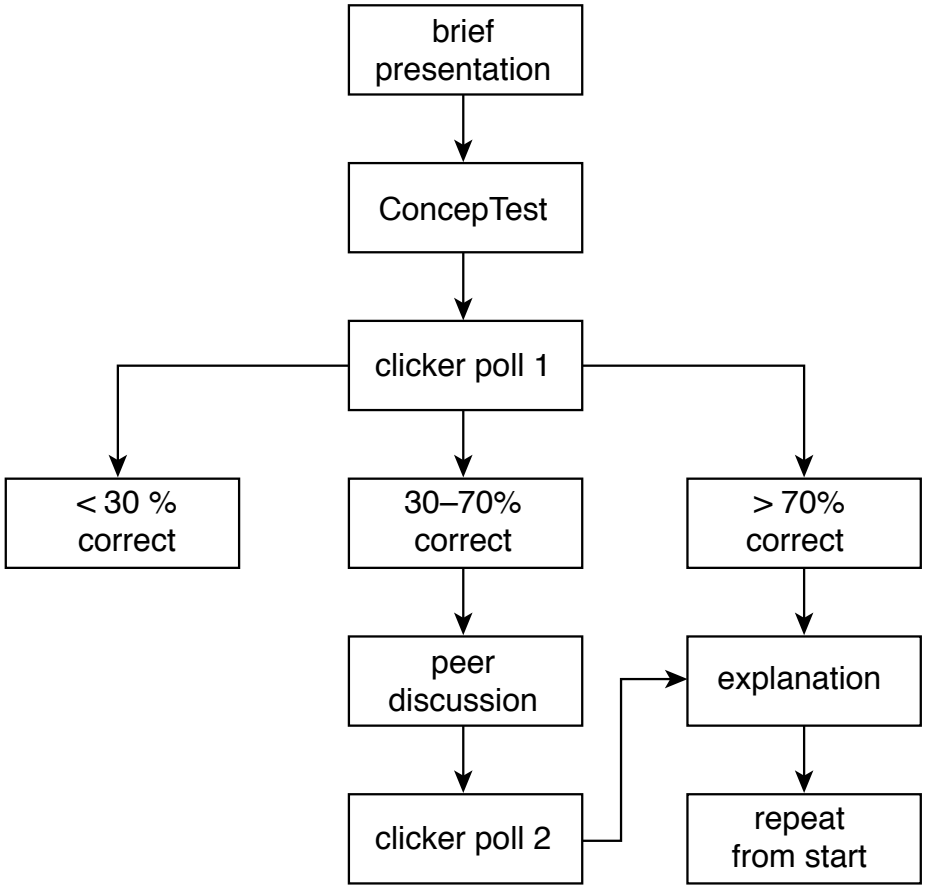

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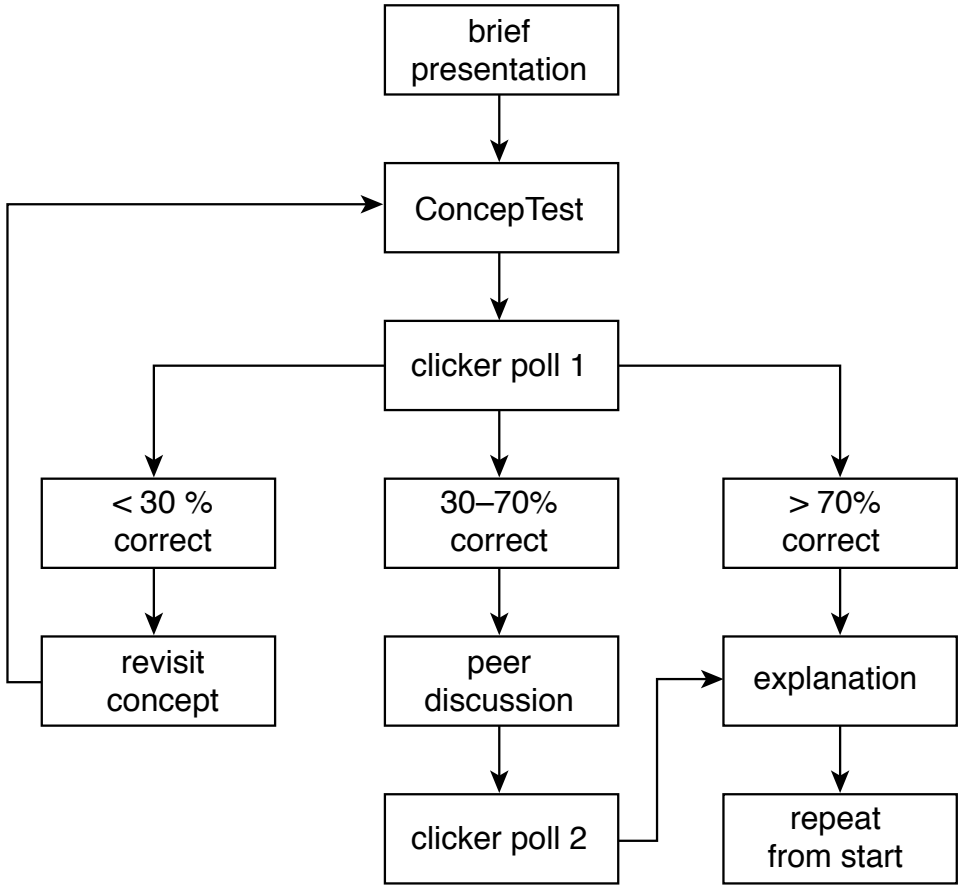

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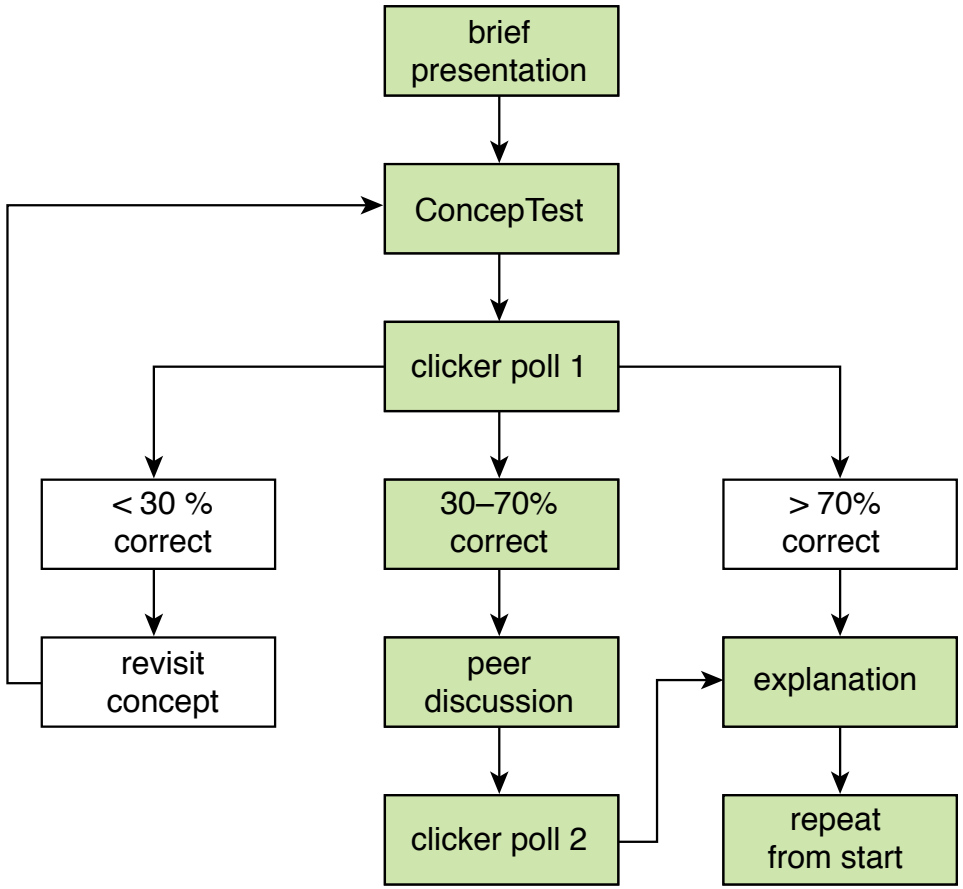
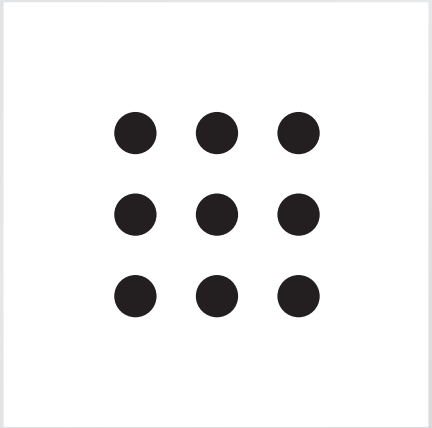


Let's try it!

thermal expansion

Let's try it!

When metals heat up, they expand because all atoms get farther away from each other.



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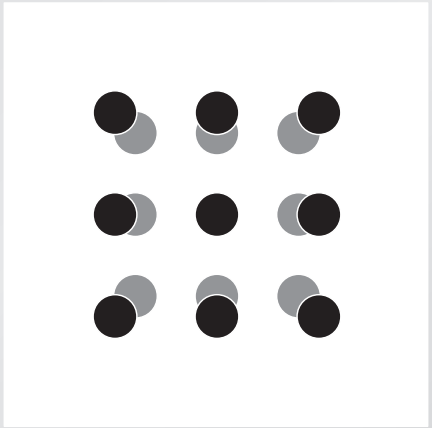
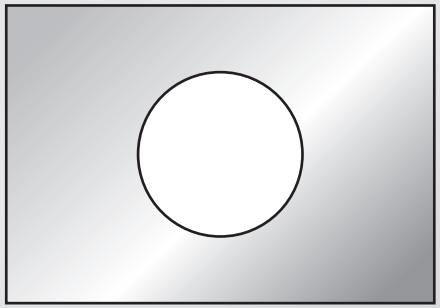


Let's try it!

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



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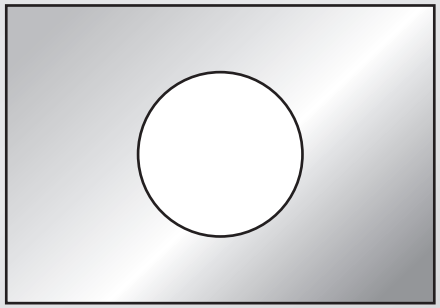


When the plate is uniformly heated, the diameter of the hole

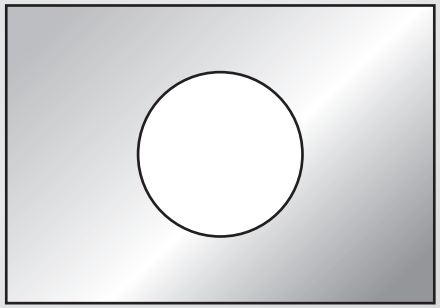
1. increases.
2. stays the same.
3. decreases.

Let's try it!

It's easy to fire up the audience!

Let's try it!

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



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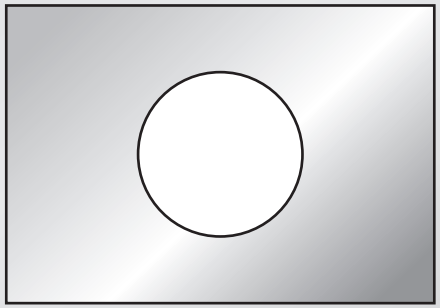

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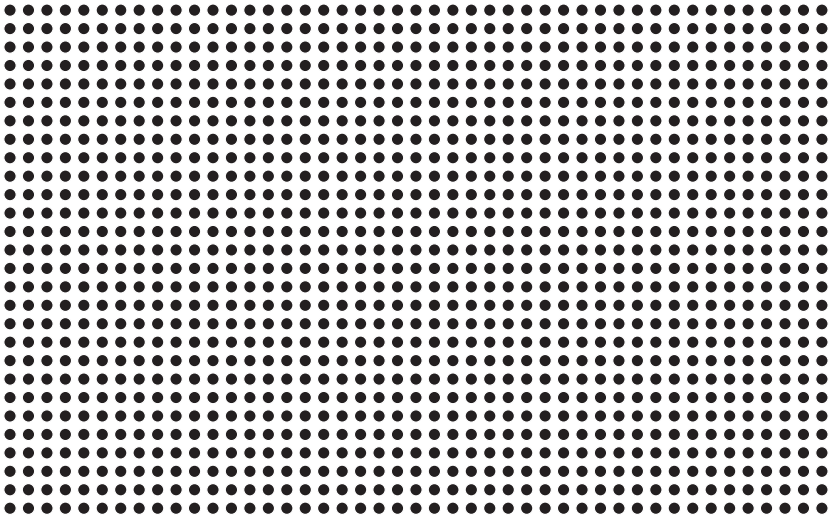
Let's try it!

remember: all atoms must get farther away from each other!



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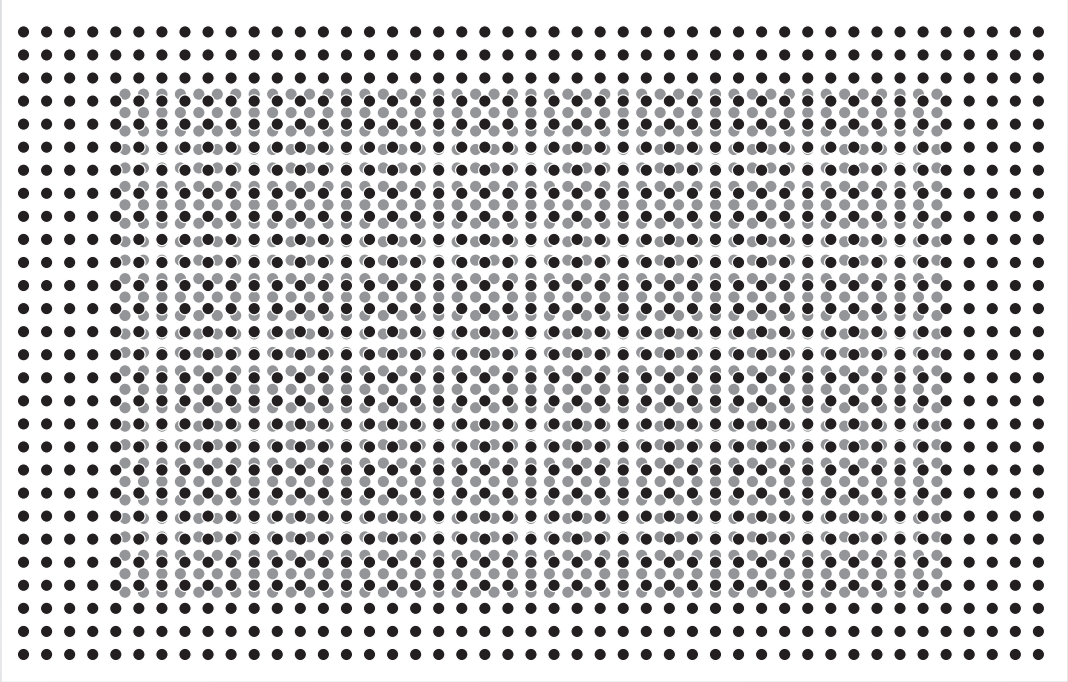
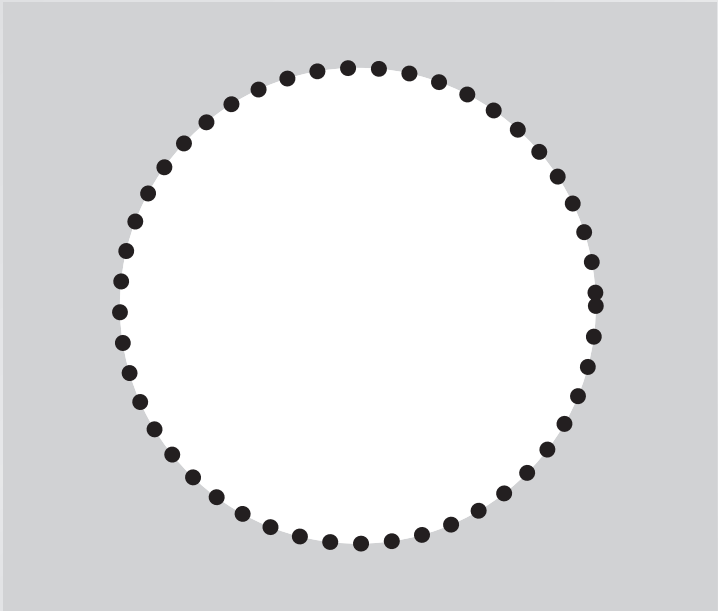


Let's try it!

consider the atoms at the rim of the hole



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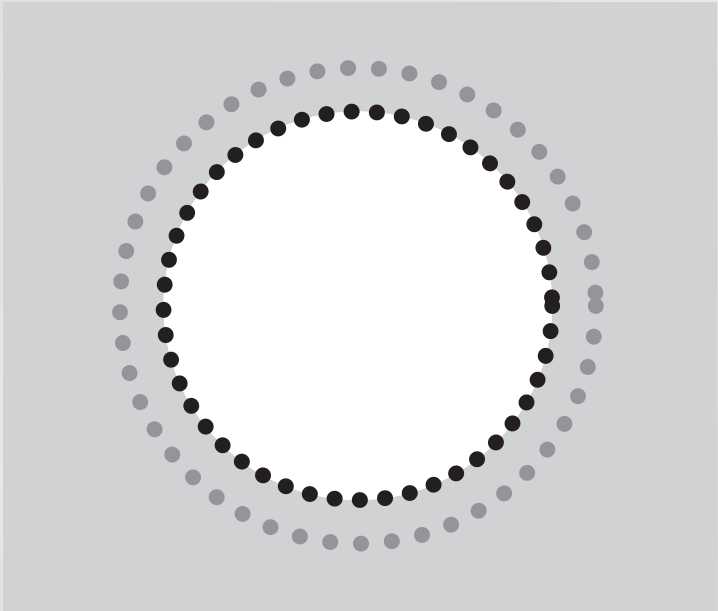

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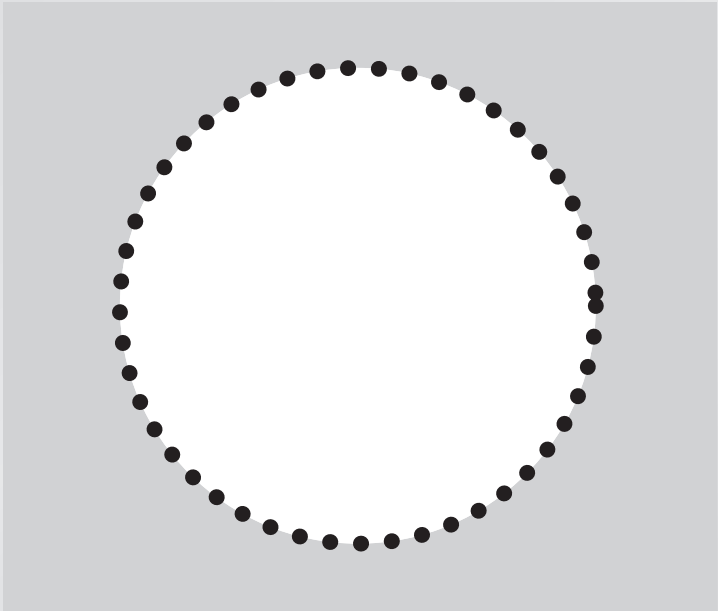

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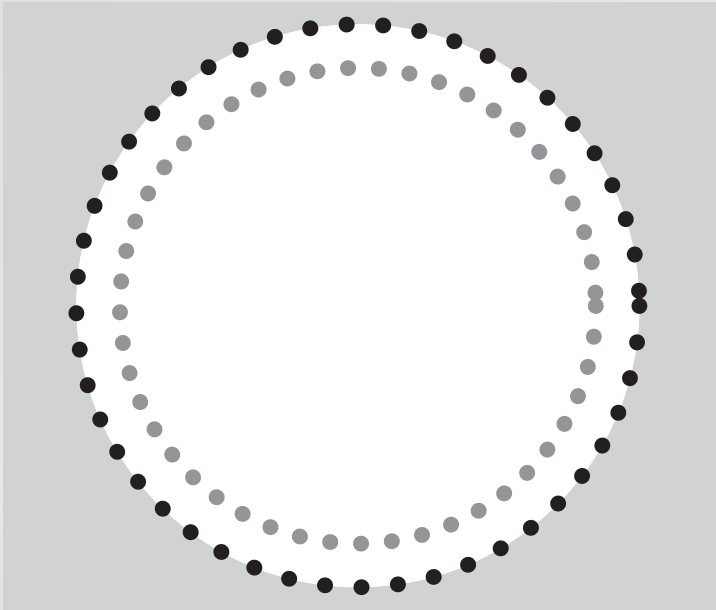
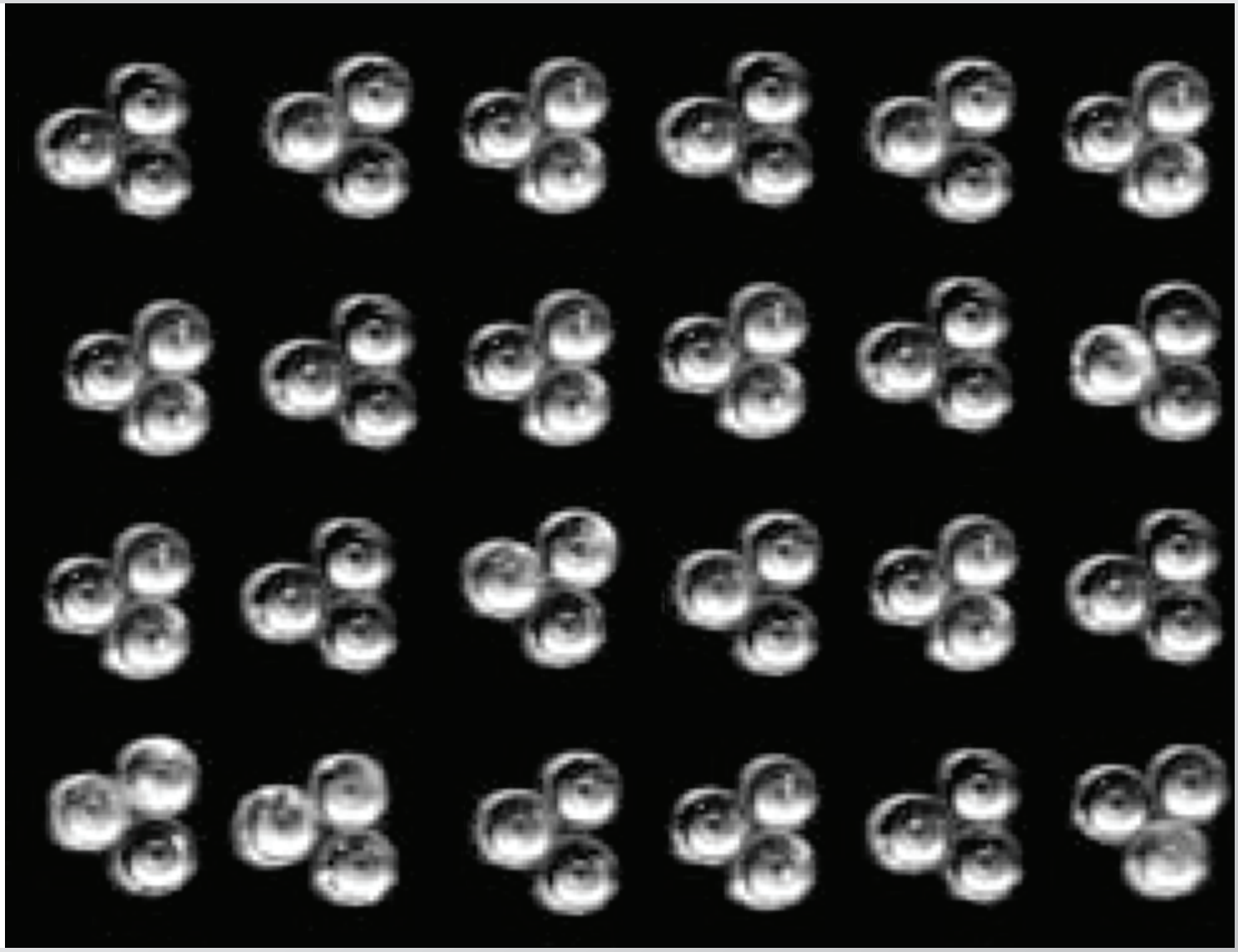


Let's try it!

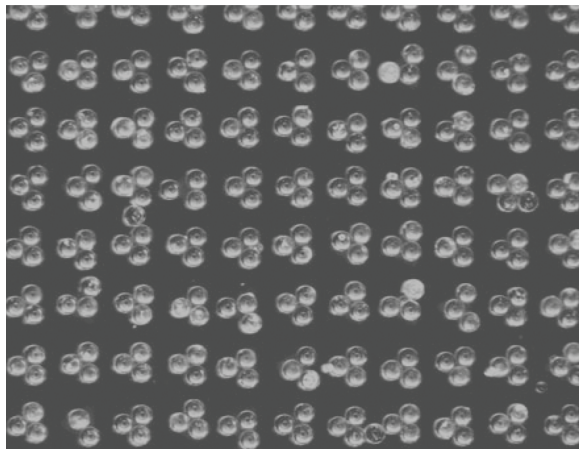
"Does this method work only with questions that have a correct answer?"

Let's try it!

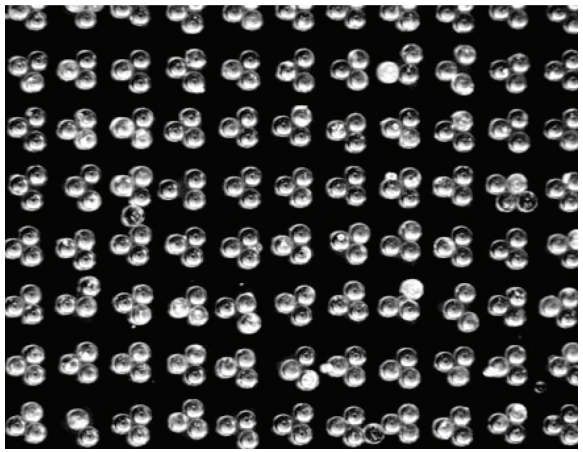


Let's try it!

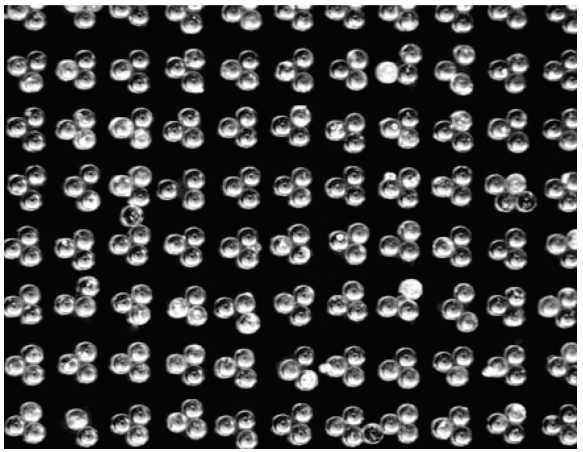
original



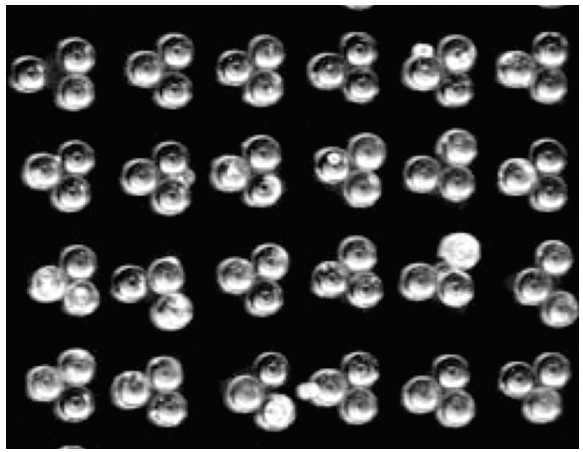
1. adjust contrast



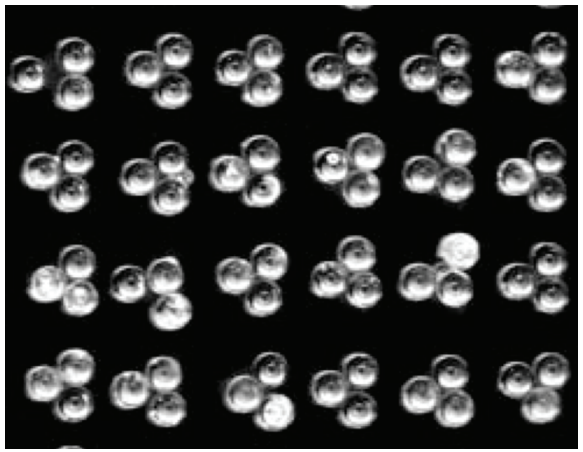
2. remove blemishes



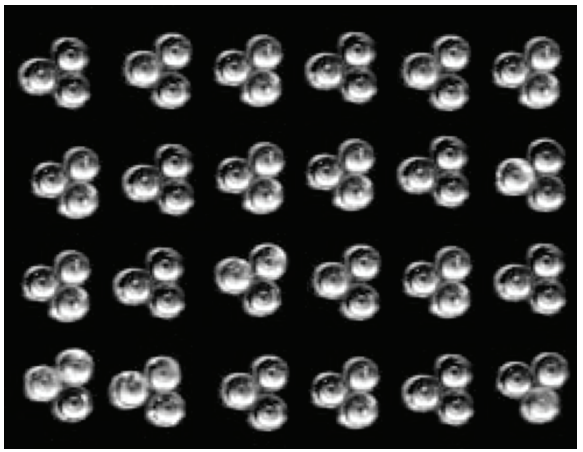
3. crop



4. remove outliers



5. reconstruct



Consider this

a couple of points worth noting:

Consider this

a couple of points worth noting:

1. you got engaged

Consider this

a couple of points worth noting:

1. you got engaged
2. no “correct” answer

Consider this

a couple of points worth noting:

1. you got engaged
2. no “correct” answer
3. you got engaged

Consider this

a couple of points worth noting:

1. you got engaged
2. no “correct” answer
3. you got engaged
4. you don’t need a correct answer!

Frequently Asked Questions

“How do I move information transfer out of classroom?”

Getting students to read

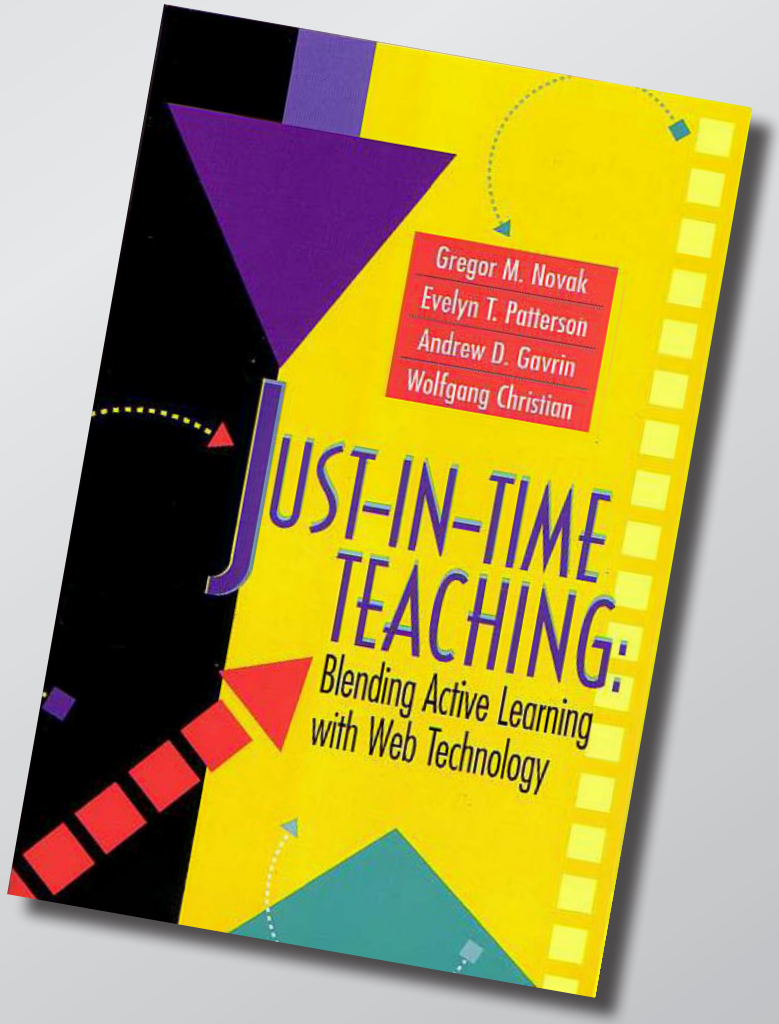
My approach:

- Reading quizzes (1991)
- Reading summaries (1994)
- Just-in-Time Teaching (1999)

Getting students to read

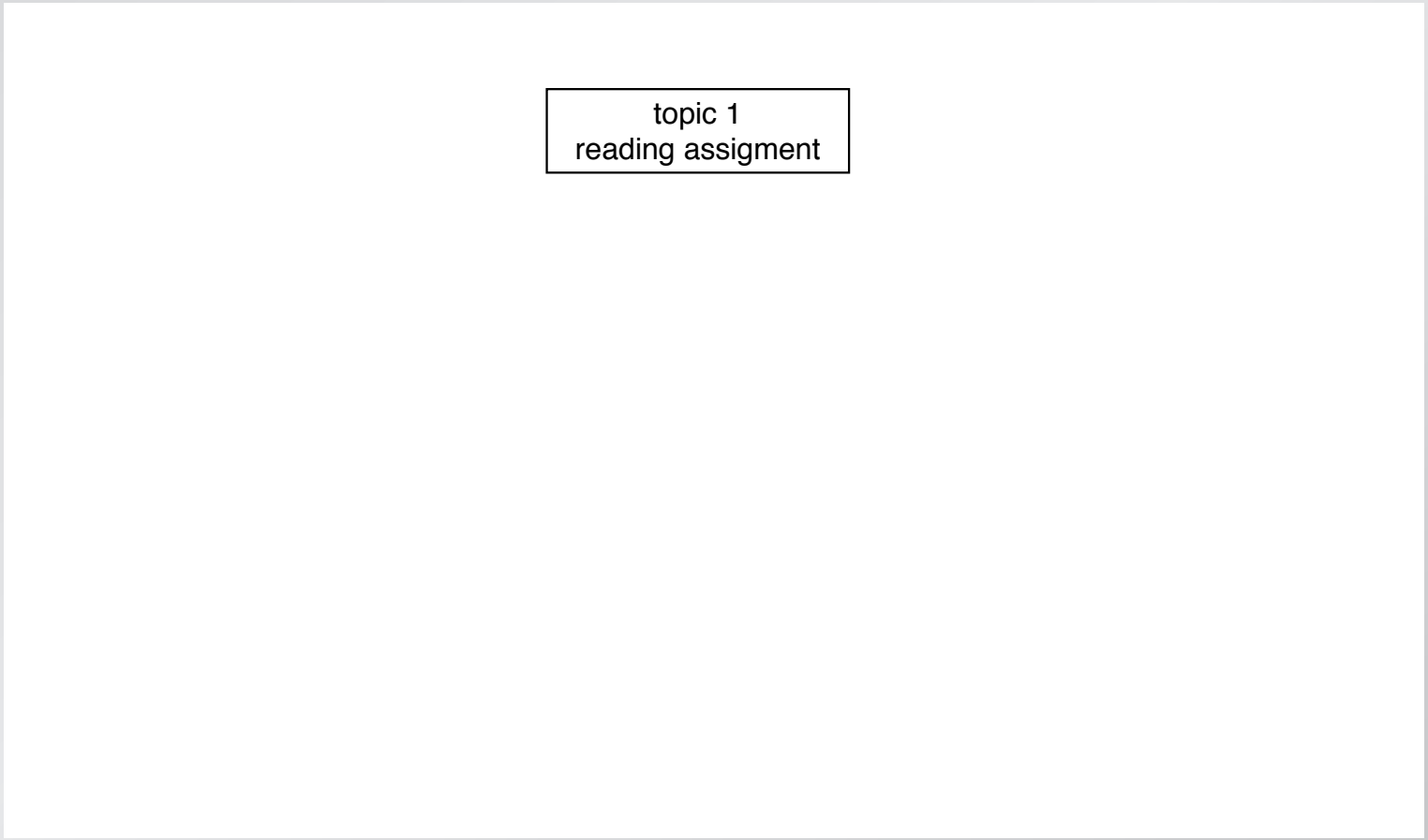
Just-in-time-Teaching (JiTT)

www.jitt.org



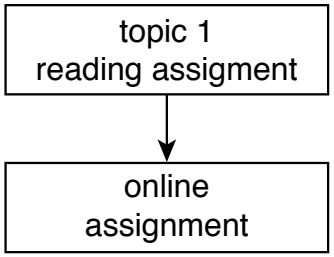
Getting students to read

JiTT workflow



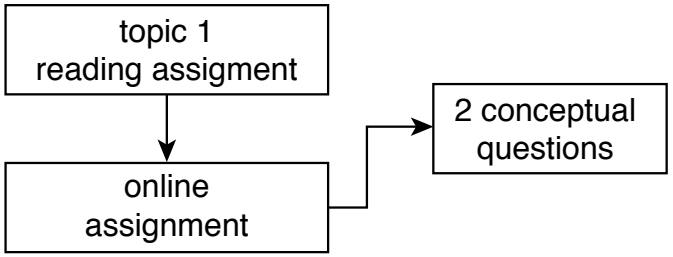
Getting students to read

JiTT workflow



Getting students to read

JiTT workflow



Getting students to read

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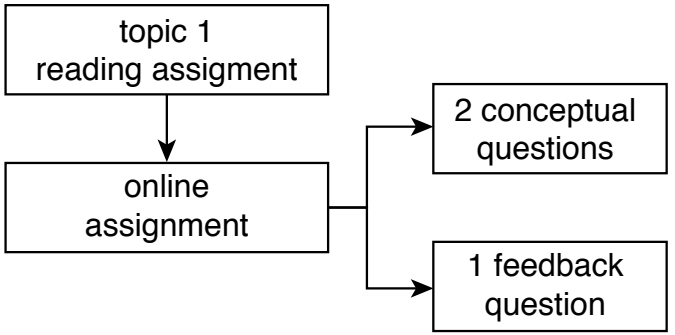

Getting students to read

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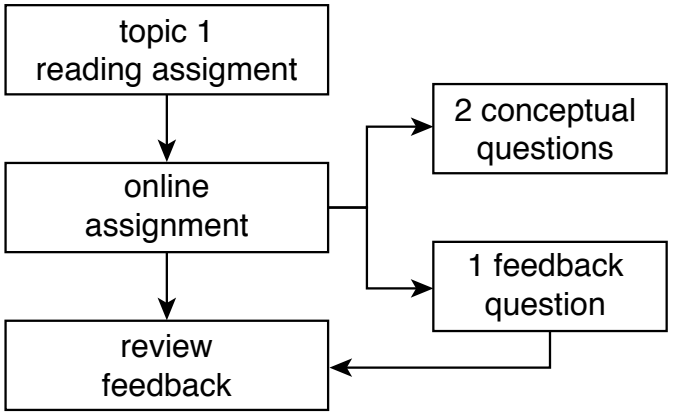

Getting students to read

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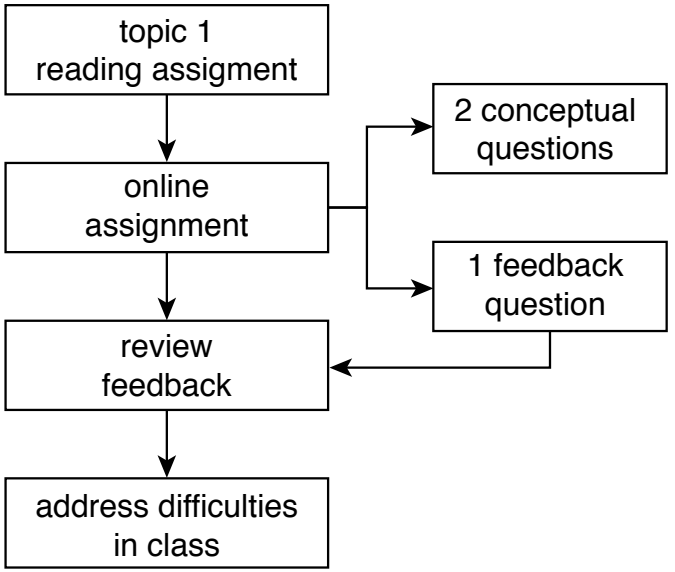

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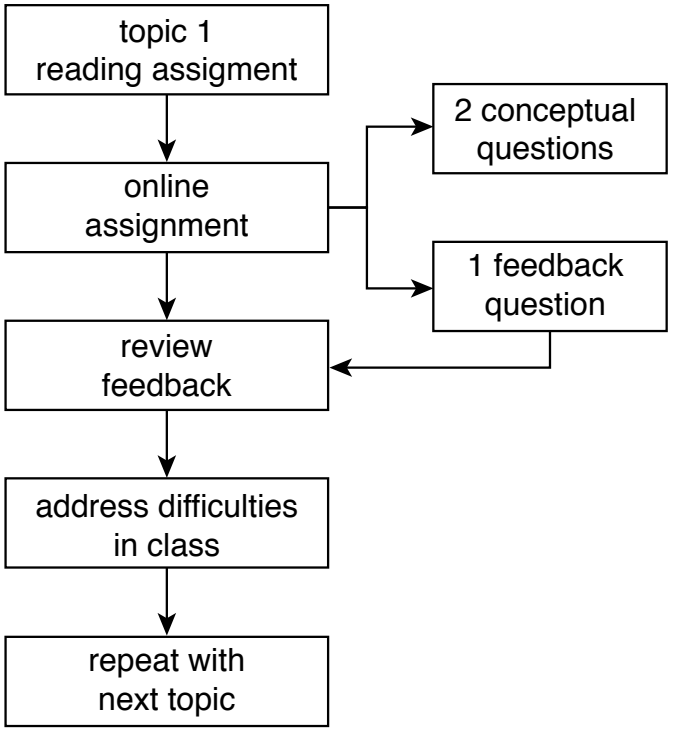
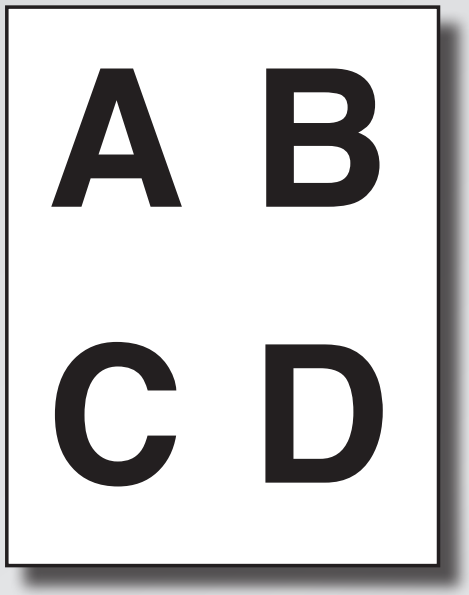


Frequently Asked Questions

“Do I need clickers?”

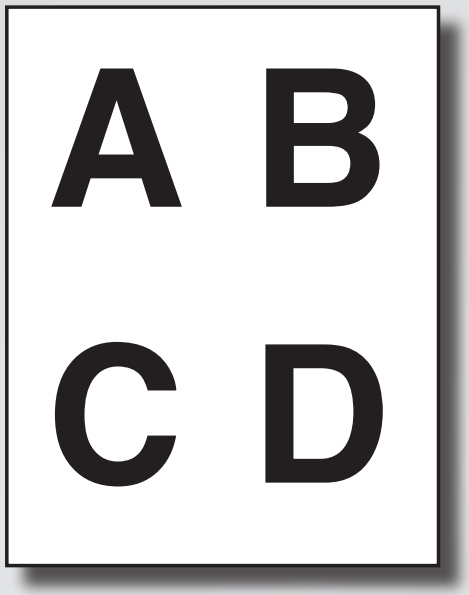
Clickers necessary?

Flashcards: simple and effective



Clickers necessary?

Flashcards: simple and effective



Meltzer and Mannivanan, South Eastern Louisiana University

Clickers necessary?

Imagine a rope that fits snugly along the equator.

Clickers necessary?

3. about 0.15 m
4. exactly 1 m
5. more than 1 m

Clickers necessary?

Imagine a rope that fits snugly along the equator.

Suppose the rope is cut and 1 m of rope is inserted between the cut ends. If the rope were to maintain a circular shape, how far off the surface of the Earth would it float?

1. the width of a few atoms
2. the width of a few hairs
3. about 0.15 m ✔
4. exactly 1 m
5. more than 1 m

Clickers necessary?

circumference at the equator:

$$2\pi R_{\mathrm{E}}$$

Clickers necessary?

circumference at the equator:

$$2\pi R_{\mathrm{E}}$$

new circumference:

$$2\pi R_{\mathrm{E}} + 1\ \mathrm{m}$$

Clickers necessary?

circumference at the equator:

$$2\pi R_{\mathrm{E}}$$

new circumference:

$$2\pi R_{\mathrm{E}} + 1\ \mathrm{m}$$

radius of circle with new circumference:

$$2\pi R = 2\pi R_{\mathrm{E}} + 1\ \mathrm{m}, \quad \textbf{and so} \quad R = R_{\mathrm{E}} + \frac{1\ \mathrm{m}}{2\pi}.$$

Clickers necessary?

You all got fired up!

Clickers necessary?

You all got fired up!

(WITHOUT CLICKERS!)

Clickers necessary?

It’s not the technology, but the pedagogy!

Clickers necessary?

It's not the technology, but the pedagogy!

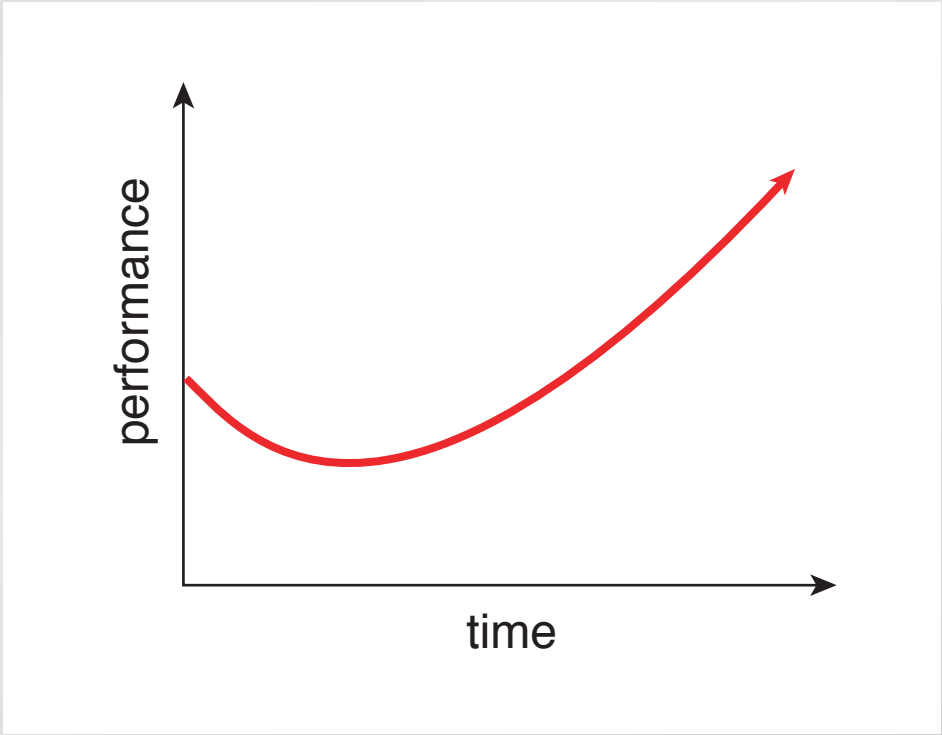
(but clickers do offer advantages)

Frequently Asked Questions

"How do I deal with students who resist this new approach to studying?"

Student resistance

After changing, things might get *worse* before they get better!



Student resistance

Written on Wednesday Feb 16, two weeks into the course:

> Subject: concerns
>
> Professor Mazur,
>
> Here are a few concerns. I speak for many of my classmates.
>
> 1) You are giving us WAY to much work. After spending multiple hours on the problem set, and not being able to figure out many of the questions, I now see that we have an additional 6 or 7 pages or homework in the workbook. I just spent 4 hours on the lab, and I am not confident on almost half of the questions. This is more work than I have had all semester in all of my other classes combined.
>
> 2) If you are going to give us this much work, I would suggest re-structuring the lectures. I find the readings very difficult to understand. I am not a bad student (I got a solid A in physics 1a), but it is very difficult to internalize the readings. You should spend most of the lecture going over, point by point, the readings in their entirety. While the PRS clickers are fun, they do not help me understand the complex material.
>
> I am extremely flustered by the incredibly large amount of work, and my inability to understand it, and I am strongly considering dropping the course.

Student resistance

Written on Monday May 23, just after the final exam:

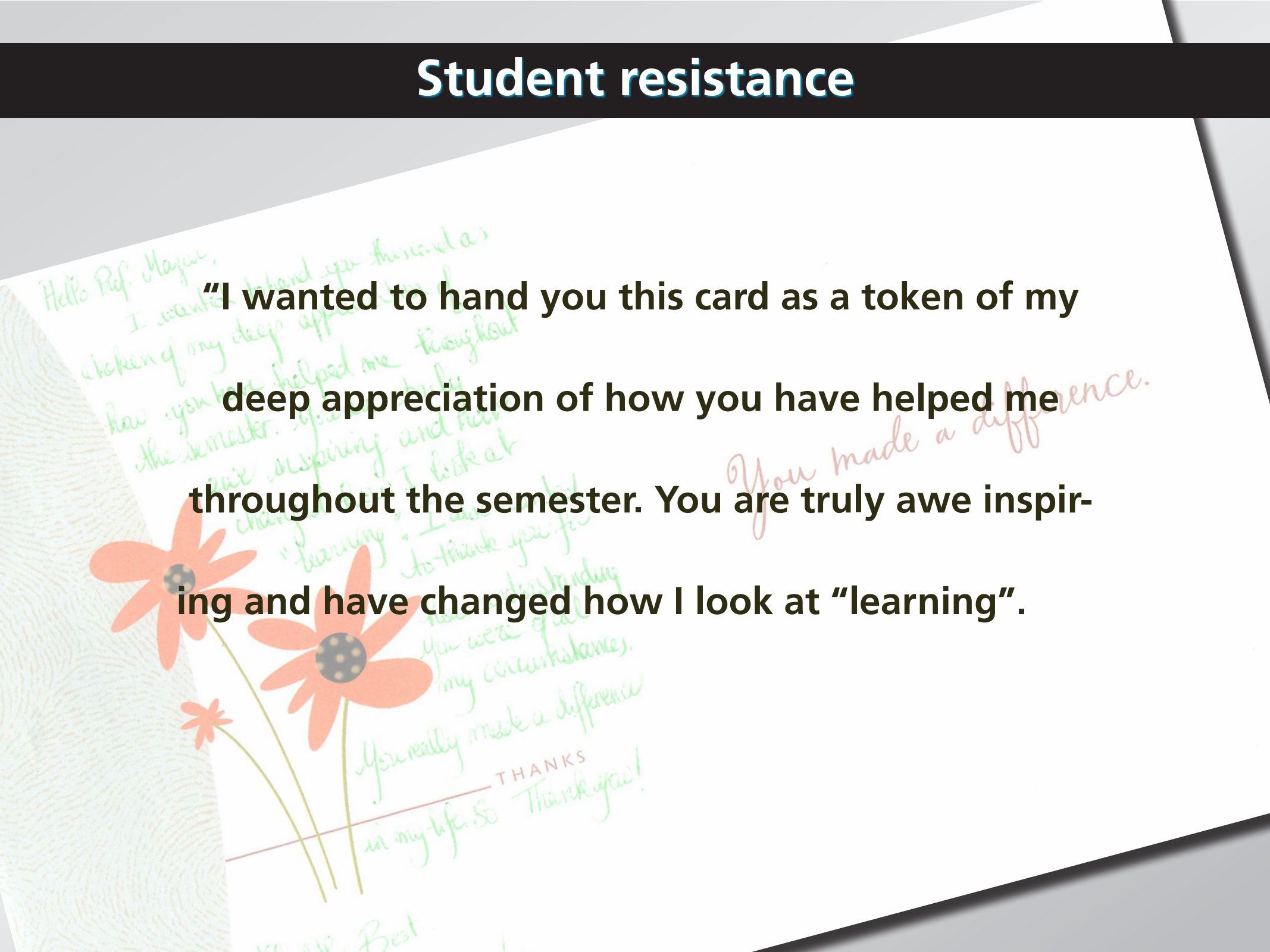
> Subject: Thanks!
>
> Professor Mazur,
>
> First of all I want to thank you for a great semester. You are an excellent professor, and it is clear that you truly care about each and every student.
>
> The exam went well today. I'm not sure to what extent you will curve the final grades (if at all), but it looks like I may be right around the cutoff point between an A and an A-. I studied as hard as I could and I'm keeping my fingers crossed about the A, but no matter what happens with my grade you should know that you are one of the best professors that I have ever had at Harvard.
>
> Thanks again!

Student resistance

Student resistance

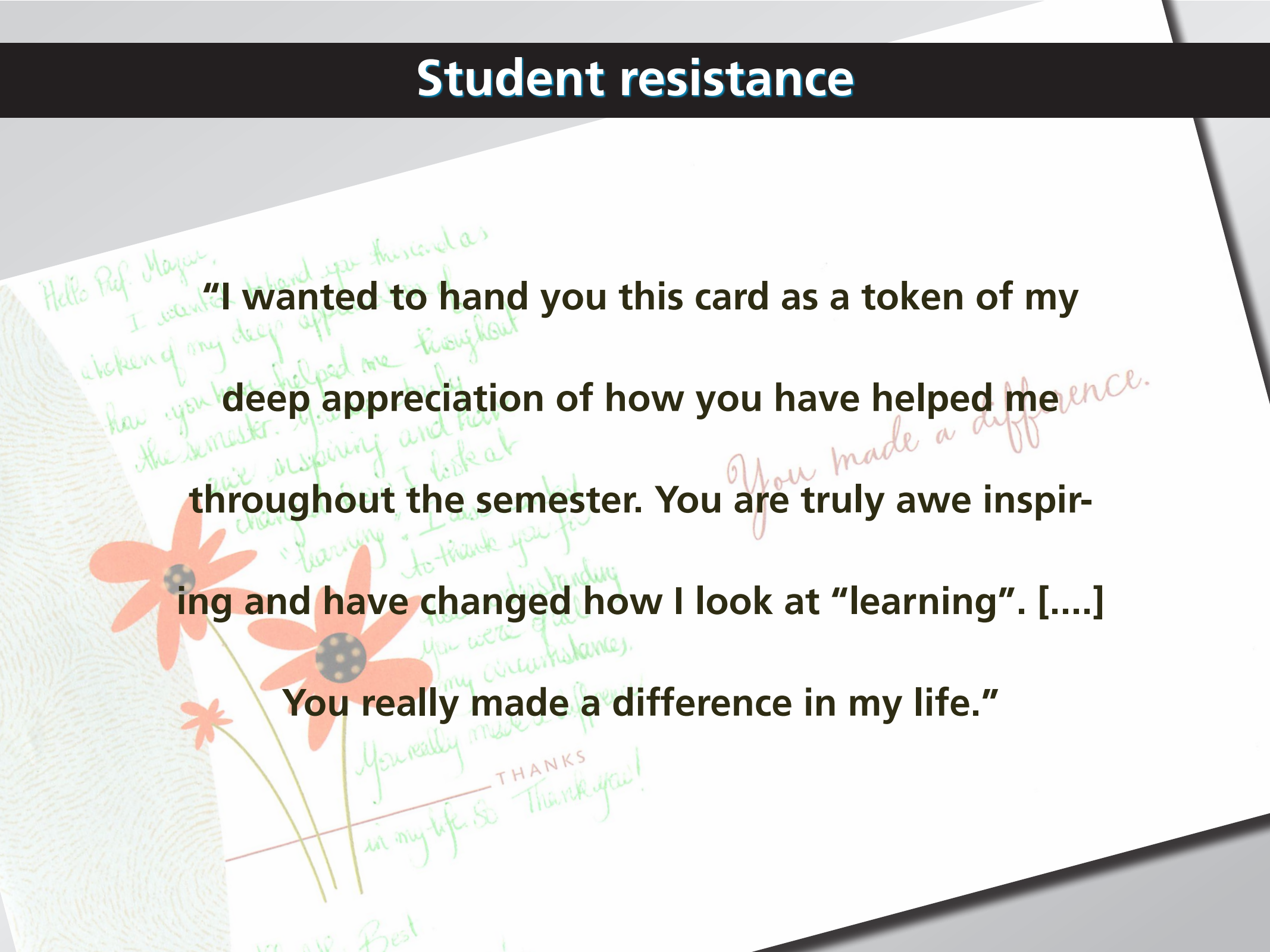
"I wanted to hand you this card as a token of my deep appreciation of how you have helped me throughout the semester.

Student resistance



"I wanted to hand you this card as a token of my deep appreciation of how you have helped me throughout the semester. You are truly awe inspiring and have changed how I look at "learning".

Student resistance



"I wanted to hand you this card as a token of my deep appreciation of how you have helped me throughout the semester. You are truly awe inspiring and have changed how I look at "learning". [....] You really made a difference in my life."

Student resistance

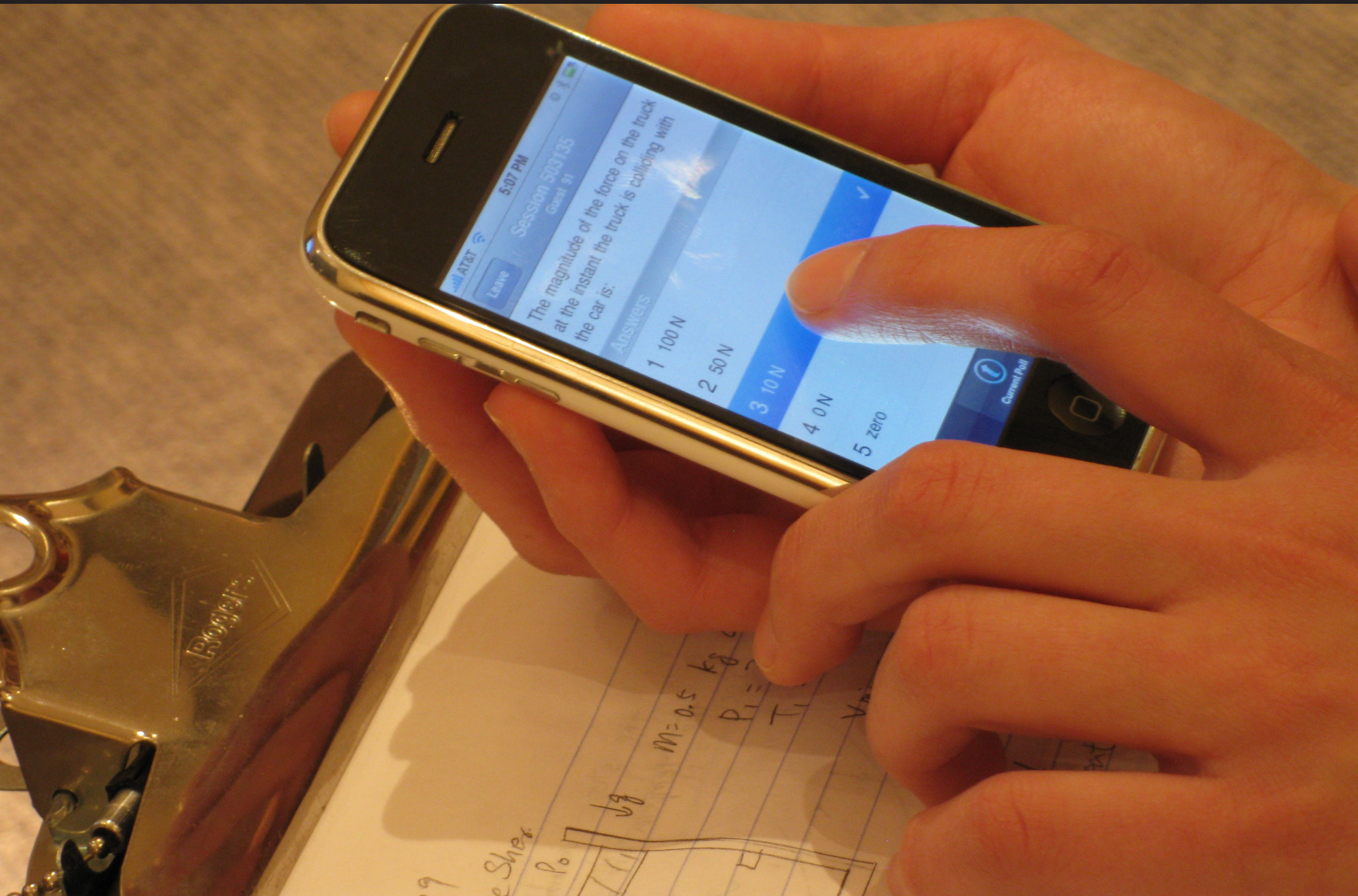
and don’t forget…

Student resistance

and don’t forget…

PI leads to better learning and retention!

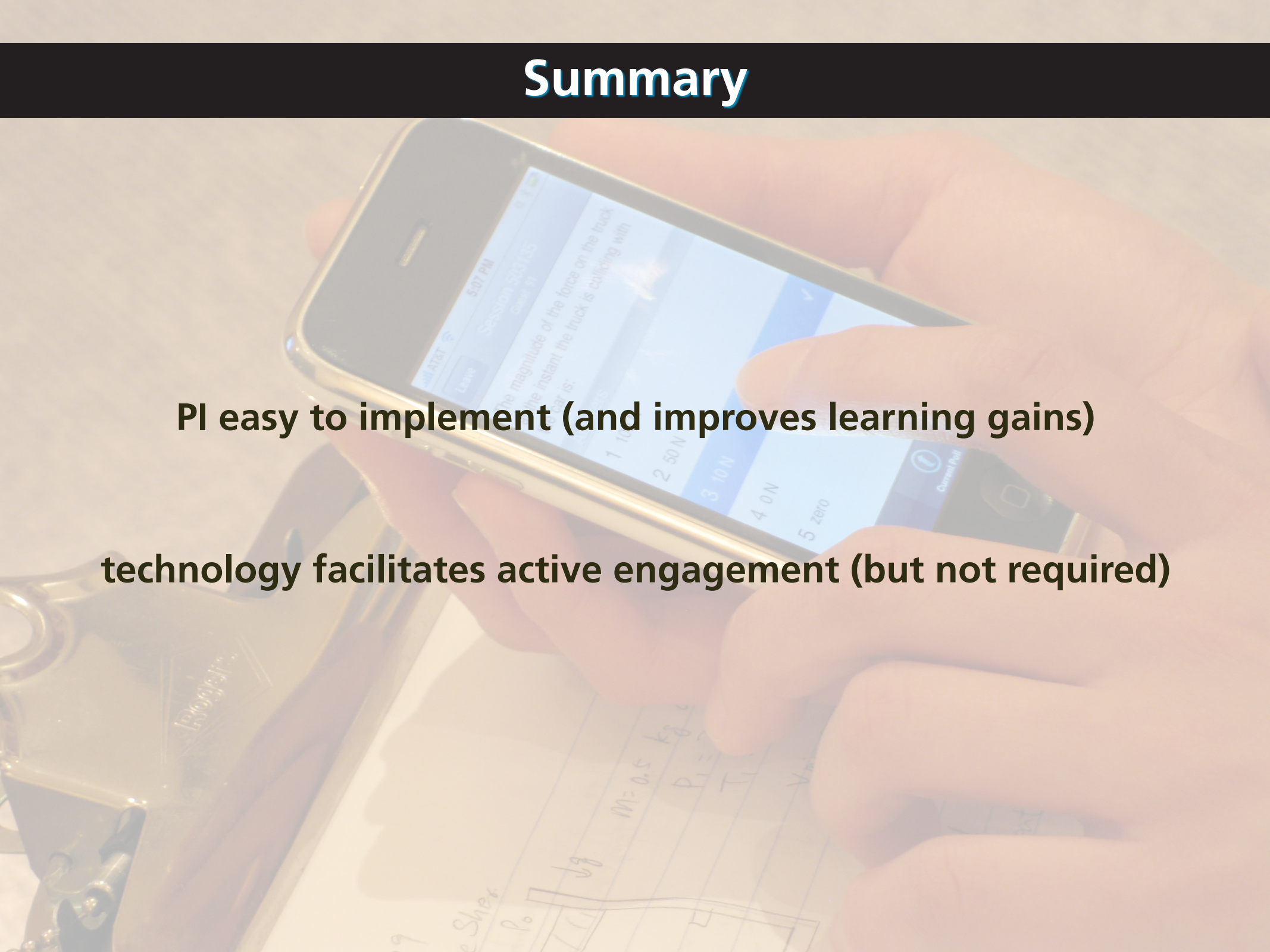
Summary


AT&T
5:07 PM
Session 5031755
Guest: 51
Leave
The magnitude of the force on the truck at the instant the truck is colliding with the car is:
Answers
1 100 N
2 50 N
3 10 N
4 0 N
5 zero
Current Poll

Summary

PI easy to implement (and improves learning gains)

Summary



PI easy to implement (and improves learning gains)

technology facilitates active engagement (but not required)

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