Peer Instruction Workshop: Part 1

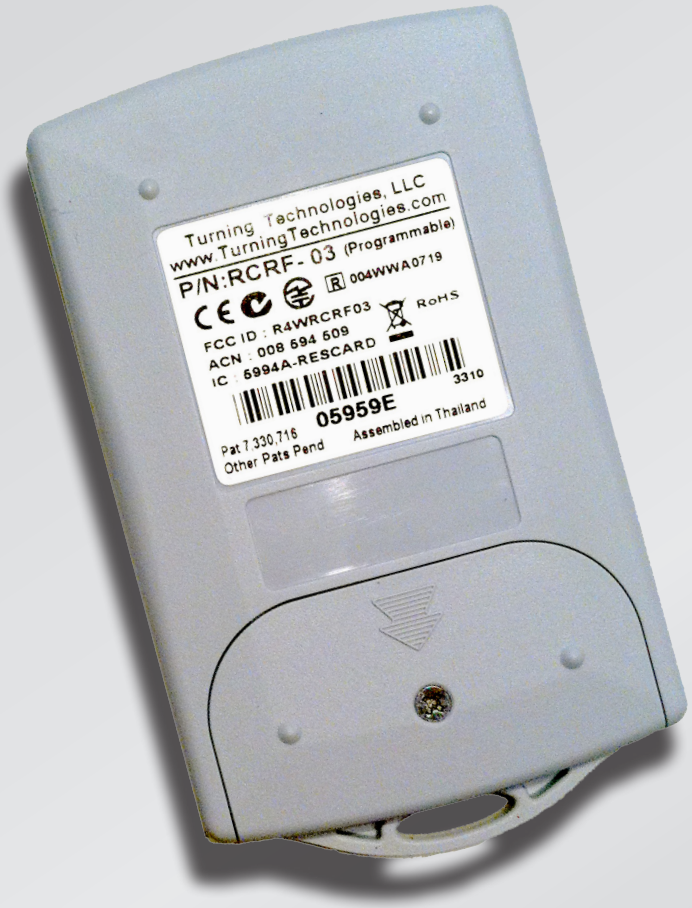
UDC-Community College
Washington DC, 9 February 2012

Get your clickers ready!

- no ON/OFF button
- only last “click” counts
- display shows recorded answer

www.TurningTechnologies.com

Get your clickers ready!



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unique ID on back of clicker

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Quick survey…

Peer Instruction…

1. Never heard of it.
2. Heard of it, but don’t really know what it is.
3. Quite familiar with it.
4. I heard you speak about it so often, I could give your talk

Quick survey…

Peer Instruction…

1. Never heard of it.
2. Don’t use it in my classes, but I’m open to it.
3. Considering using it in my classes.
4. I have used it it in my classes a few times only.
5. I use it regularly in my classes.

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.

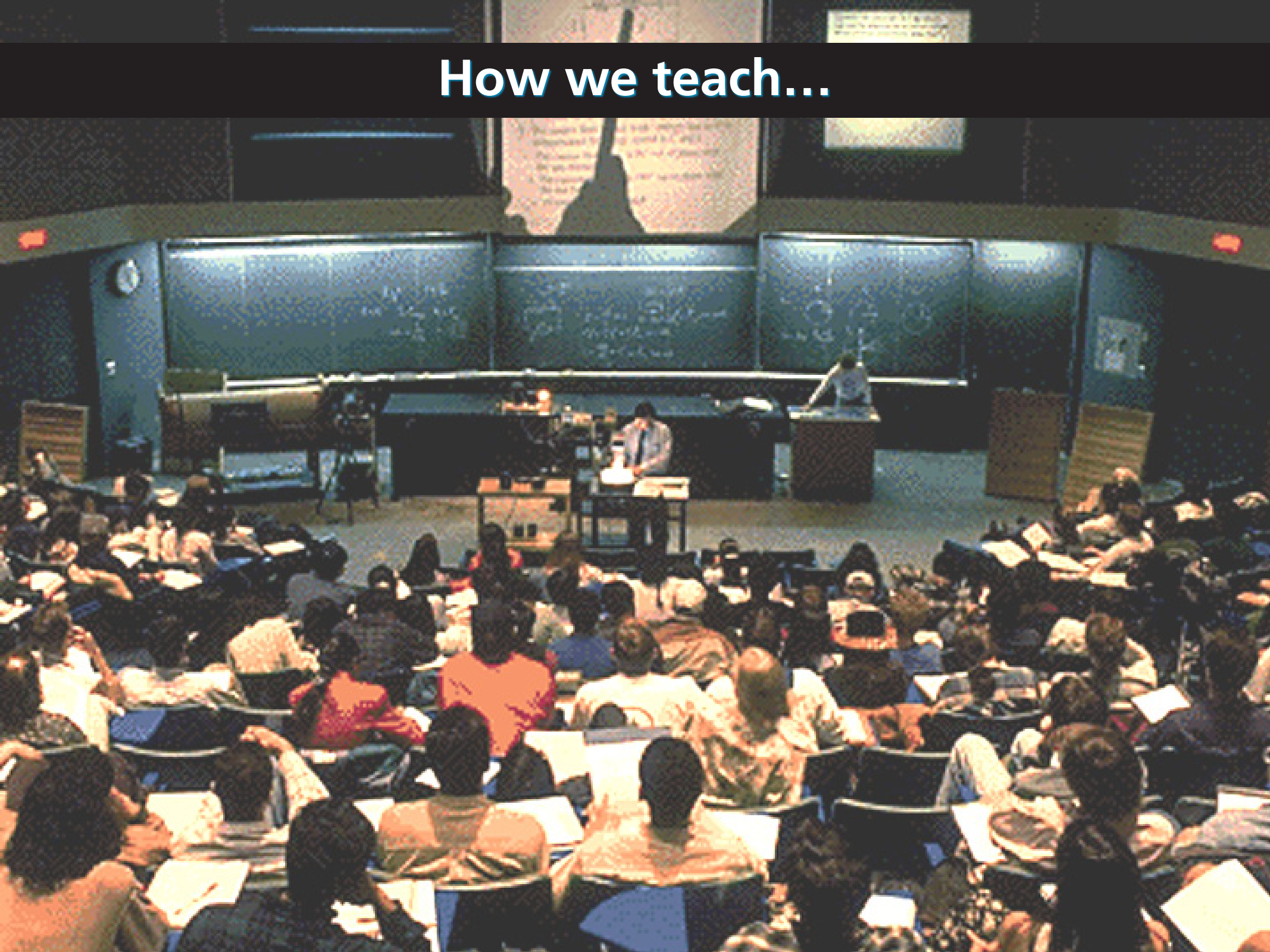
***How* did you become good at this?**

How do we learn?

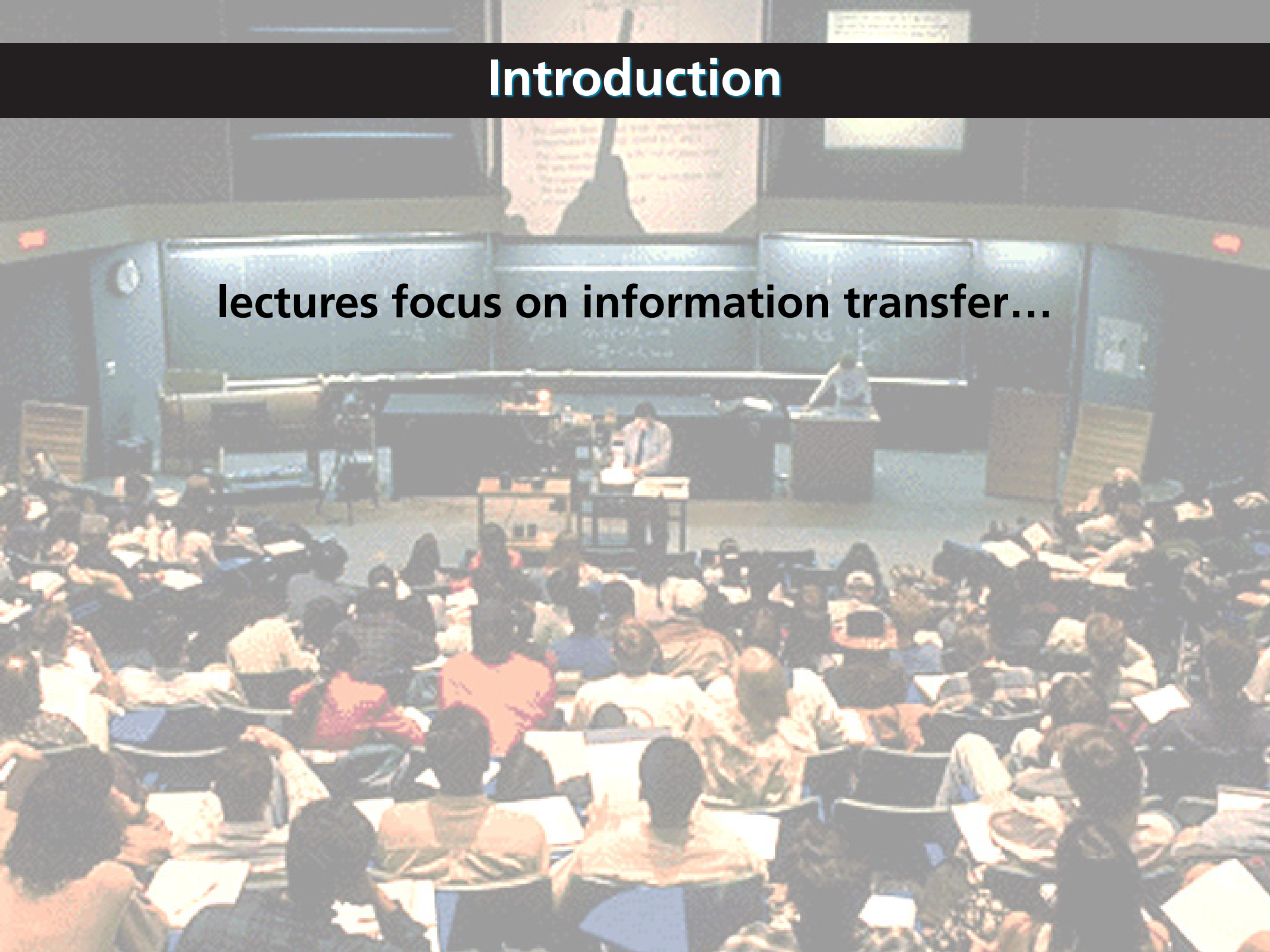
Became good at it by:

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

How we teach…

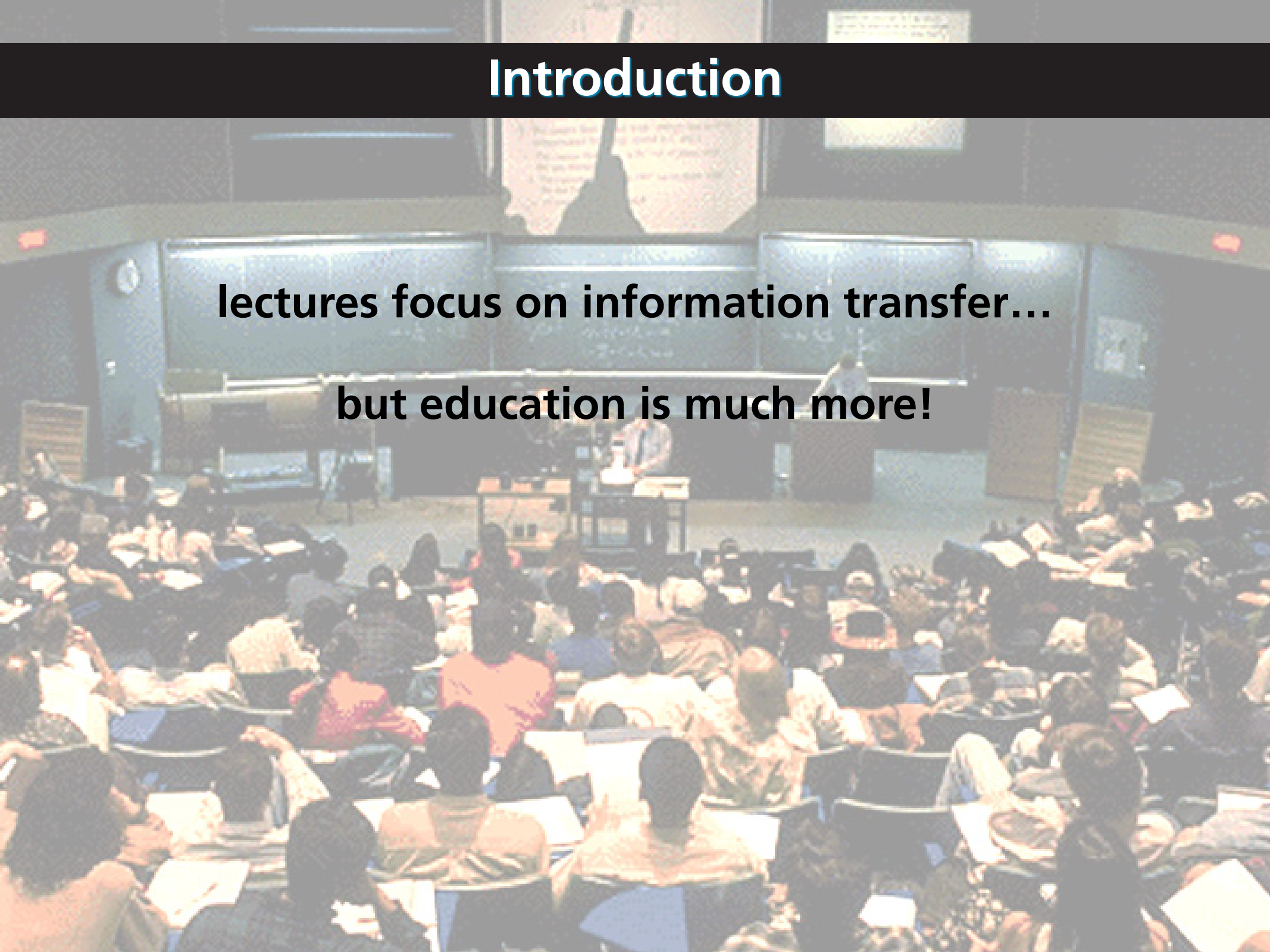


Introduction



lectures focus on information transfer…

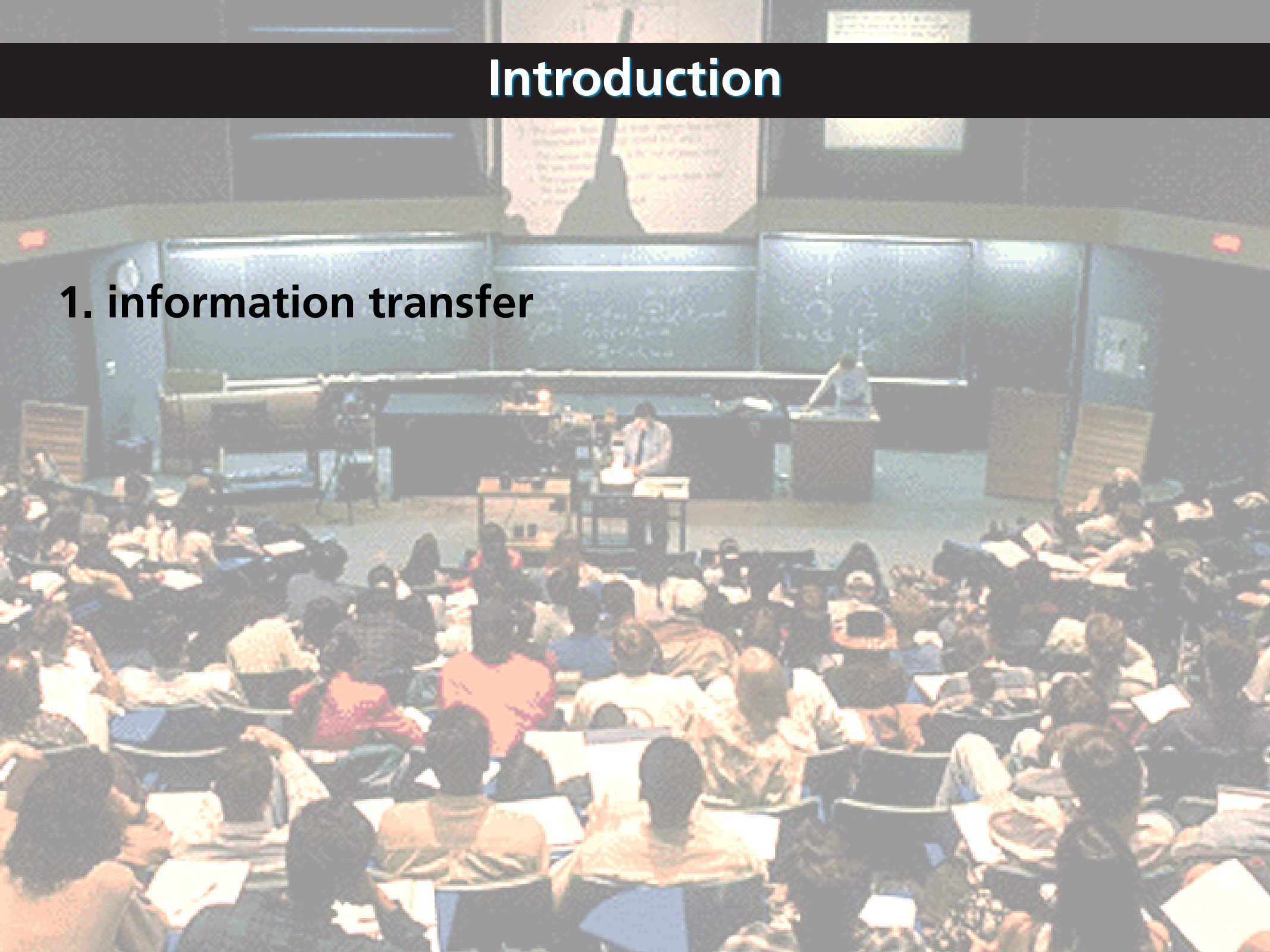
Introduction



lectures focus on information transfer…

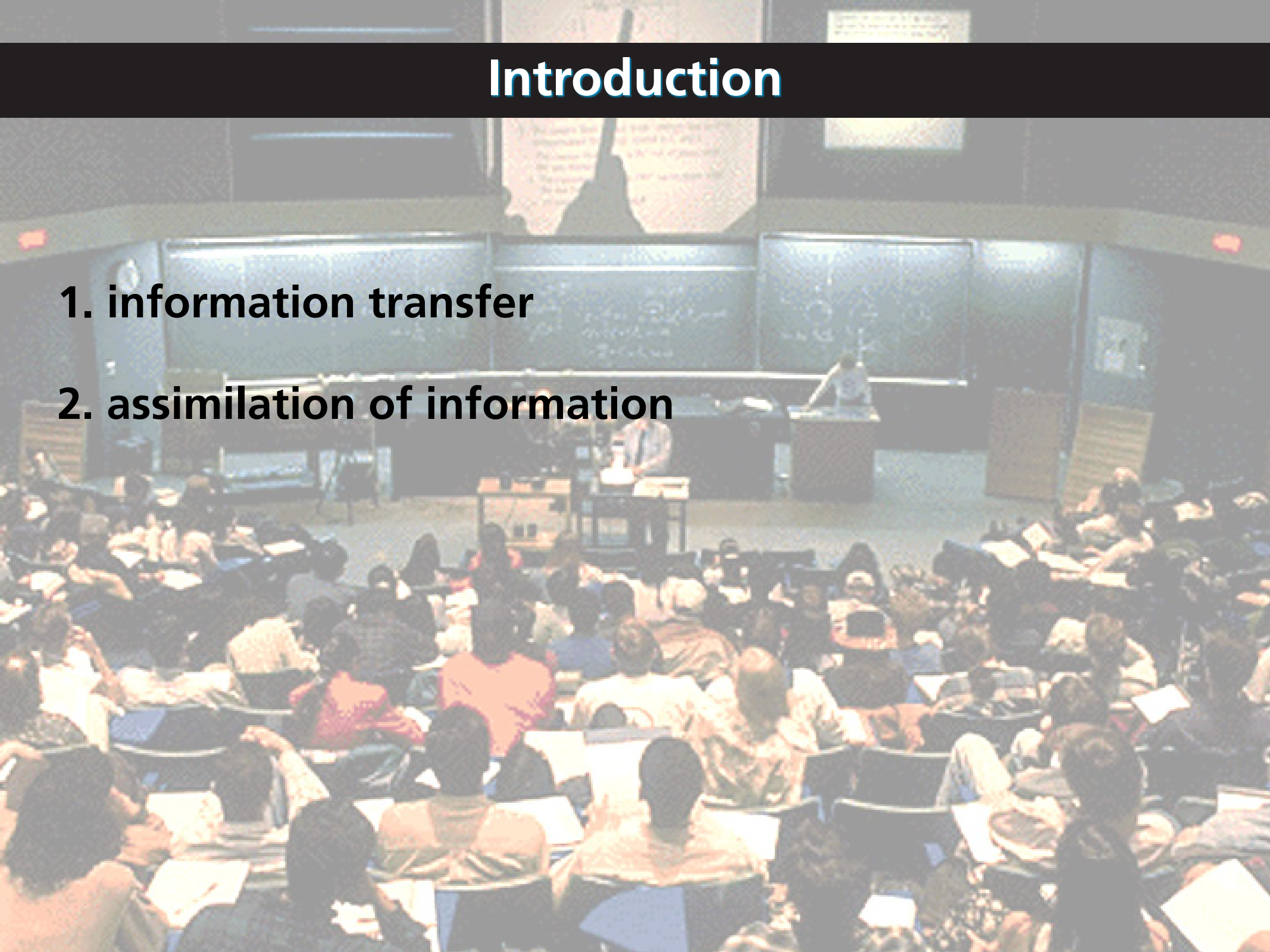
but education is much more!

Introduction



1. information transfer

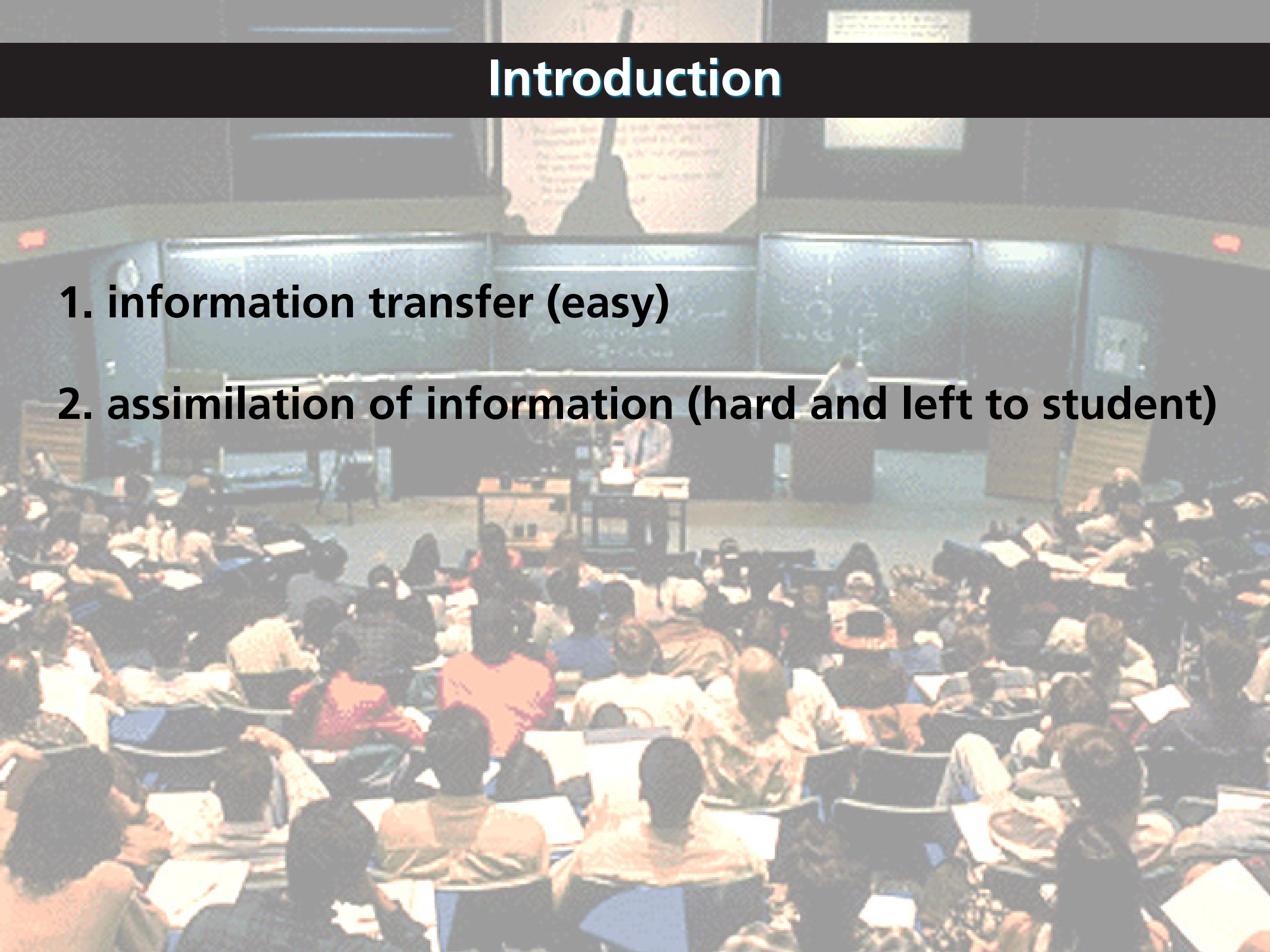
Introduction



1. information transfer

2. assimilation of information

Introduction



1. information transfer (easy)

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

Introduction

Solution: move information transfer out of classroom!

Introduction

How to move information transfer out of classroom?

Introduction

How to move information transfer out of classroom?

Use JiTT (before class) and PI (in class)!

Survey

Lecturing is the best way for me to cover the amount of material I need to cover in my course.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

Interactive teaching requires significantly more instructor preparation time than traditional lecture.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

Interactive teaching requires clickers.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

I know how to get my students to do their reading before class.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

It is difficult to see how to apply interactive teaching techniques in the humanities or social sciences.

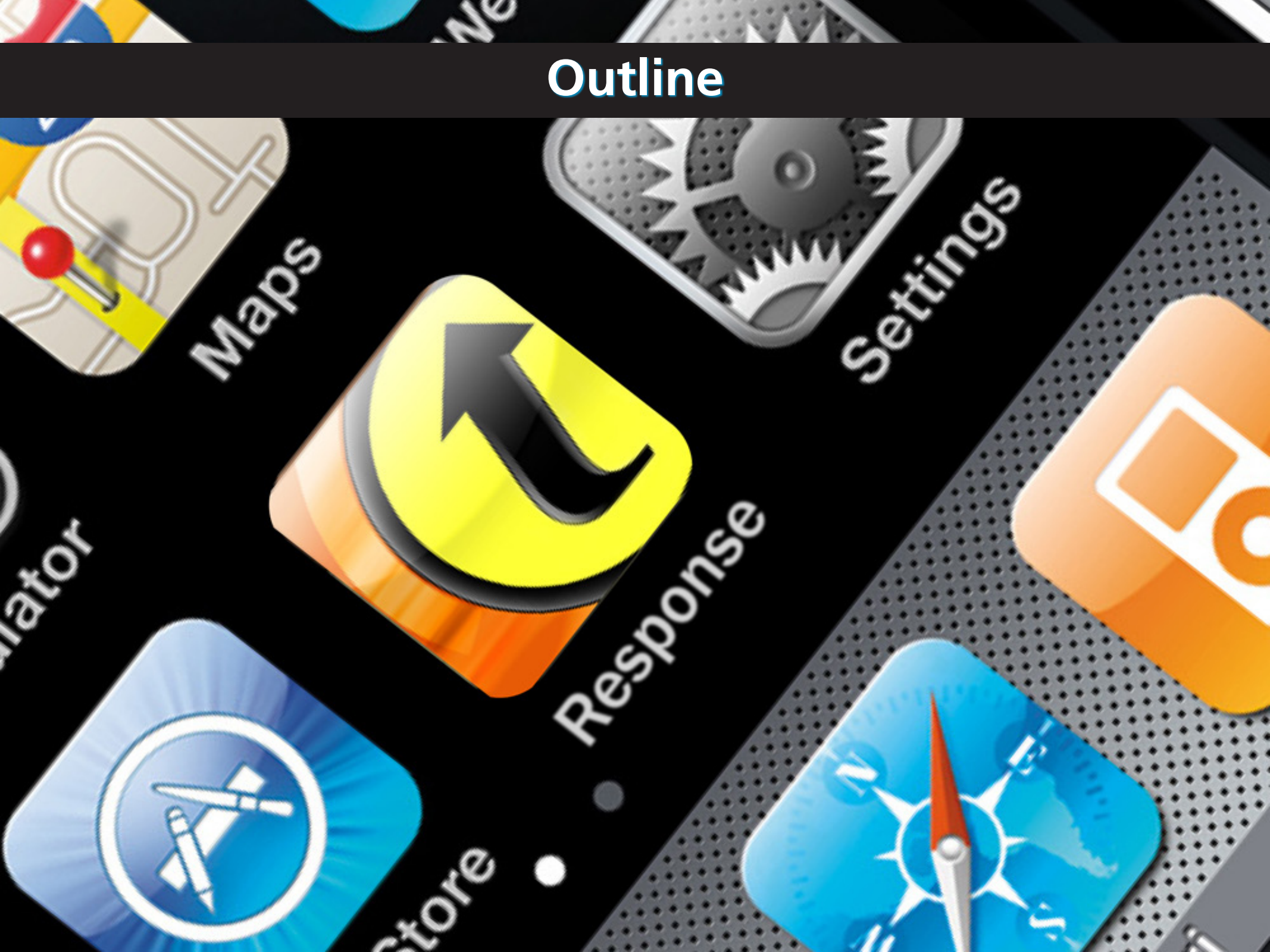
1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

I am worried that interactive teaching will negatively affect my end-of-course evaluations.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Outline



Outline

- PI & JiTT Overview
- Implementing PI & JiTT
- ConcepTests

PI & JiTT Overview

"How I can be sure that my students will prepare for class?"

PI & JiTT Overview

Students do not come to class prepared, because…

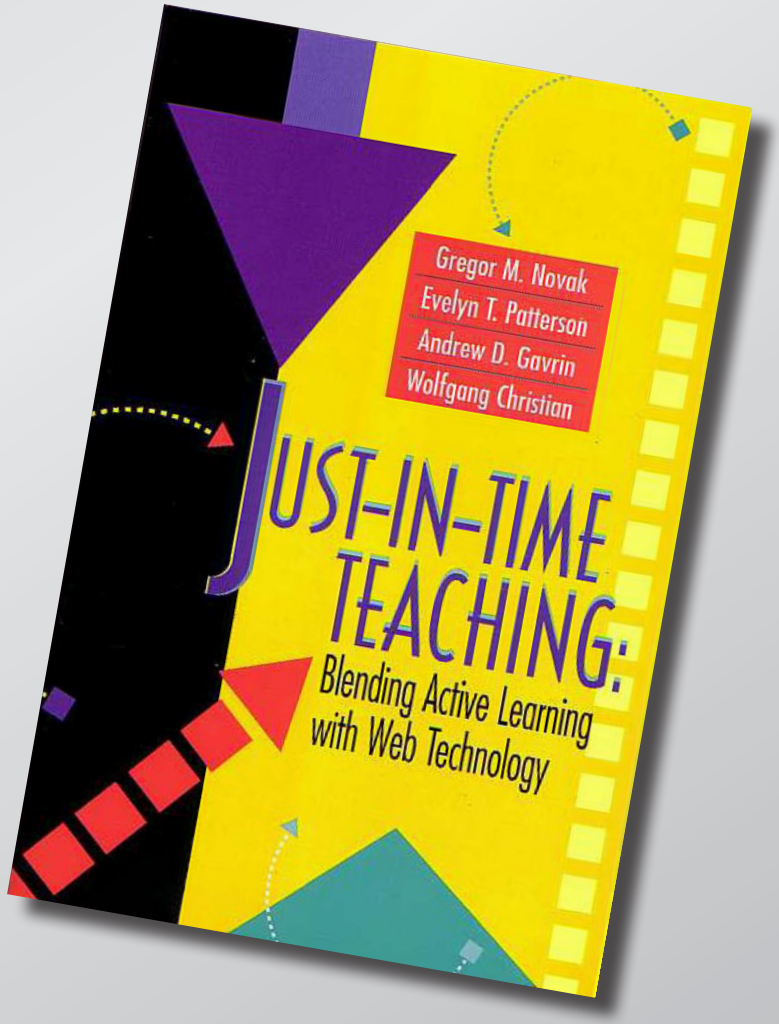
1. they don't have time.
2. they are not motivated to learn.
3. their instructors take away the incentive.
4. they do not have the requisite skills.
5. of some other reason.
6. They do come prepared in my class!

(select what you consider to be the main reason)

PI & JiTT Overview

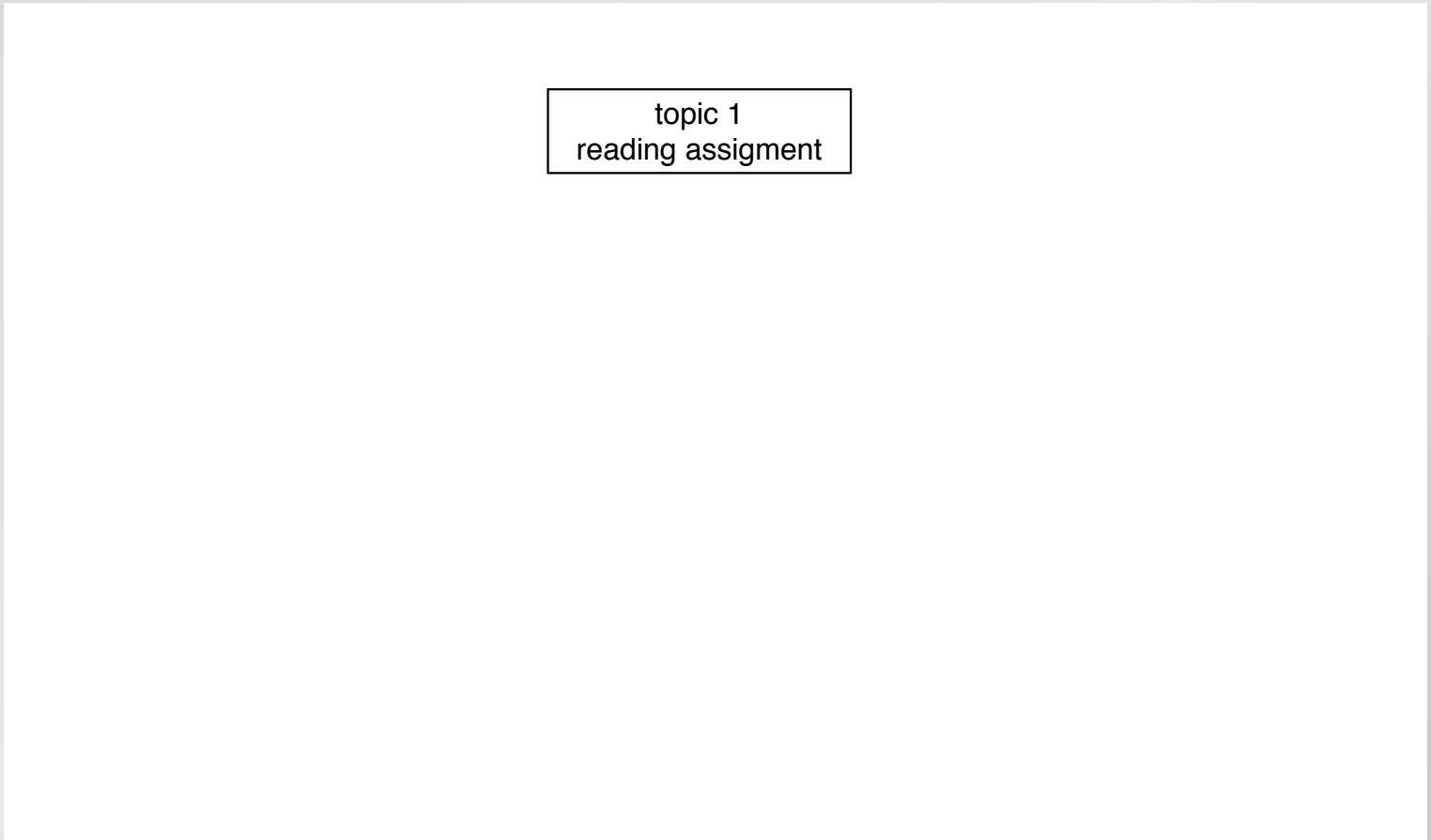
Just-in-time-Teaching (JiTT)

www.jitt.org



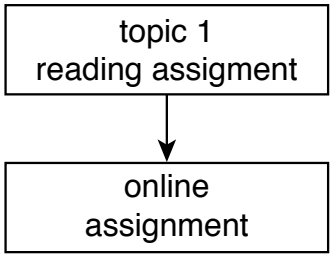
PI & JiTT Overview

JiTT workflow



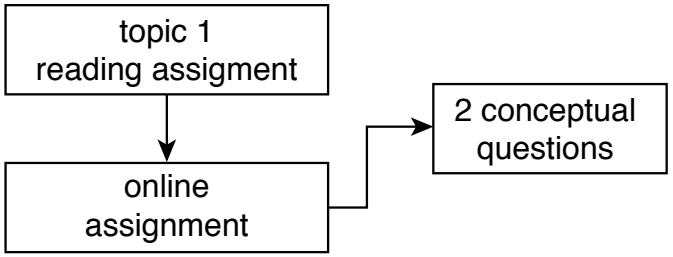
PI & JiTT Overview

JiTT workflow



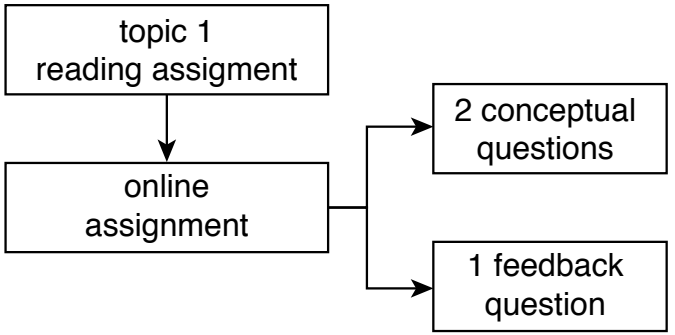
PI & JiTT Overview

JiTT workflow



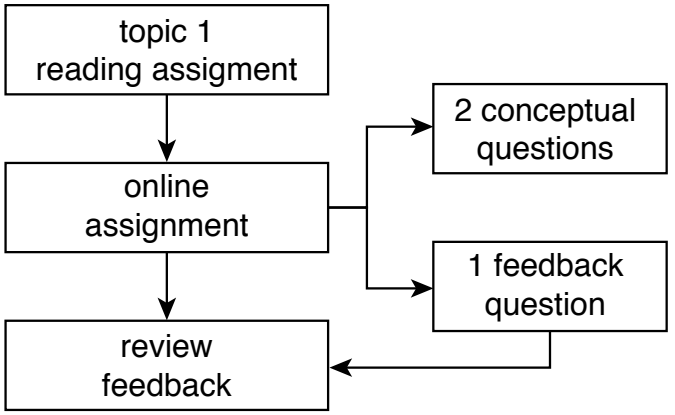
PI & JiTT Overview

JiTT workflow



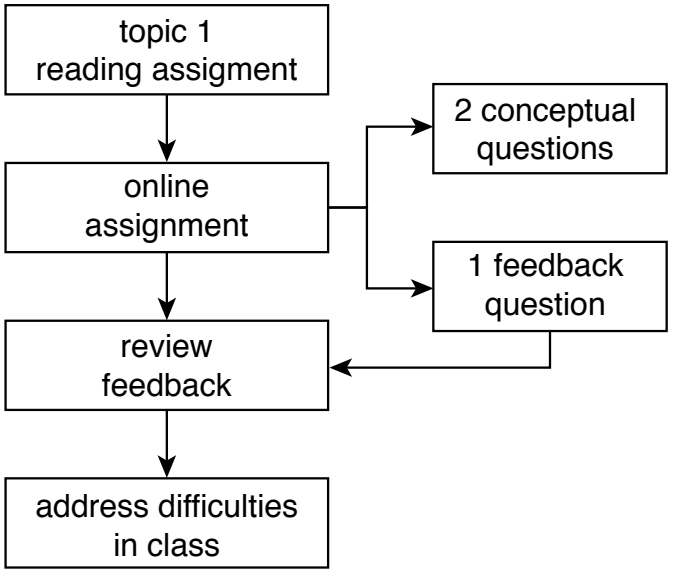
PI & JiTT Overview

JiTT workflow



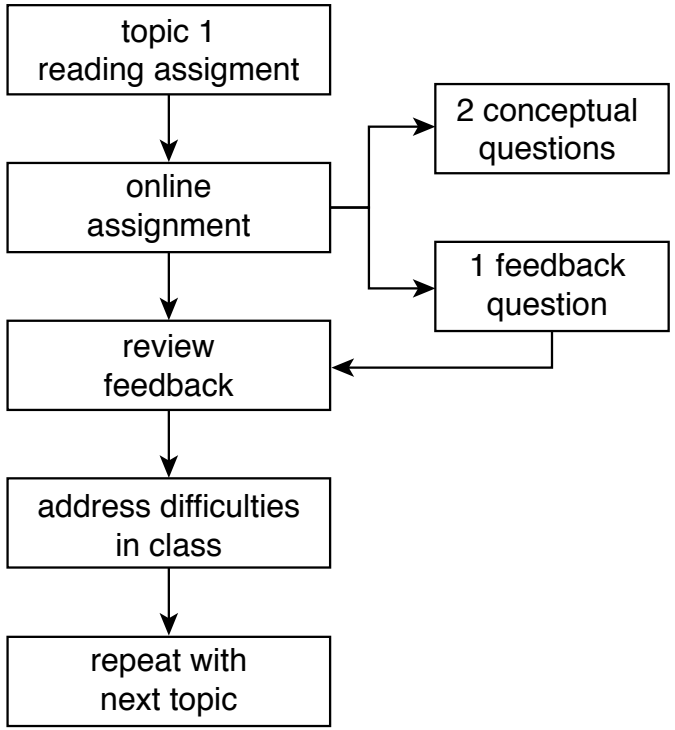
PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

JiTT workflow



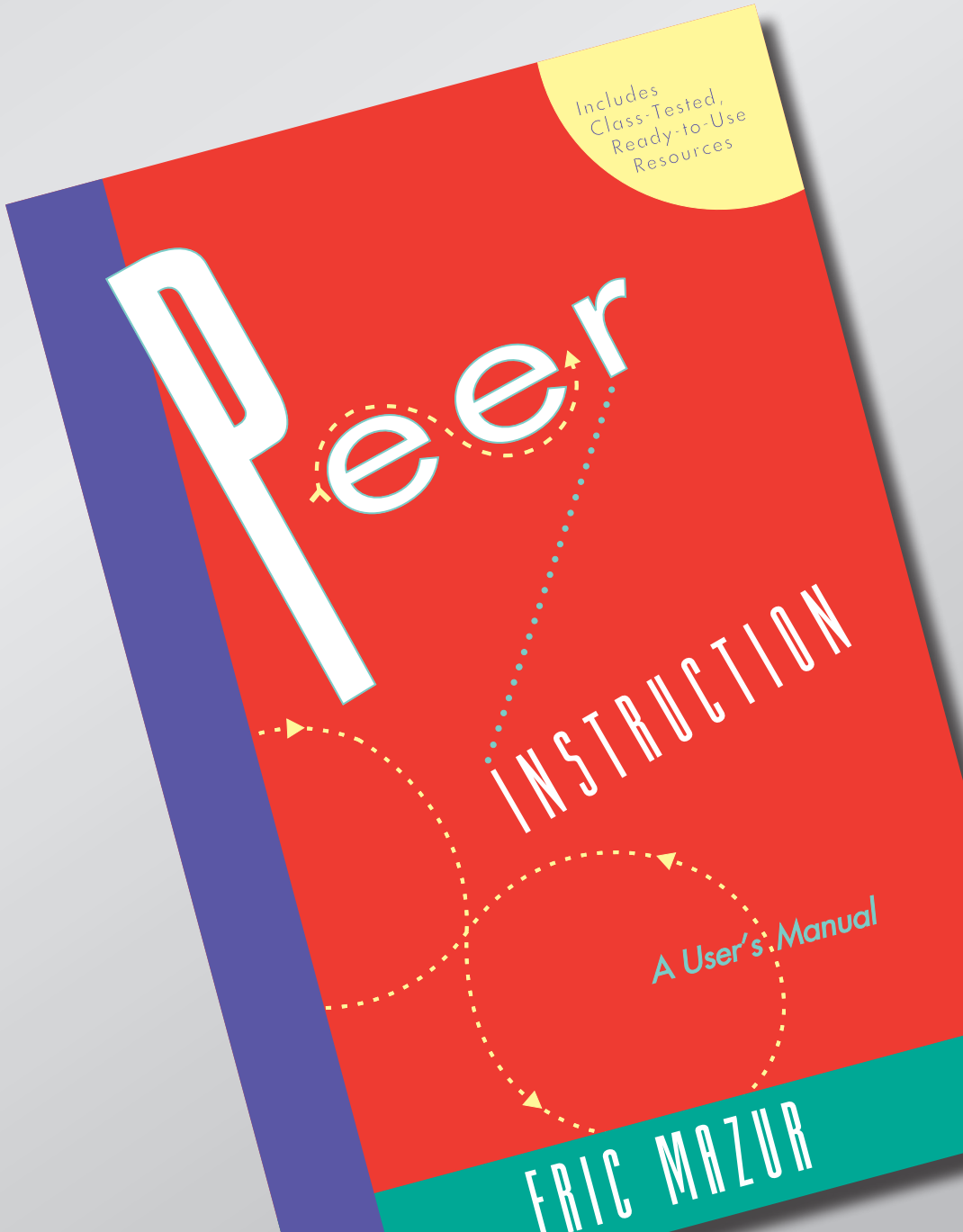
PI & JiTT Overview

JiTT:

- prepares you for class
- prepares students for class
- helps you address student difficulties

PI & JiTT Overview

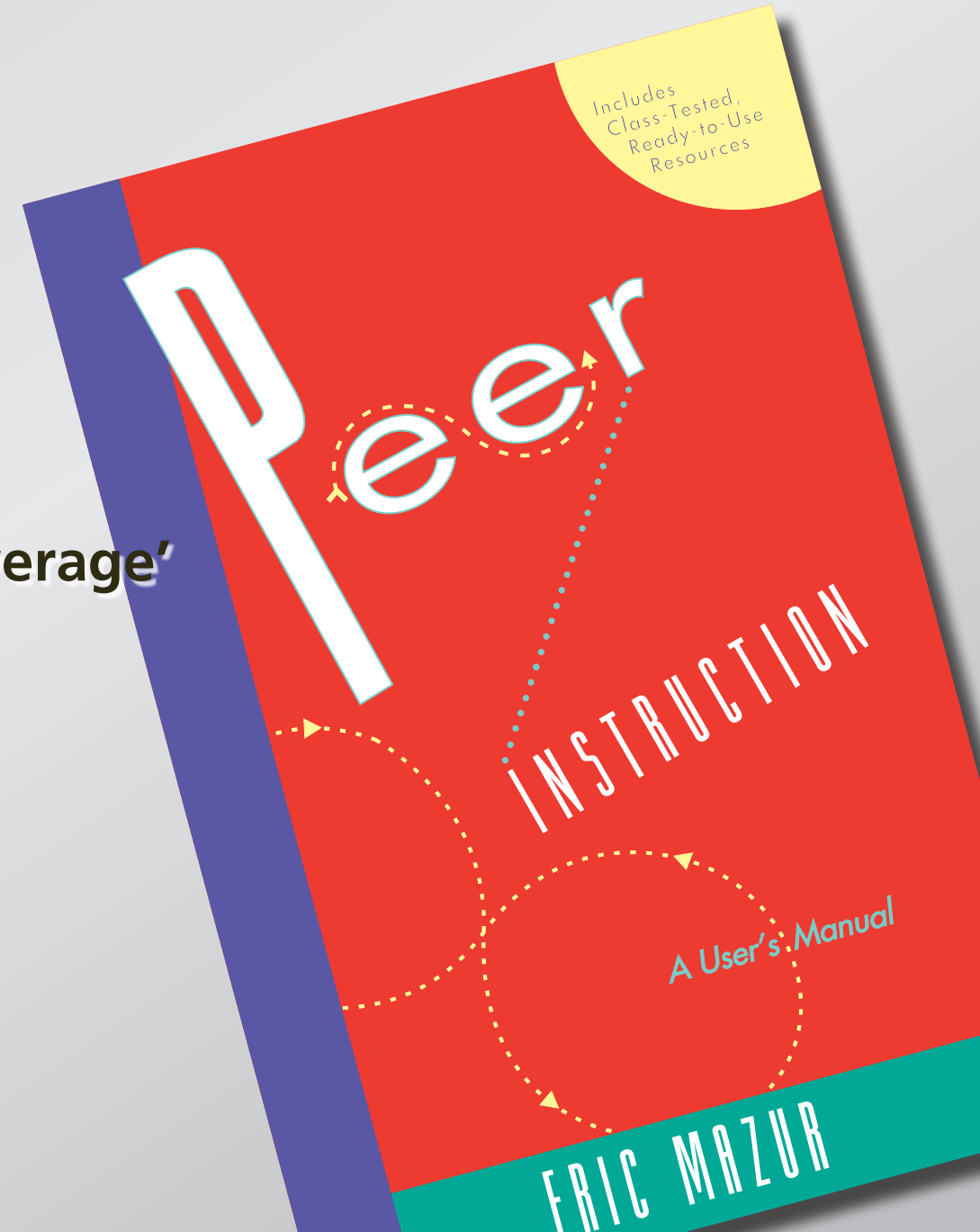
Peer Instruction (PI)



PI & JiTT Overview

Main features:

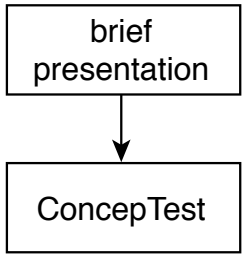
- **pre-class reading**
- **in-class: depth, not 'coverage'**
- **ConcepTests**



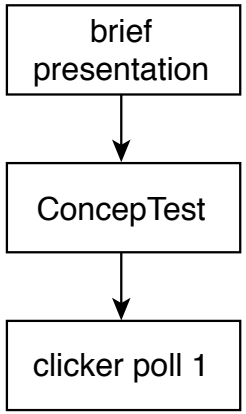
PI & JiTT Overview

brief
presentation

PI & JiTT Overview



PI & JiTT Overview



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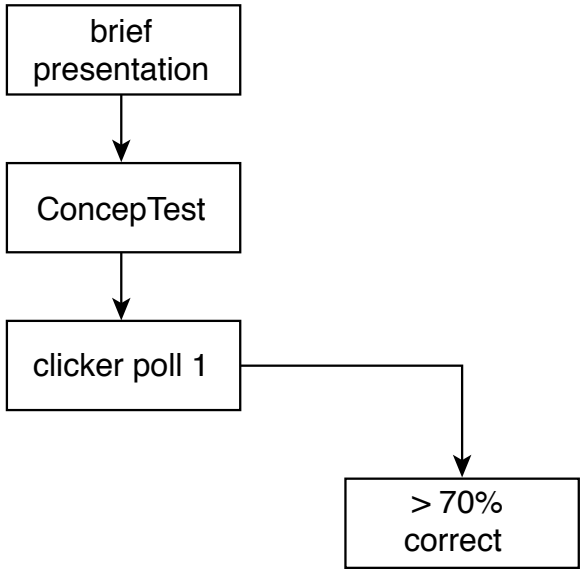

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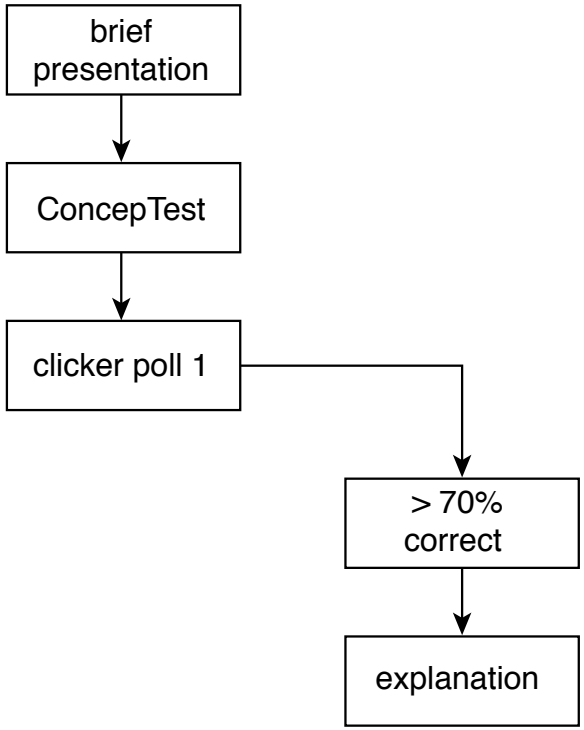
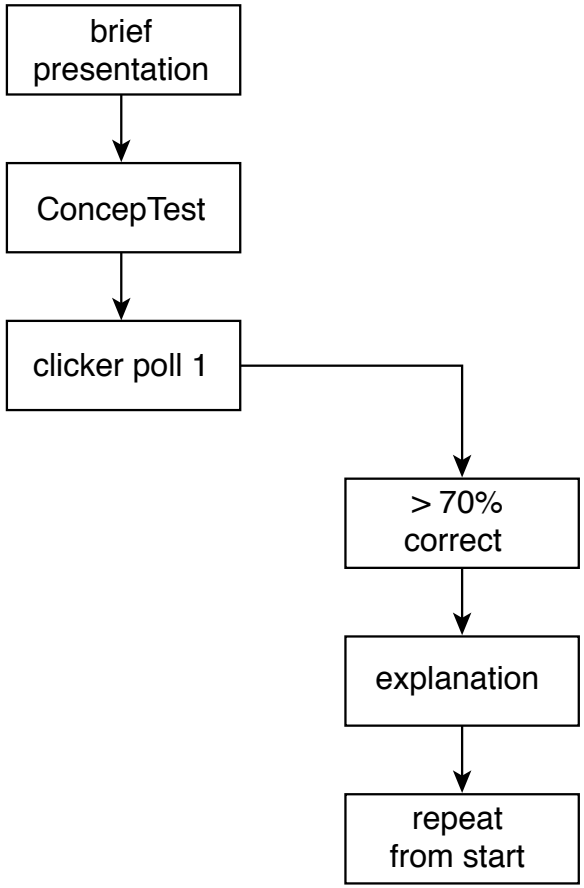


PI & JiTT Overview



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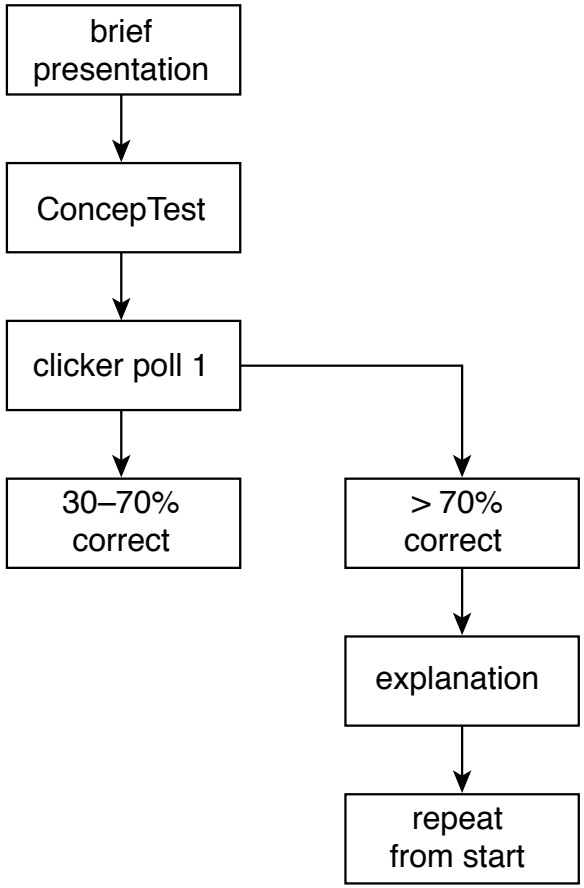

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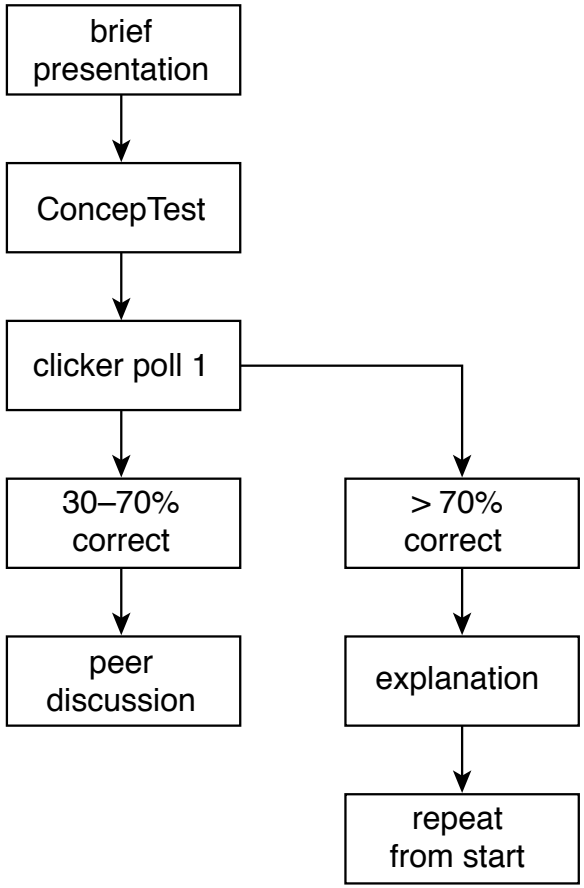

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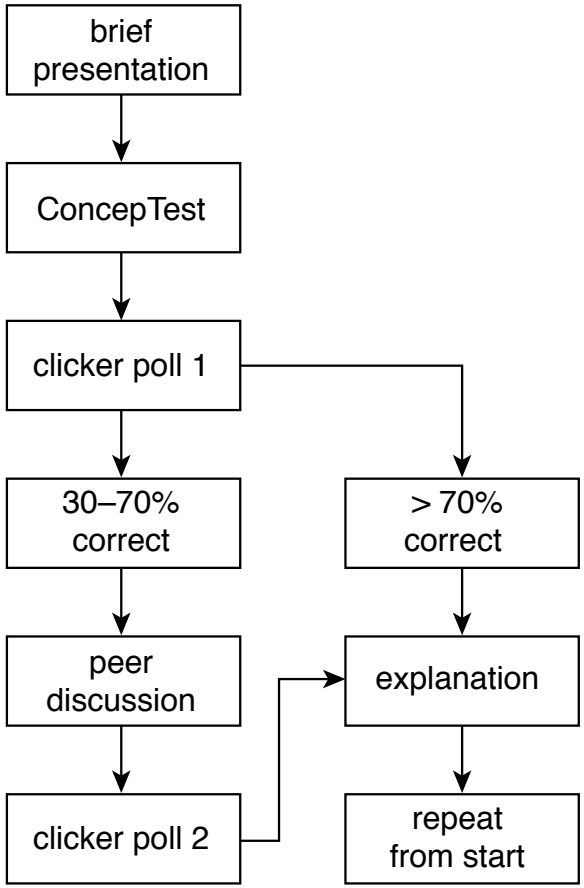

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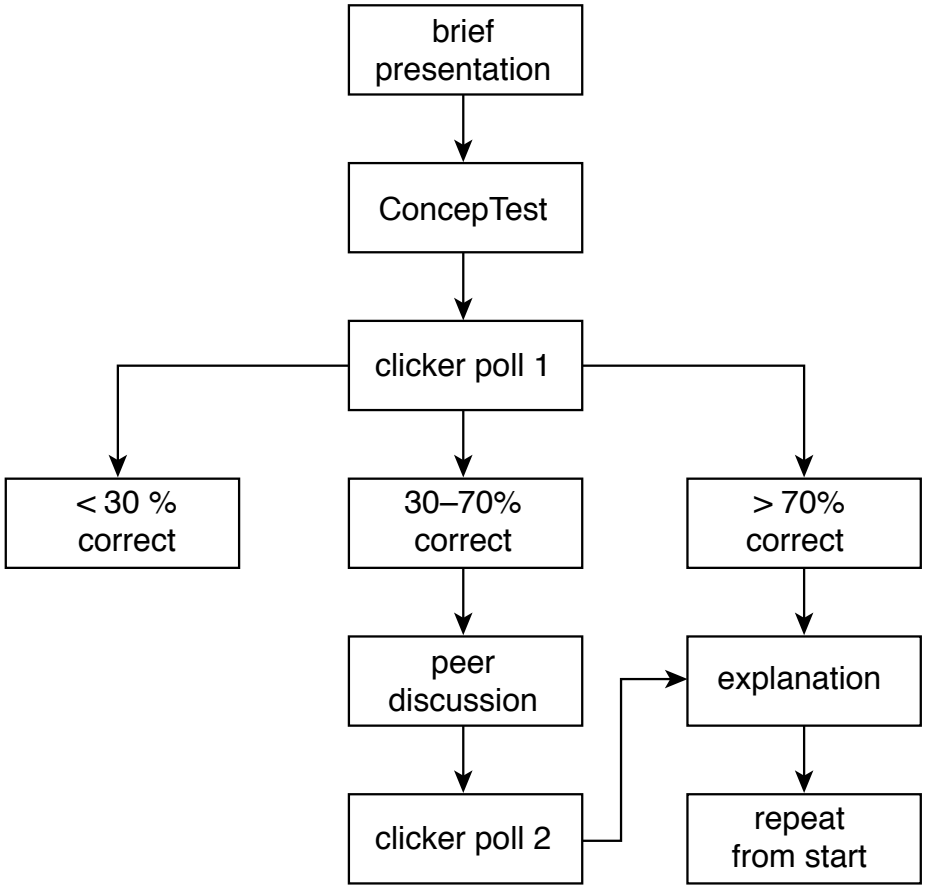

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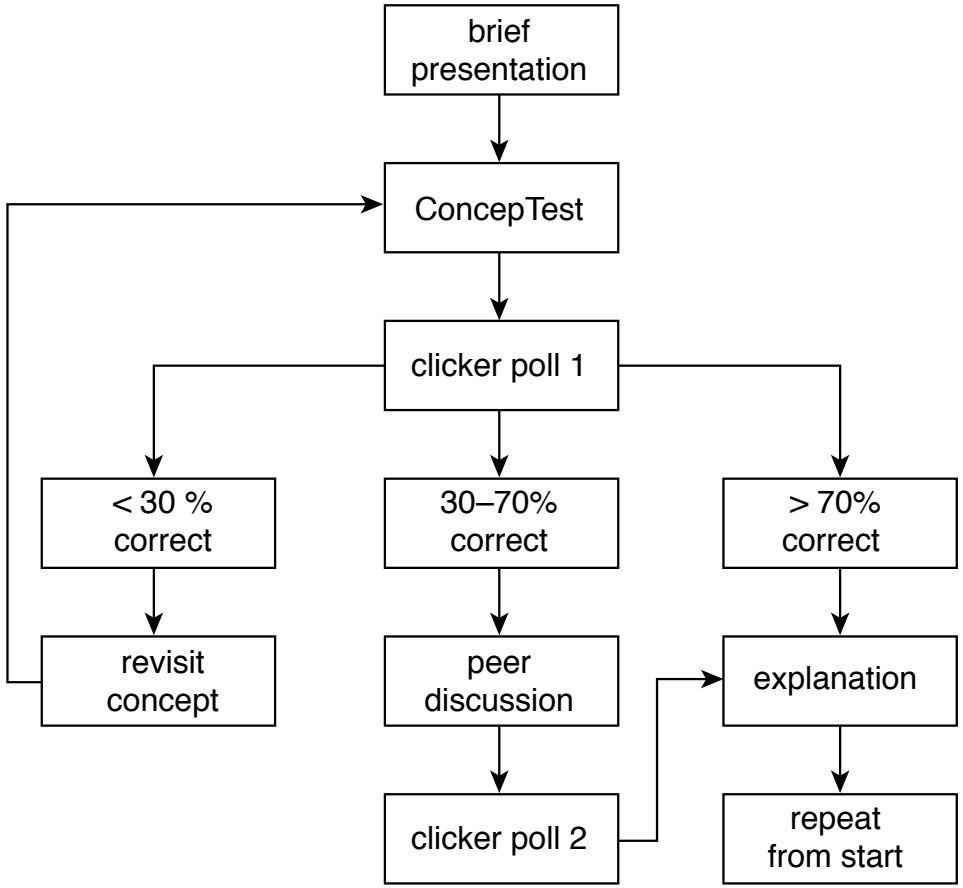

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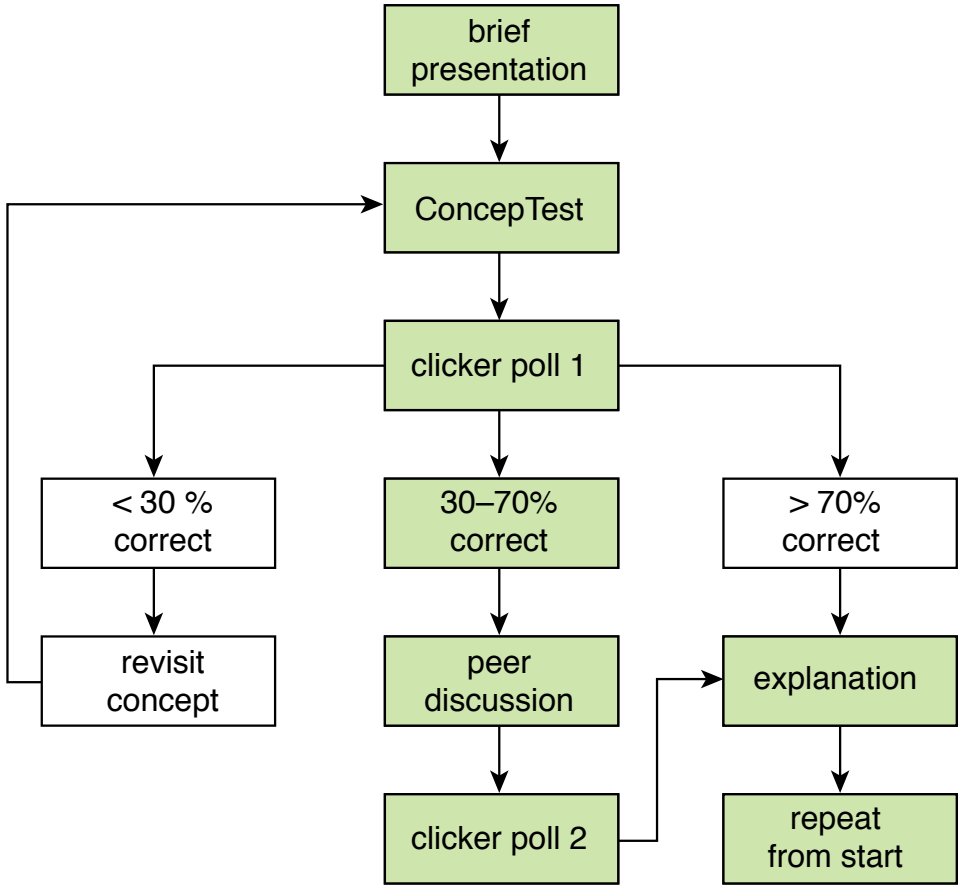


PI & JiTT Overview

PI:

- **helps students overcome difficulties**
- **encourages deep learning**
- **provides depth, not “coverage”**
- **helps you become aware of misconceptions**

PI & JiTT Overview

“Students tend to form homogeneous groups.

How do I promote fruitful discussion?”

PI & JiTT Overview

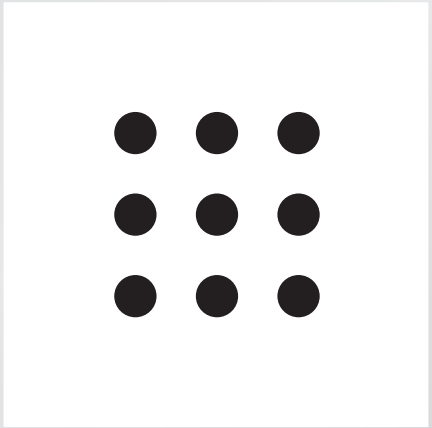
find someone with a *different* answer

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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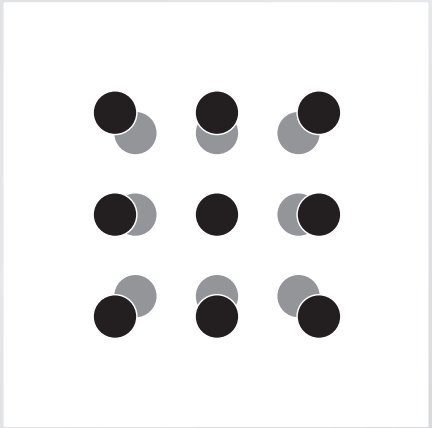
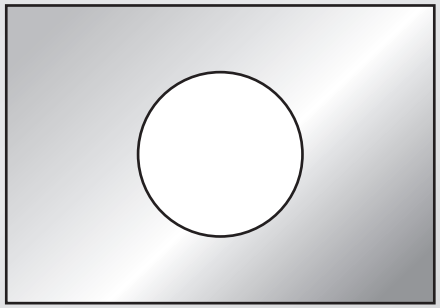


Let's try it!

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



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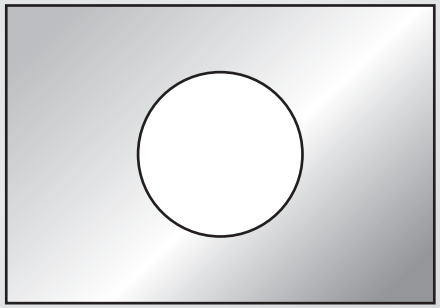


When the plate is uniformly heated, the diameter of the hole

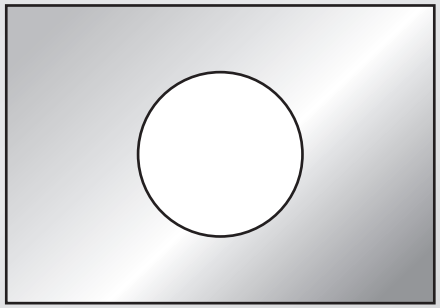
1. increases.
2. stays the same.
3. decreases.

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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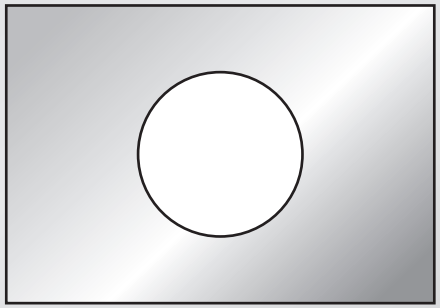
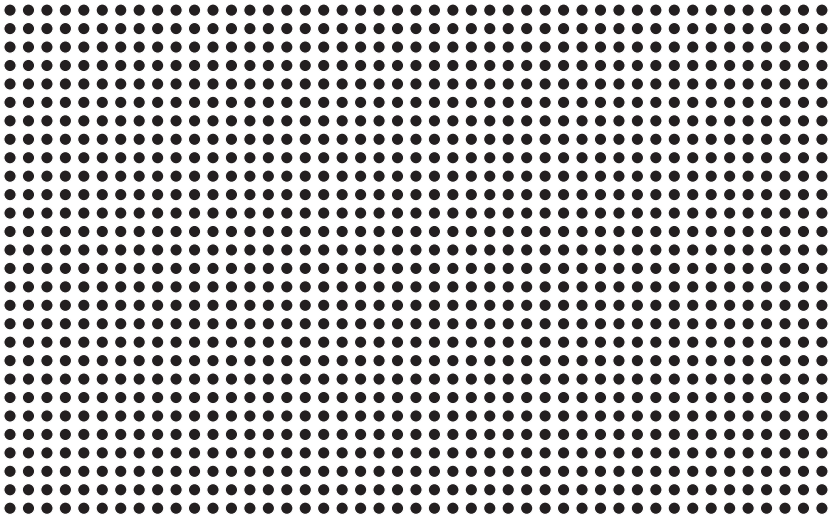


When the plate is uniformly heated, the diameter of the hole

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

Let's try it!

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



Let's try it!

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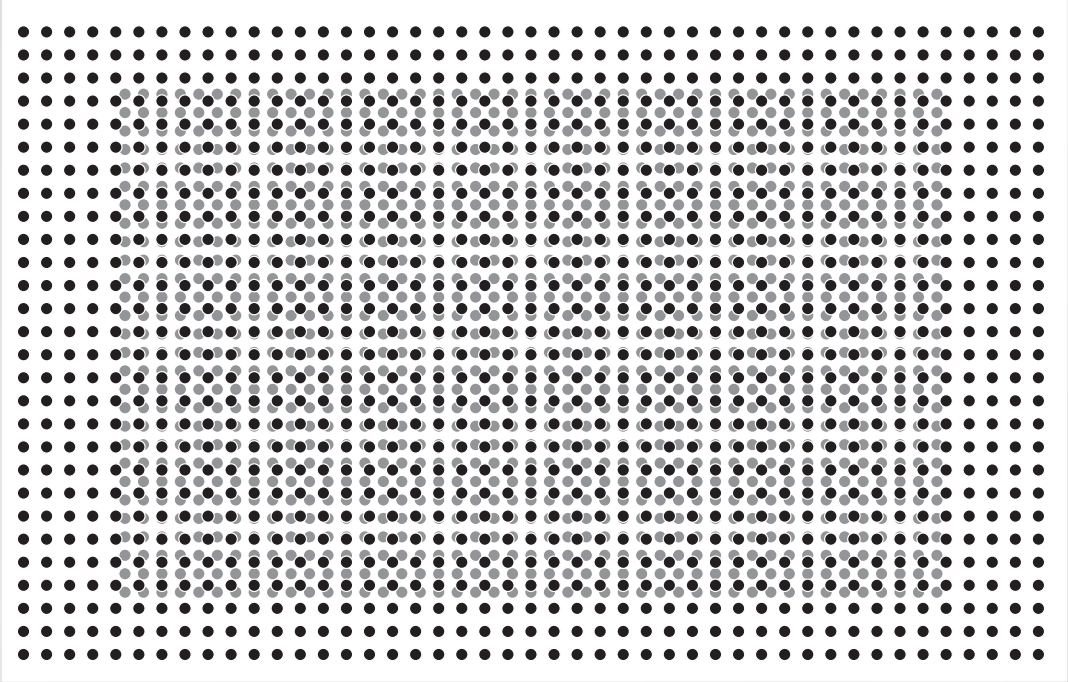
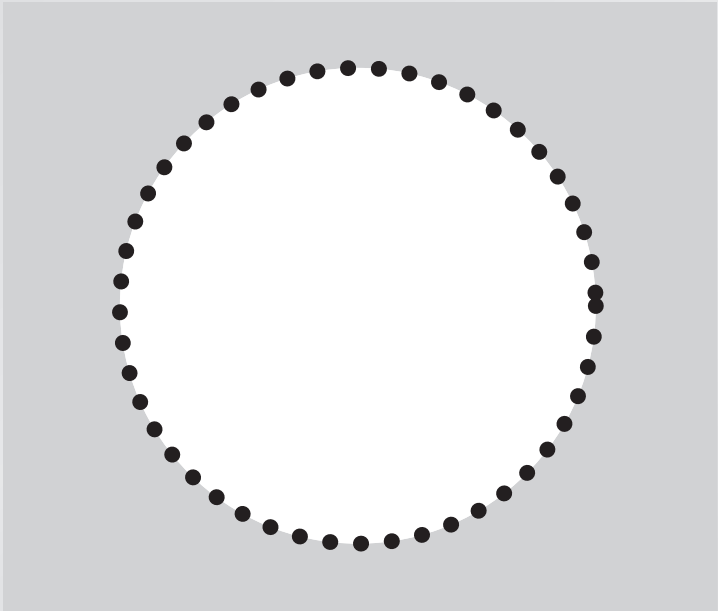


Let's try it!

consider the atoms at the rim of the hole



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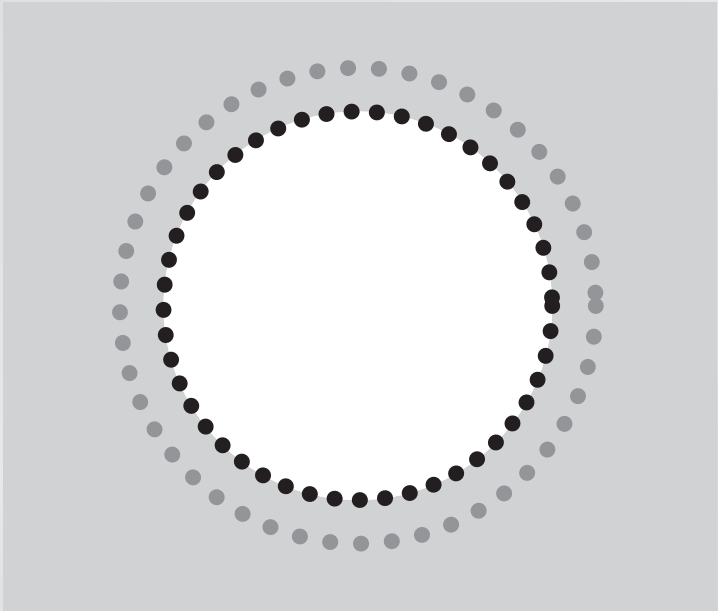

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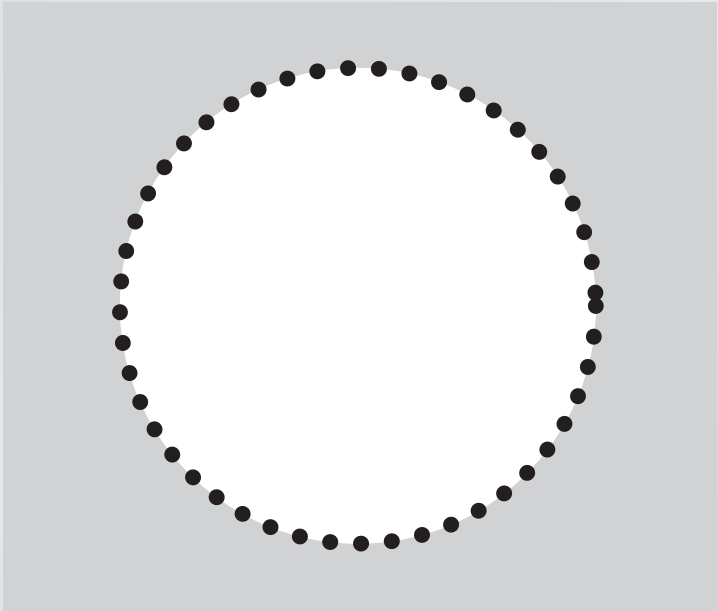

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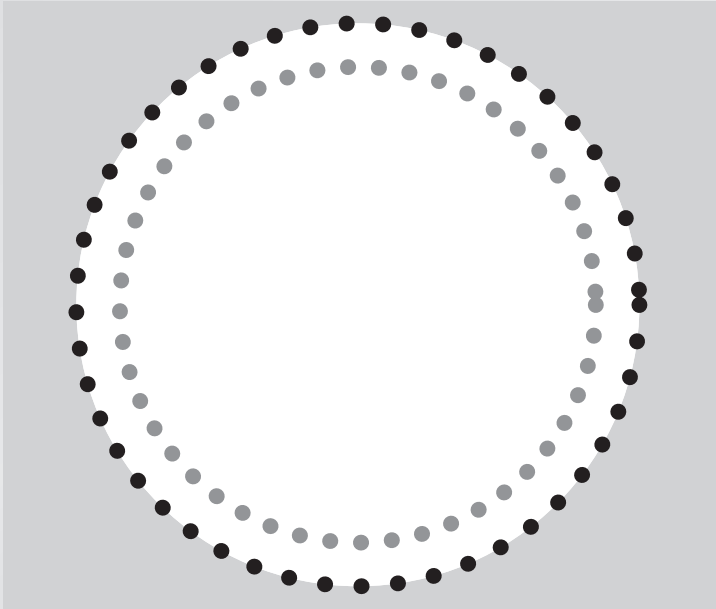
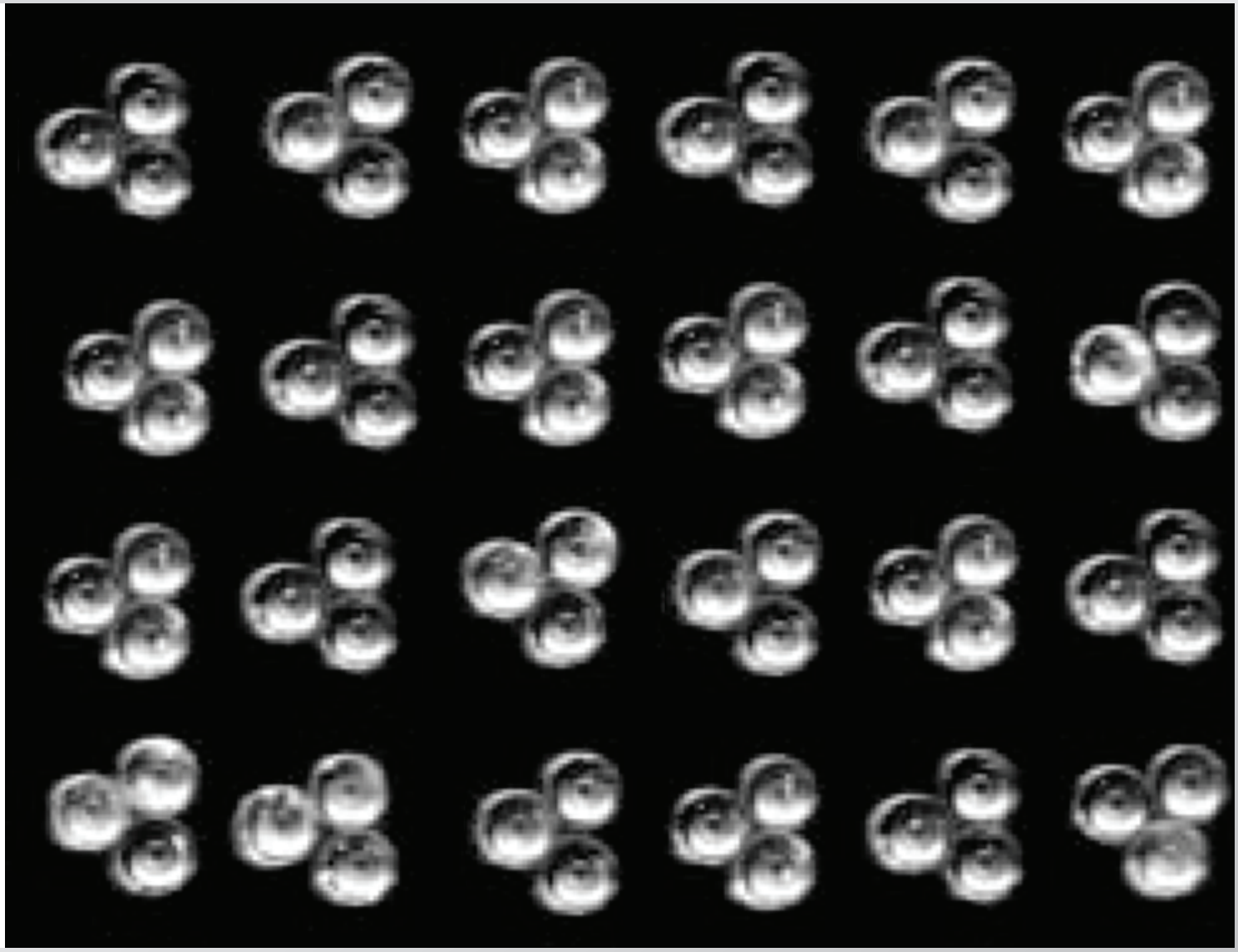


PI & JiTT Overview

"Can this method be used in disciplines where

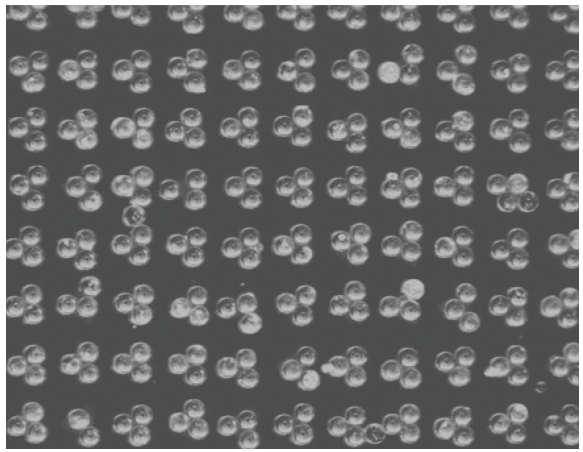
questions might not have right or wrong answers?"

Let's try it!

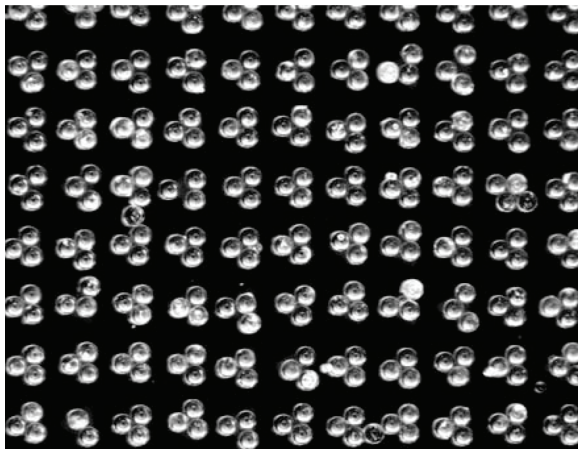


PI & JiTT Overview

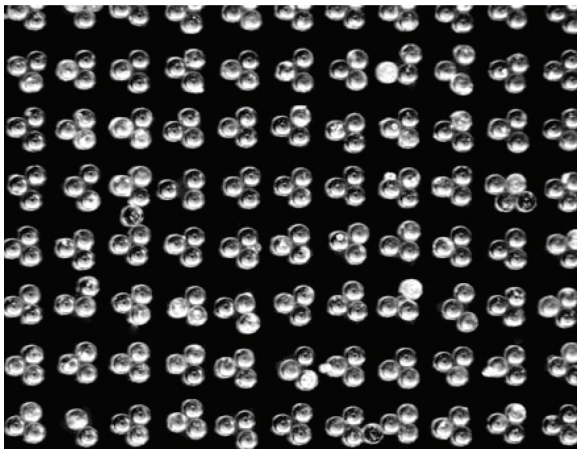
original



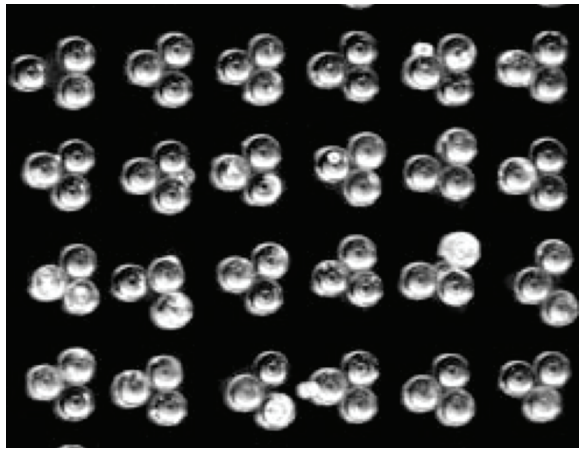
1. adjust contrast



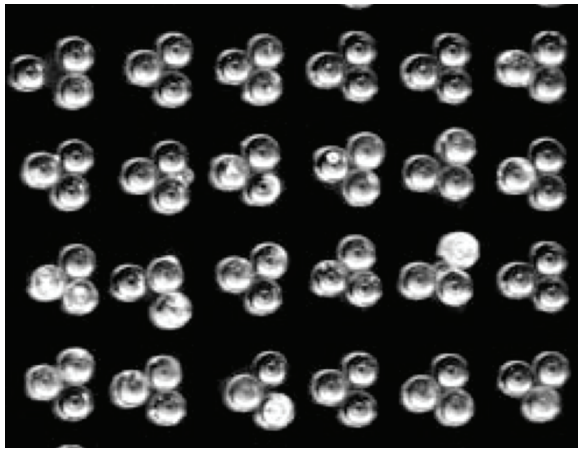
2. remove blemishes



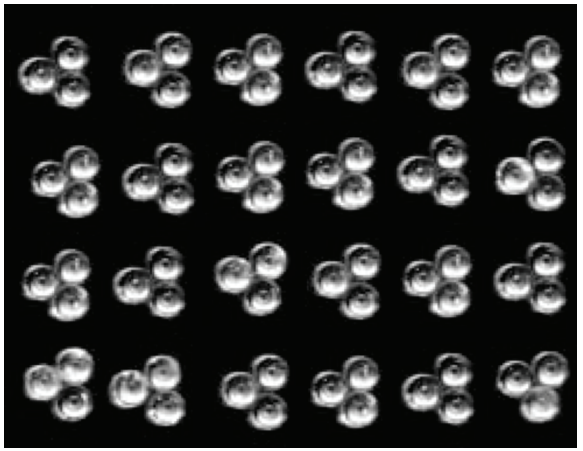
3. crop



4. remove outliers



5. reconstruct



PI & JiTT Overview

At which of the above steps were acceptable standards of ethics violated?

1. **Optimize brightness/contrast**
2. **Remove blemishes**
3. **Crop on optimal area**
4. **Retouch outliers**
5. **Replace outliers with parts copied from other locations**

PI & JiTT Overview

Don’t need a correct answer!

Outline

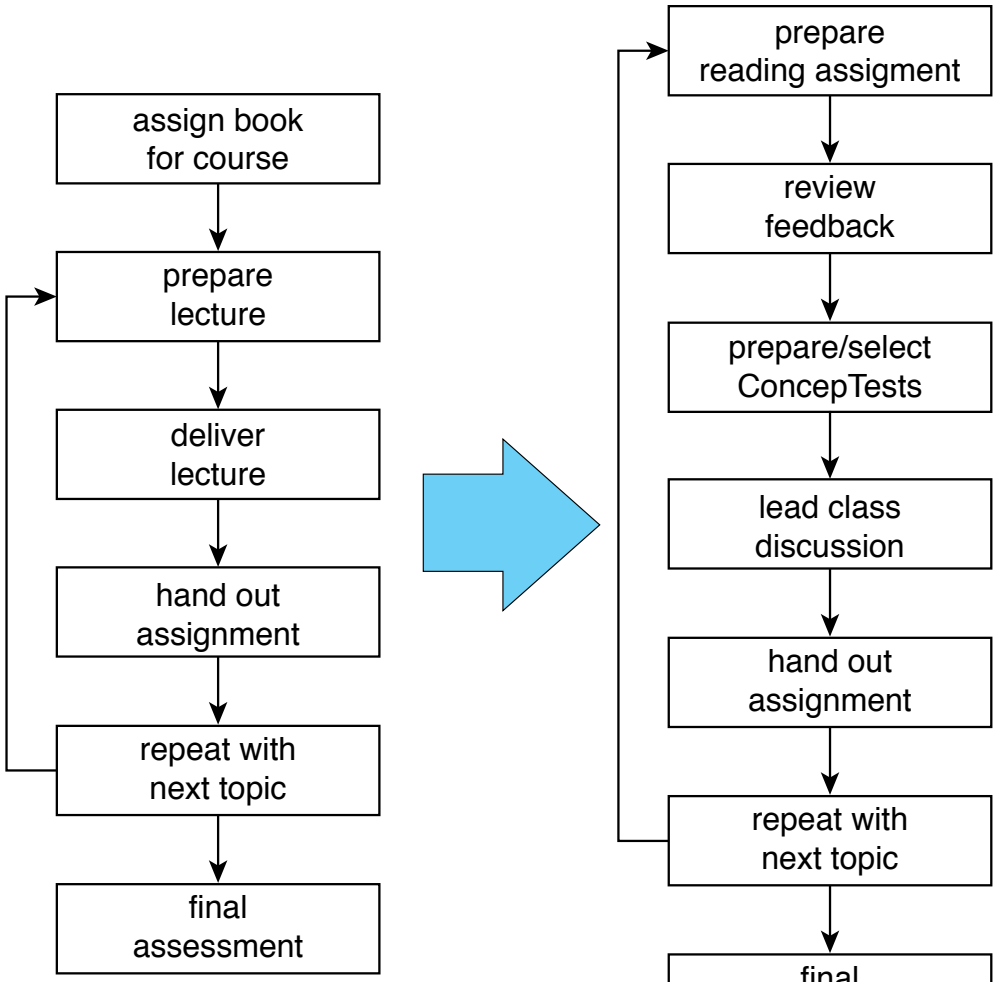
- PI & JiTT Overview
- **Implementing PI & JiTT**
- ConcepTests

Implementing PI & JiTT

"How is preparing a PI class different from preparing a lecture-based class?"

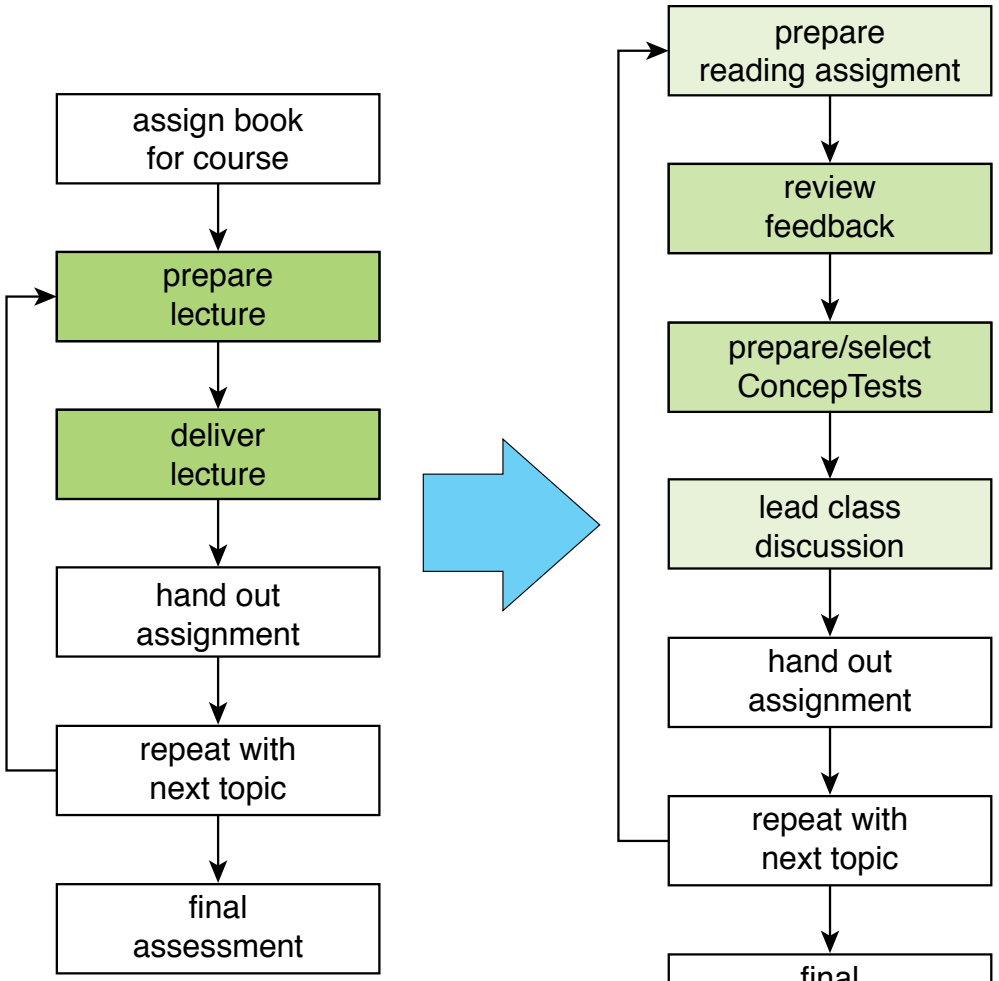
Implementing PI & JiTT

transitioning: where does the effort go?



Implementing PI & JiTT

transitioning: where does the effort go?



Implementing PI & JiTT

New activities:

1. **Reading assignment**
2. **ConcepTests**

Implementing PI & JiTT

“How do I make sure all topics can be covered using this method?”

Implementing PI & JiTT

"How do I do a better job of evaluating my students learning?"

Implementing PI & JiTT

What constitutes a good problem?

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Requires:

Assumptions
Developing a model
Applying that model

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces. On average people shop for 2 hours.

How long do you have to wait before someone frees up a space?

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces. On average people shop for 2 hours.

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Assuming people leave at regularly-spaced intervals, how long do you have to wait before someone frees up a space?

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces. On average people shop for 2 hours.

Assuming people leave at regularly-spaced intervals, how long do you have to wait before someone frees up a space?

Requires:

Applying a (new) model

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area, where people are known to shop, on average, for 2 hours. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area, where people are known to shop, on average, for 2 hours. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

$$t_{wait} = \frac{T_{shop}}{N_{spaces}}$$

Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmetered spaces near a shopping area, where people are known to shop, on average, for 2 hours. You circle around, but there are no empty spots. You decide to wait at one end of the lot, where you can see (and command) about 20 spaces.

How long do you have to wait before someone frees up a space?

Requires:

Using a calculator

$$t_{wait} = \frac{T_{shop}}{N_{spaces}}$$

Implementing PI & JiTT

Need to test meaningful skills!

Implementing PI & JiTT

Need to test meaningful skills!

(what are the goals of your course?)

Outline

- PI & JiTT Overview
- Implementing PI & JiTT
- ConcepTests

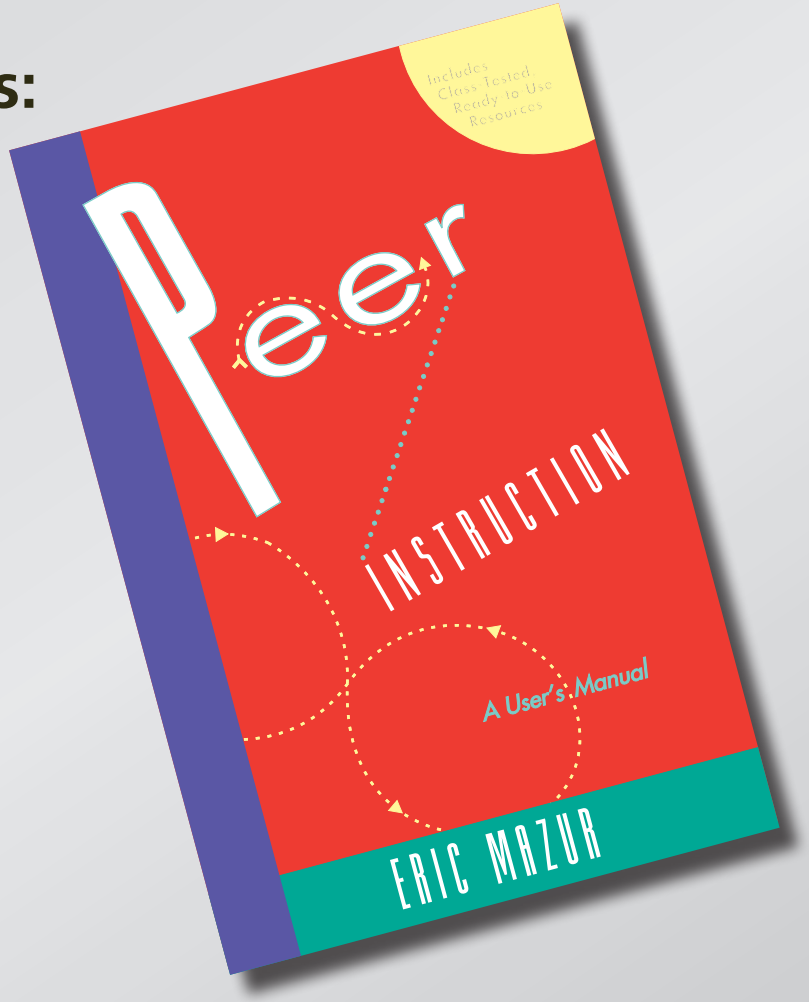
ConcepTests

"How do I get examples of good questions?"

ConcepTests

Books with ConcepTests:

- **Physics (Prentice Hall)**



ConcepTests

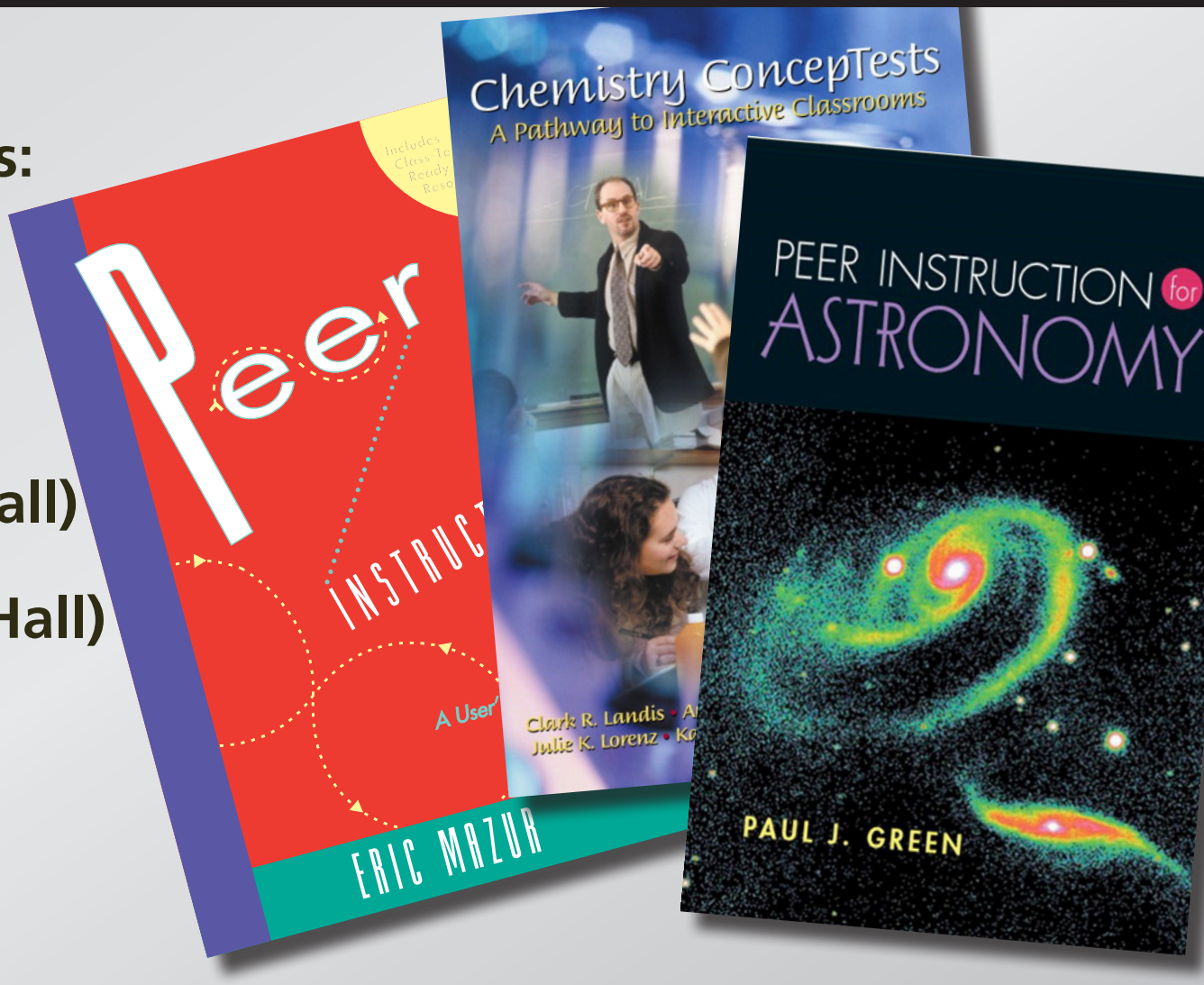
Books with ConcepTests:

- Physics (Prentice Hall)
- Chemistry (Prentice Hall)

ConcepTests

Books with ConcepTests:

- Physics (Prentice Hall)
- Chemistry (Prentice Hall)
- Astronomy (Prentice Hall)



ConcepTests

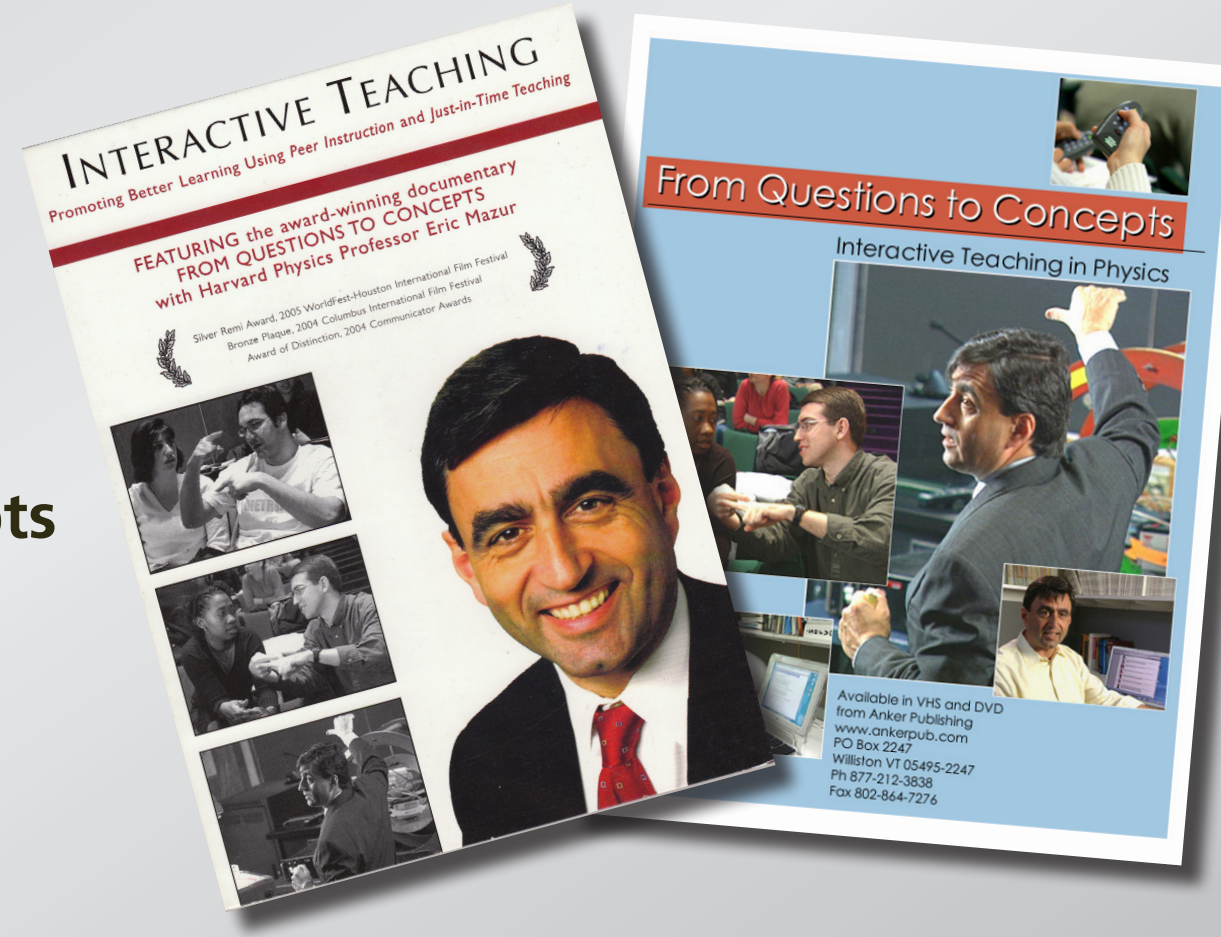
Books with ConcepTests:

- Physics (Prentice Hall)
- Chemistry (Prentice Hall)
- Astronomy (Prentice Hall)
- Calculus (Wiley)

ConcepTests

Videos:

- Interactive Teaching DVD
- From questions to concepts



ConcepTests

Google:

<your discipline> ConcepTest

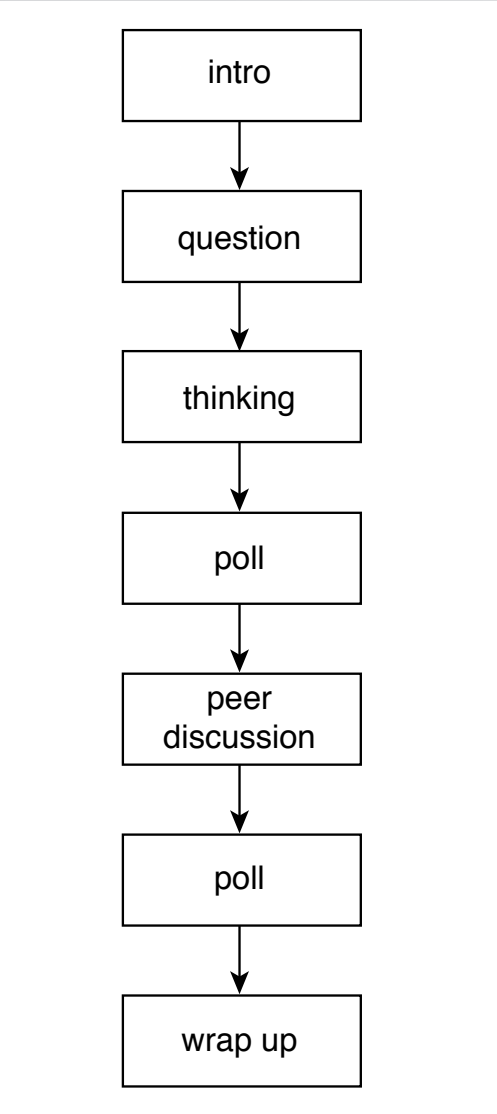
<your discipline> “Concept Test”

<your discipline> “Peer Instruction”

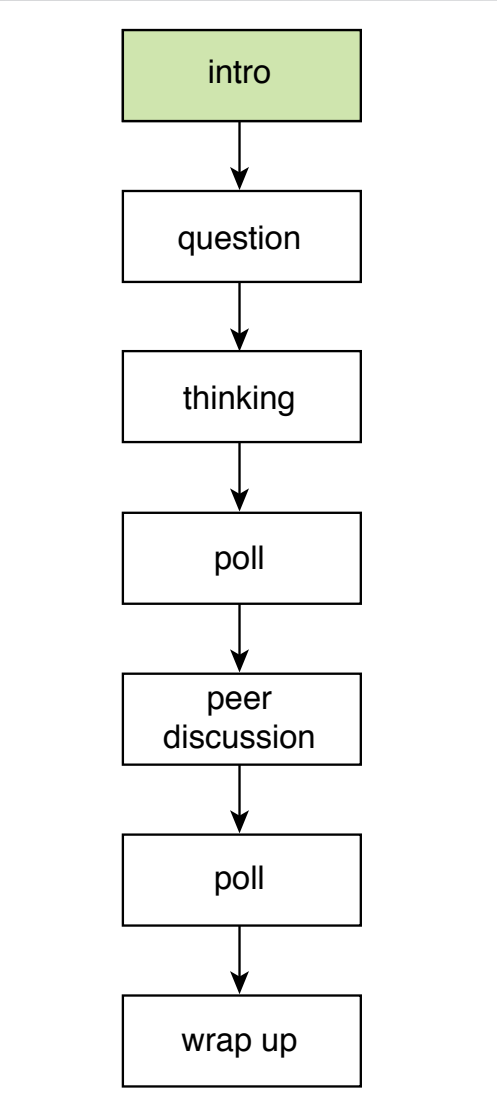
ConcepTests

"What are the important parts of a ConcepTest?"

ConcepTests

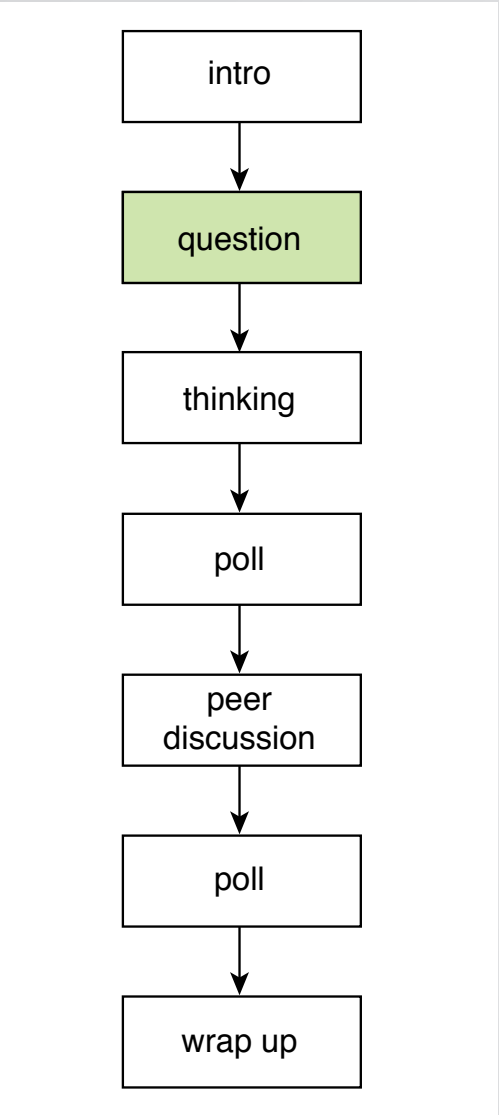


ConcepTests



setting context

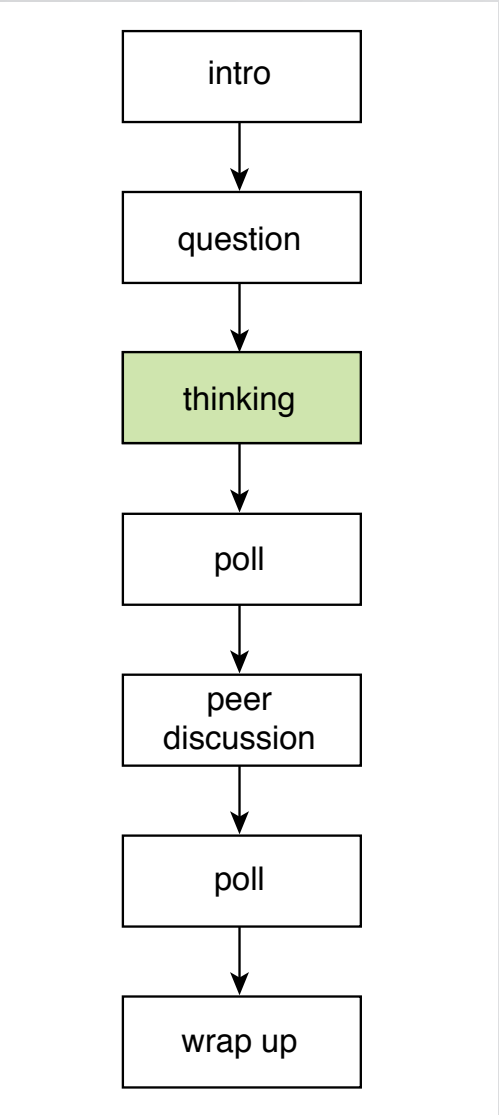
ConcepTests



setting context

posing question

ConcepTests

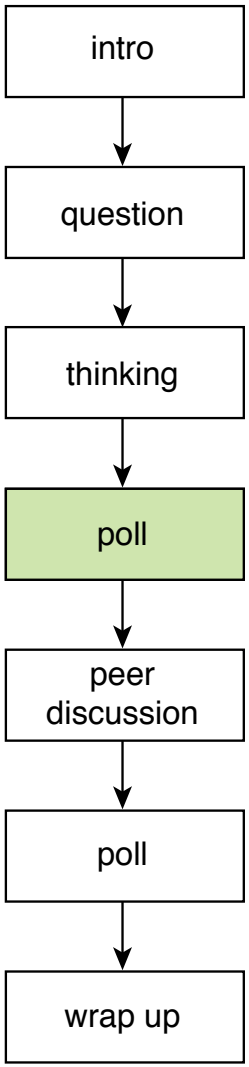


setting context

posing question

reflection

ConcepTests



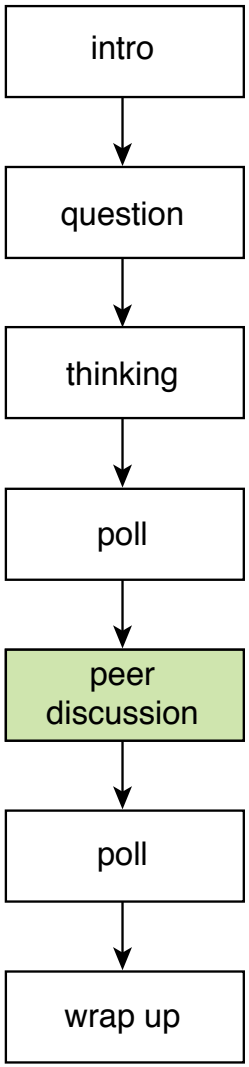
setting context

posing question

reflection

baseline data

ConcepTests



setting context

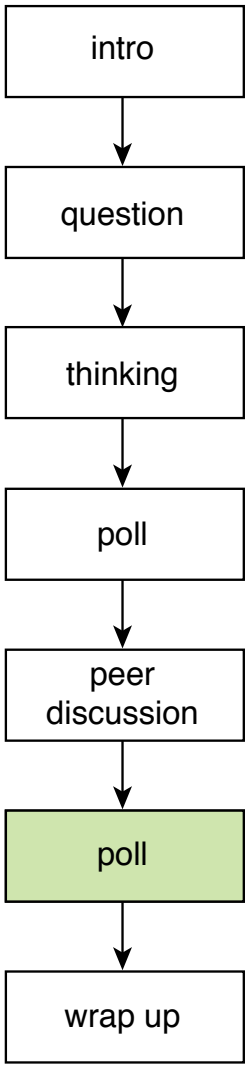
posing question

reflection

baseline data

peer instruction

ConcepTests



setting context

posing question

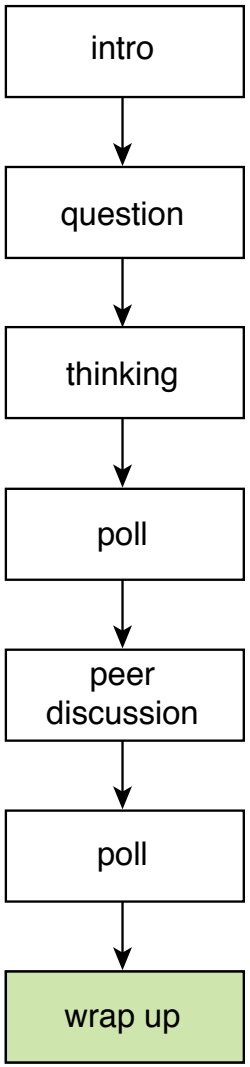
reflection

baseline data

peer instruction

gain data

ConcepTests



setting context

posing question

reflection

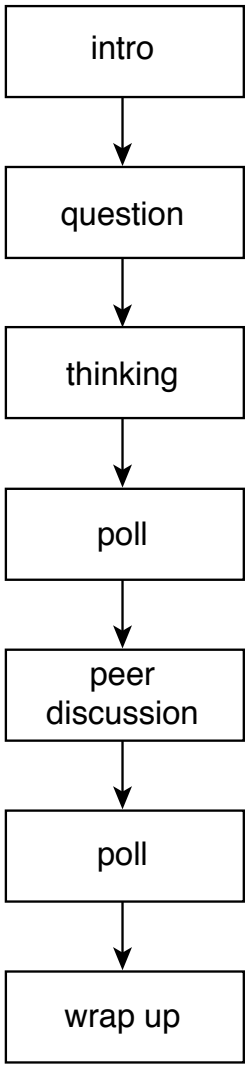
baseline data

peer instruction

gain data

closure

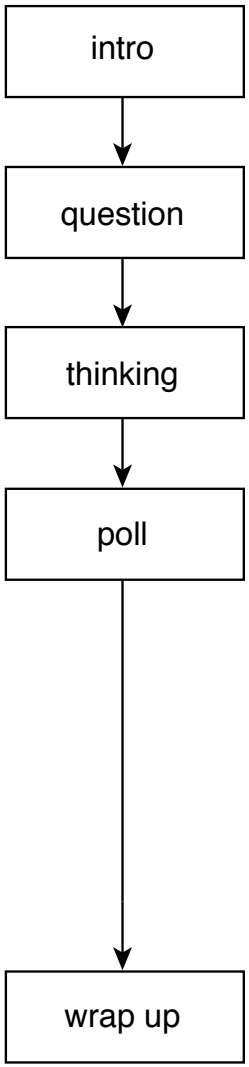
ConcepTests



setting context	5 min (max)
posing question	1 min
reflection	1–2 min
baseline data	
peer instruction	2–3 min
gain data	
closure	5 min (max)

ConcepTests

potential shortcuts

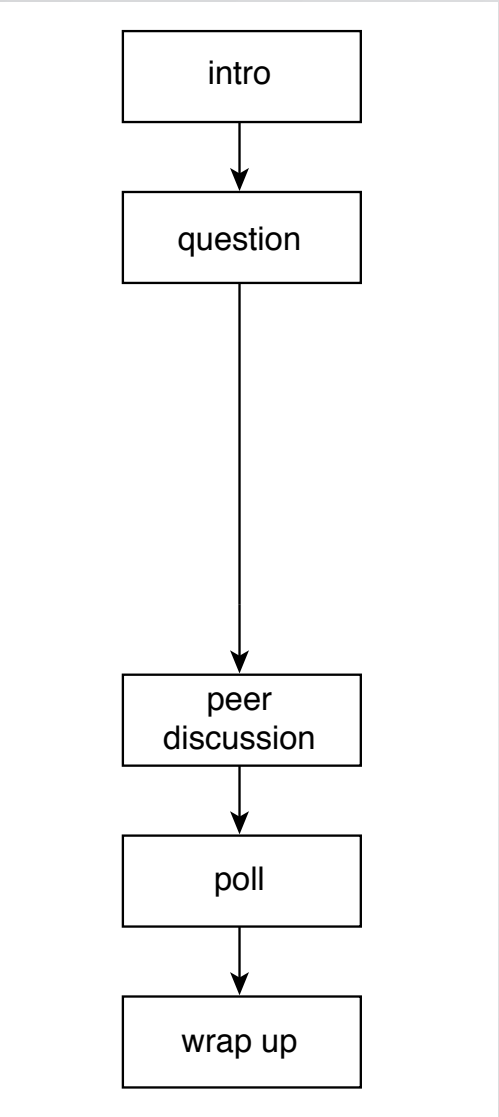


2–3 min saved, but…

takes the “Peer” out of “Peer Instruction”

ConcepTests

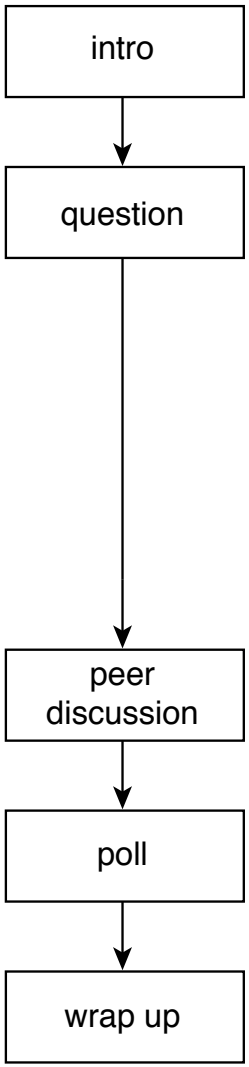
potential shortcuts



launch straight into discussion?

ConcepTests

potential shortcuts

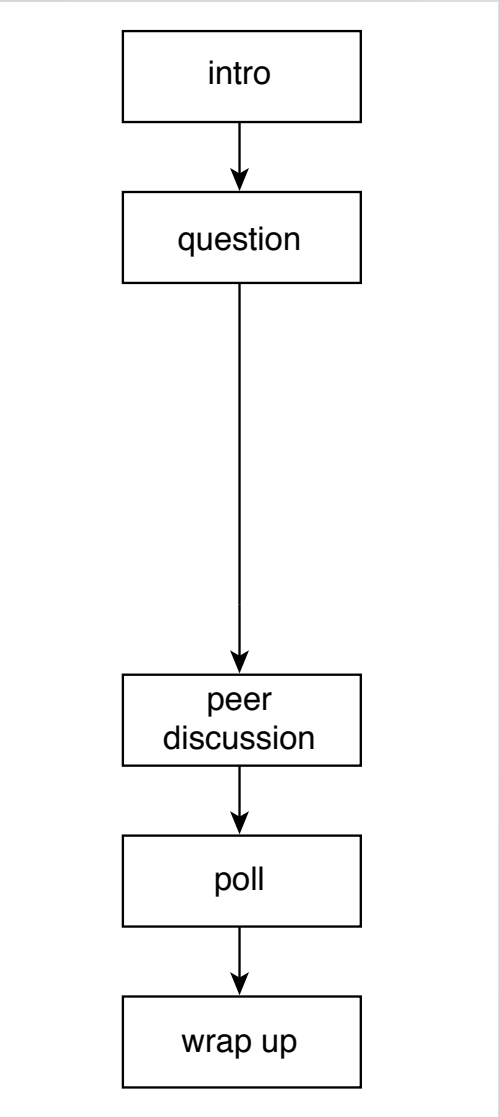


1–2 min saved, but…

no opportunity to commit before discussion

ConcepTests

potential shortcuts



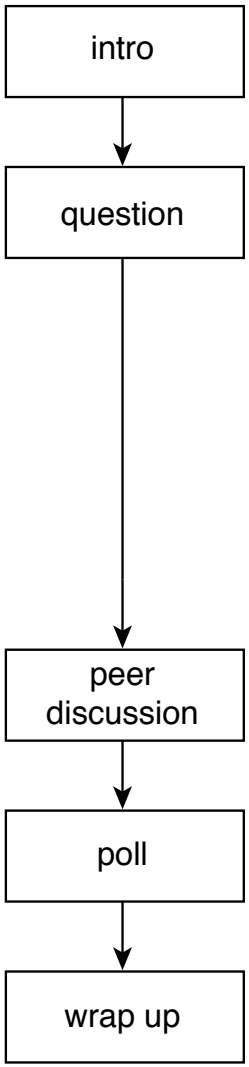
1–2 min saved, but…

no opportunity to commit before discussion

Boyle, *et. al*, Studies in Higher Education, 28, 4 (2003) 457

ConcepTests

potential shortcuts



1–2 min saved, but…

no opportunity to commit before discussion

(and no information on effectiveness of CT!)

ConcepTests

should count on about 15 min per ConcepTest

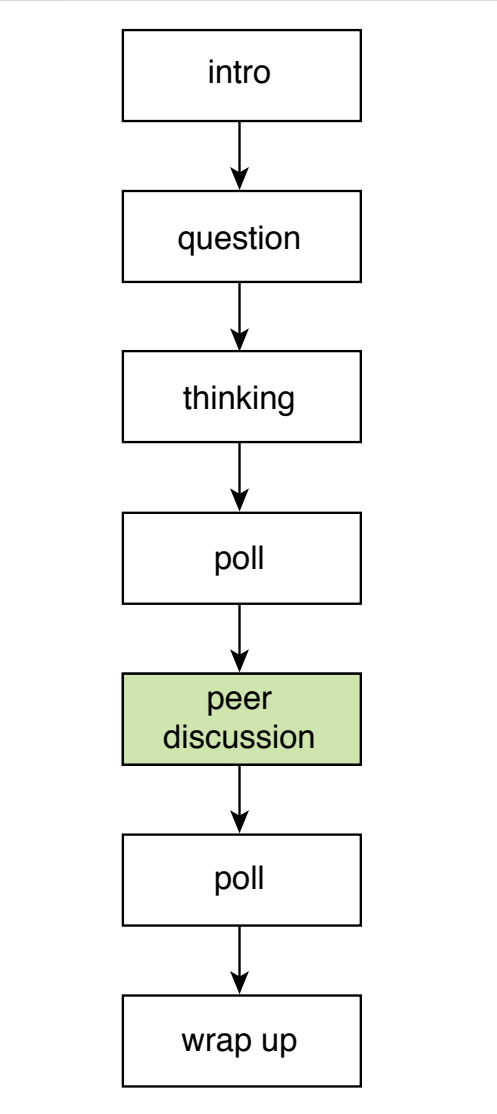
ConcepTests

should count on about 15 min per ConcepTest

(including two pollings)

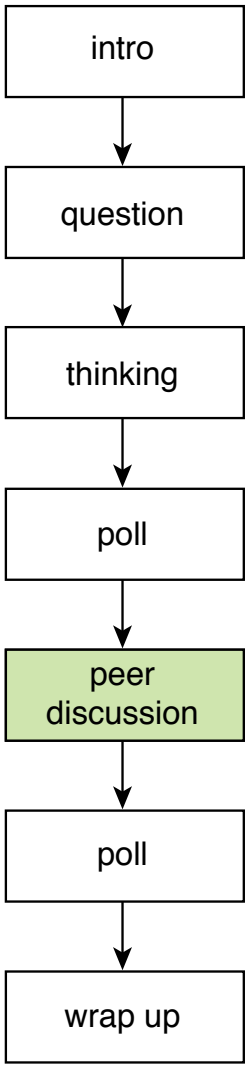
ConcepTests

importance of peer discussion



ConcepTests

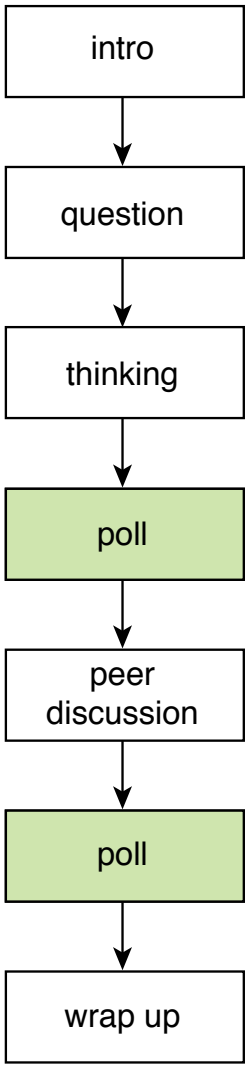
importance of peer discussion



vary activity

ConcepTests

importance of peer discussion



vary activity, measure poll-repoll gain

ConcepTests

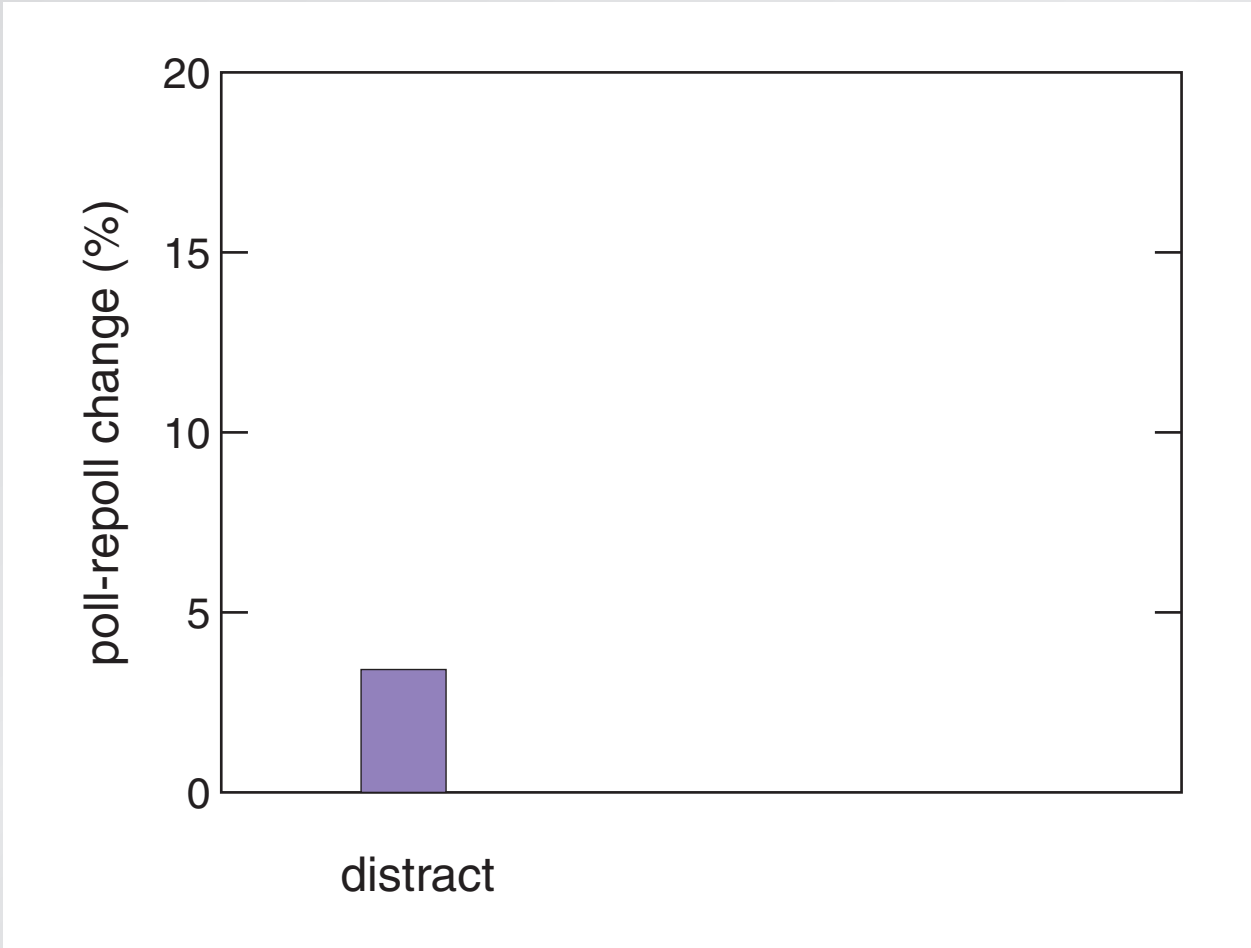
importance of peer discussion

compare poll-repoll gain for 3 activities:

- distract
- reflect
- discuss

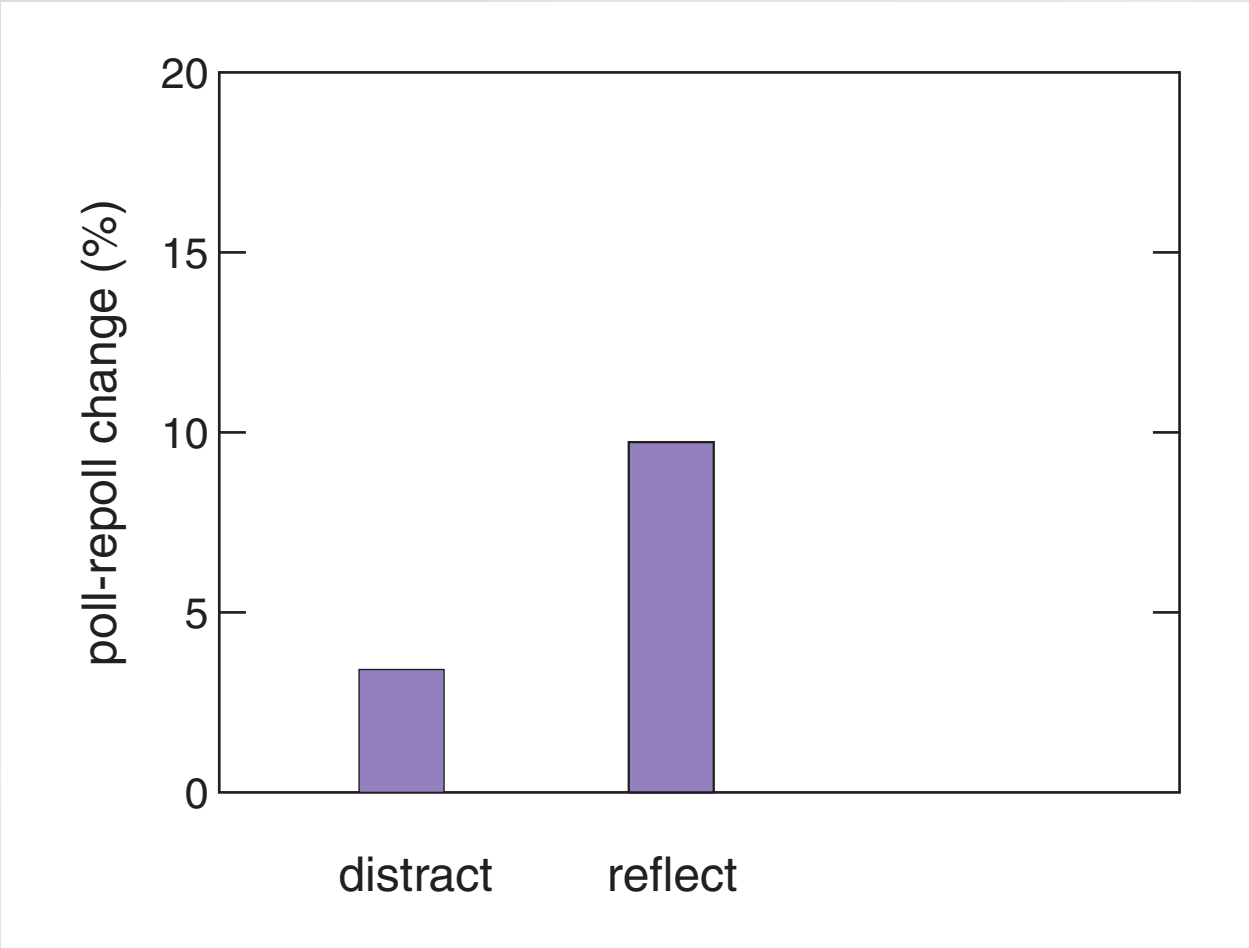
ConcepTests

importance of peer discussion



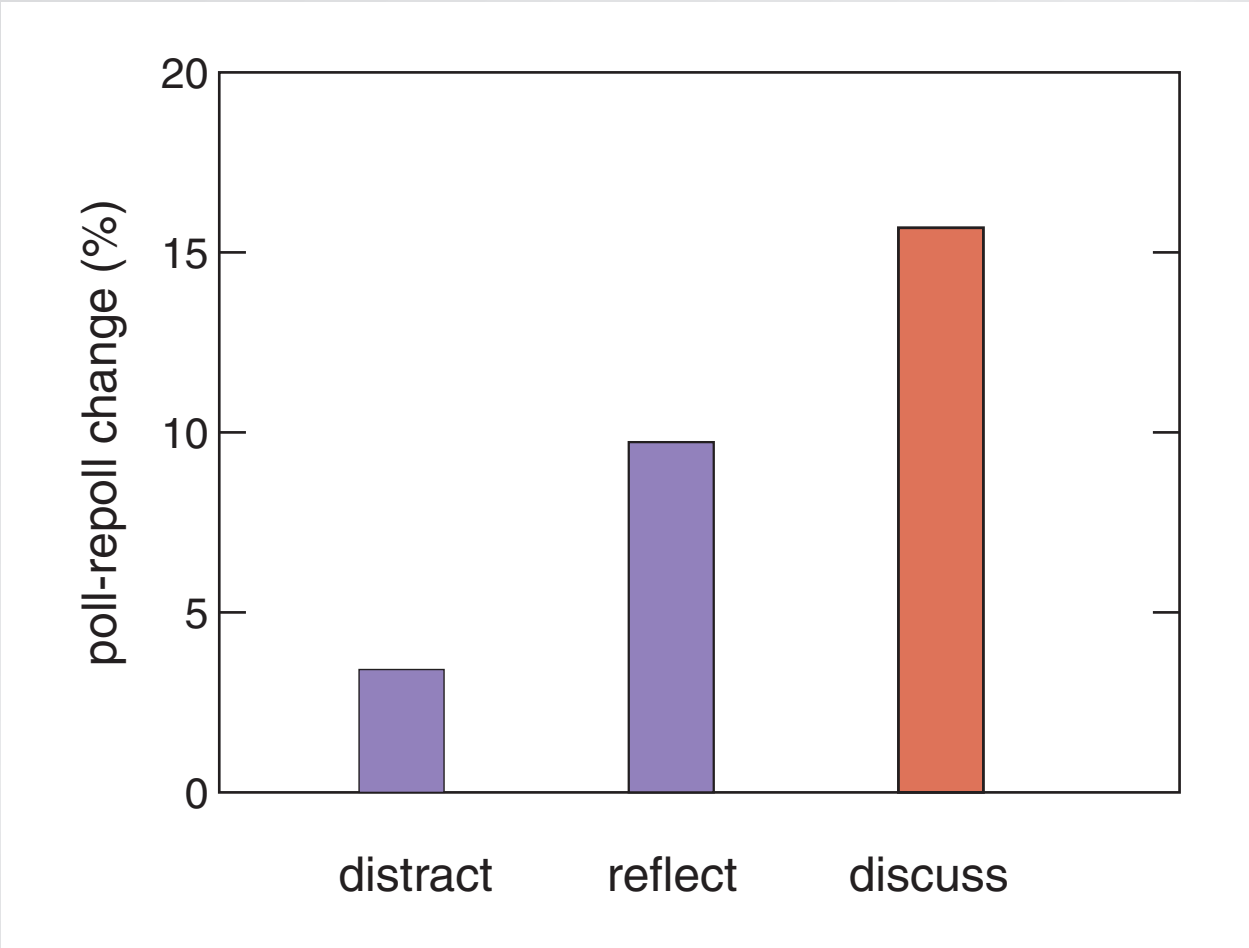
ConcepTests

importance of peer discussion



ConcepTests

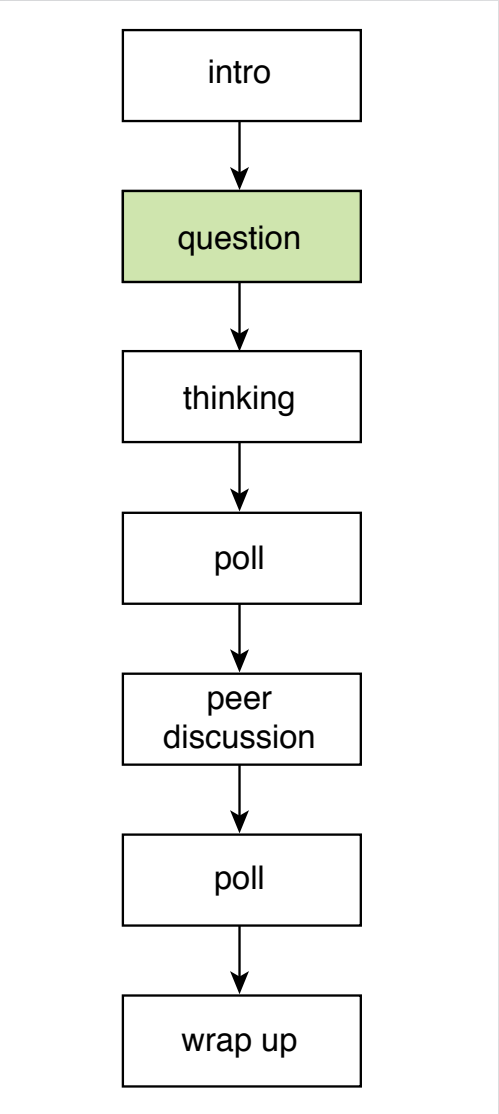
importance of peer discussion



ConcepTests

“With this method, can I use only multiple choice questions?”

ConcepTests



You can start with free response questions!

ConcepTests

Types of questions

- survey
- discussion
- model testing
- select from list

ConcepTests

Which of the following airlines tries to save fuel by suggesting that its passengers use the bathroom before boarding?

1. Delta Airlines
2. Lufthansa
3. All Nippon Airways
4. British Midland Airways
5. Air France
6. JAL
7. Aboriginal Air Services
8. Aeroflot
9. Are you kidding me? None of the above.

ConcepTests

Which of the following airlines tries to save fuel by suggesting that its passengers use the bathroom before boarding?

1. Delta Airlines
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3. **All Nippon Airways** ✔
4. British Midland Airways
5. Air France
6. JAL
7. Aboriginal Air Services
8. Aeroflot
9. Are you kidding me? None of the above.

ConcepTests

hole in plate

microscopy image

airline

model

discussion

fact

ConcepTests

hole in plate

model

microscopy image

discussion

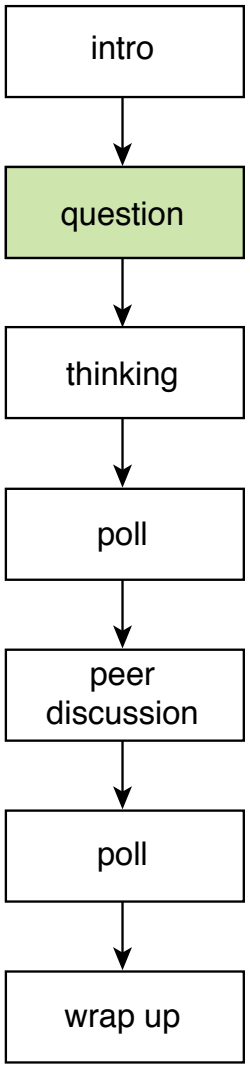
airline

fact

fact-recall not engaging

ConcepTests

To create **YOUR** ConcepTests, you need…



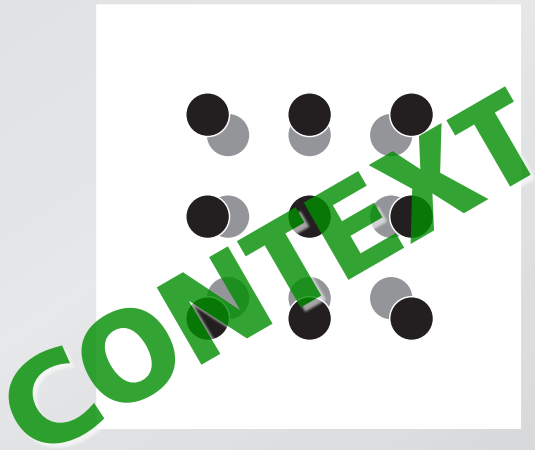
1. context

2. question

3. closure

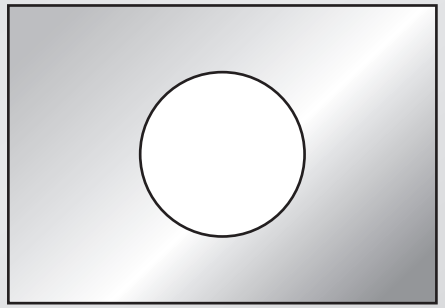
ConcepTests

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



ConcepTests

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



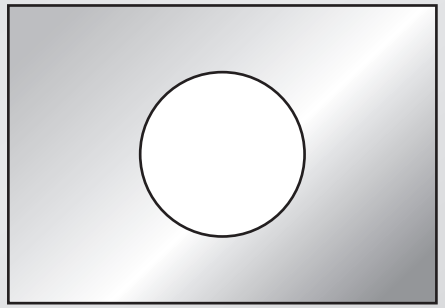
When the plate is uniformly heated, the diameter of the hole

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

QUESTION

ConcepTests

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



stem

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

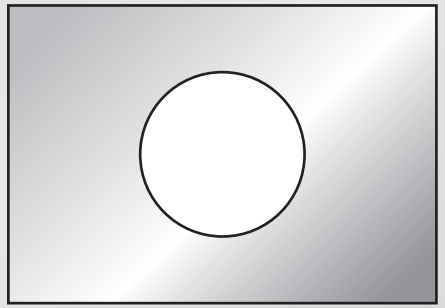
QUESTION

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

ConcepTests

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

stem



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

choices

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

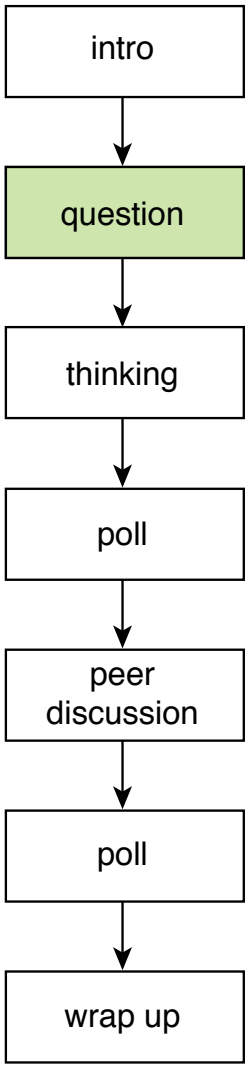
QUESTION

ConcepTests

consider the atoms at the rim of the hole

ConcepTests

some basic design rules

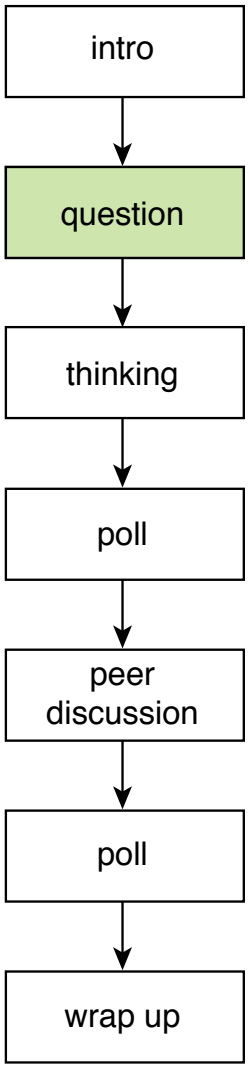


General tips:

- focus on one idea/concept/model
- keep questions concise
- define all terms
- keep vocabulary simple

ConcepTests

some basic design rules

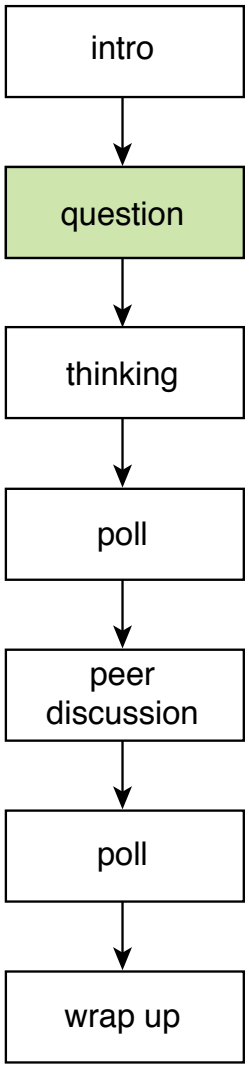


Remove:

- barriers for knowledgeable students
- clues for less-knowledgeable students

ConcepTests

some basic design rules

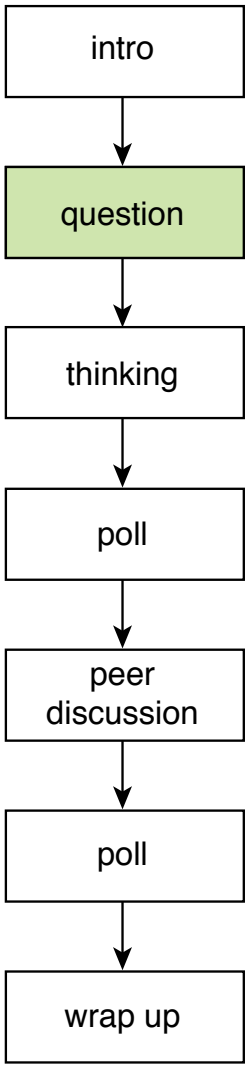


Writing good “stems”:

- ask complete question
- avoid common knowledge
- avoid negative statements (“not”, “no”,…)

ConcepTests

some basic design rules

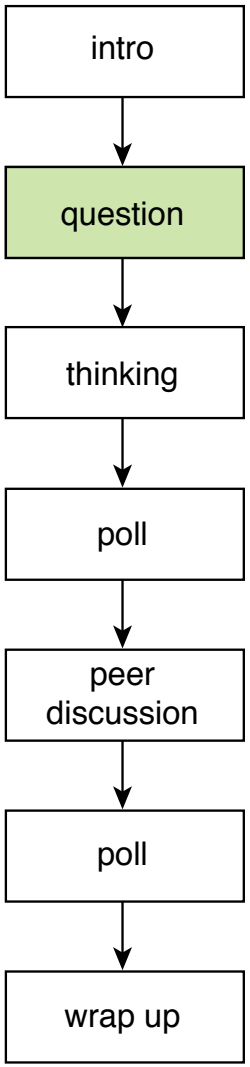


Writing good answer choices:

- aim for 3–5 options
- order choices logically
- make all roughly same length
- avoid repeating words (move to stem)
- avoid “All/None of the above”, “Other”

ConcepTests

Example: a nonsense question



Choose most likely correct answer, based on what you know about informed guessing on tests.

Under what circumstances do *ermazoa* coagulate?

A. Only when *jushespora* increase.

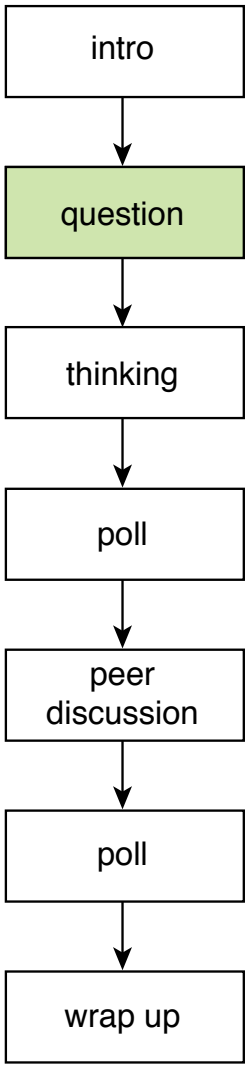
B. Only when *jushespora* change color.

C. When *jushespora* draw into a circle.

D. Usually when *jushespora* increase, but occasionally when *jushespora* decrease.

ConcepTests

Example: another nonsense question



What is the color of *ermazoa*?

A. Blue.

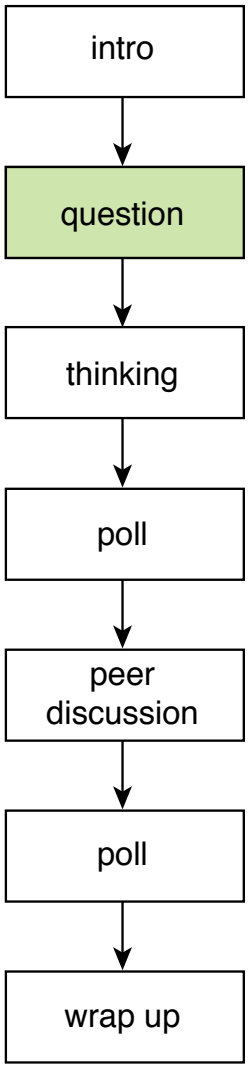
B. Red.

C. Green.

D. Yellow.

ConcepTests

Example: a well-crafted question



Which statement refers to measurement as opposed to evaluation?

A. Emily got 90% correct on her math quiz.

B. Mary's test scores have increased satisfactorily this year.

C. Paul's score of 20 on this test indicates that his study habits are ineffective.

D. Linda received a B+ for her art project.

Research Funding:

Pew Charitable Trust, Pearson/Prentice Hall, Davis Foundation, Engineering Information Foundation, Derek Bok Center for Teaching and Learning, National Science Foundation

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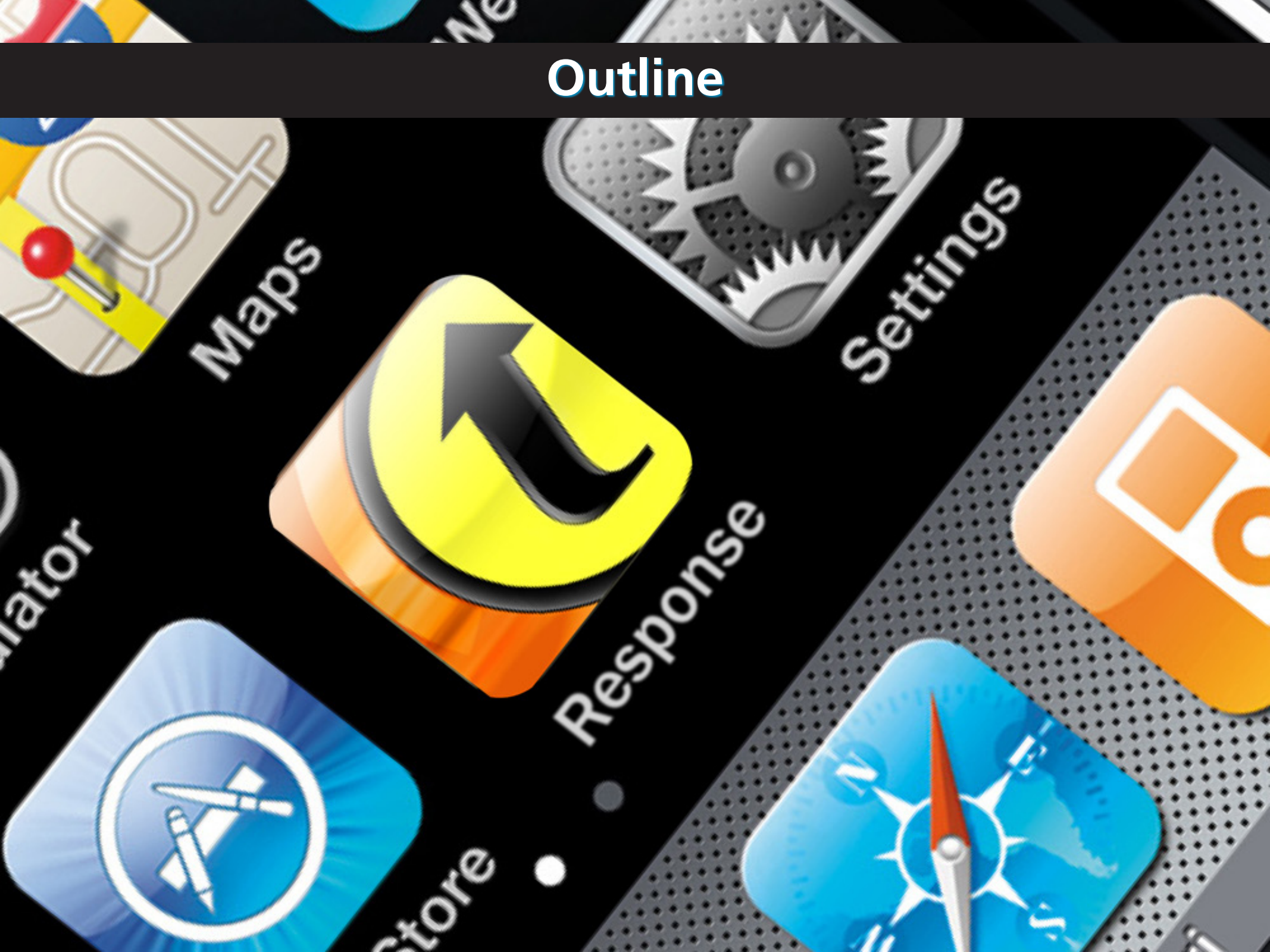
Peer Instruction Workshop: Part 2

UDC-Community College
Washington DC, 8 February 2012

Outline



Outline

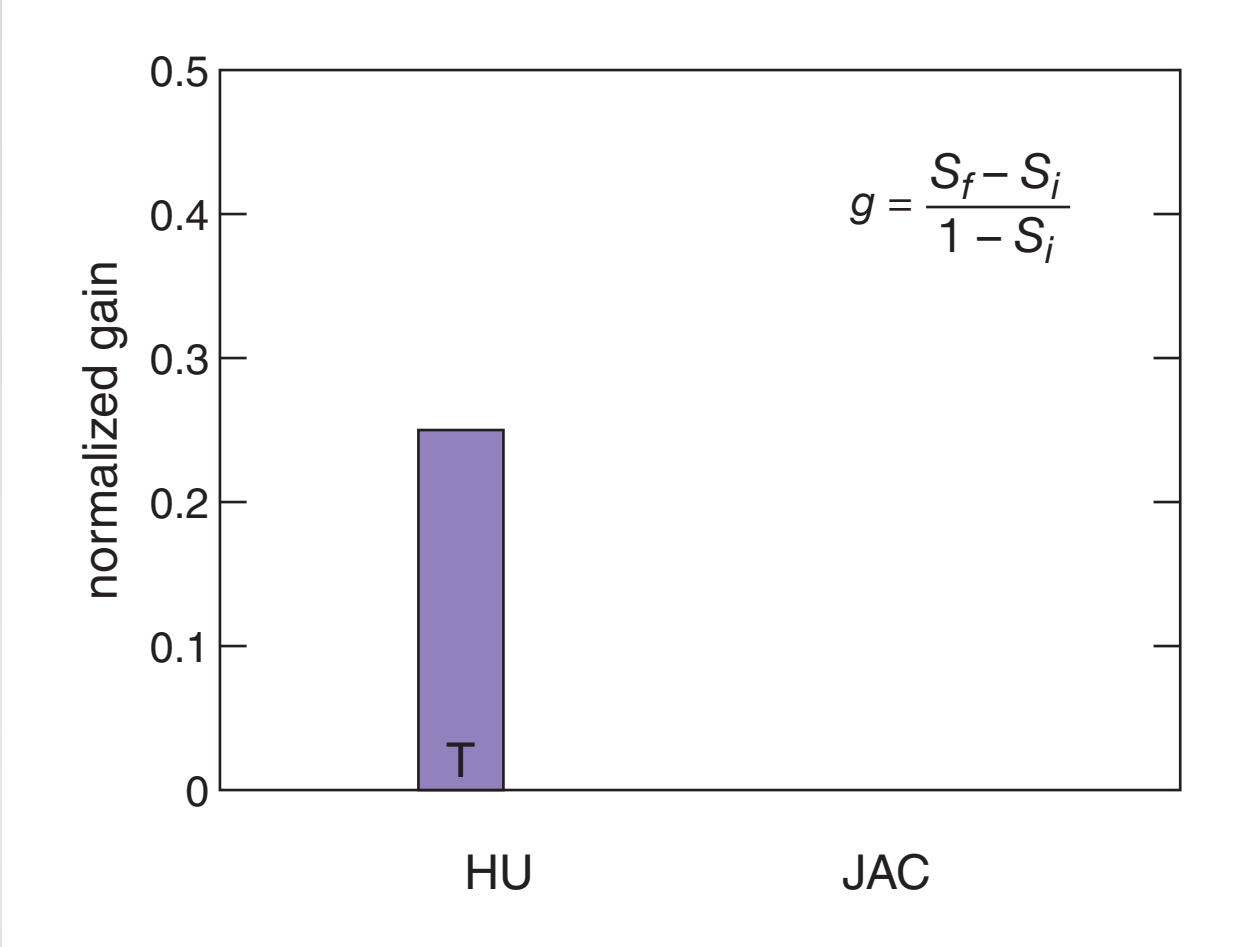
- Your questions
- Developing PI/JiTT questions
- Strategies for assessment

It works here…

…but will it work here?

Will it work at my institution?

FCI normalized gain



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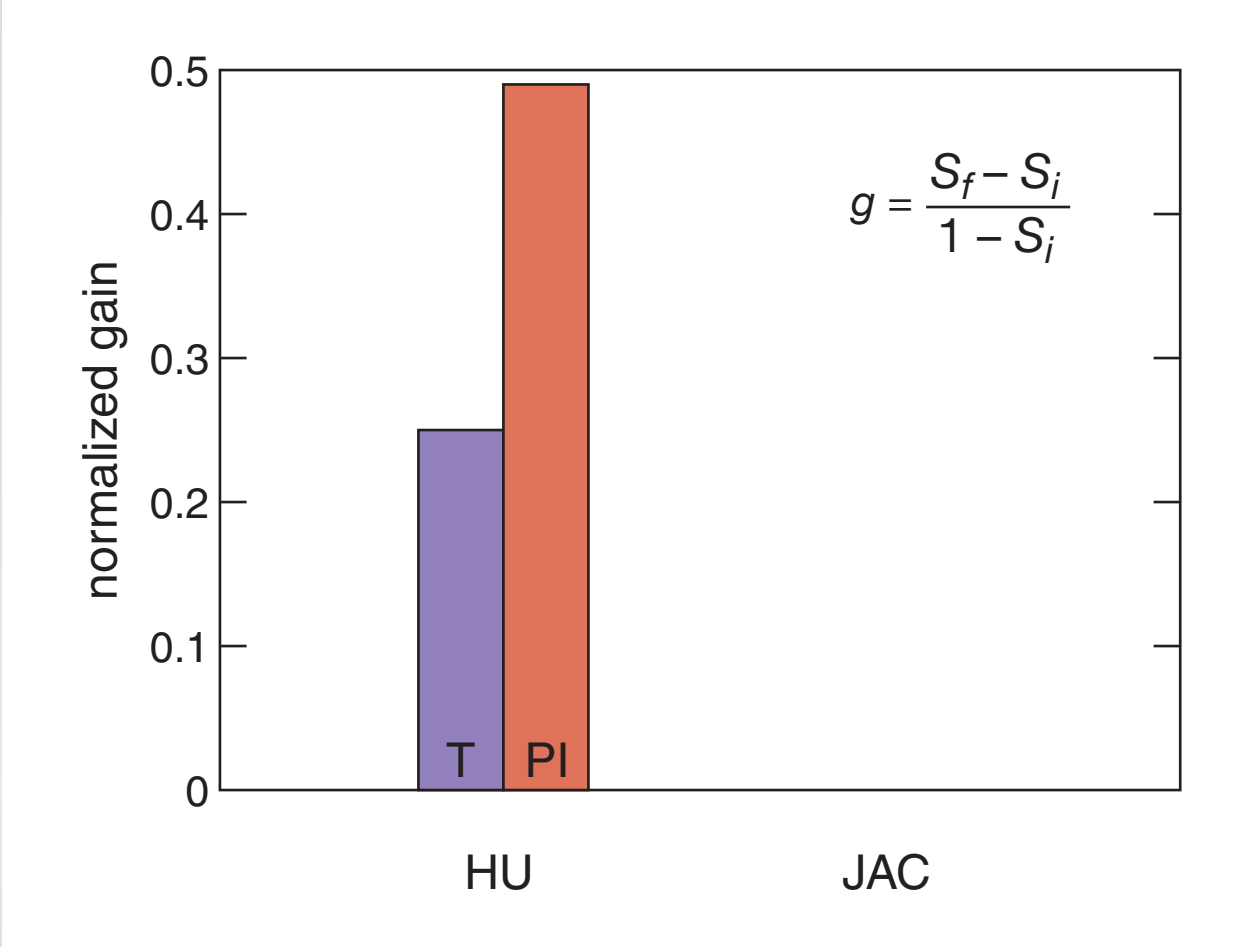

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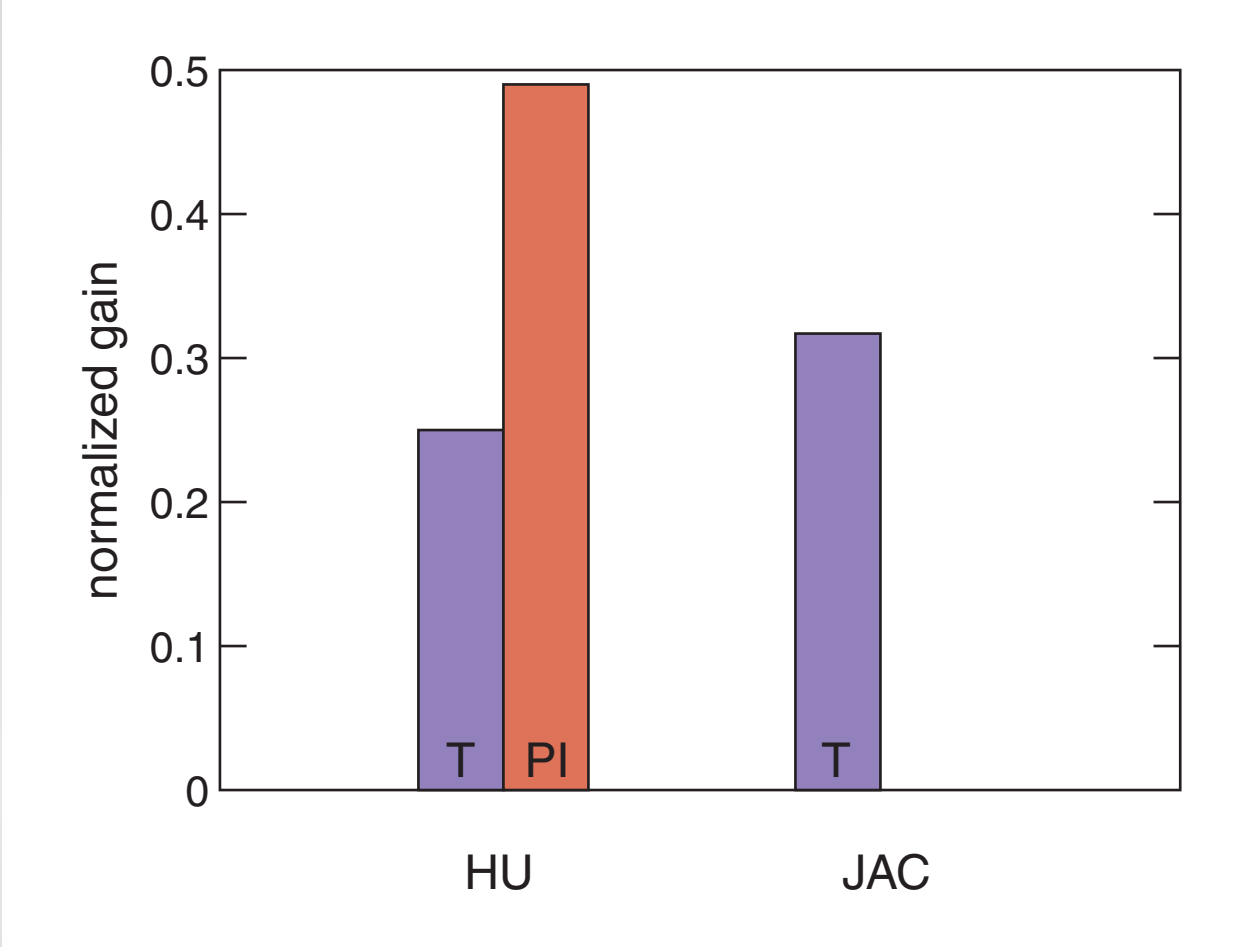

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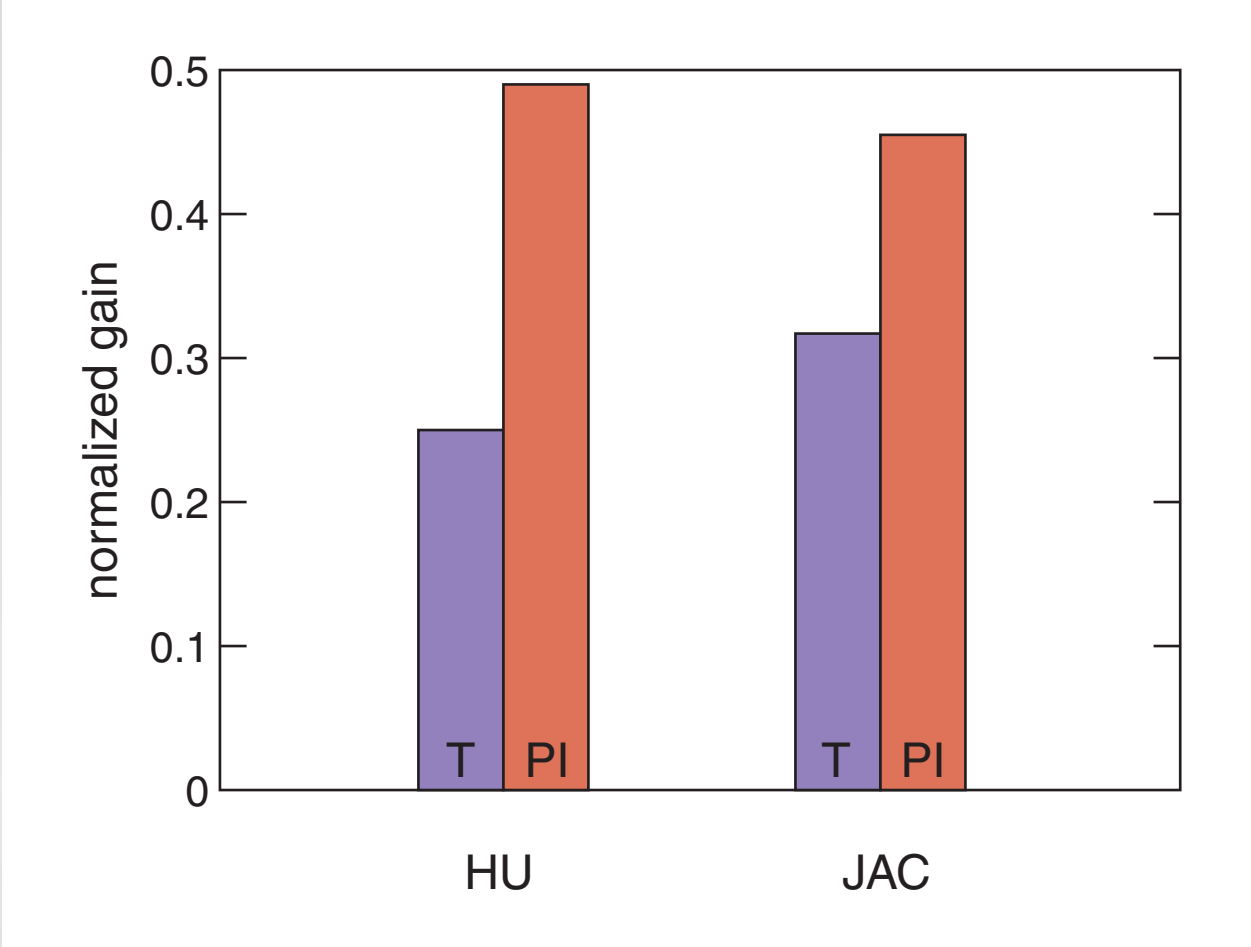
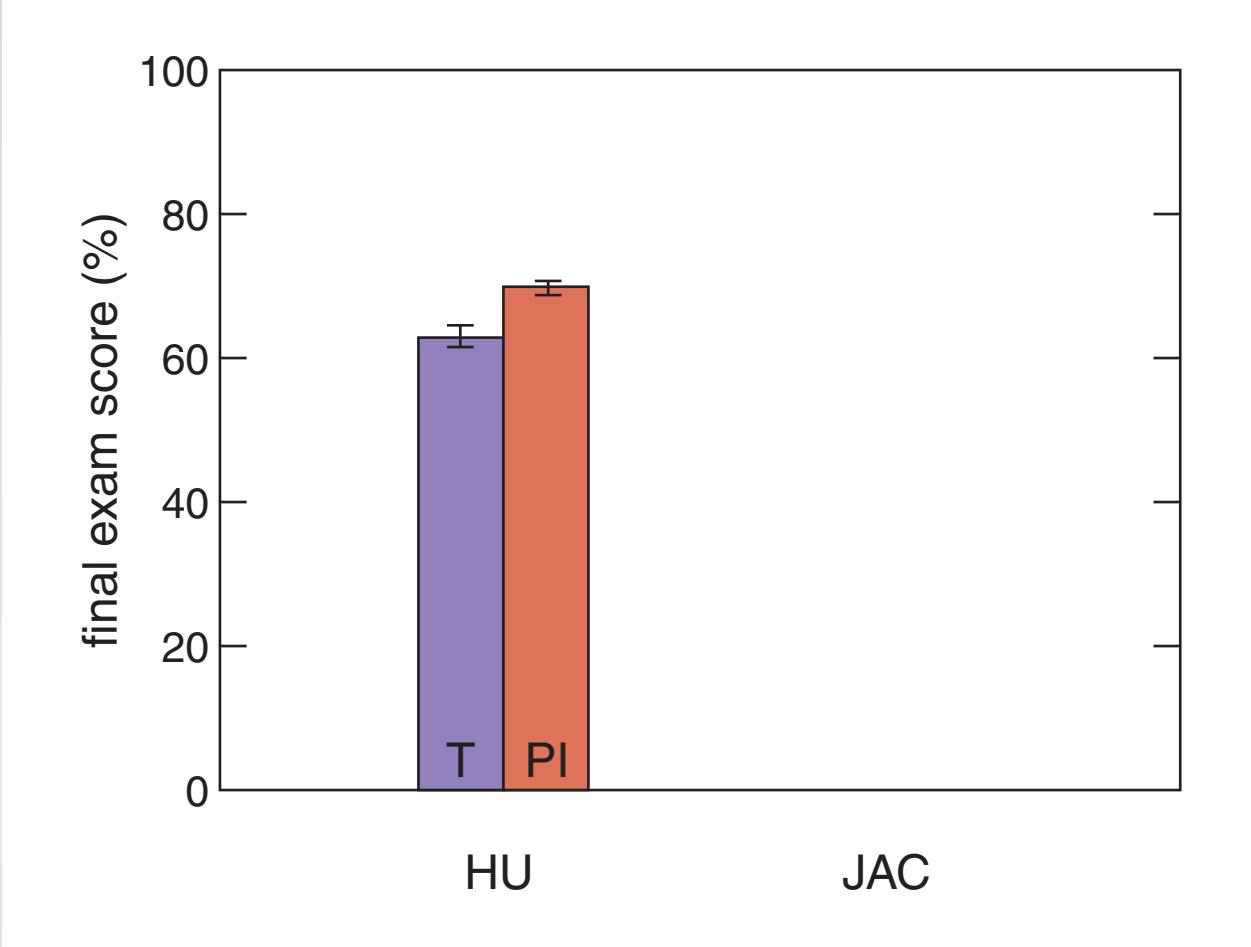


Will it work at my institution?

exam performance



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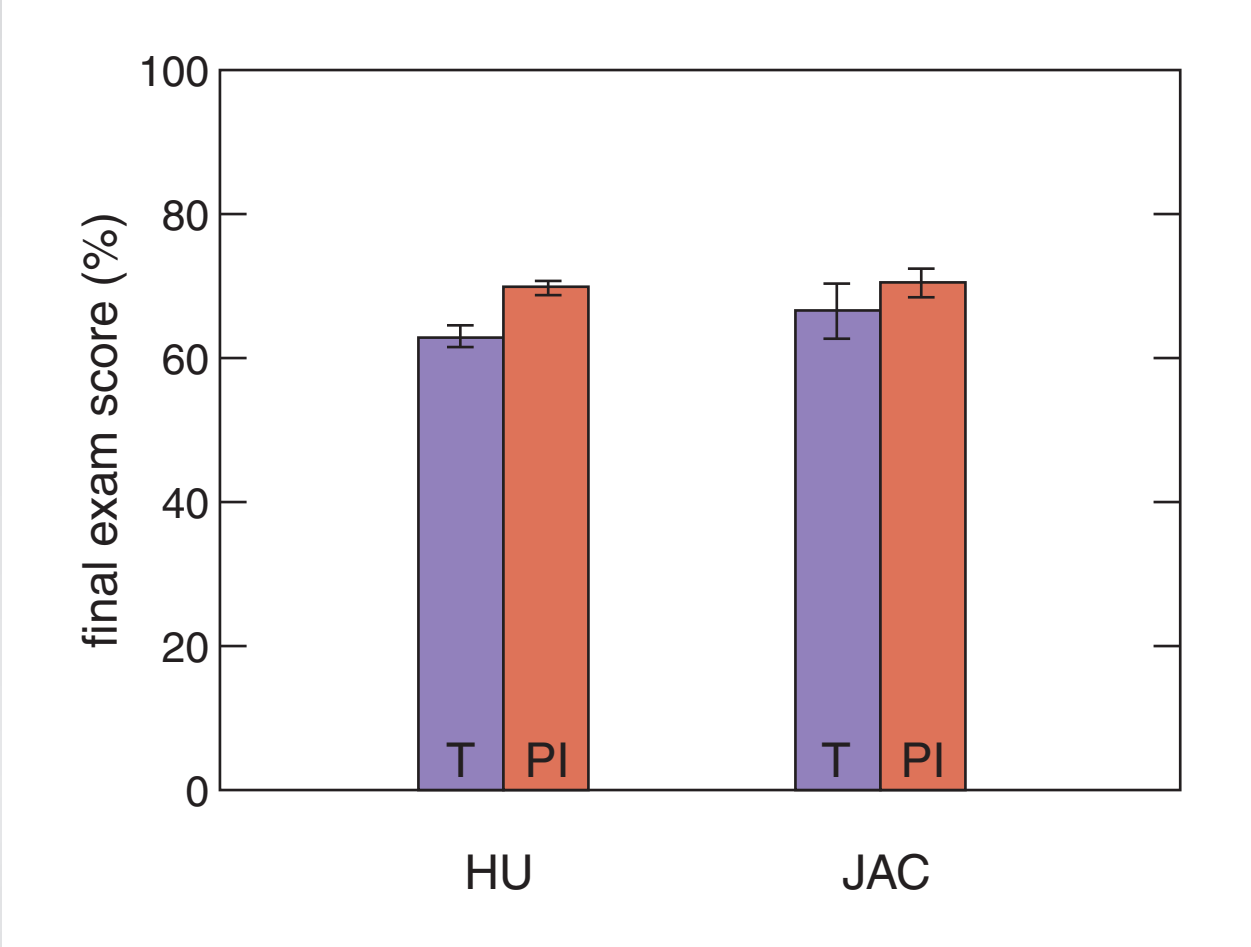
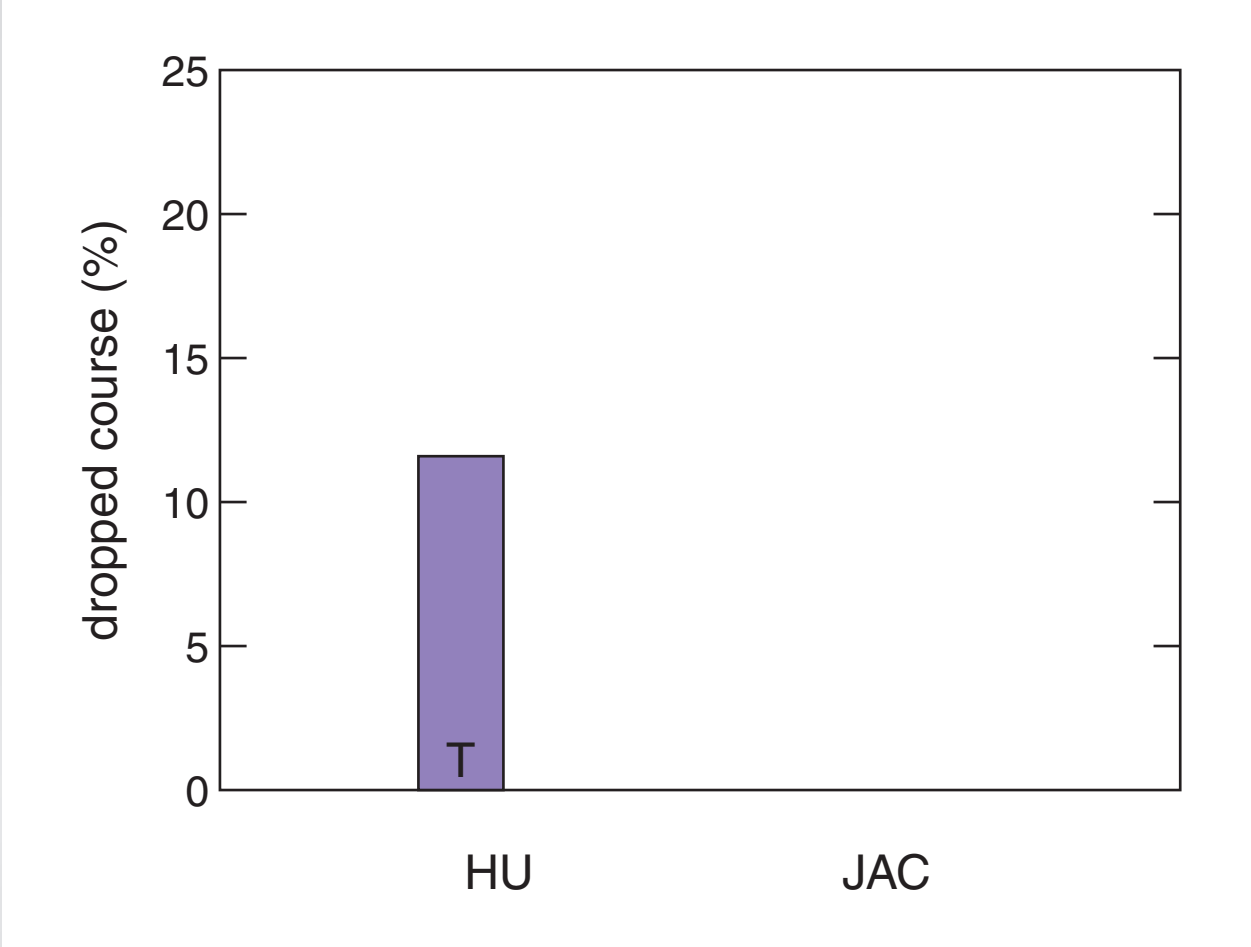


Will it work at my institution?

student retention



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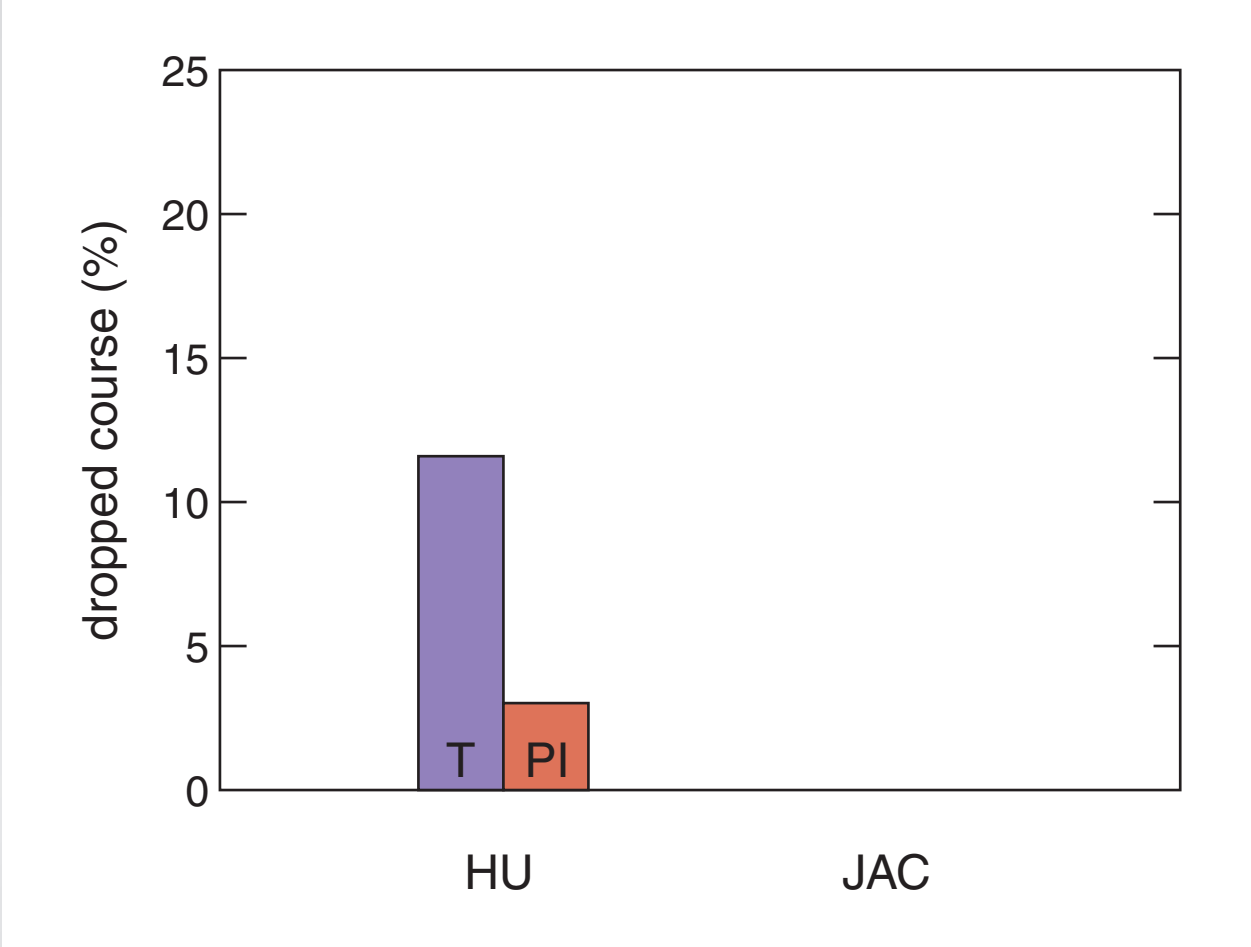

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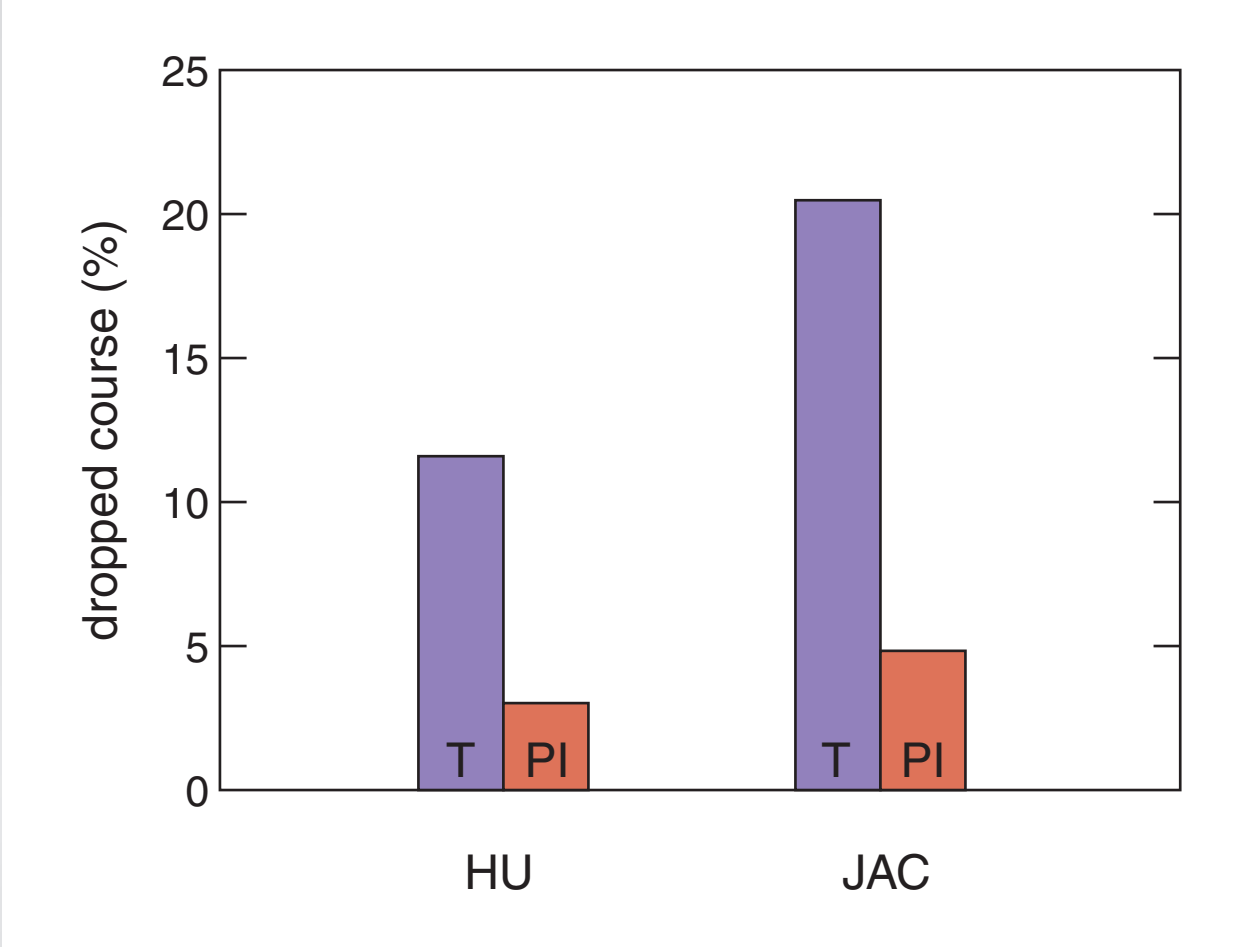


Will it work at my institution?

similar learning gains in different environments

Administering ConcepTests

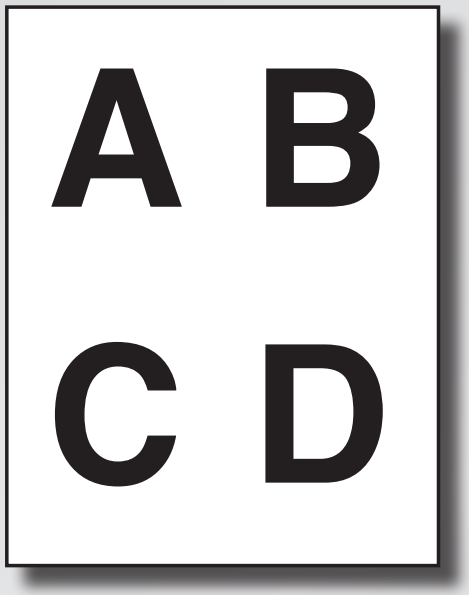
"How do you control marginalization of students from minority groups?"

Frequently Asked Questions

“Do I need clickers?”

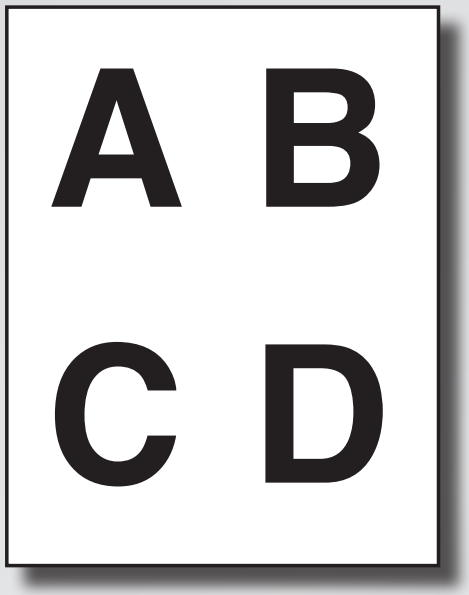
Clickers necessary?

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?

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?

You all got fired up!

Clickers necessary?

You all got fired up!

(WITHOUT CLICKERS!)

Clickers necessary?

Imagine a rope that fits snugly along the equator.

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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?

It’s not the technology, but the pedagogy!

Clickers necessary?

It's not the technology, but the pedagogy!

(but clickers do offer advantages)

Student resistance

"What happens if the students expect a lecture, and are neither prepared for, nor receptive to the new approach — a mismatch of expectations?"

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!

Outline

- Your questions
- **Developing PI/JiTT questions**
- Strategies for assessment

Developing PI/JiTT questions

Best way to learn how to create CTs: try it out!

Developing PI/JiTT questions

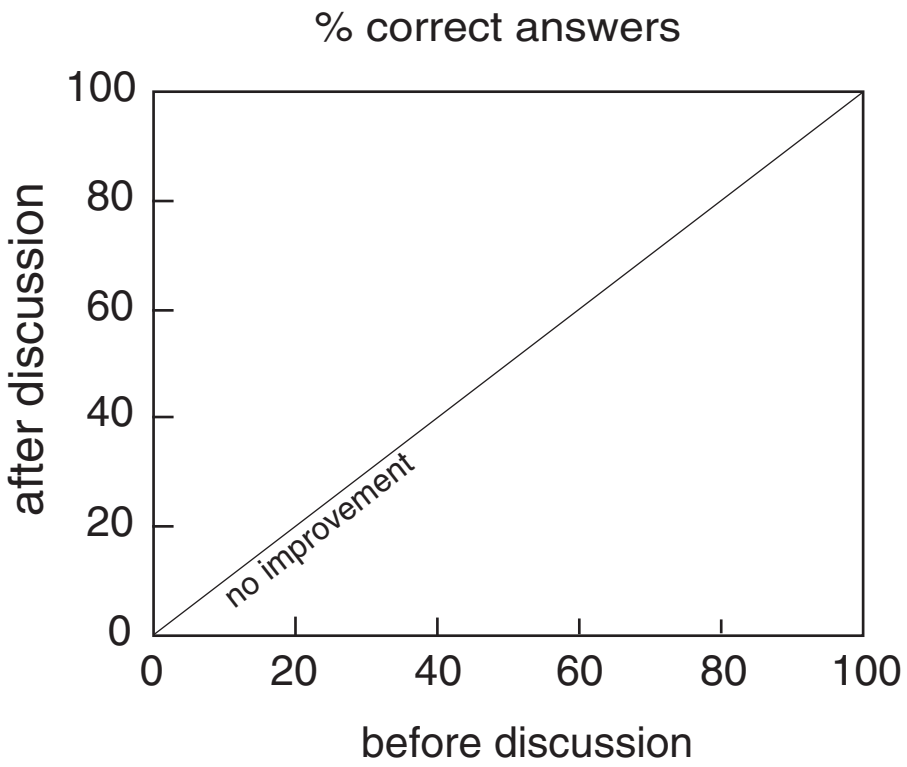
“How do I select which concepts to evaluate?”

Developing PI/JiTT questions

"How do I make sure the CT is not too easy/hard?"

Developing PI/JiTT questions

ConcepTest data



Developing PI/JiTT questions

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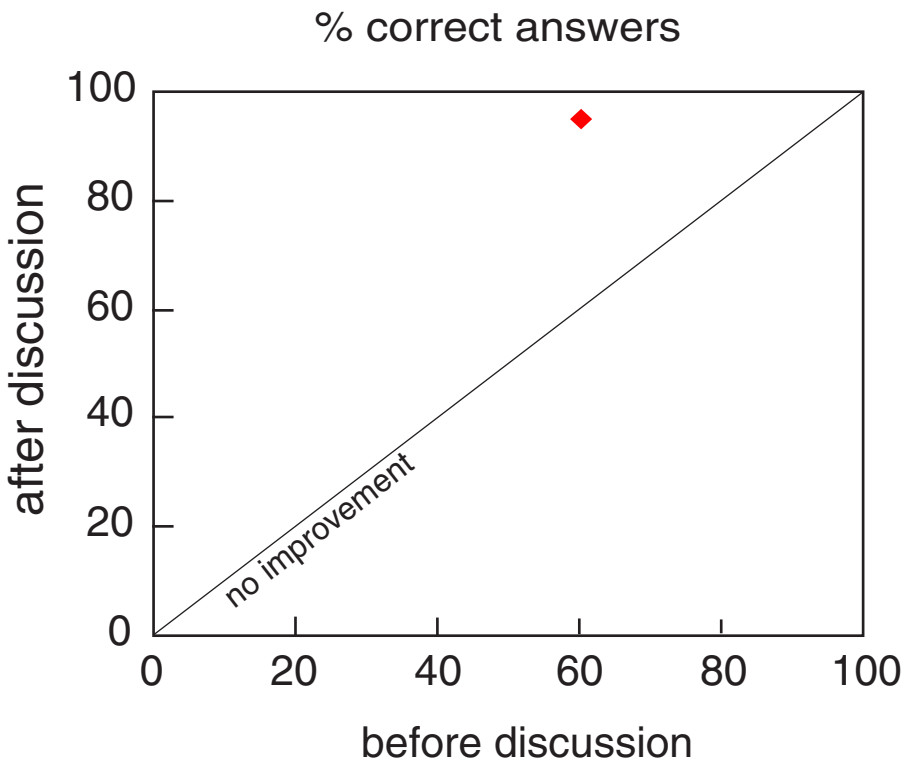

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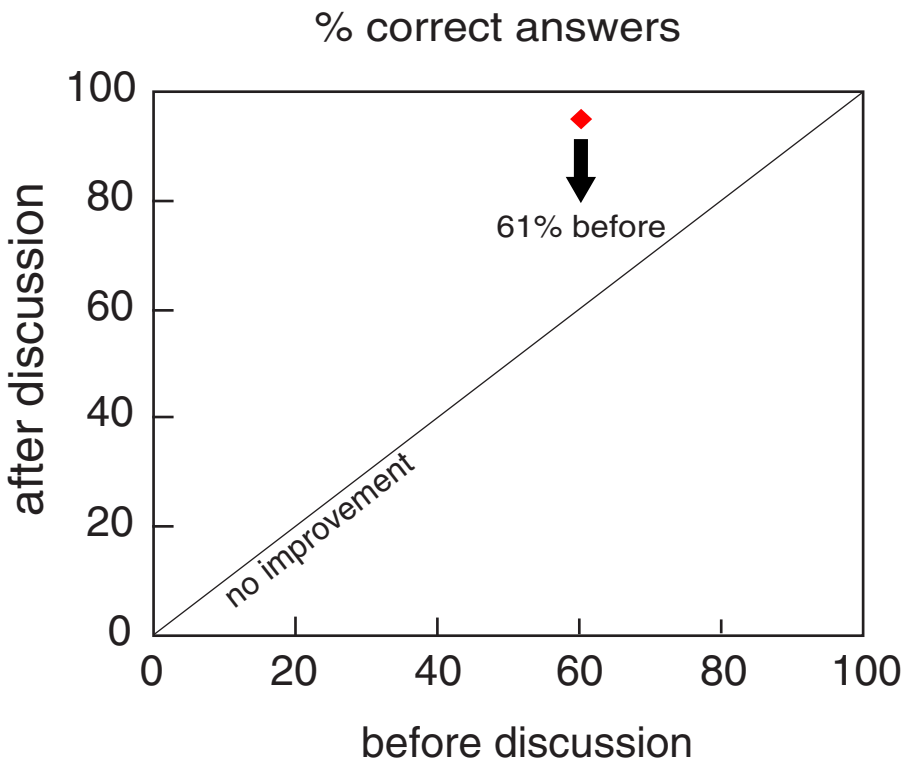

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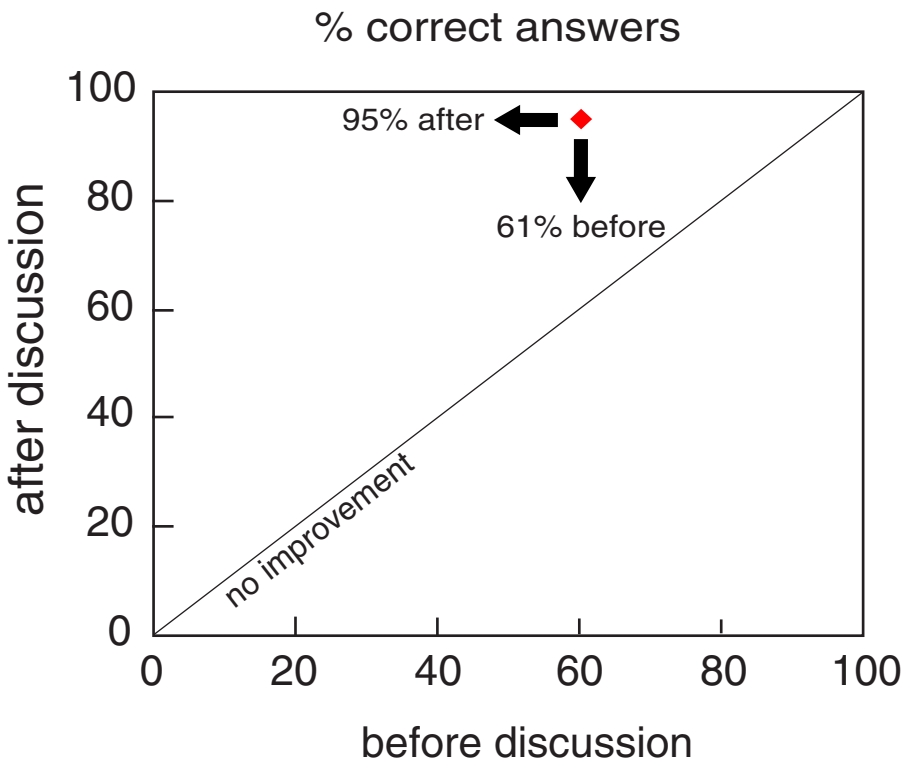

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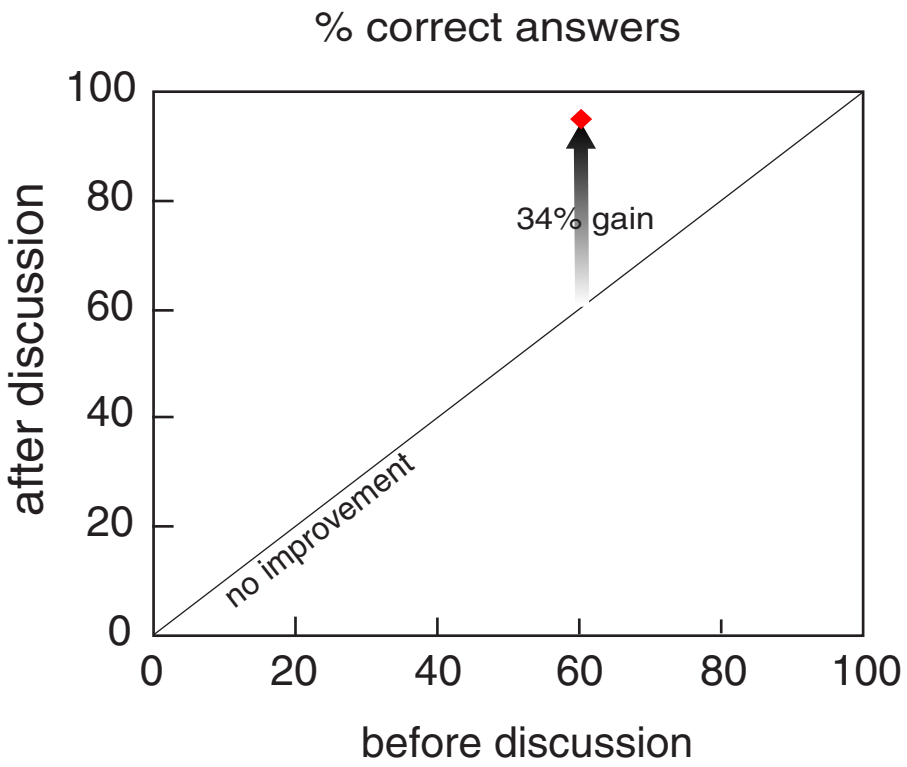

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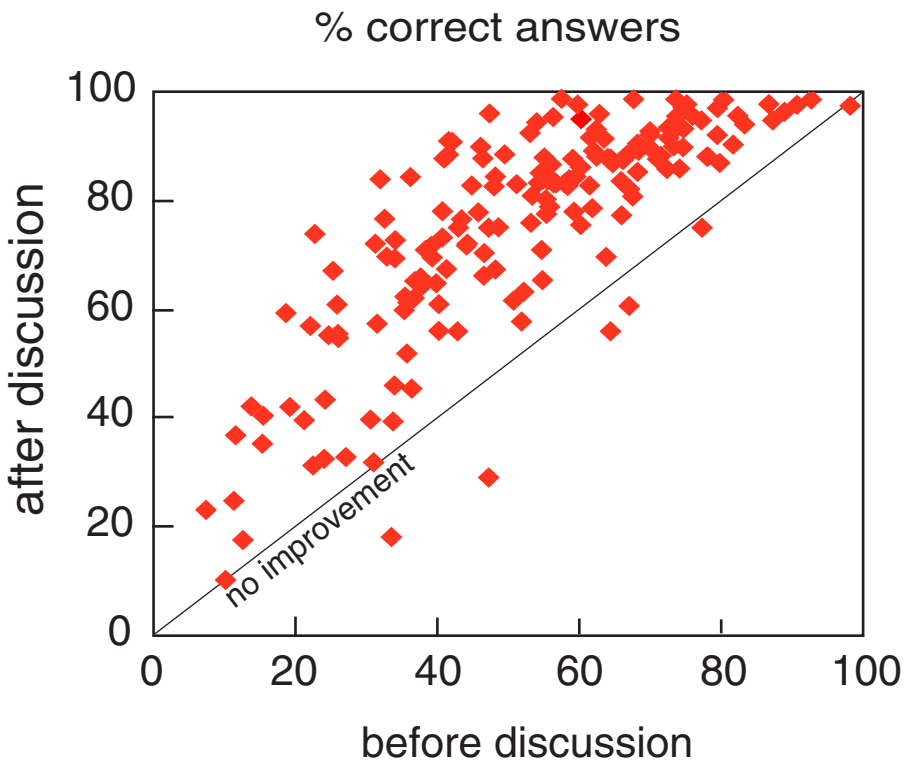

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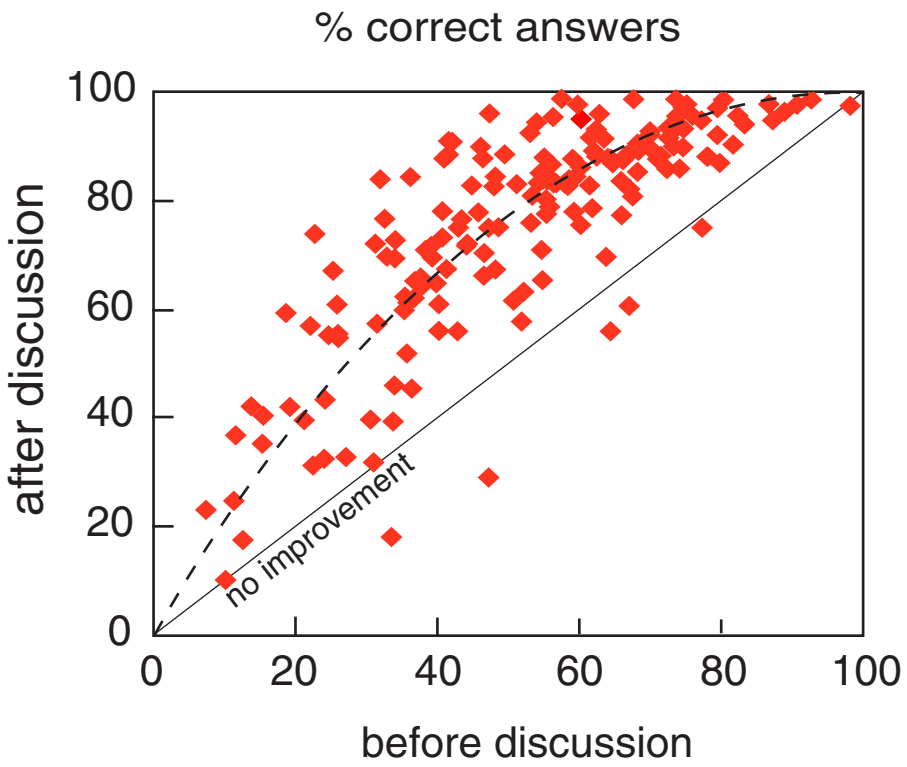

Developing PI/JiTT questions

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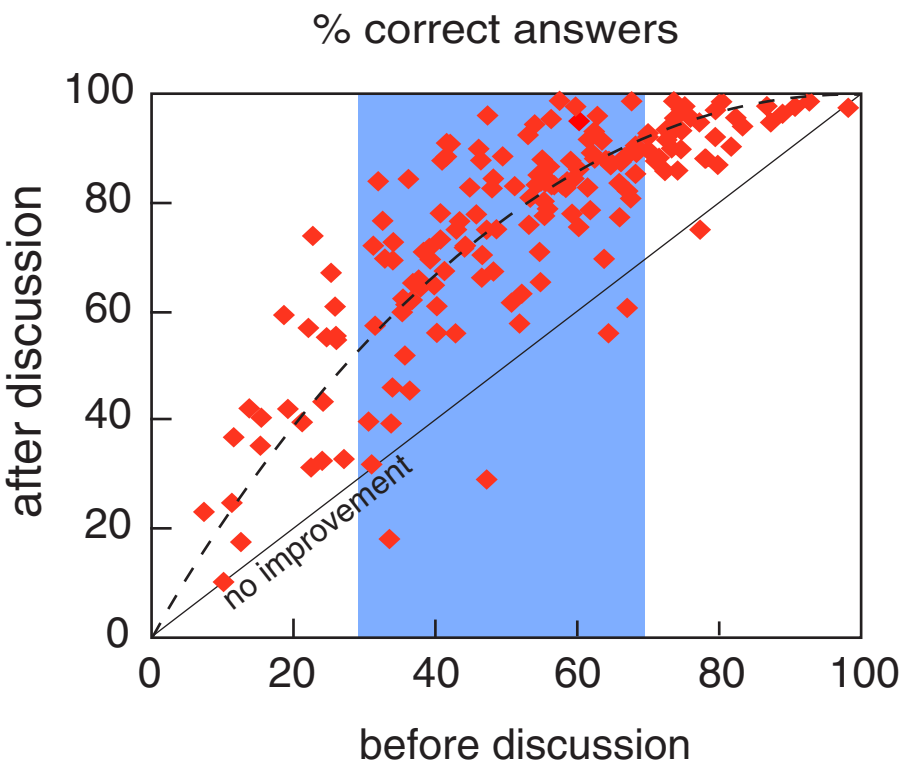
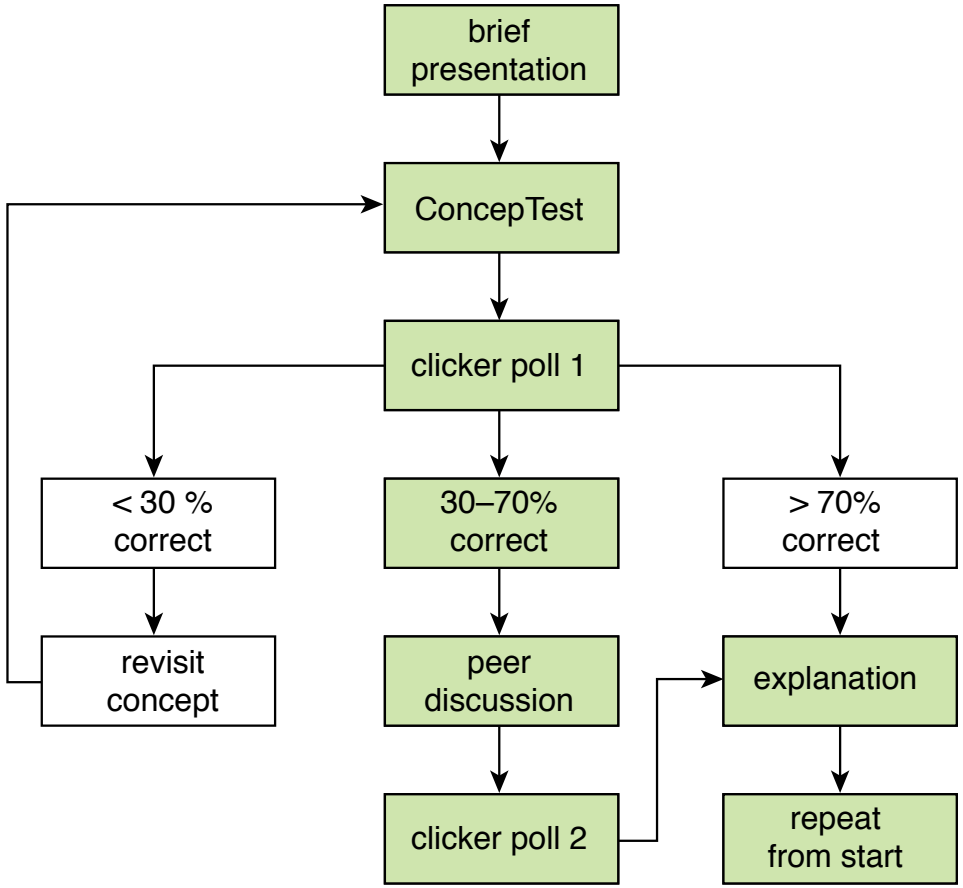


Developing PI/JiTT questions



Developing PI/JiTT questions

"Do you know of any networks of users who share questions?"


Join now!
PeerInstruction.net

Developing PI/JiTT questions

"I would like to see a real class to see what the professor says…"

Outline

- Your questions
- Developing PI/JiTT questions
- Strategies for assessment

Strategies for assessment

"How do we assess whether students have understood or whether they have memorized?"

Strategies for assessment

Some ideas:

- Open book/computer
- Collaborative exam
- Multidimensional

Strategies for assessment

How do you assess students of different abilities and keep them all motivated?

Survey

Lecturing is the best way for me cover the amount of material I need to cover in my course.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

Interactive teaching requires significantly more instructor preparation time than traditional lecture.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

Interactive teaching requires clickers.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

I know how to get my students to do their reading before class.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

It is difficult to see how to apply interactive teaching techniques in the humanities or social sciences.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

Survey

I am worried that interactive teaching will negatively affect my end-of-course evaluations.

1. Strongly Agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

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