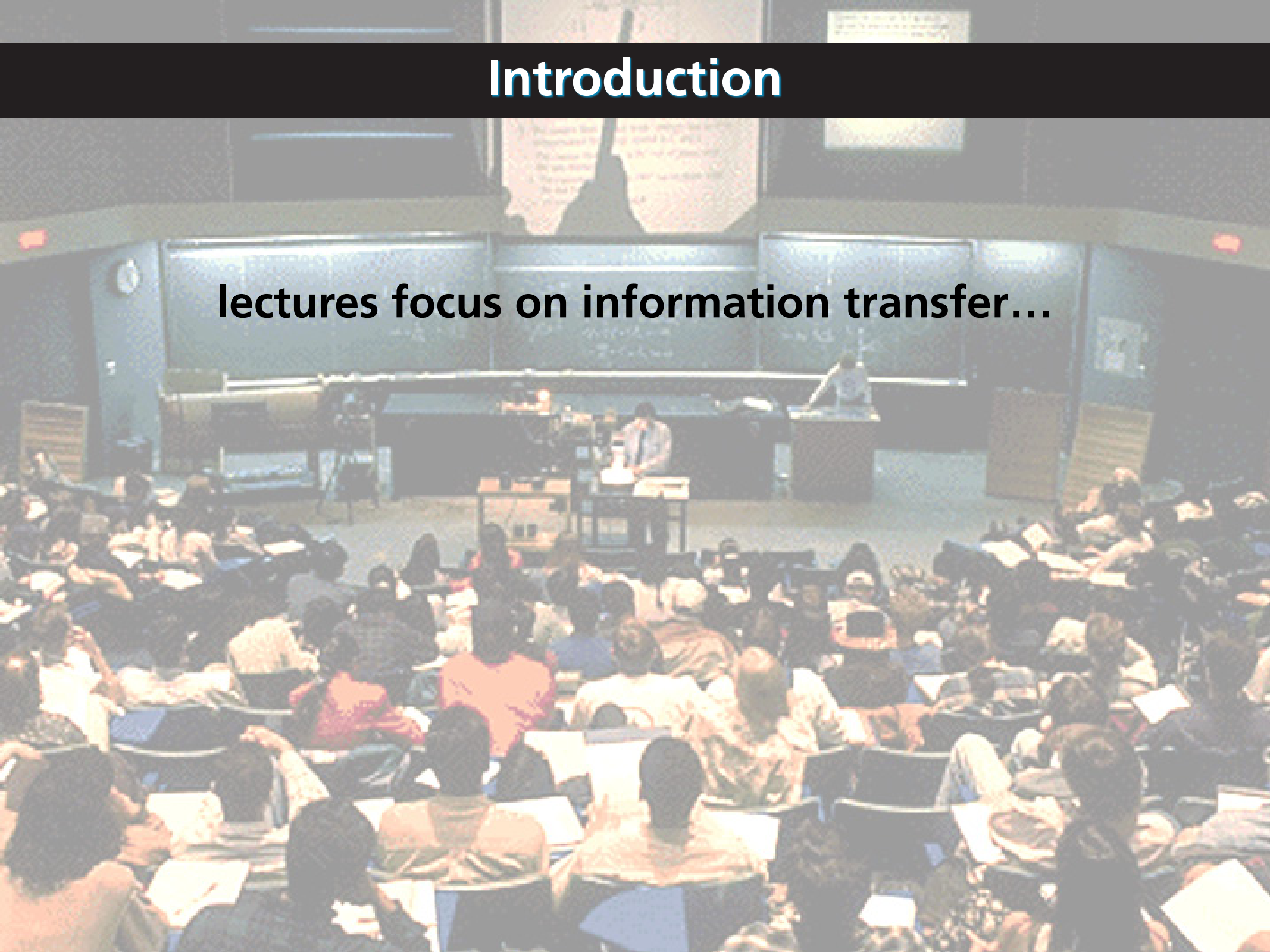
Engaging Students One-on-One, All At Once
Session 1

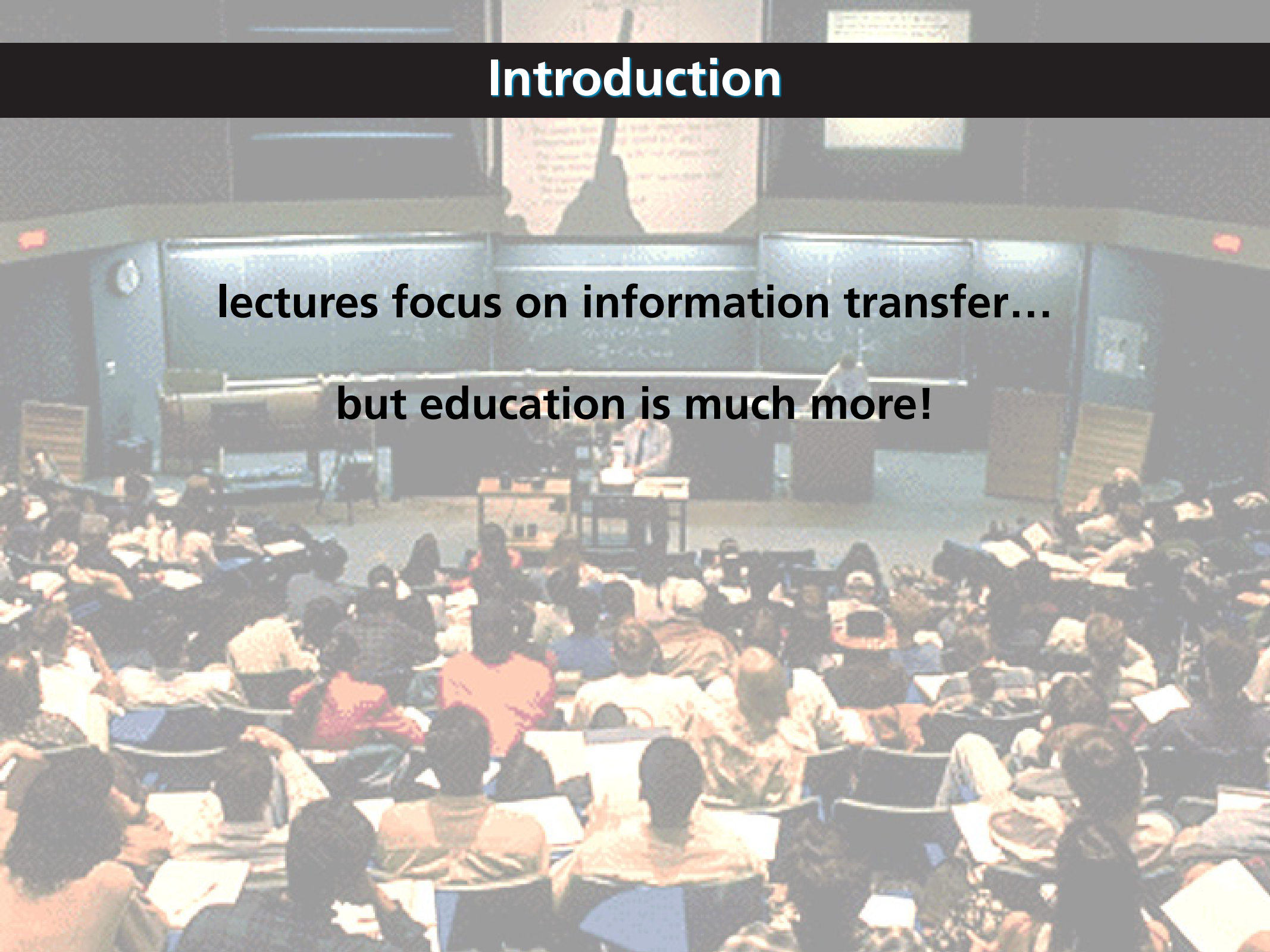
LASPAU/IDIA
Universidad de Los Andes
Online short-course, 5 January 2012

Introduction



lectures focus on information transfer…

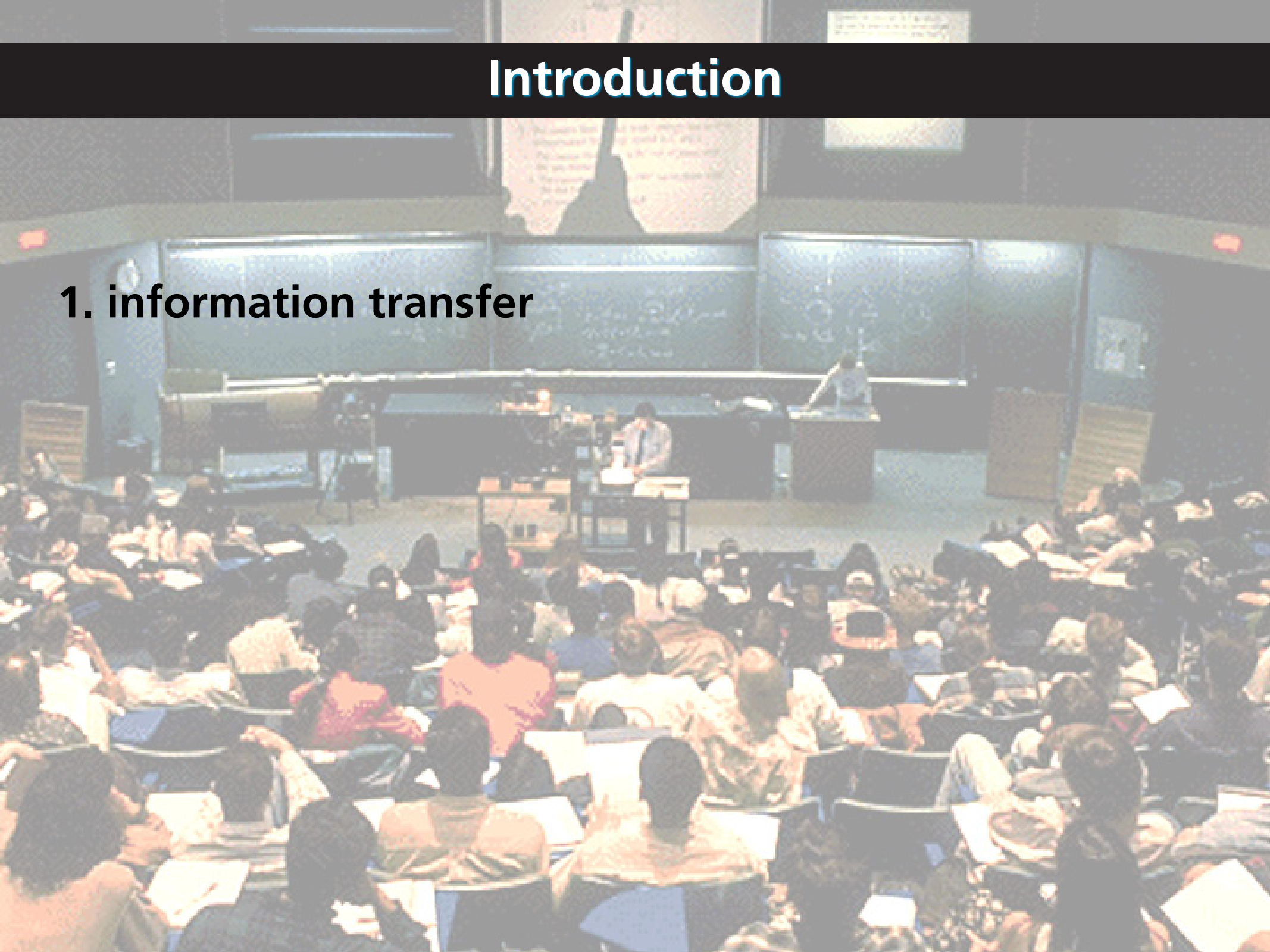
Introduction



lectures focus on information transfer…

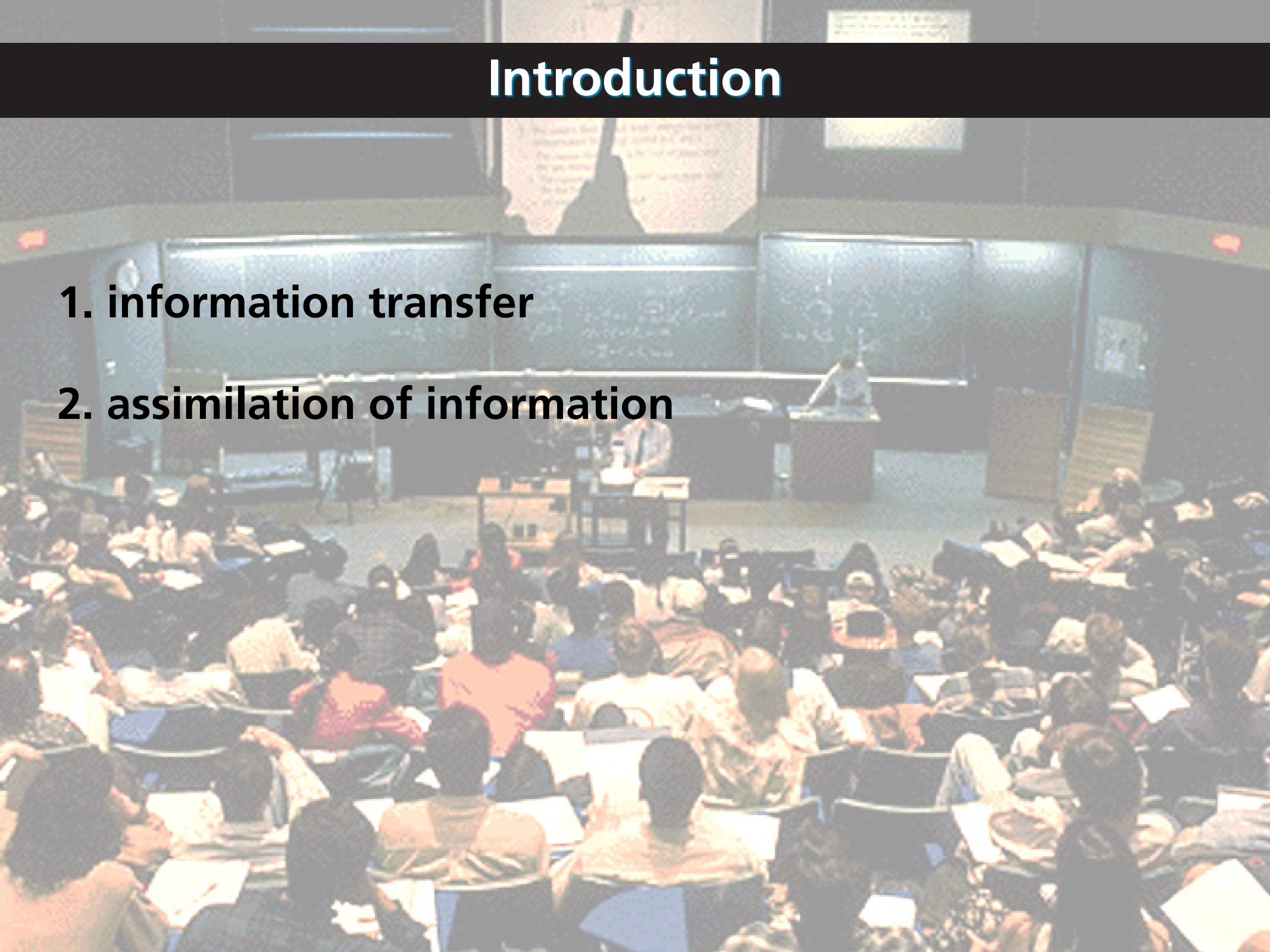
but education is much more!

Introduction



1. information transfer

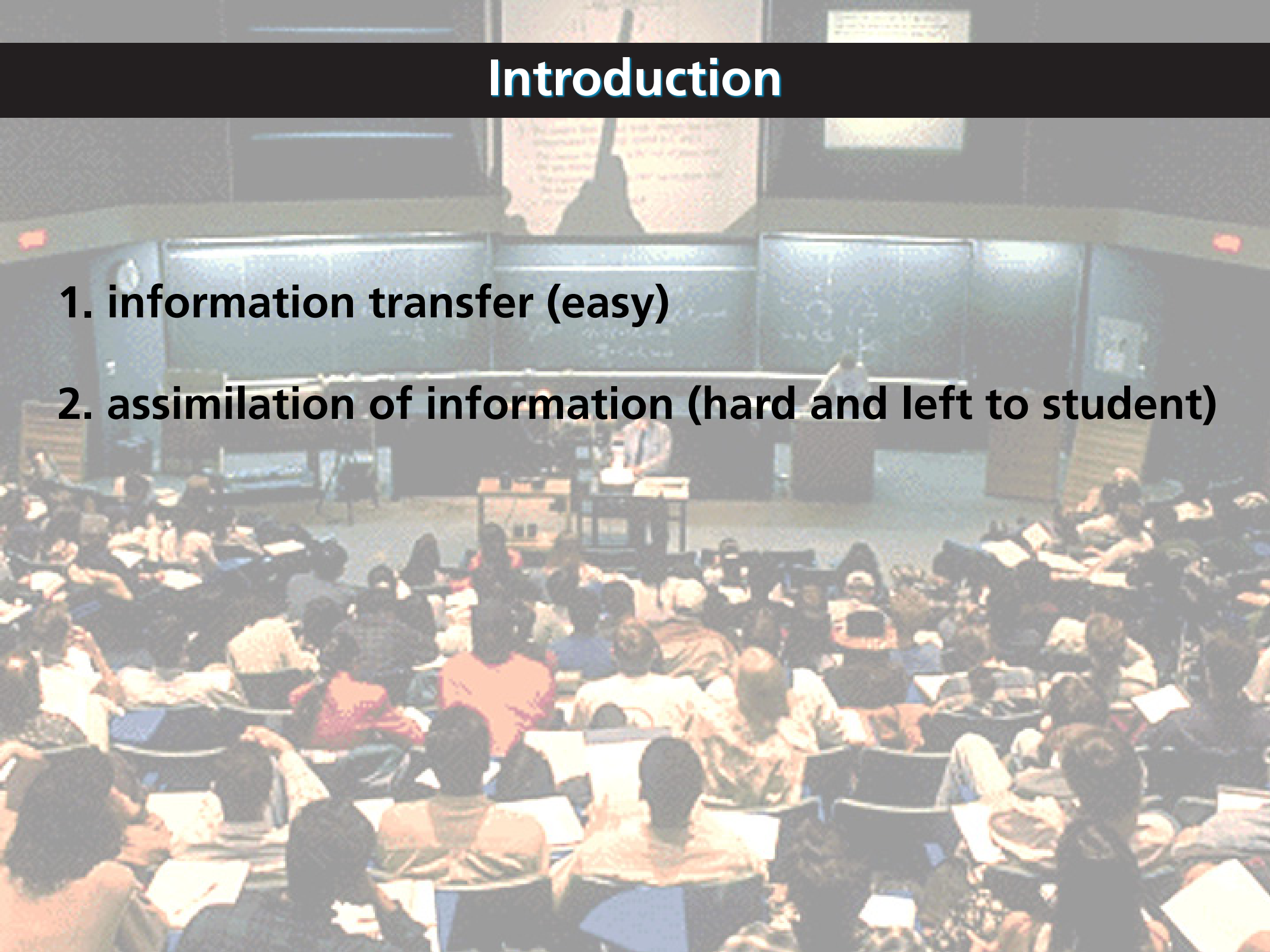
Introduction



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

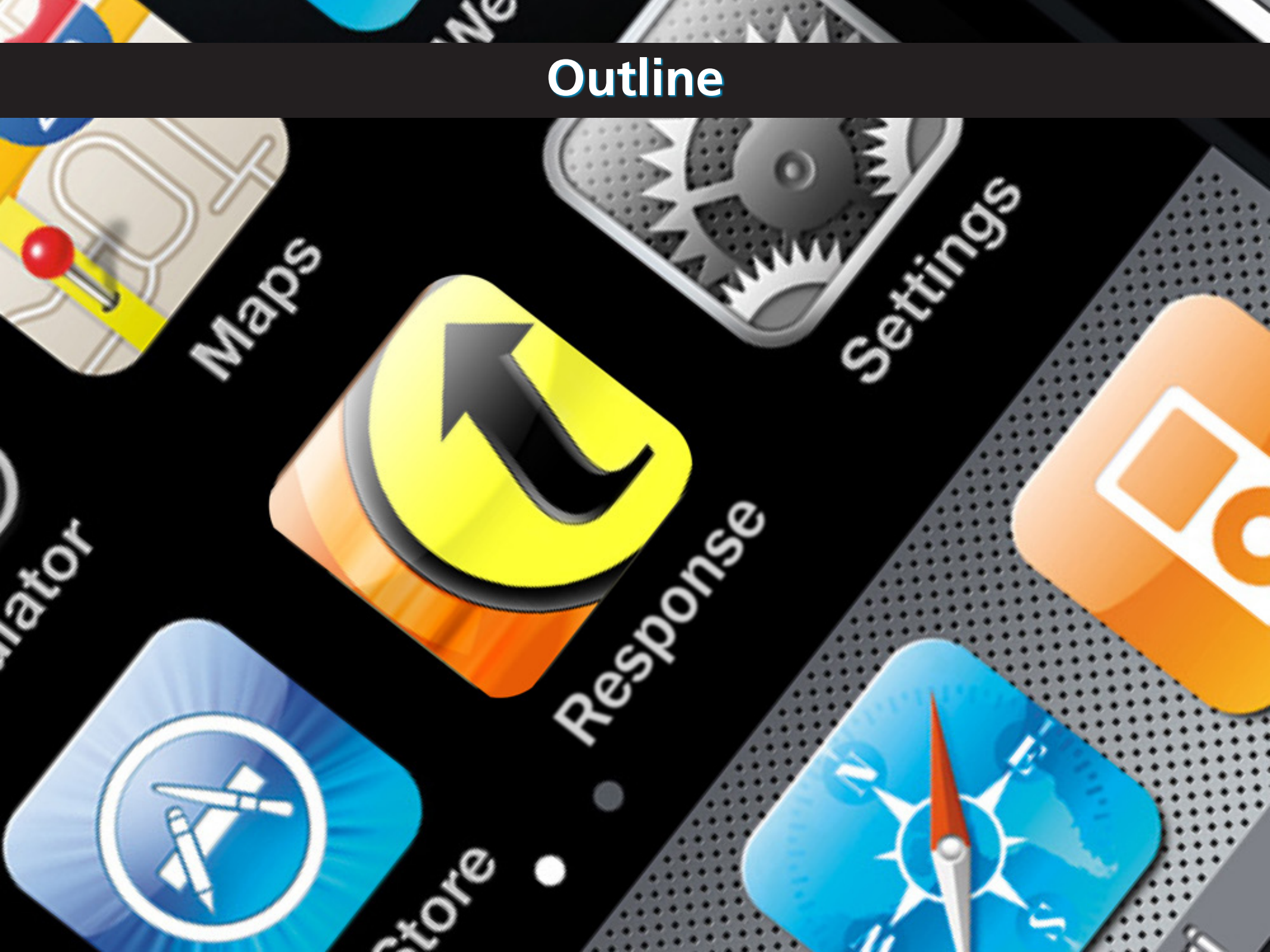
How to move information transfer out of classroom?

Introduction

How to move information transfer out of classroom?

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

Outline



Outline

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

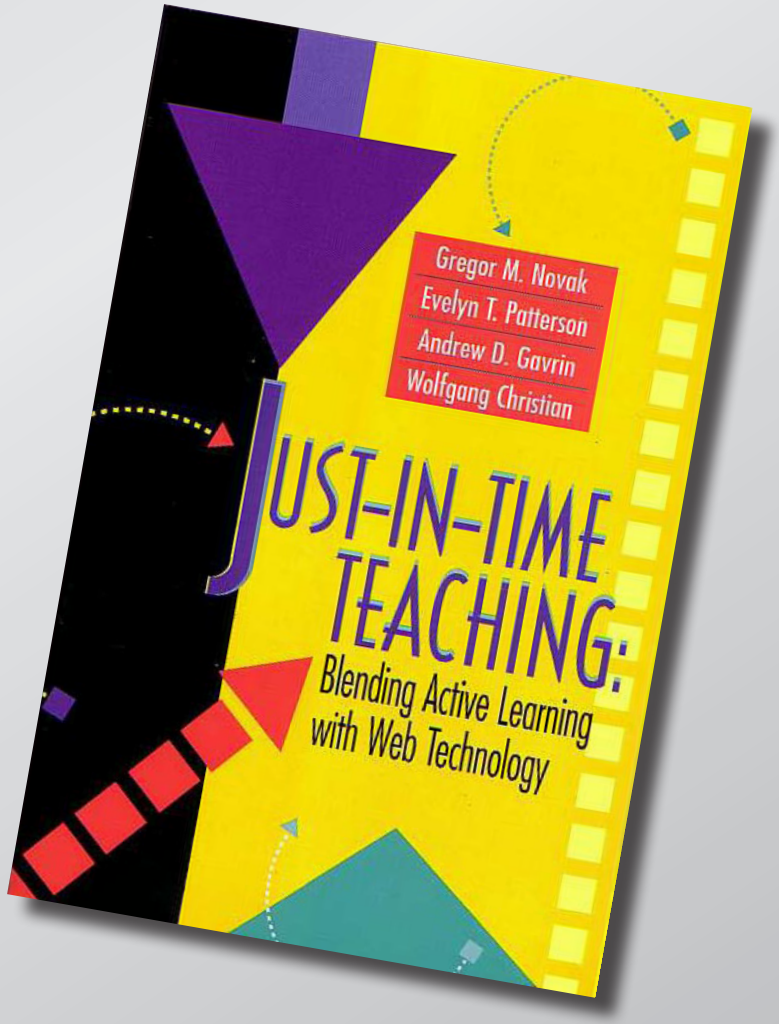
PI & JiTT Overview

"How I can be sure that my students will prepare for class, especially because they are in their first year?"

PI & JiTT Overview

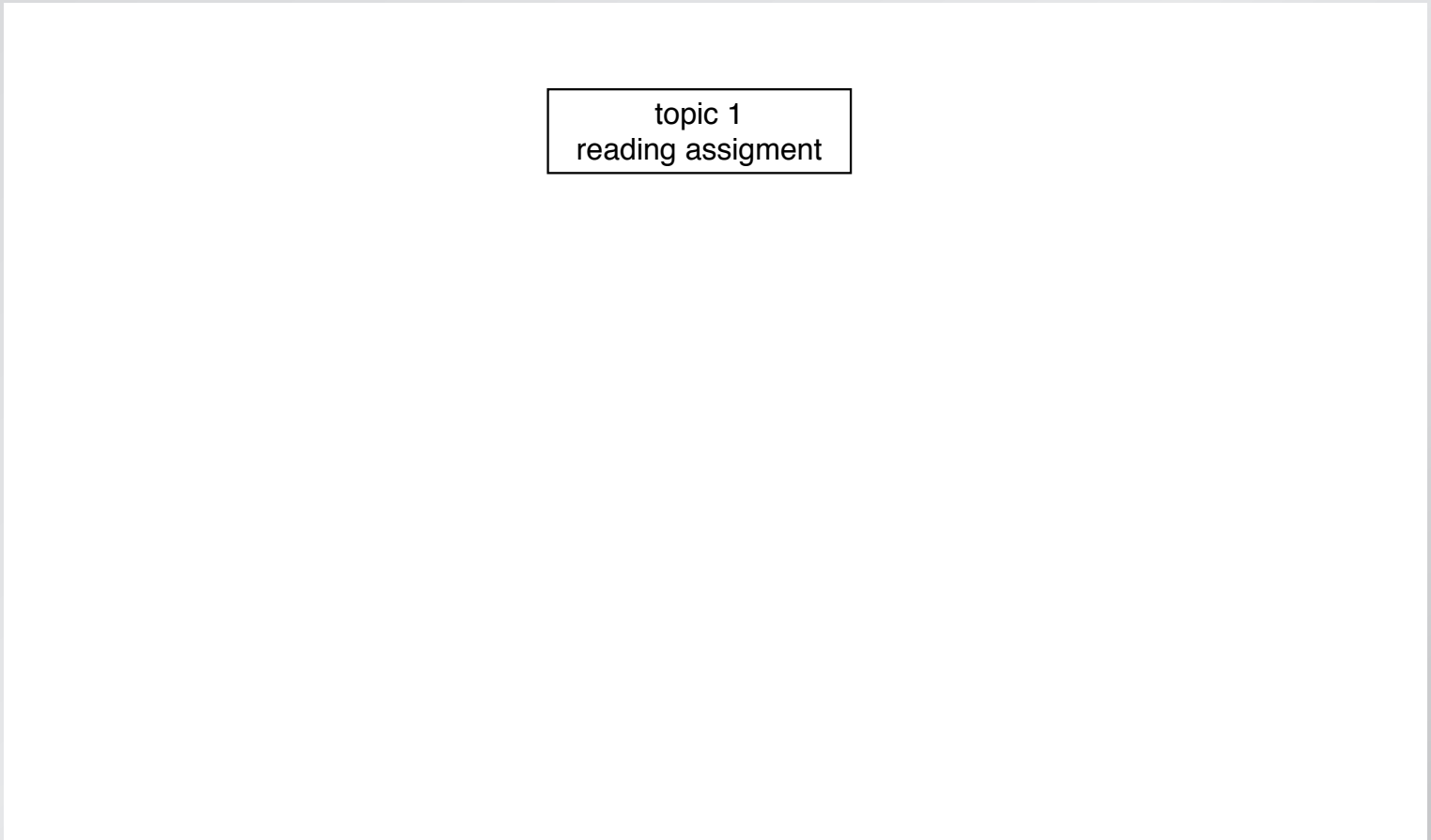
Just-in-time-Teaching (JiTT)

www.jitt.org



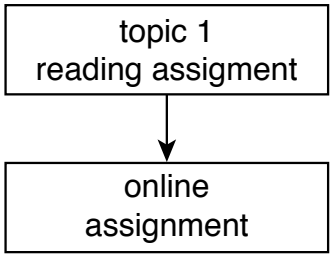
PI & JiTT Overview

JiTT workflow



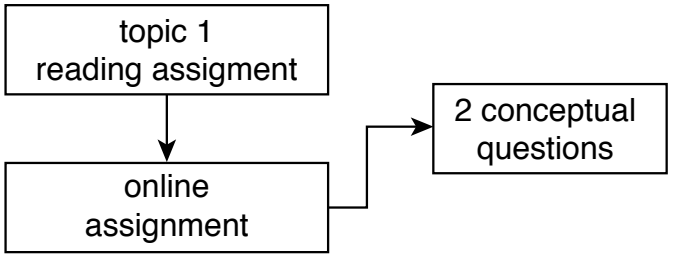
PI & JiTT Overview

JiTT workflow



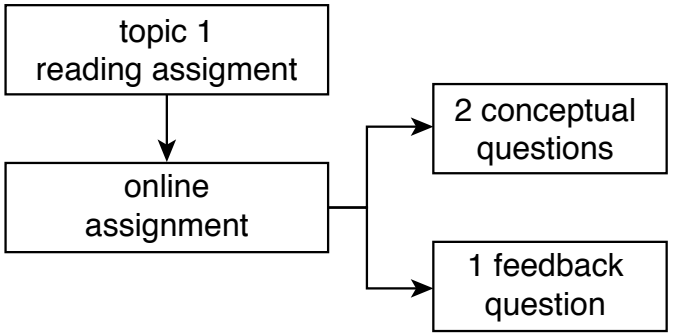
PI & JiTT Overview

JiTT workflow



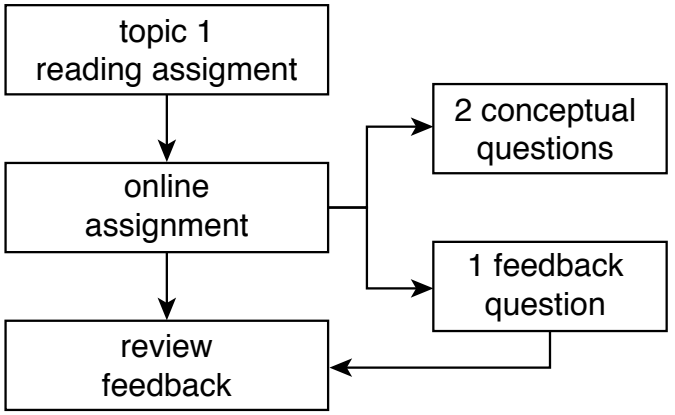
PI & JiTT Overview

JiTT workflow



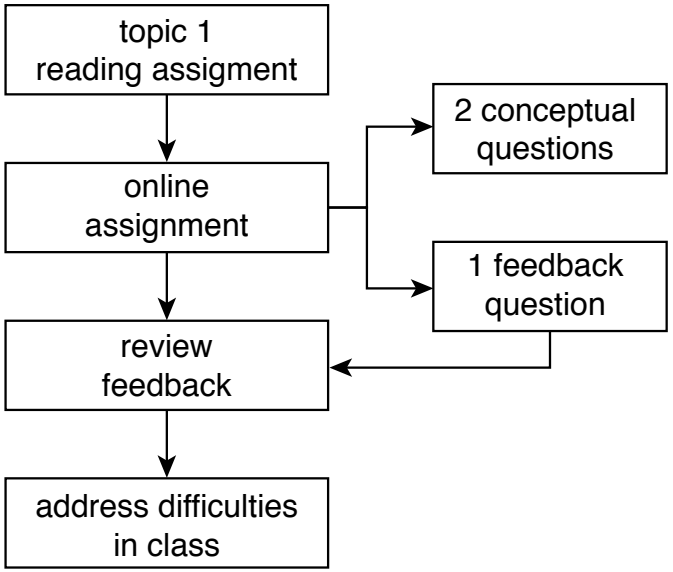
PI & JiTT Overview

JiTT workflow



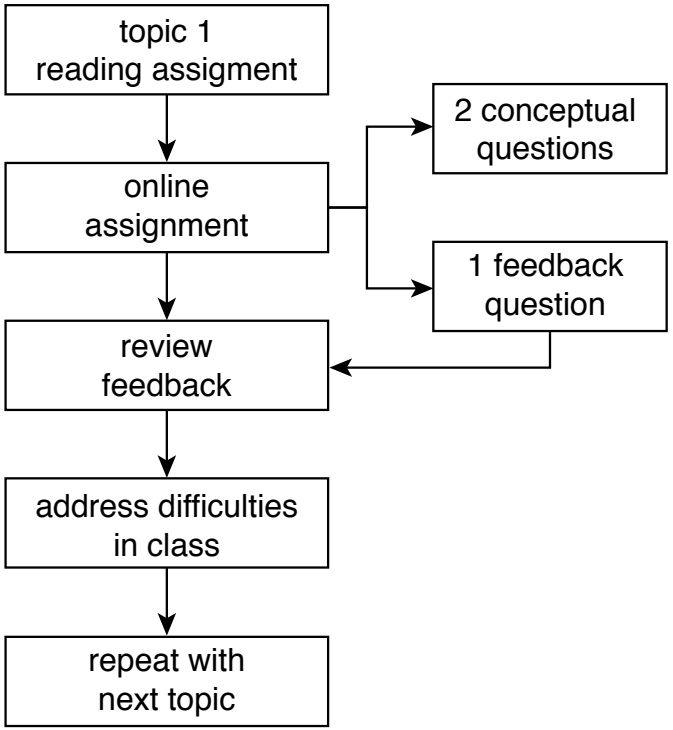
PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

JiTT workflow



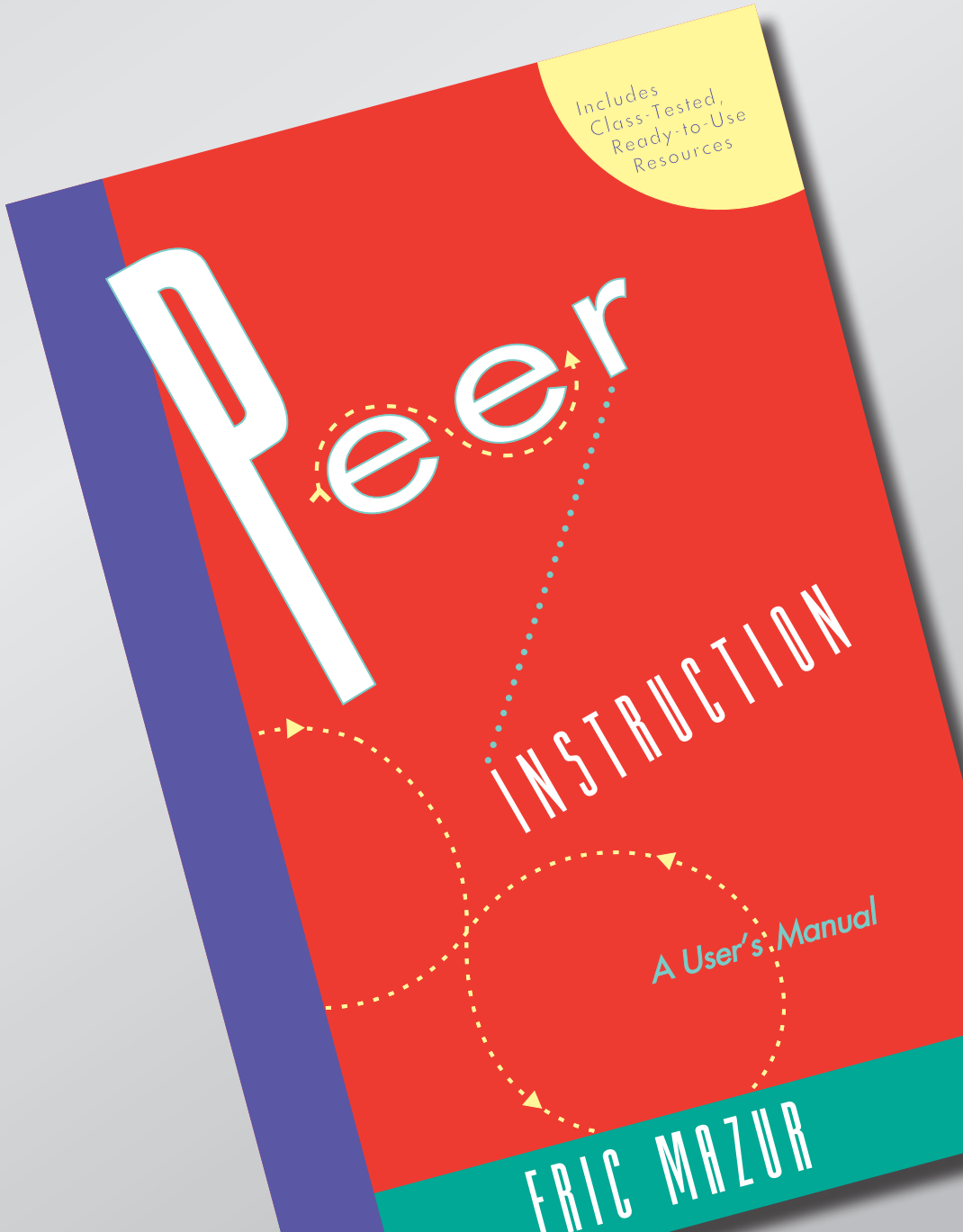
PI & JiTT Overview

JiTT:

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

PI & JiTT Overview

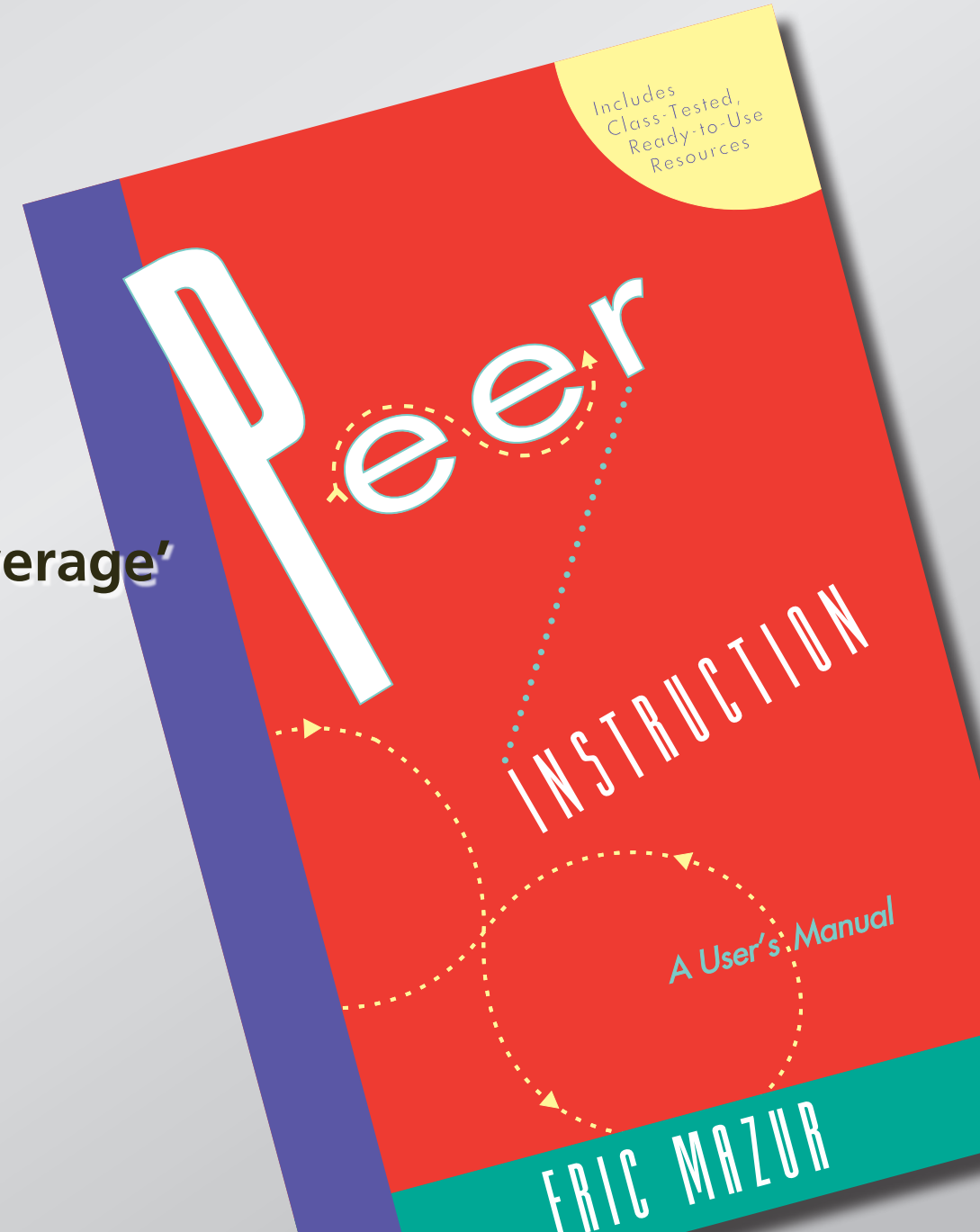
Peer Instruction (PI)



PI & JiTT Overview

Main features:

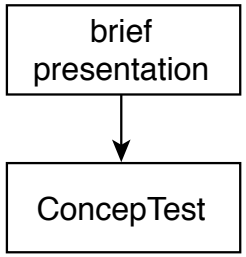
- **pre-class reading**
- **in-class: depth, not 'coverage'**
- **ConcepTests**



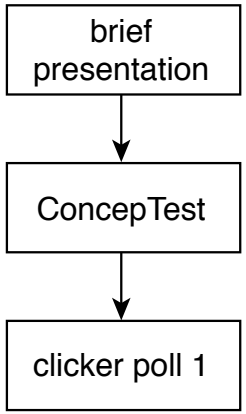
PI & JiTT Overview

brief
presentation

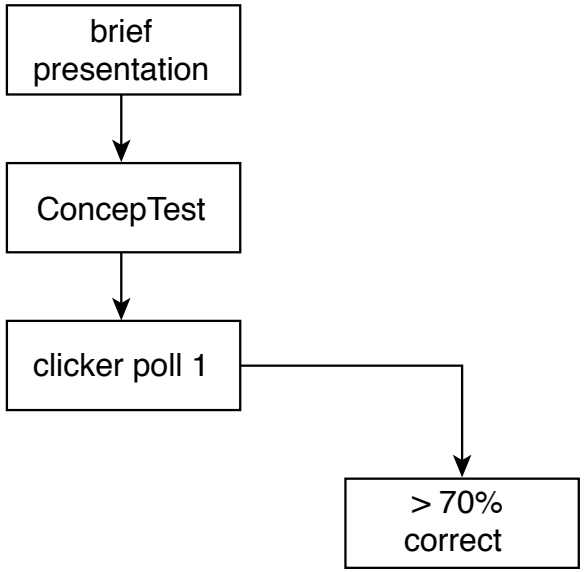
PI & JiTT Overview



PI & JiTT Overview



PI & JiTT Overview



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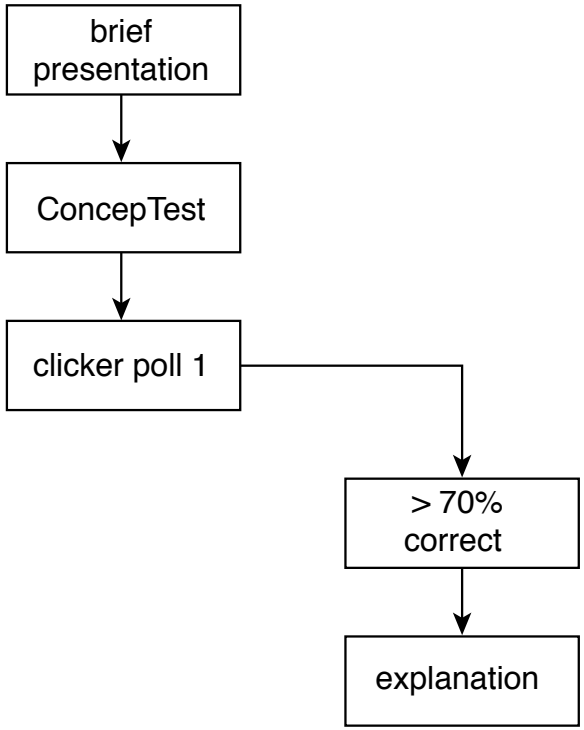

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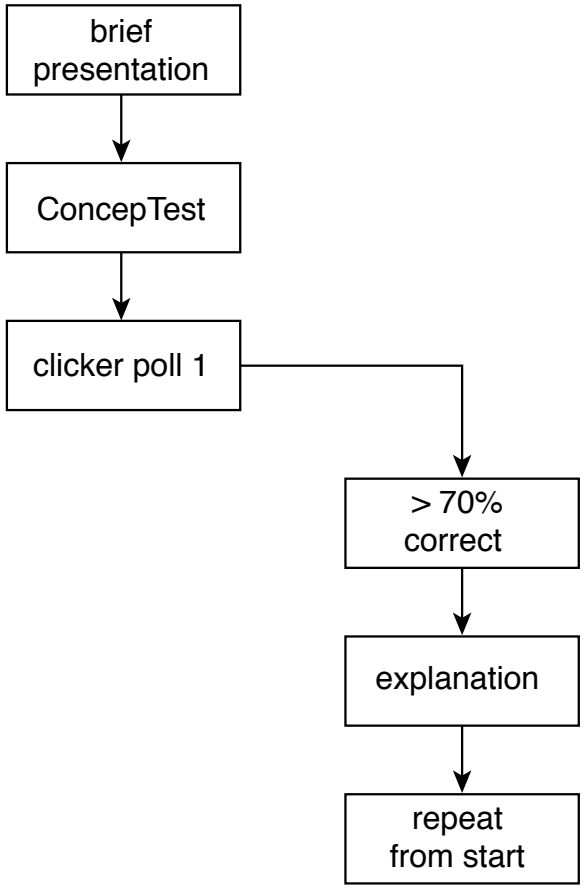

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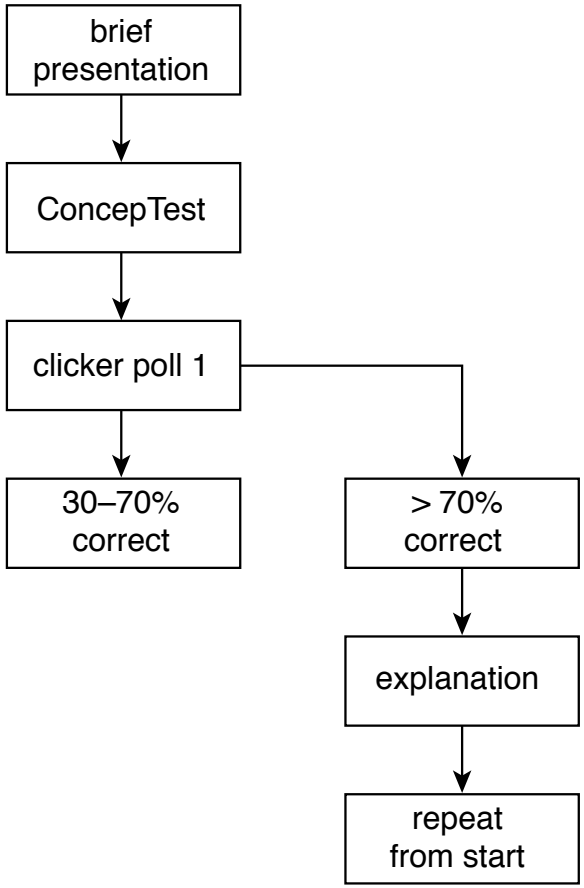

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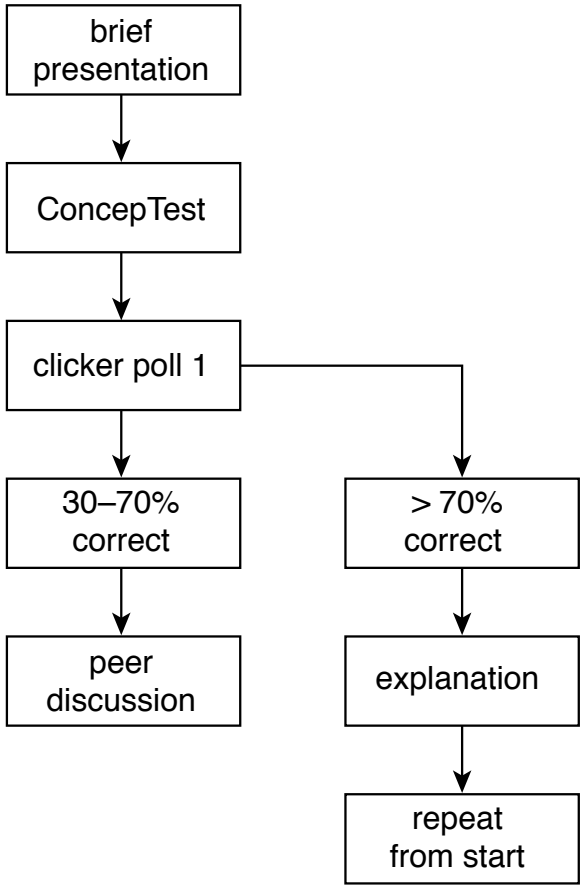

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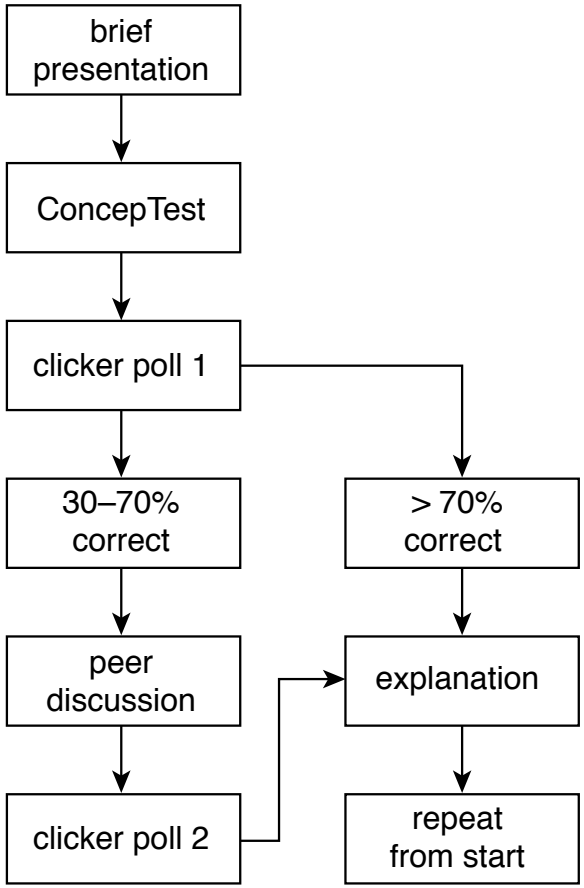

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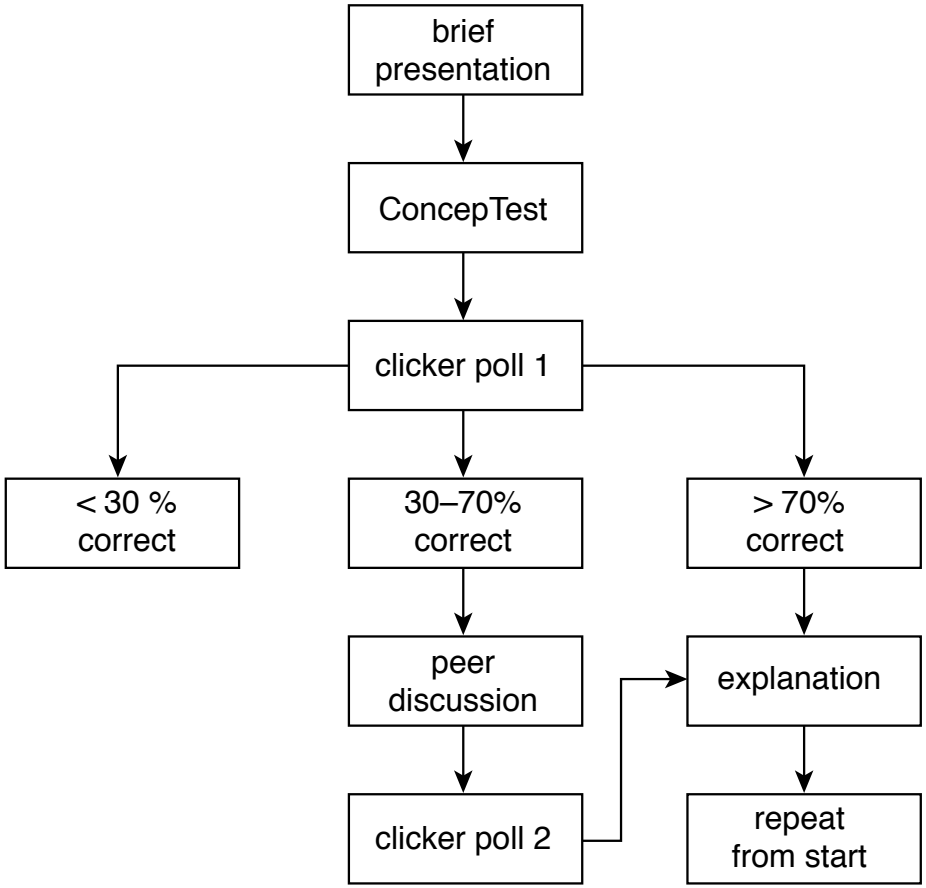
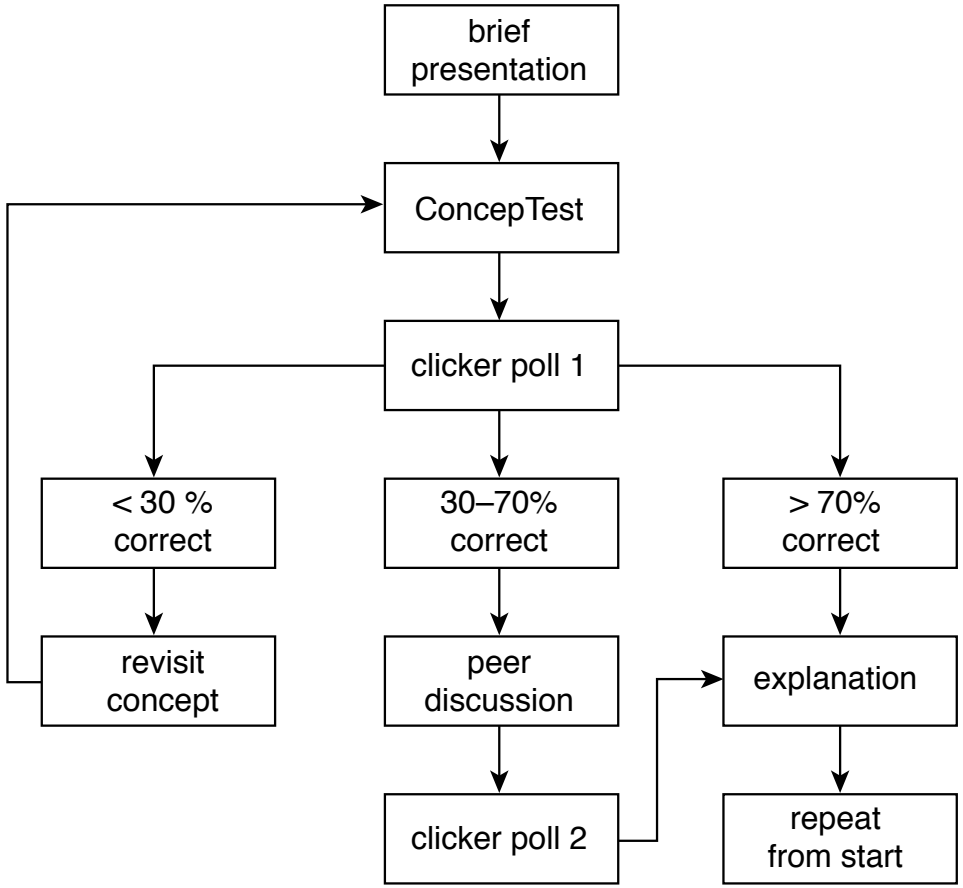


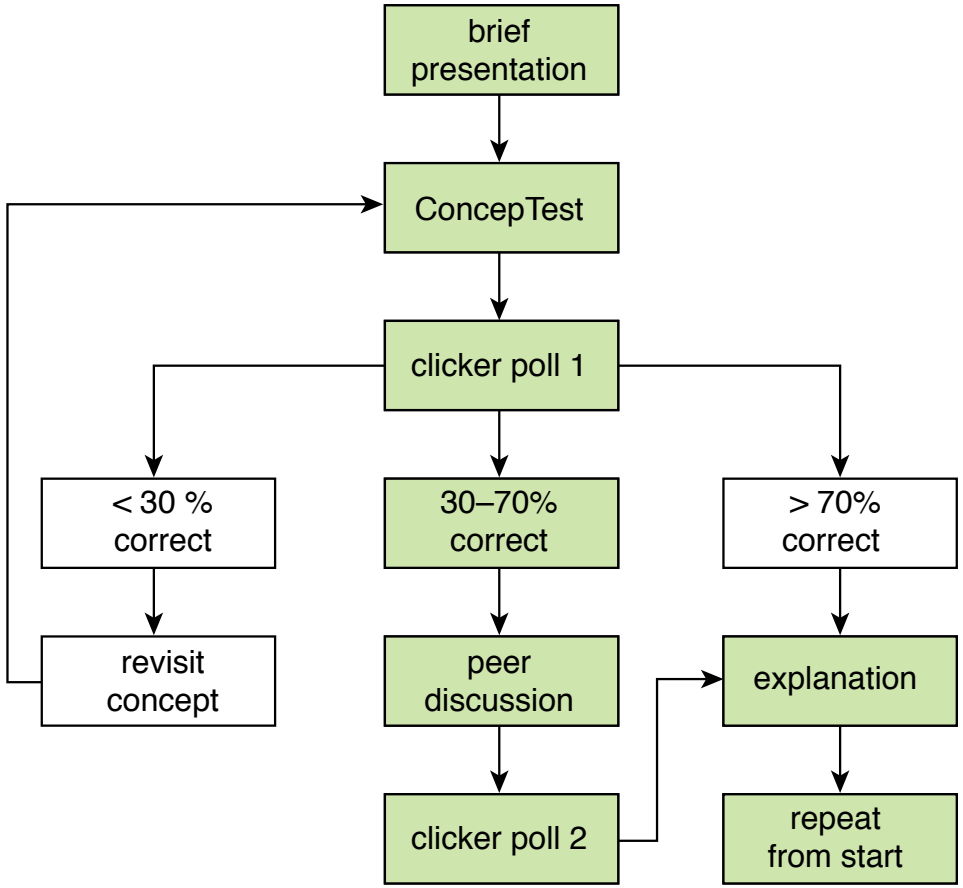
PI & JiTT Overview



PI & JiTT Overview

"How do I decide to omit/ignore the Peer Instruction and continue with the next questions?"

PI & JiTT Overview



PI & JiTT Overview

PI:

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

PI & JiTT Overview

"It is very common that students that most of time give correct answers sit together. How can I mix them with other students to favor the peer effect without losing much time?"

PI & JiTT Overview

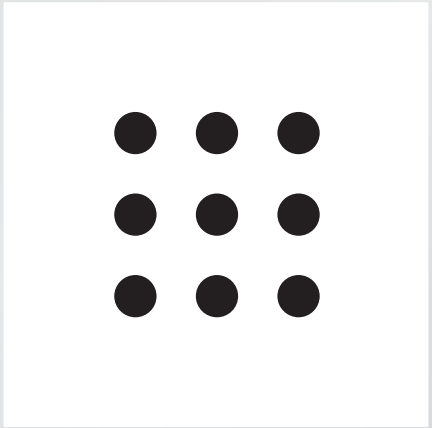
find someone with a *different* answer

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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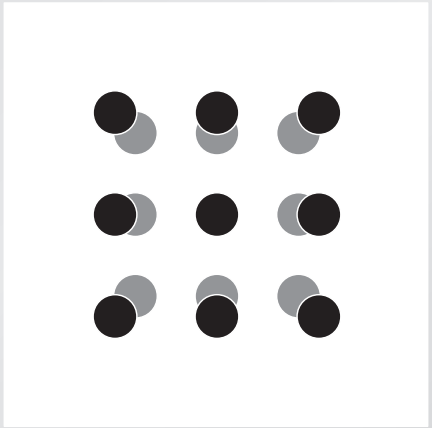
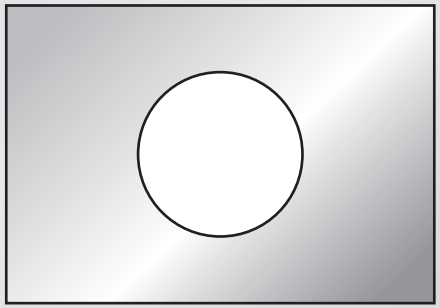


Let's try it!

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



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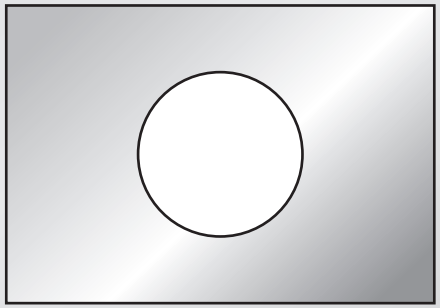


When the plate is uniformly heated, the diameter of the hole

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

Let’s try it!

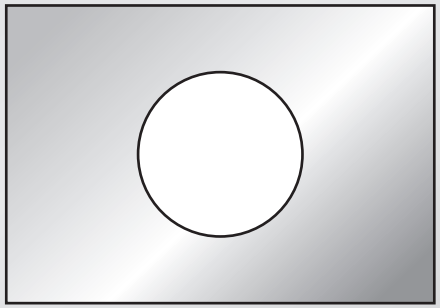
It’s easy to fire up the audience!

Let's try it!

"I would like to know how to deal with the chaos that is likely to emerge in class when they are allow to discuss the questions among them. I'm afraid that it could be very difficult to get them to pay attention again."

Let's try it!

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



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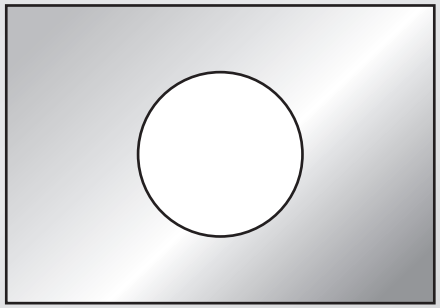

When the plate is uniformly heated, the diameter of the hole

1. increases. ✔
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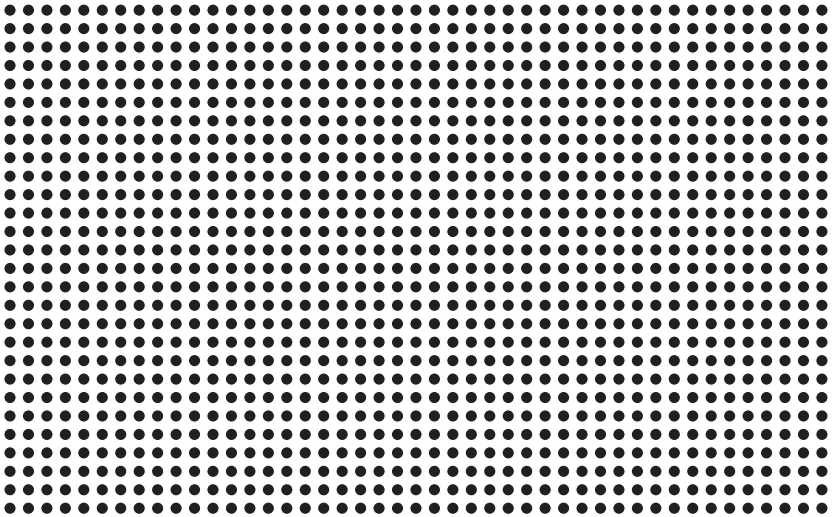
3. decreases.

Let's try it!

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



Let's try it!

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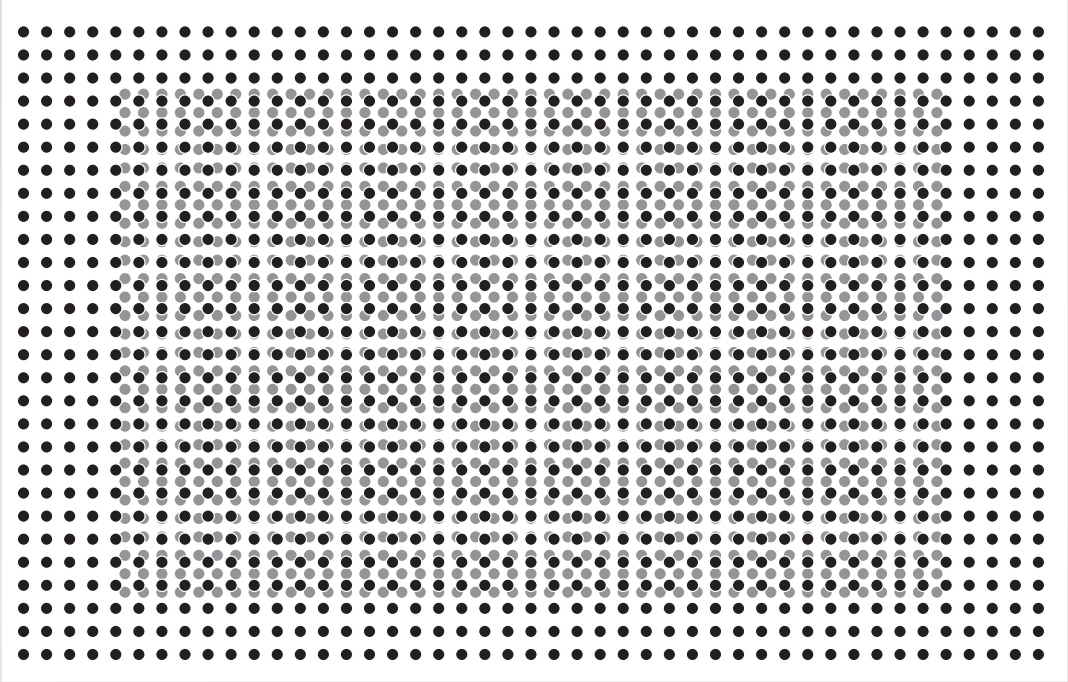
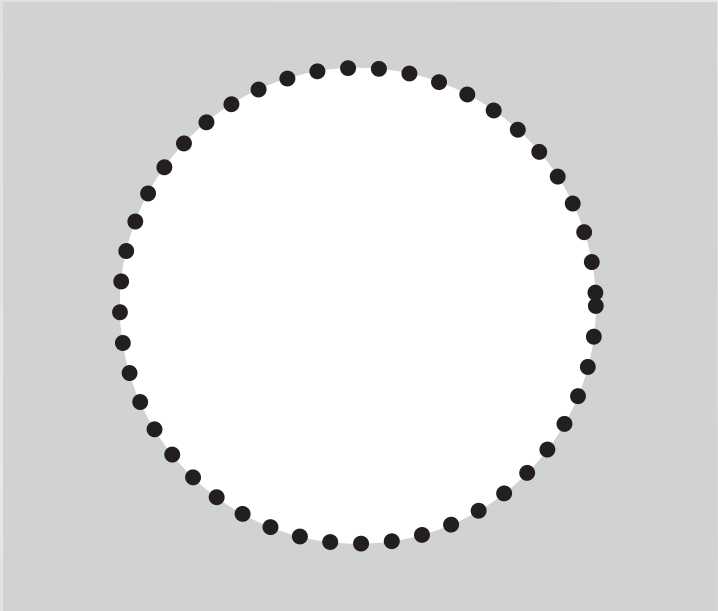


Let's try it!

consider the atoms at the rim of the hole



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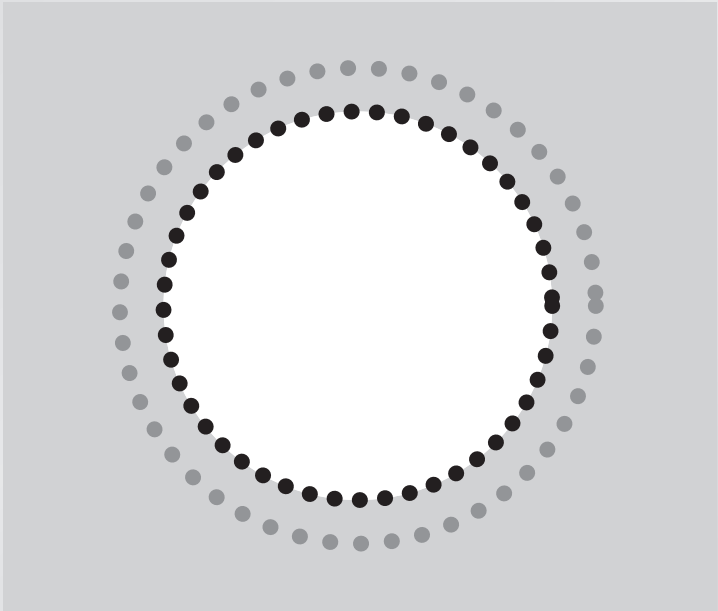

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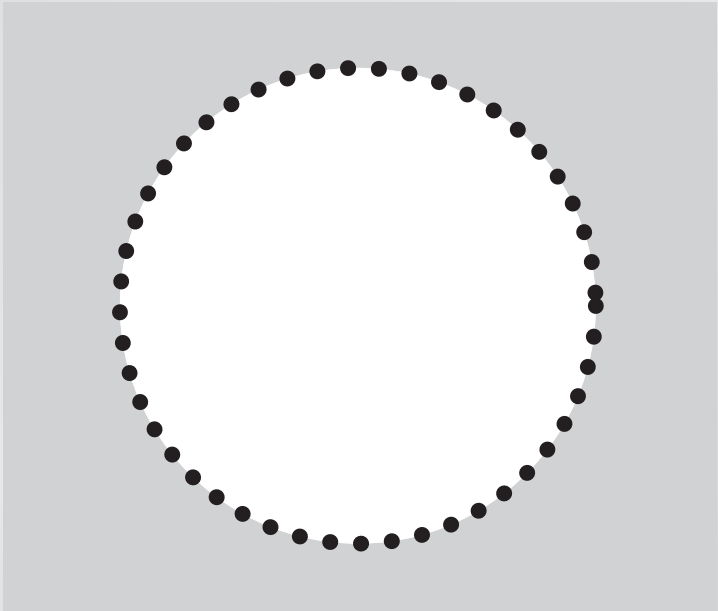

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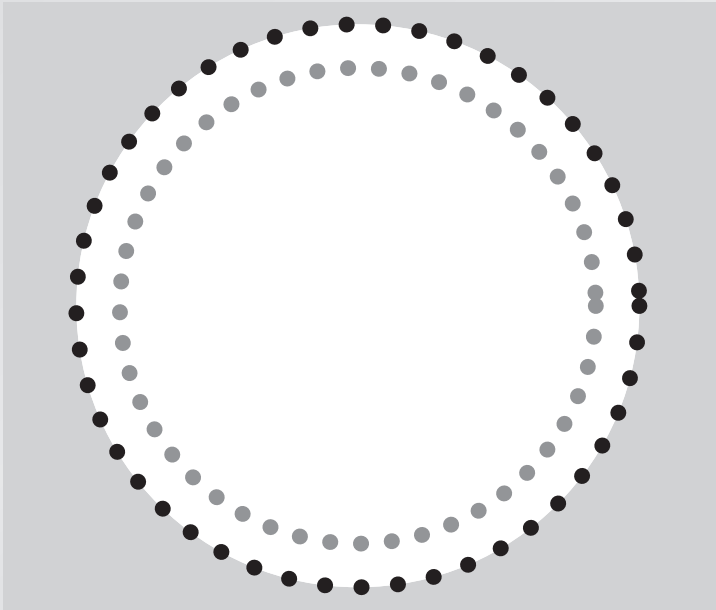


PI & JiTT Overview

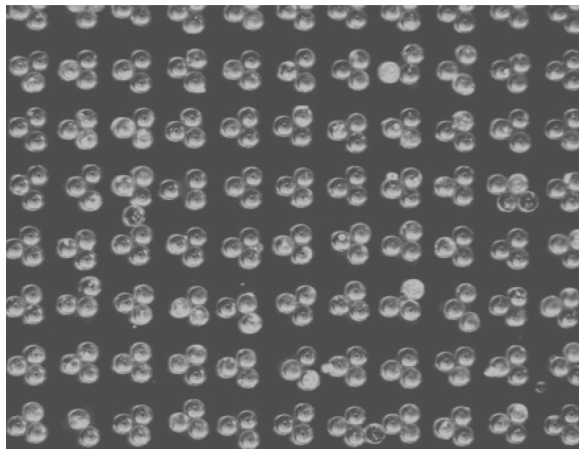
"When designing a ConcepTest

does there need to be ONE correct answer?

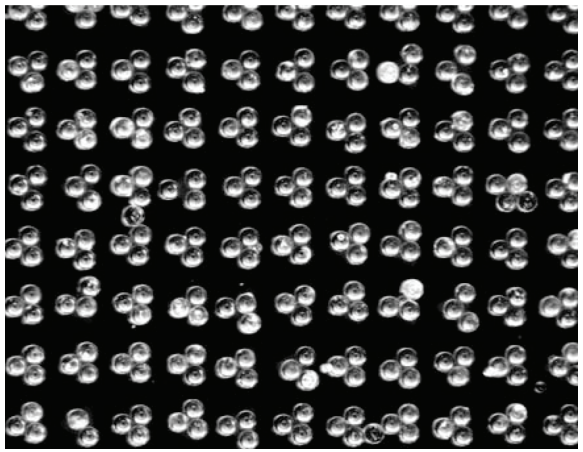
(or can you use ConcepTests in a psychology or history class?)"

PI & JiTT Overview

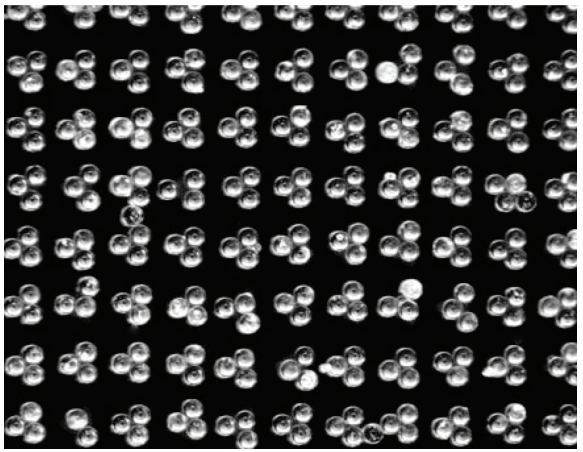
original



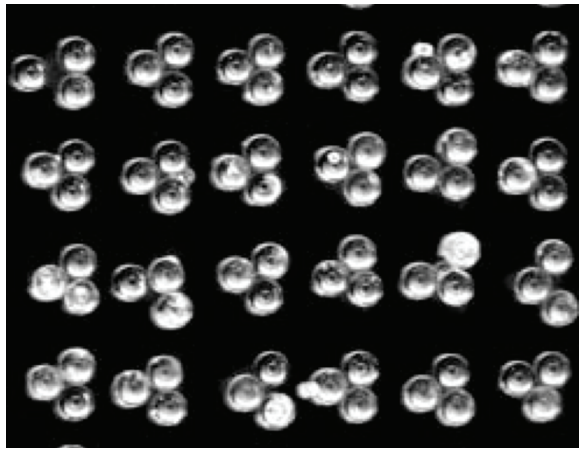
1. adjust contrast



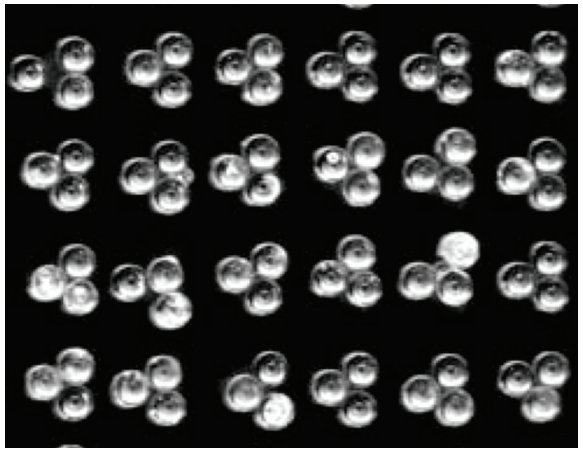
2. remove blemishes



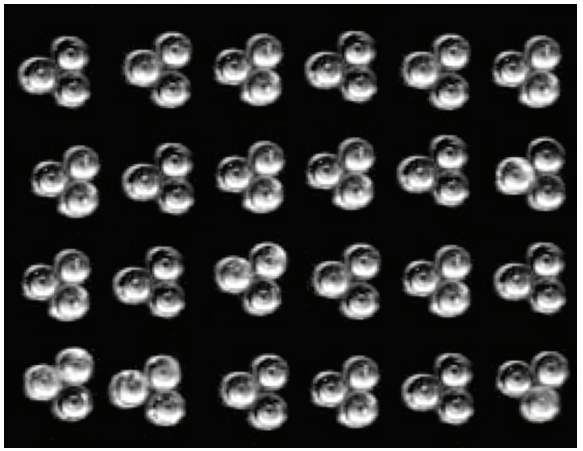
3. crop



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!

PI & JiTT Overview

Benefits:

- helps develop conceptual models
- solidifies understanding
- provides feedback
- empowers students

Outline

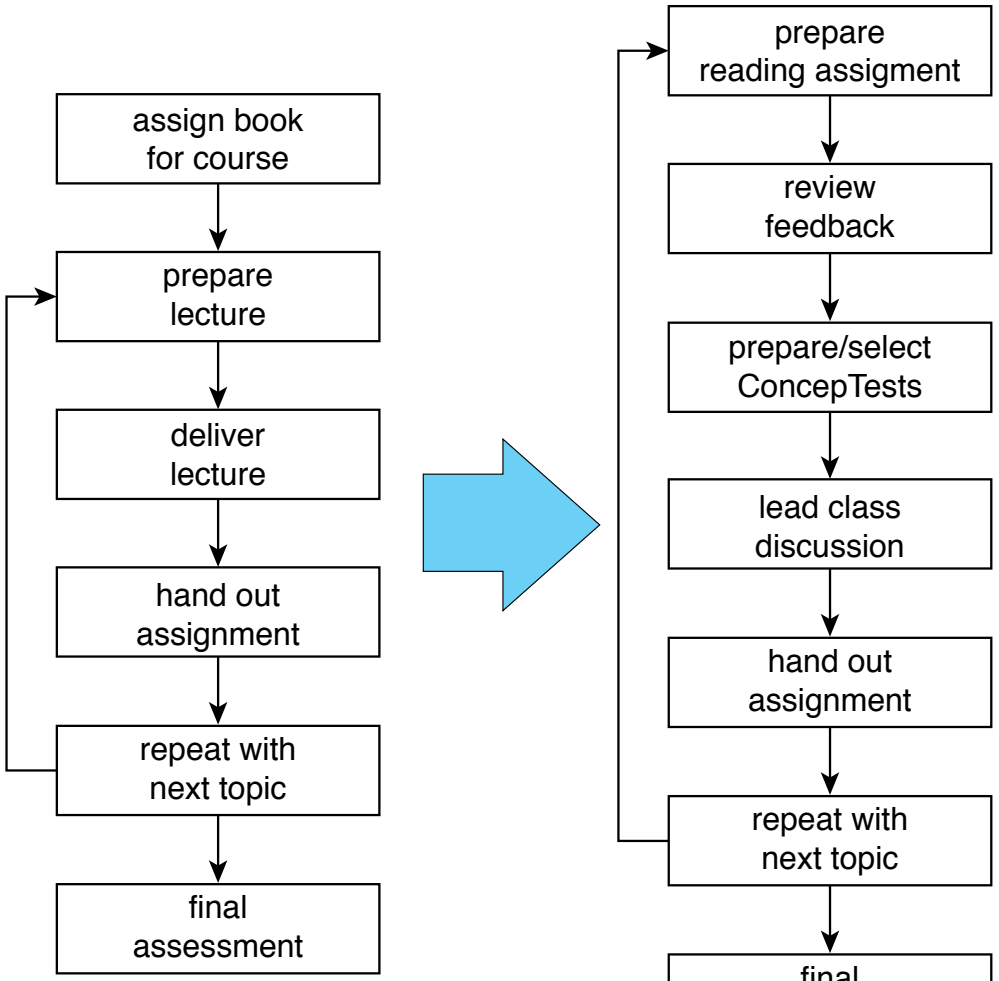
- PI & JiTT Overview
- **Implementing PI & JiTT**
- ConcepTests

Implementing PI & JiTT

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

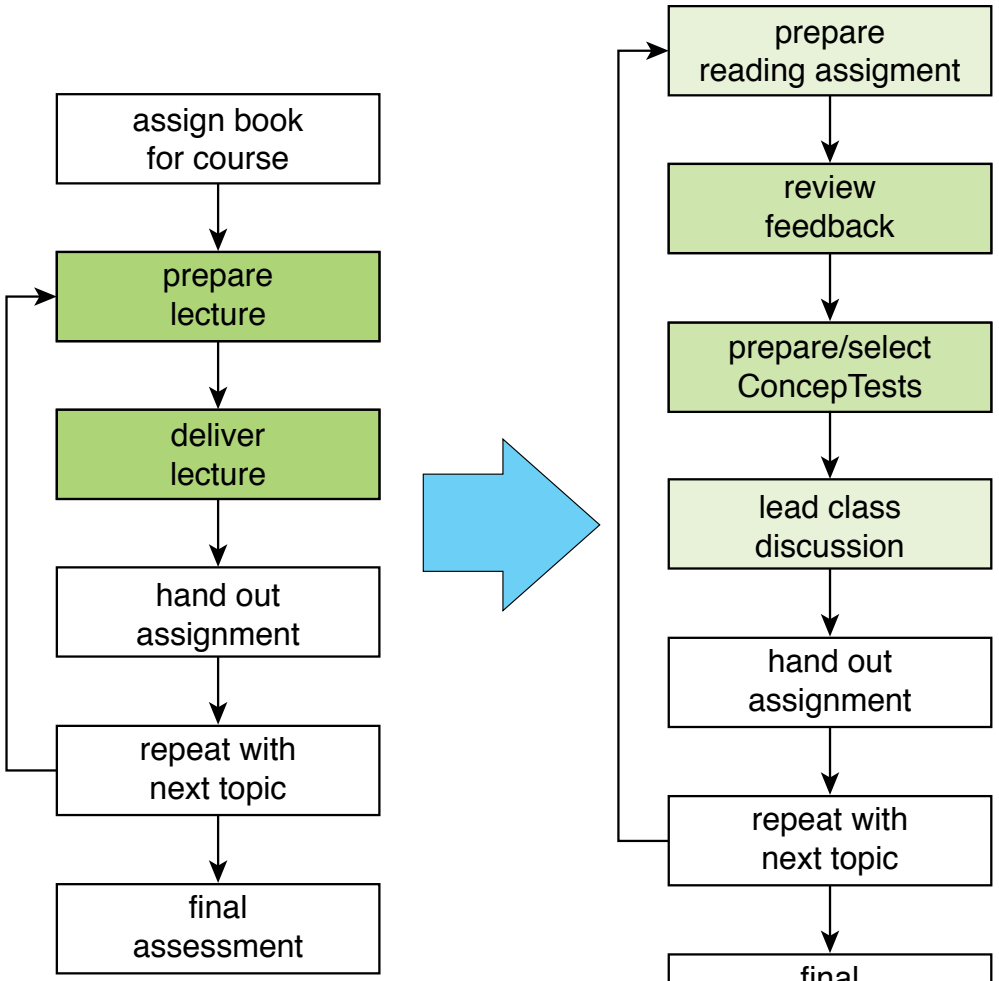
Implementing PI & JiTT

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

"Is it necessary for the reading questions to be due the day before? What happens if my class starts at 8.30 in the morning, should I be receiving responses until 12.00 am the night before?"

Implementing PI & JiTT

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

Implementing PI & JiTT

"I don't understand how can I save the clicker answers given from my students at the end of a ConcepTest and how can then I use those answers"

Implementing PI & JiTT

www.ltichile.cl

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.

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

Requires:

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.

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

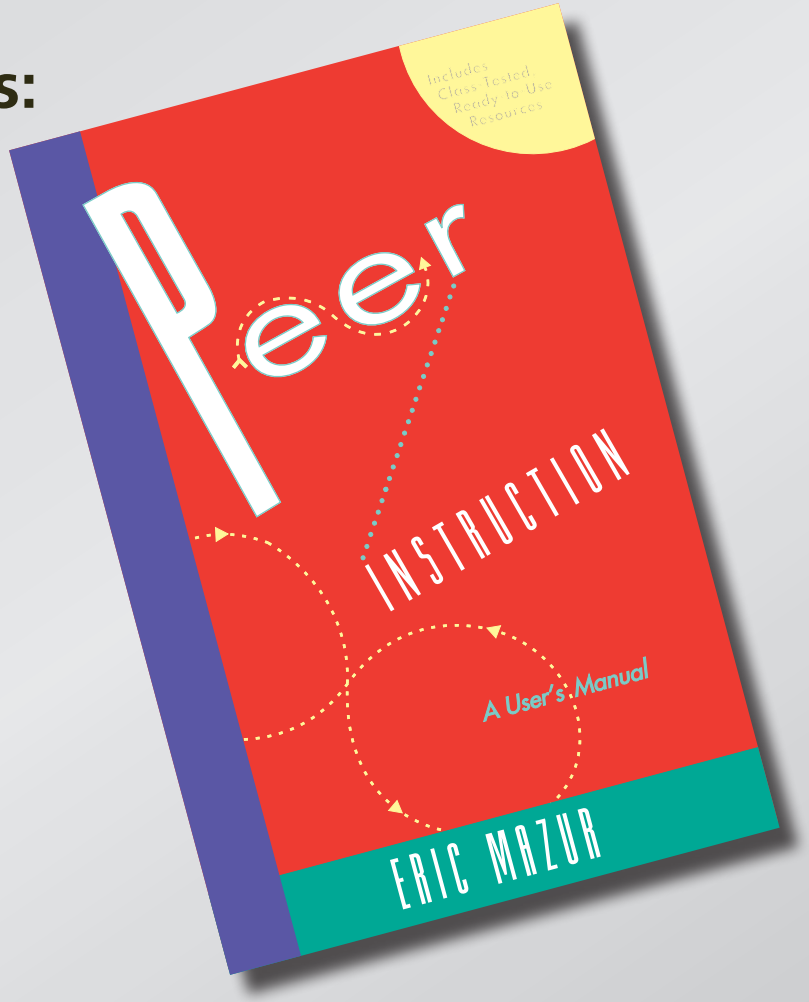
ConcepTests

"How do I get examples of good questions?"

ConcepTests

Books with ConcepTests:

- **Physics (Prentice Hall)**



ConcepTests

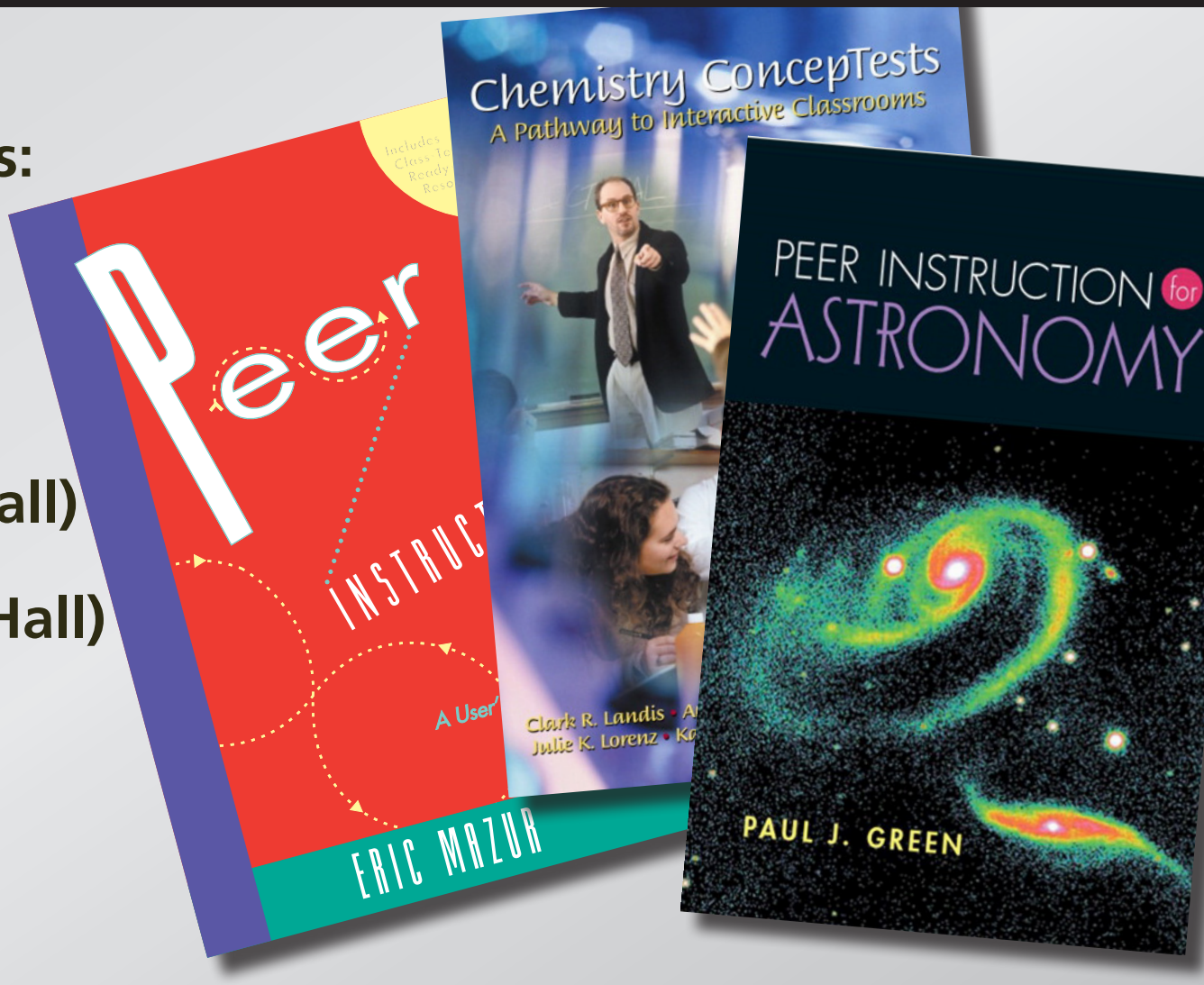
Books with ConcepTests:

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

ConcepTests

Books with ConcepTests:

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



ConcepTests

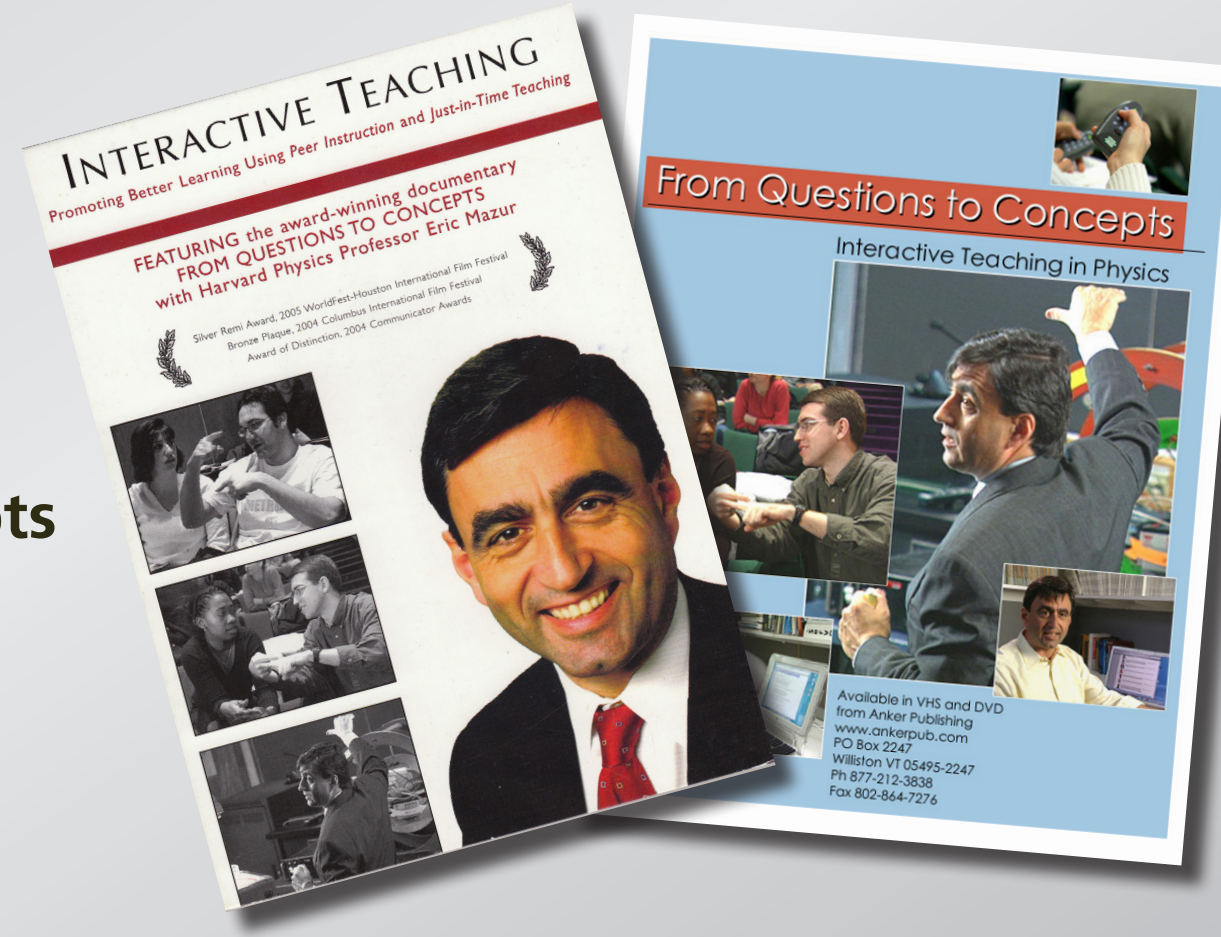
Books with ConcepTests:

- 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

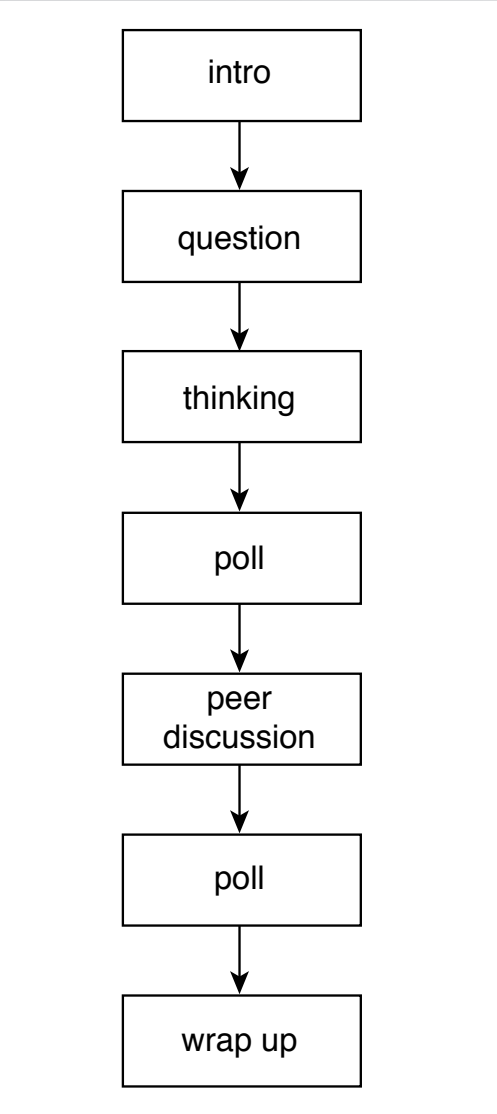
<your discipline> “Concept Test”

<your discipline> “Peer Instruction”

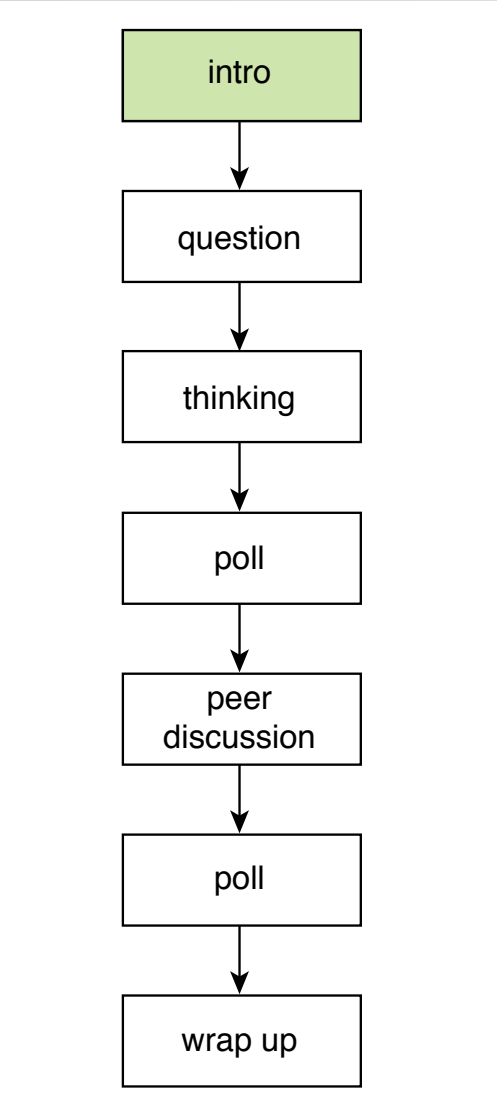
ConcepTests

"What are the important parts of a ConcepTest?"

ConcepTests

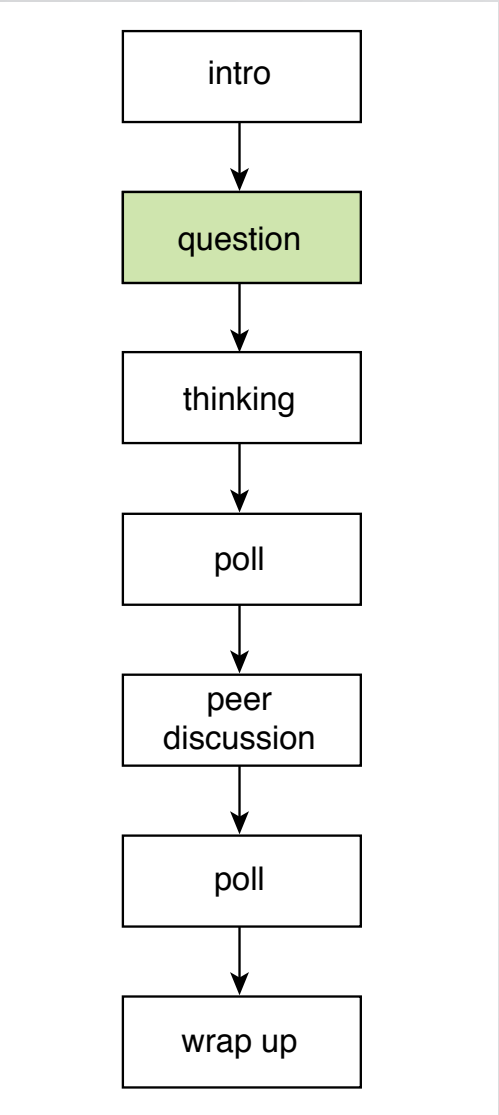


ConcepTests



setting context

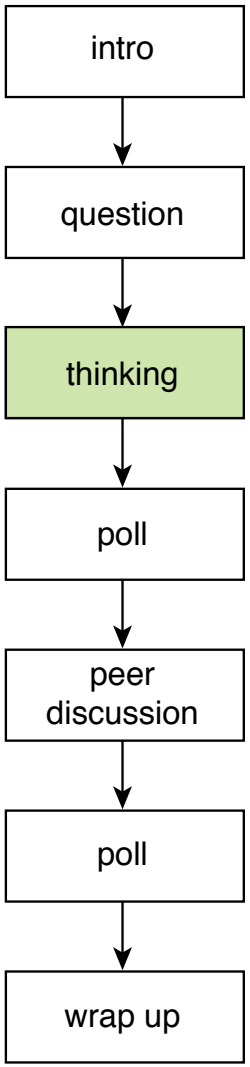
ConcepTests



setting context

posing question

ConcepTests

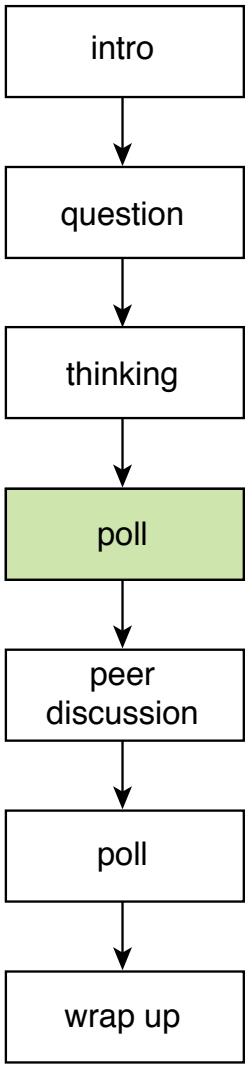


setting context

posing question

reflection

ConcepTests



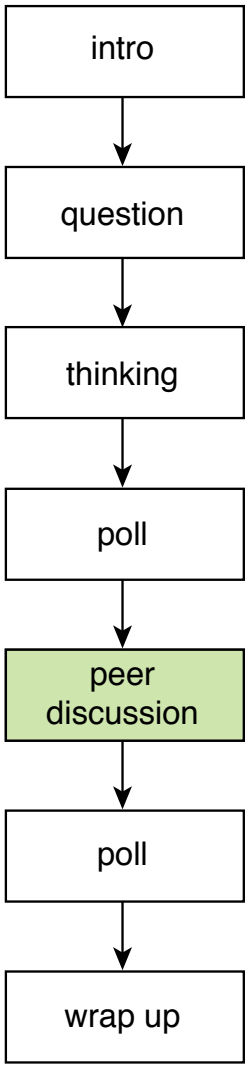
setting context

posing question

reflection

baseline data

ConcepTests



setting context

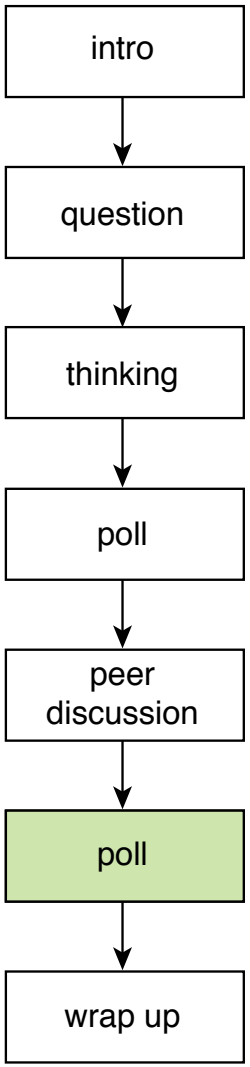
posing question

reflection

baseline data

peer instruction

ConcepTests



setting context

posing question

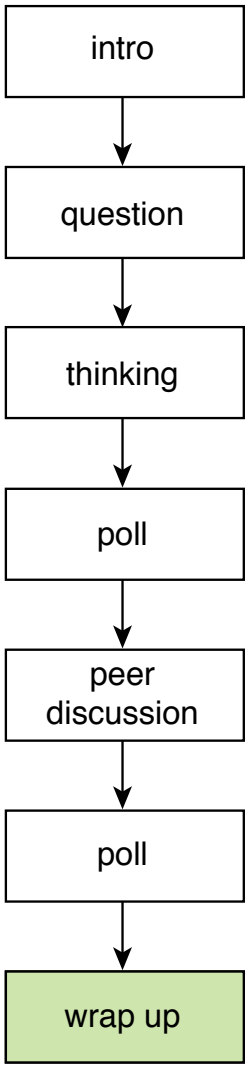
reflection

baseline data

peer instruction

gain data

ConcepTests



setting context

posing question

reflection

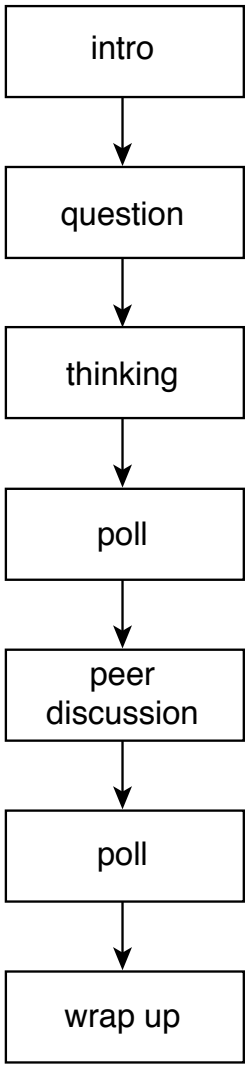
baseline data

peer instruction

gain data

closure

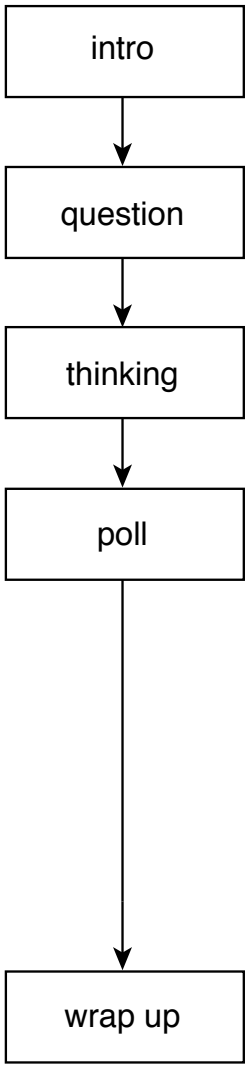
ConcepTests



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

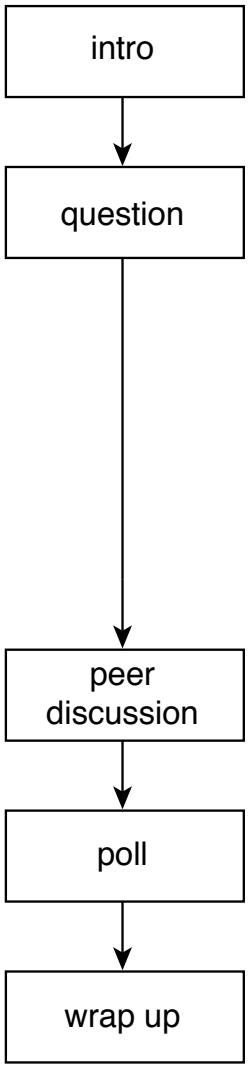


2–3 min saved, but…

takes the “Peer” out of “Peer Instruction”

ConcepTests

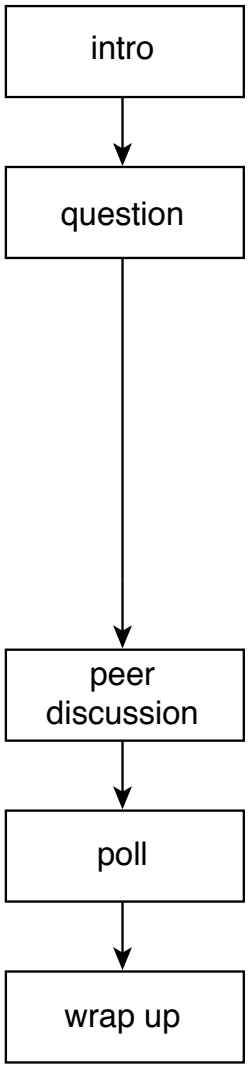
potential shortcuts



launch straight into discussion?

ConcepTests

potential shortcuts

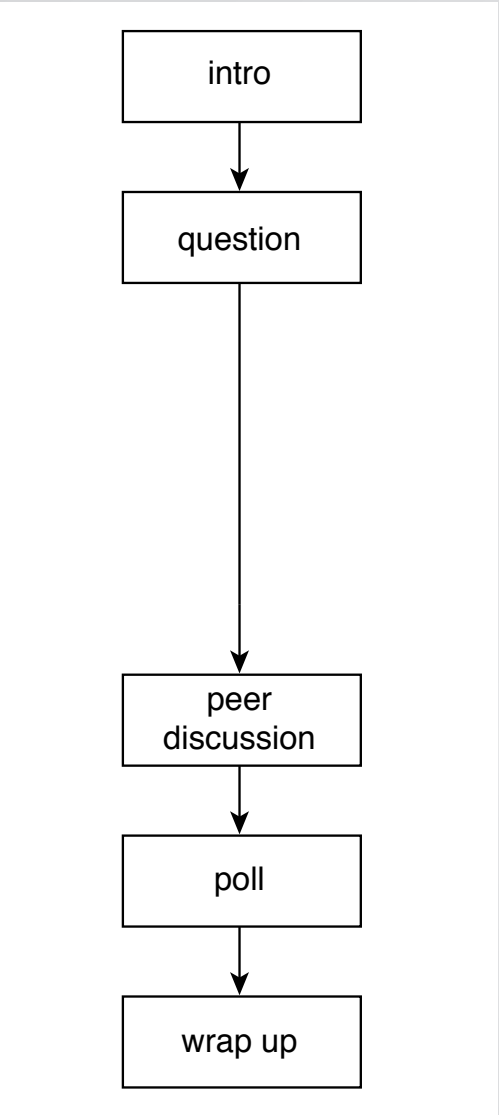


1–2 min saved, but…

no opportunity to commit before discussion

ConcepTests

potential shortcuts



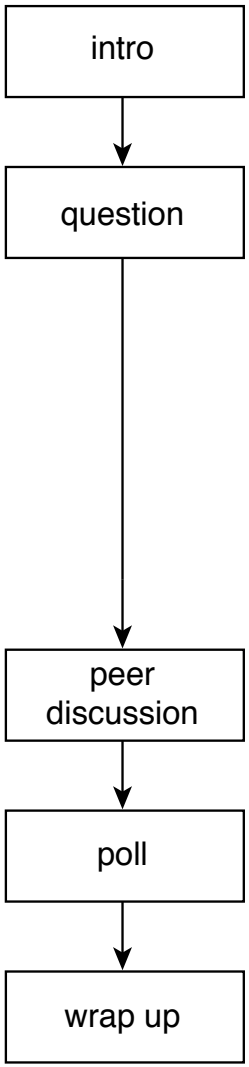
1–2 min saved, but…

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

"How frequent should the ConcepTests be?
Should I spend the whole hour with ConcepTests?"

ConcepTests

should count on about 15 min per ConcepTest

ConcepTests

should count on about 15 min per ConcepTest

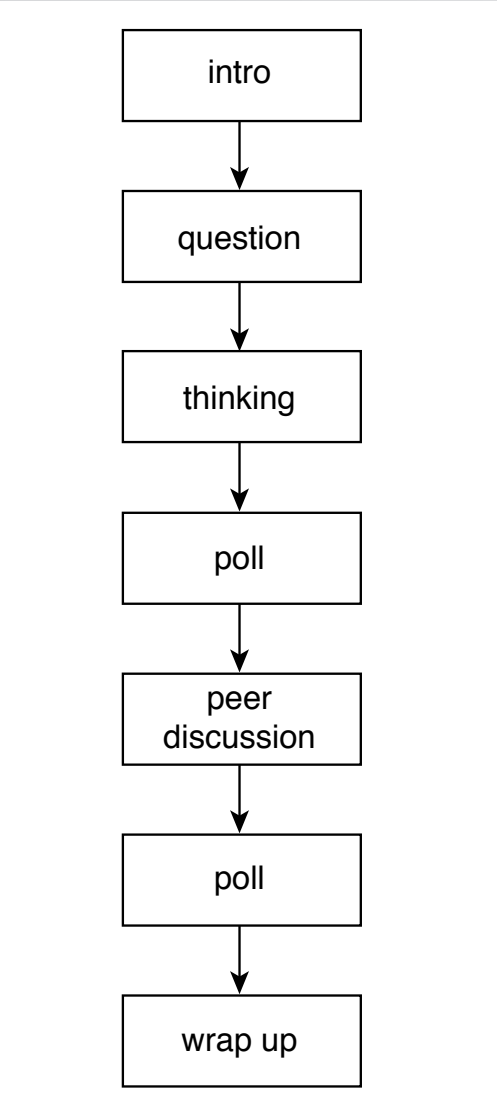
(including two pollings)

ConcepTests

“How do I make sure my students learn with this method?”

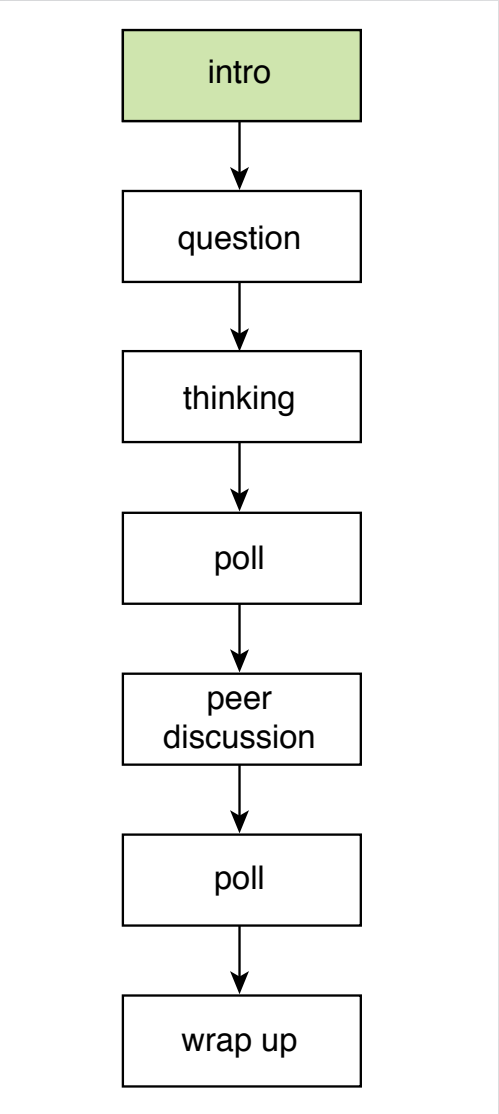
ConcepTests

engendering “deep learning”



ConcepTests

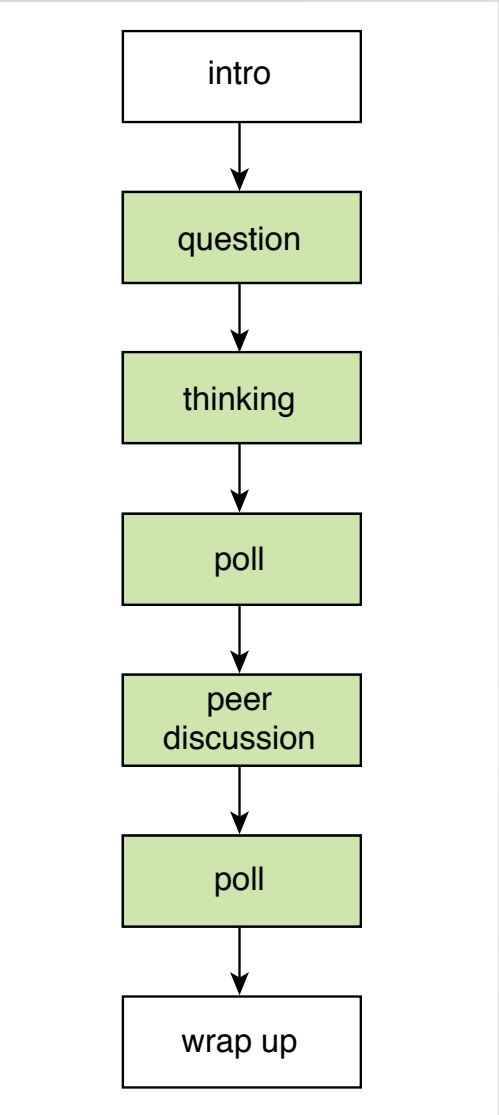
engendering “deep learning”



pre-class activity determines context

ConcepTests

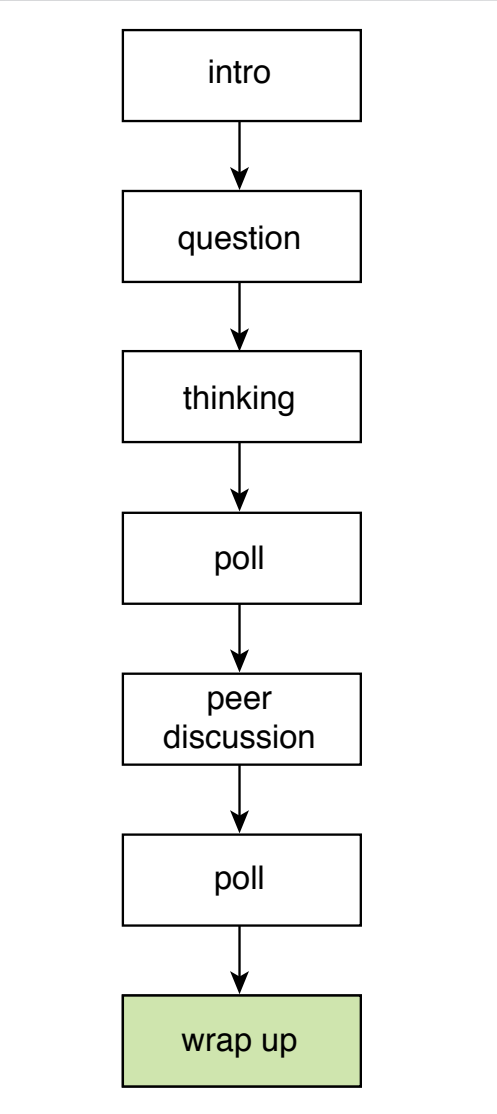
engendering “deep learning”



question transfers concepts to new context

ConcepTests

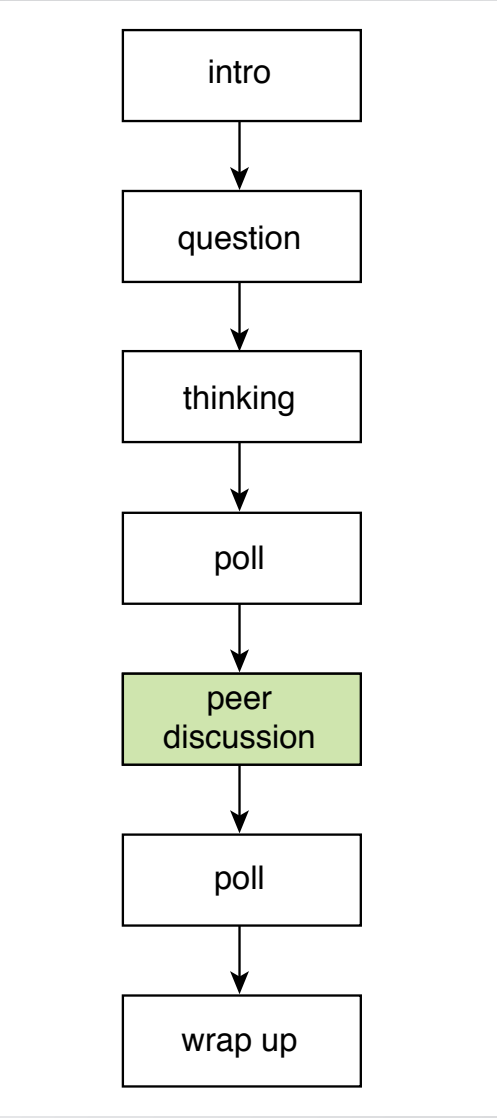
engendering “deep learning”



provide *your* explanation

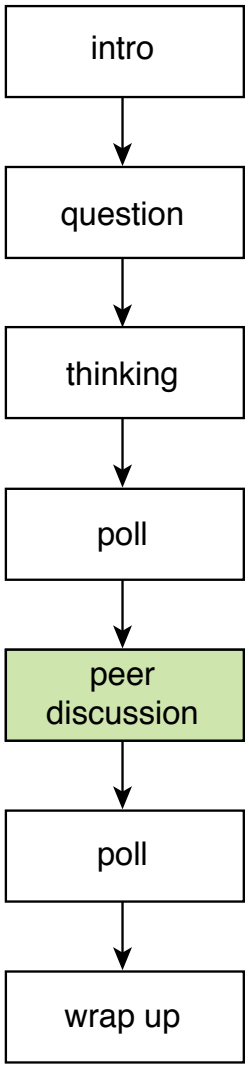
ConcepTests

importance of peer discussion



ConcepTests

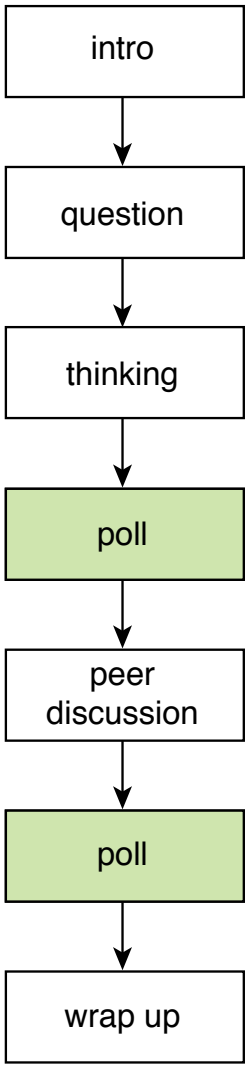
importance of peer discussion



vary activity

ConcepTests

importance of peer discussion



vary activity, measure poll-repoll gain

ConcepTests

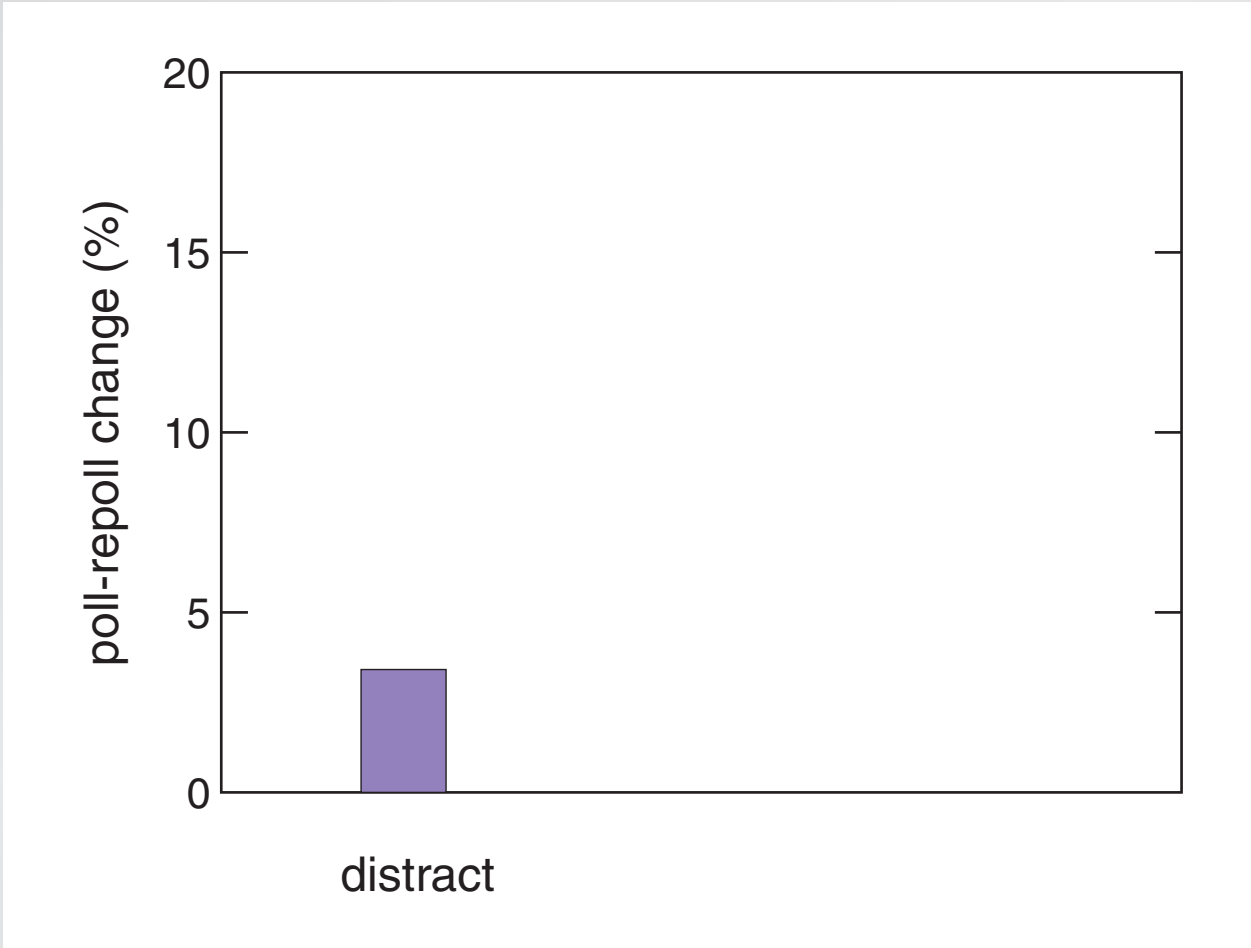
importance of peer discussion

compare poll-repoll gain for 3 activities:

- distract
- reflect
- discuss

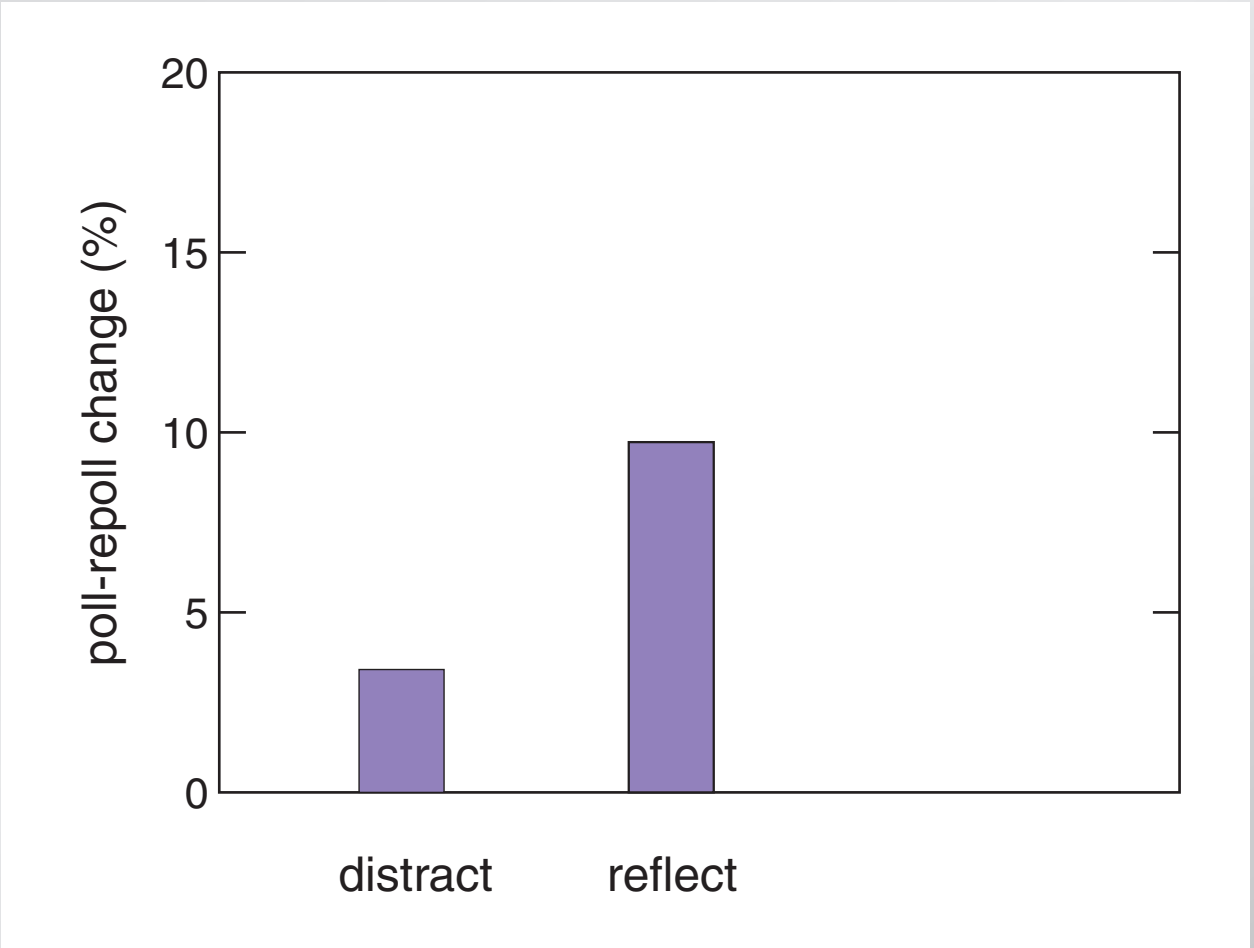
ConcepTests

importance of peer discussion



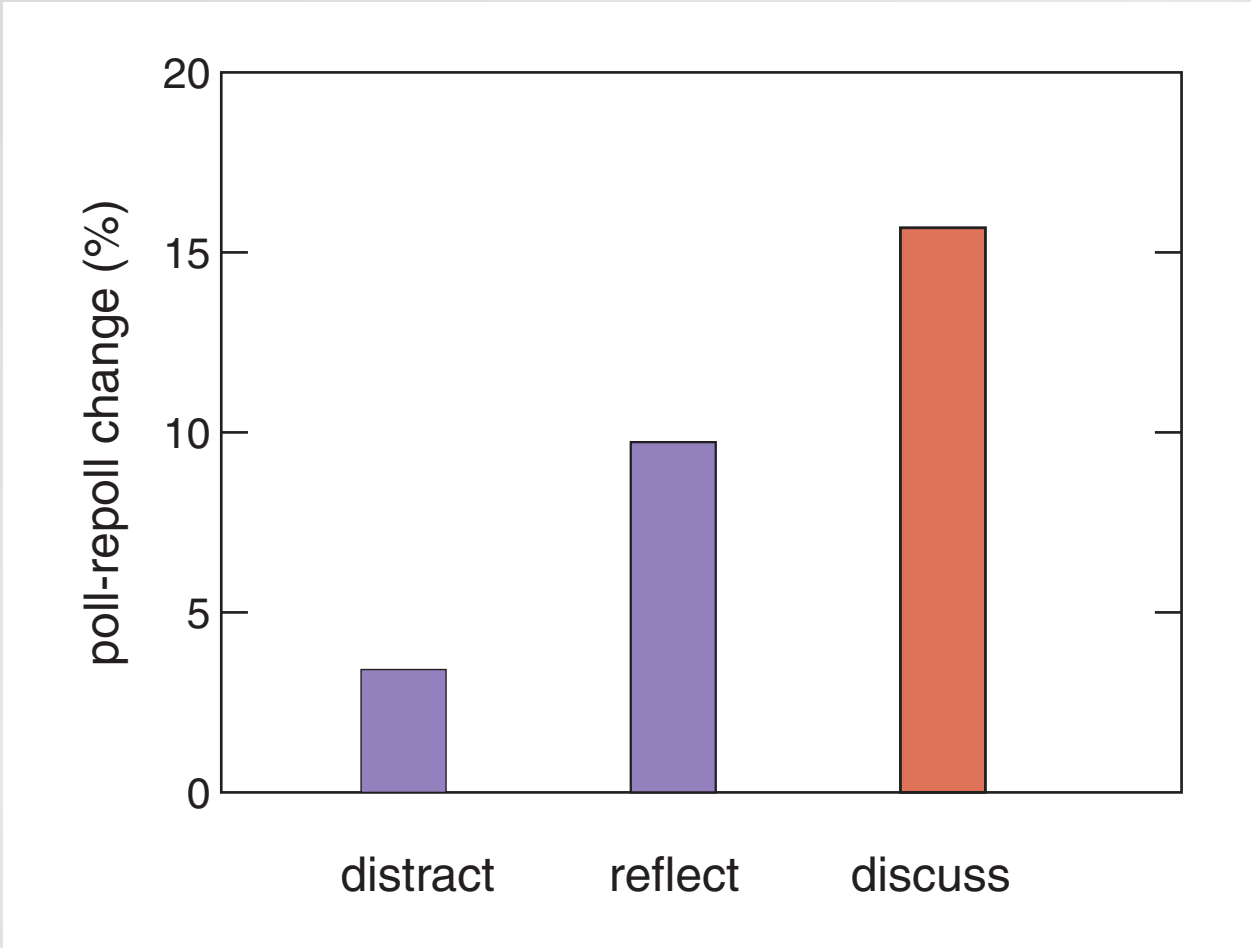
ConcepTests

importance of peer discussion



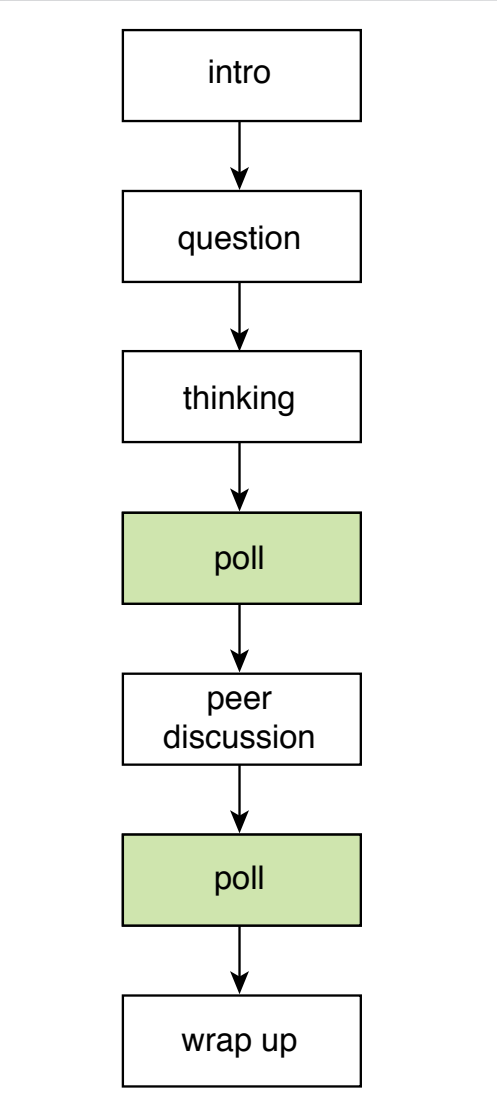
ConcepTests

importance of peer discussion



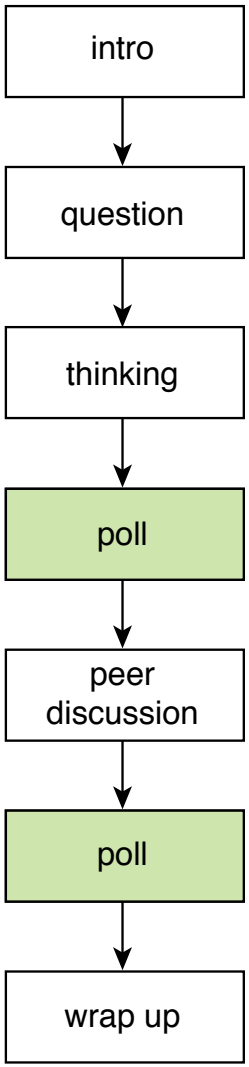
ConcepTests

Are clickers required?



ConcepTests

Are clickers required?



normalized FCI gain:

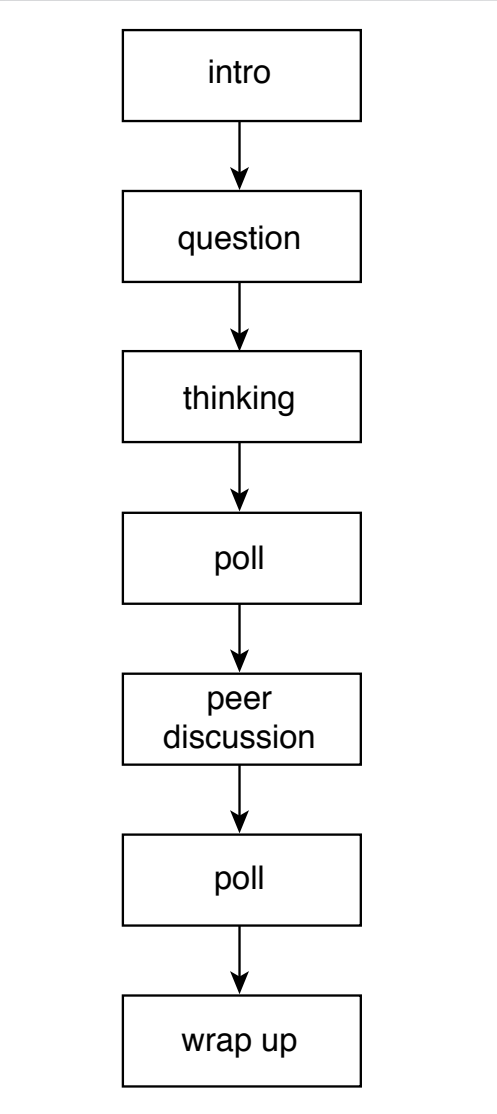
flashcards: 0.47

clickers: 0.44

Phys. Teacher, **46**, 242-244 (2008)

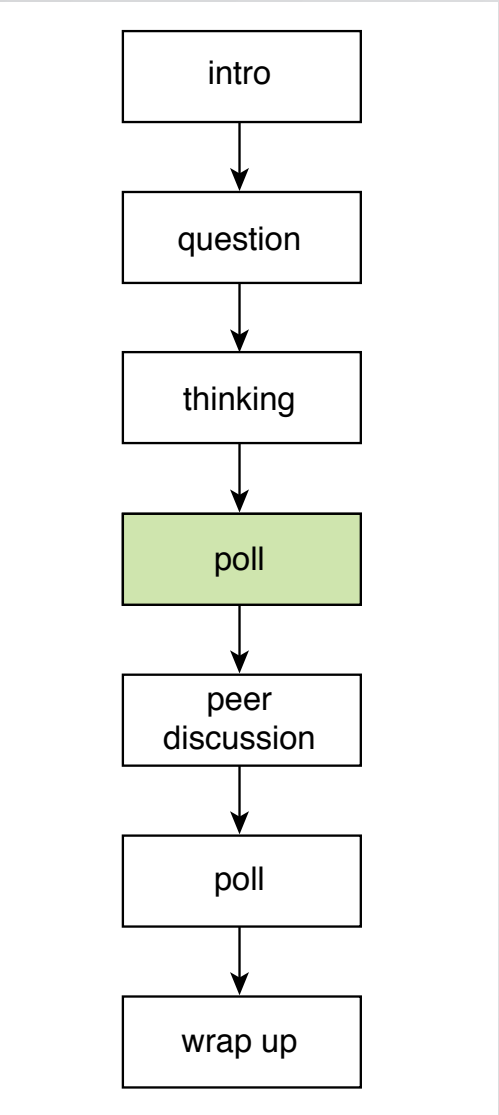
ConcepTests

show histograms?



ConcepTests

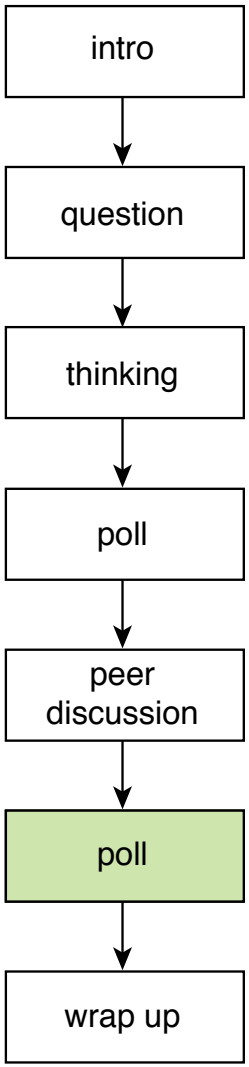
show histograms?



no — biases discussion

ConcepTests

show histograms?

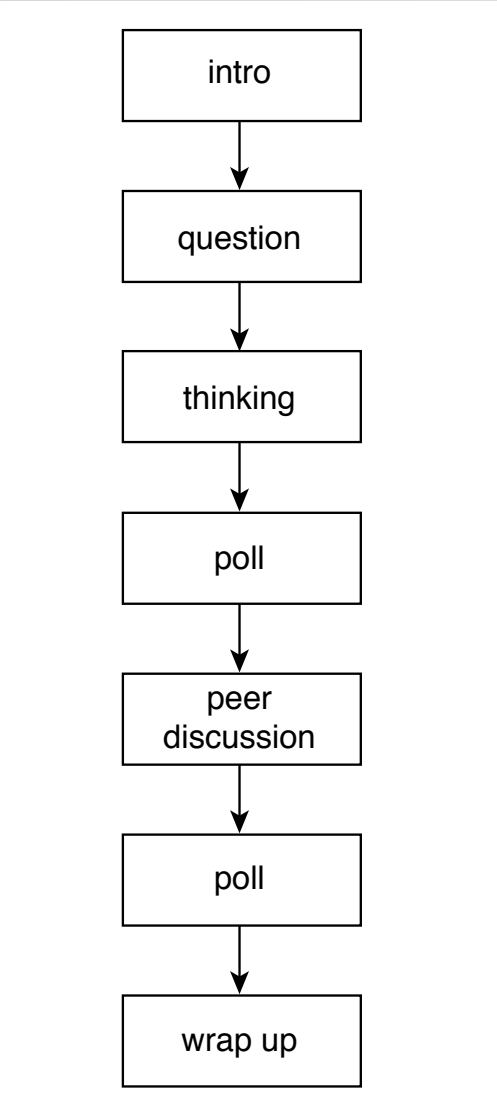


no — biases discussion

yes — helps bring closure

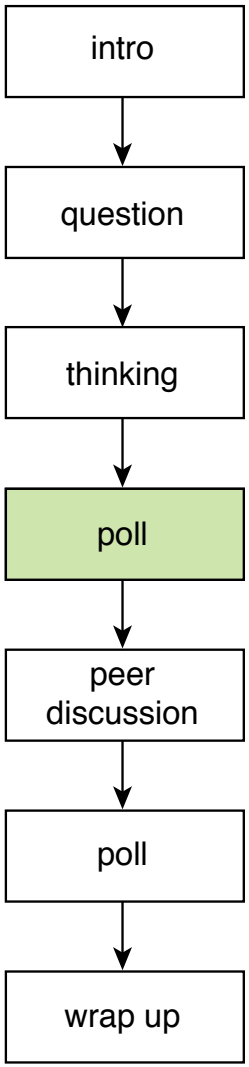
ConcepTests

have individual students defend choices?



ConcepTests

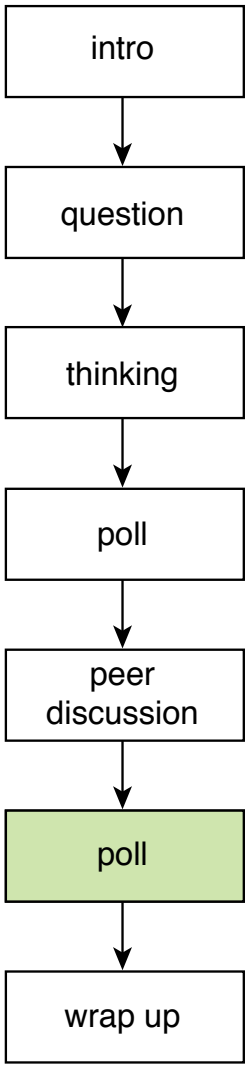
have individual students defend choices?



provides additional insights for discussion

ConcepTests

have individual students defend choices?

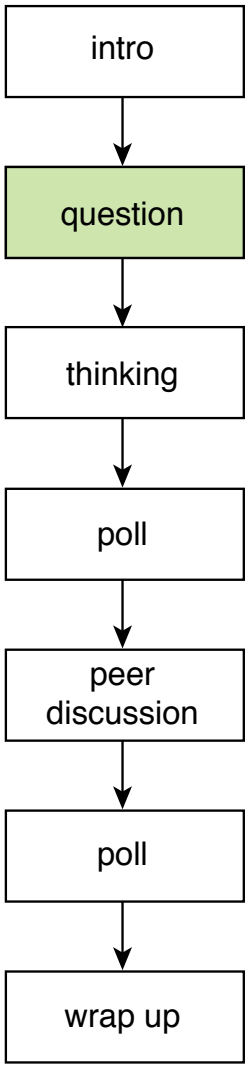


involves students in wrap up

ConcepTests

"What are the main characteristics of a good ConcepTest?"

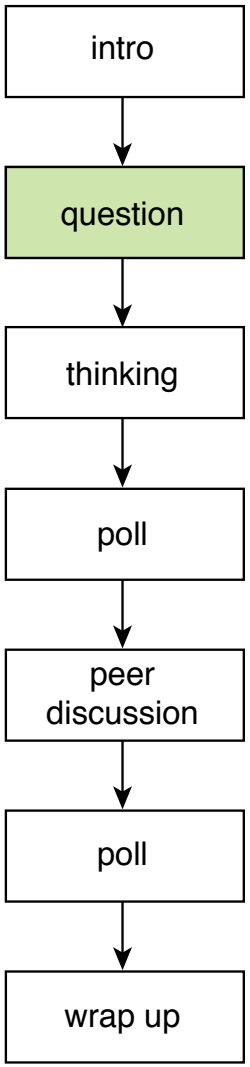
ConcepTests



An effective ConcepTest…

- is driven by student needs
- tests understanding, not memorization
- pushes students (but not too much)

ConcepTests



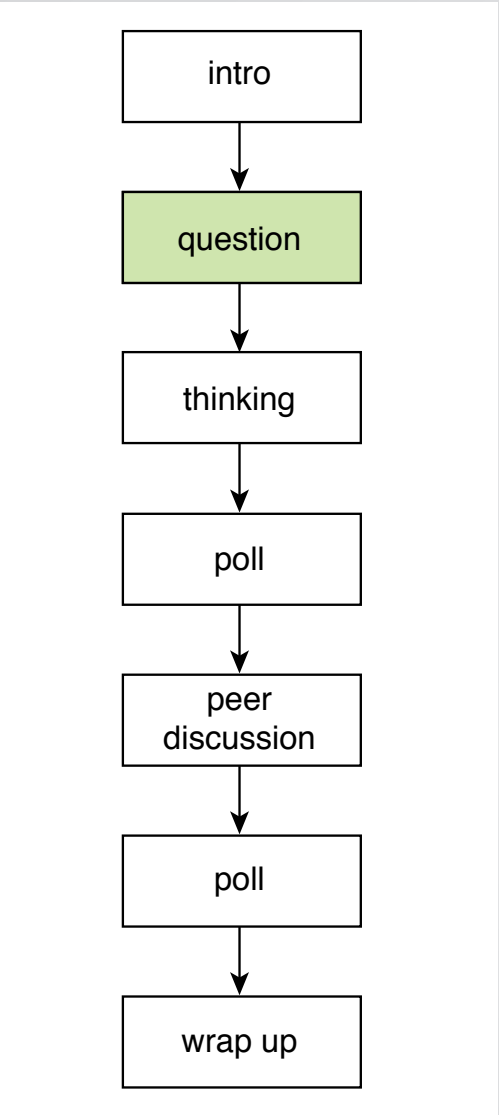
Sources of ConcepTests:

- literature/web (you'd be surprised!)
- pre-class assignments
- other assignments

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
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

hole in plate

microscopy image

airline

model

discussion

fact

ConcepTests

hole in plate

model

microscopy image

discussion

airline

fact

fact-recall not engaging

Outline

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

Assignment

To do before next online session:

1. identify resources in your discipline

2. create and review a ConcepTest

ConcepTests

To identify resources in your discipline Google:

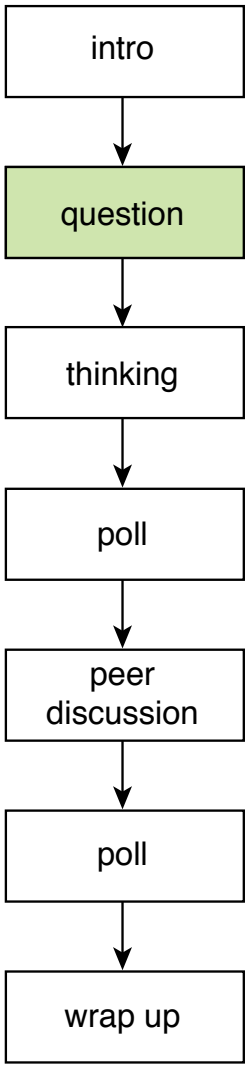
<your discipline> ConcepTest

<your discipline> “Concept Test”

<your discipline> “Peer Instruction”

Assignment

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



1. context

2. question

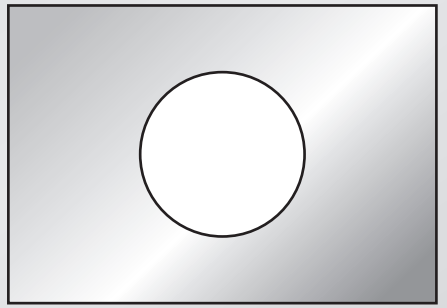
3. closure

Assignment

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

Assignment

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



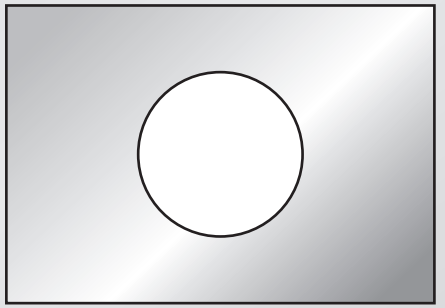
When the plate is uniformly heated, the diameter of the hole

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

QUESTION

Assignment

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



stem

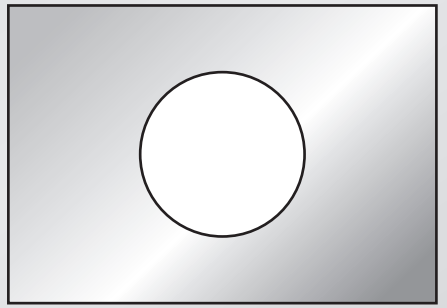
When the plate is uniformly heated, the diameter of the hole

QUESTION

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

Assignment

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.

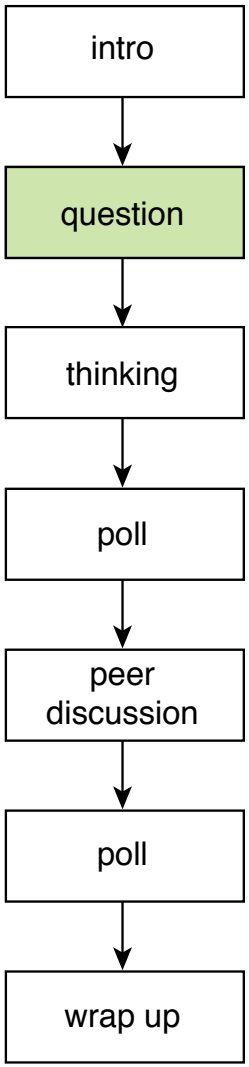
QUESTION

Assignment

consider the atoms at the rim of the hole

Assignment

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



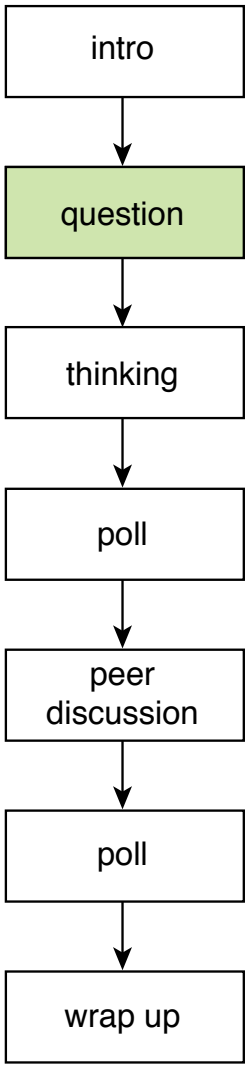
1. context

2. question

3. closure

Assignment

some basic design rules

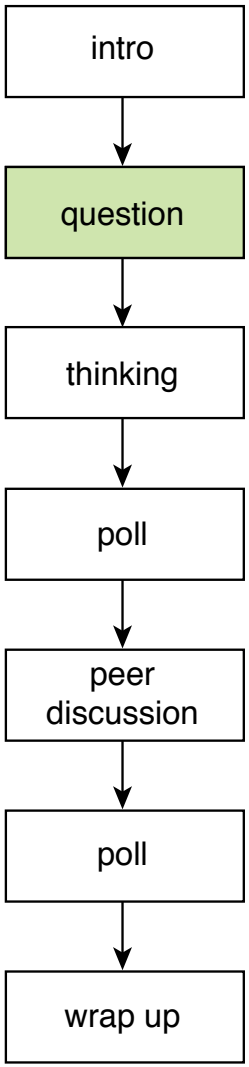


General tips:

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

Assignment

some basic design rules

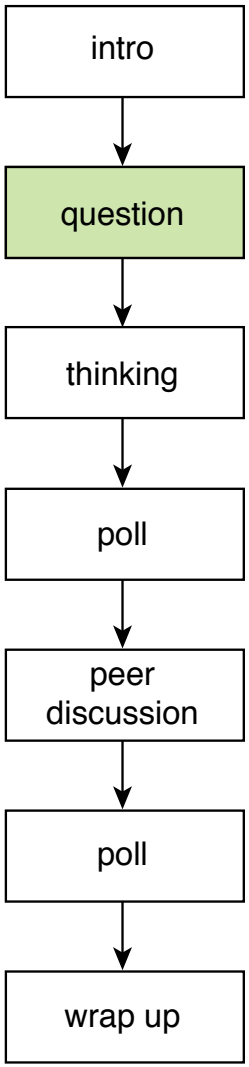


Remove:

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

Assignment

some basic design rules

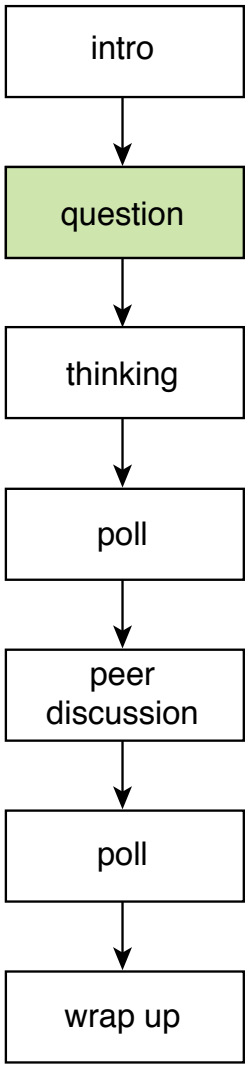


Writing good “stems”:

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

Assignment

some basic design rules

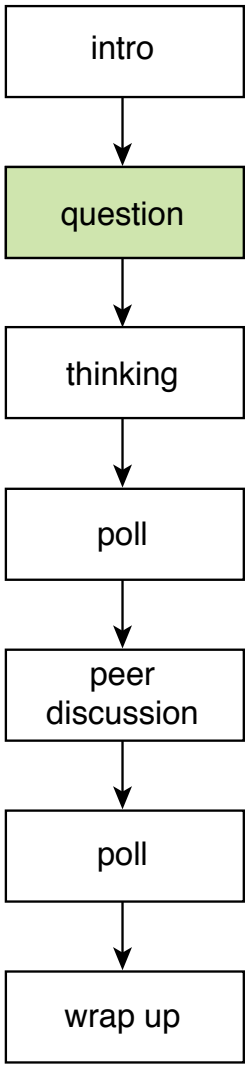


Writing good answer choices:

- 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”

Assignment

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.

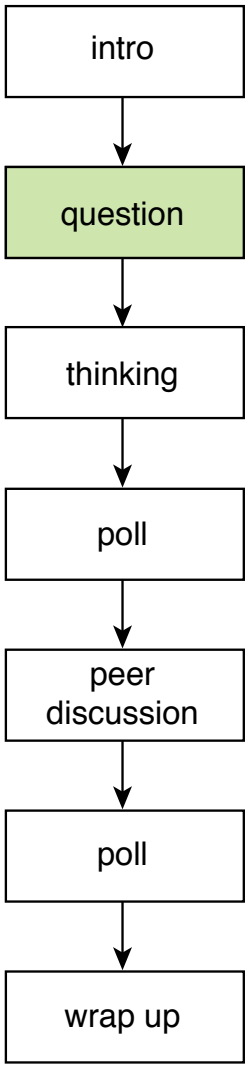
B. Only when *jushespora* change color.

C. When *jushespora* draw into a circle.

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

Assignment

Example: another nonsense question



What is the color of *ermazoa*?

A. Blue.

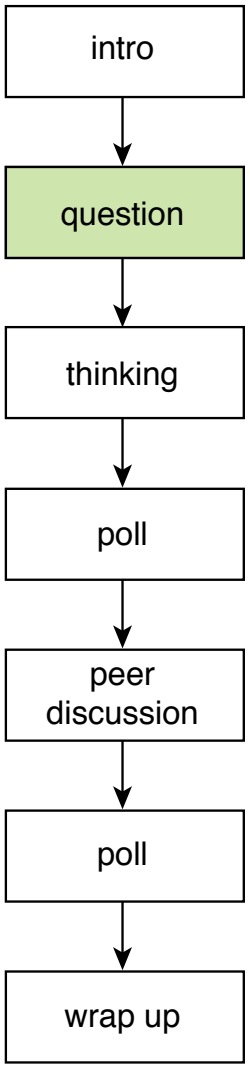
B. Red.

C. Green.

D. Yellow.

Assignment

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.

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