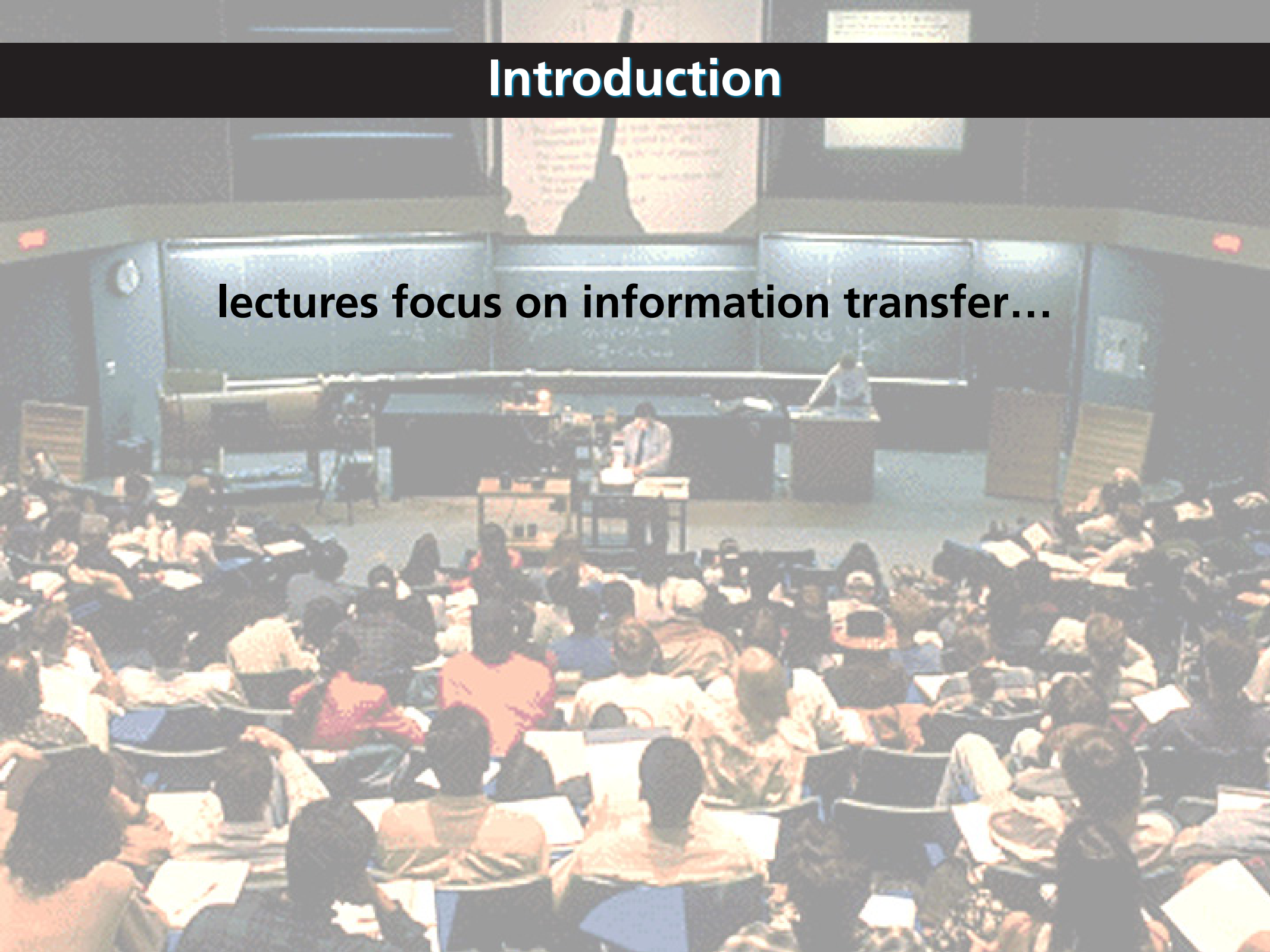
Engaging Students One-on-One, All At Once
Session 1

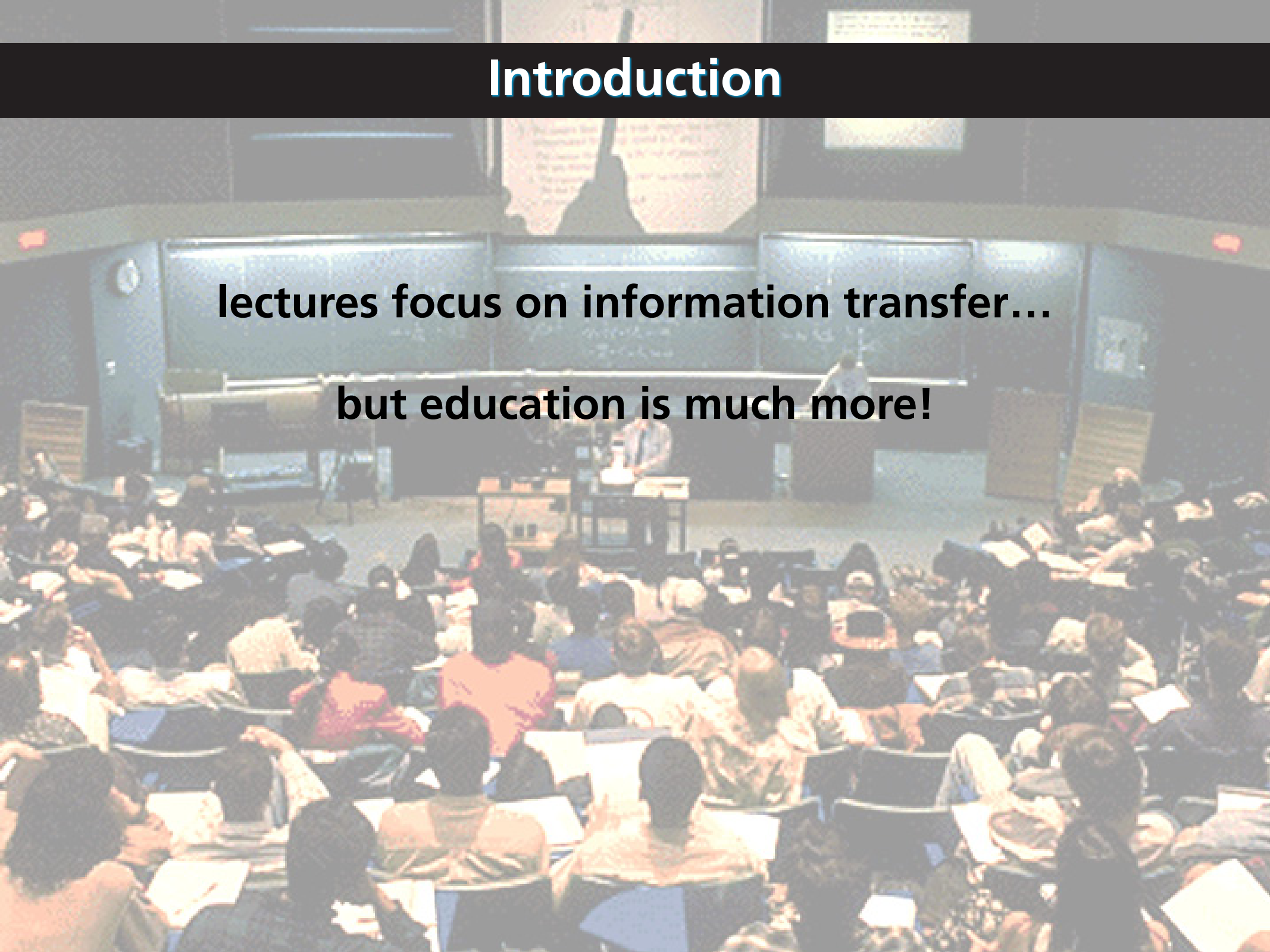
LASPAU/IDIA
Online short-course, 8 august 2011

Introduction



lectures focus on information transfer…

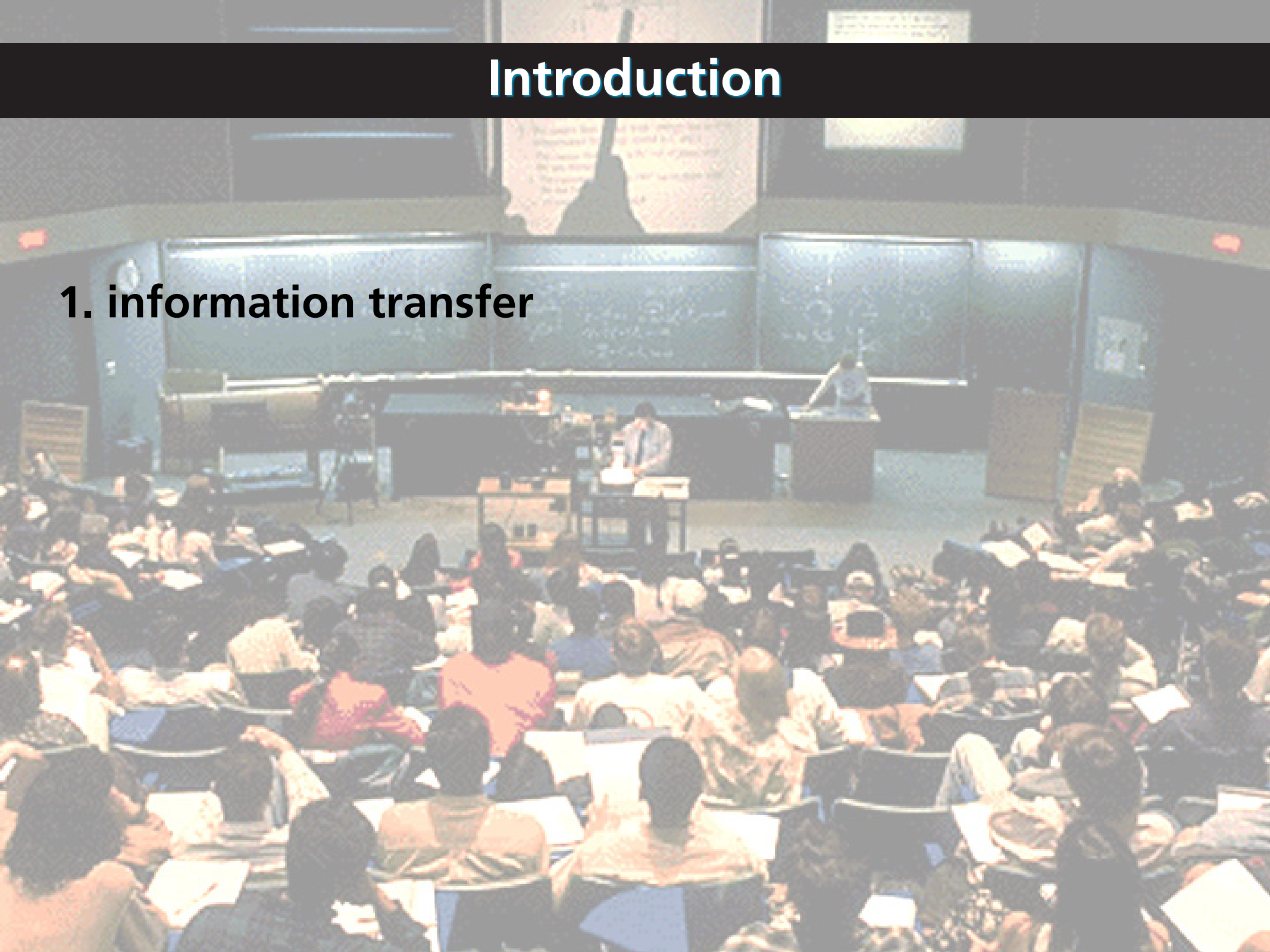
Introduction



lectures focus on information transfer…

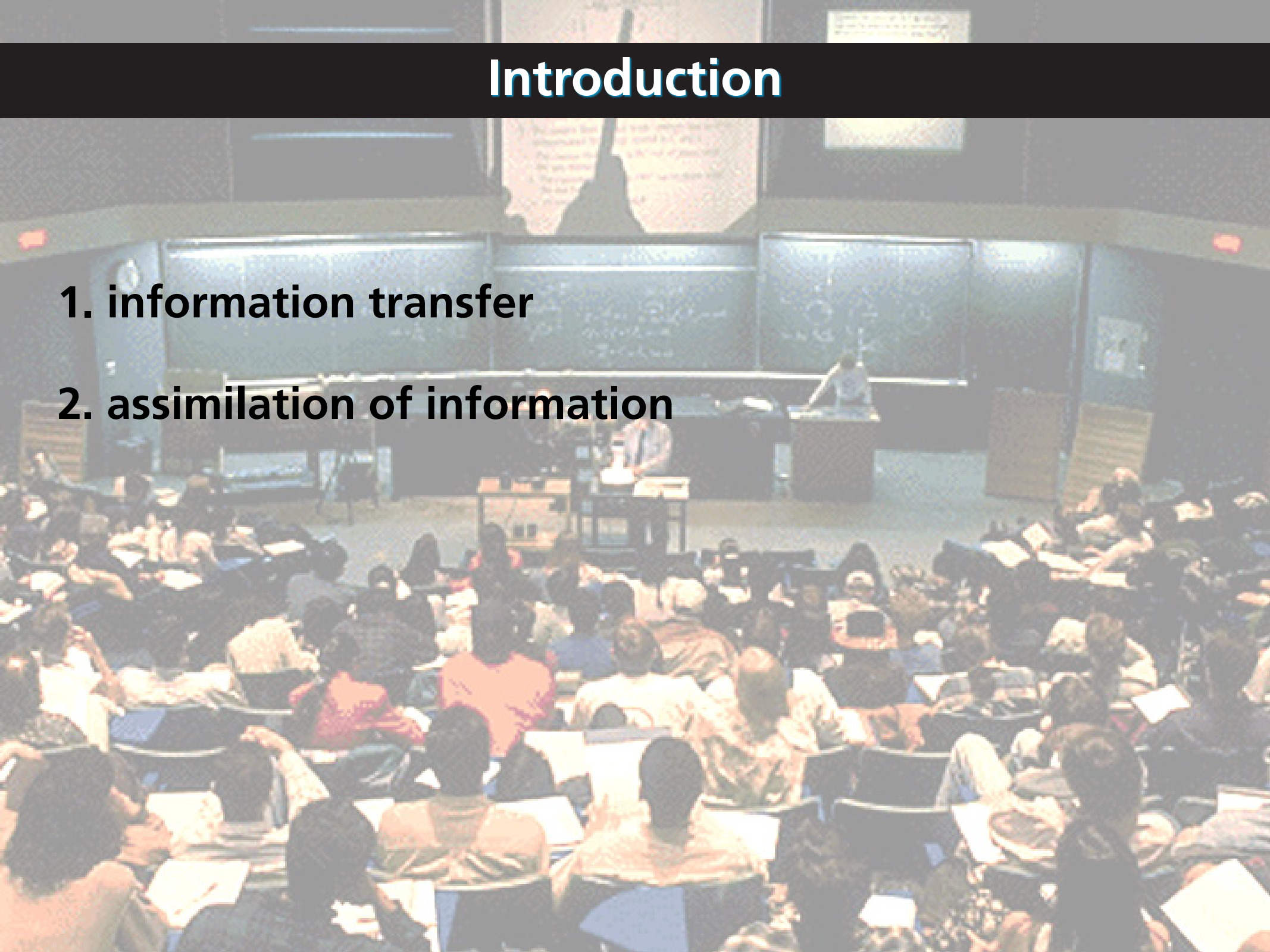
but education is much more!

Introduction



1. information transfer

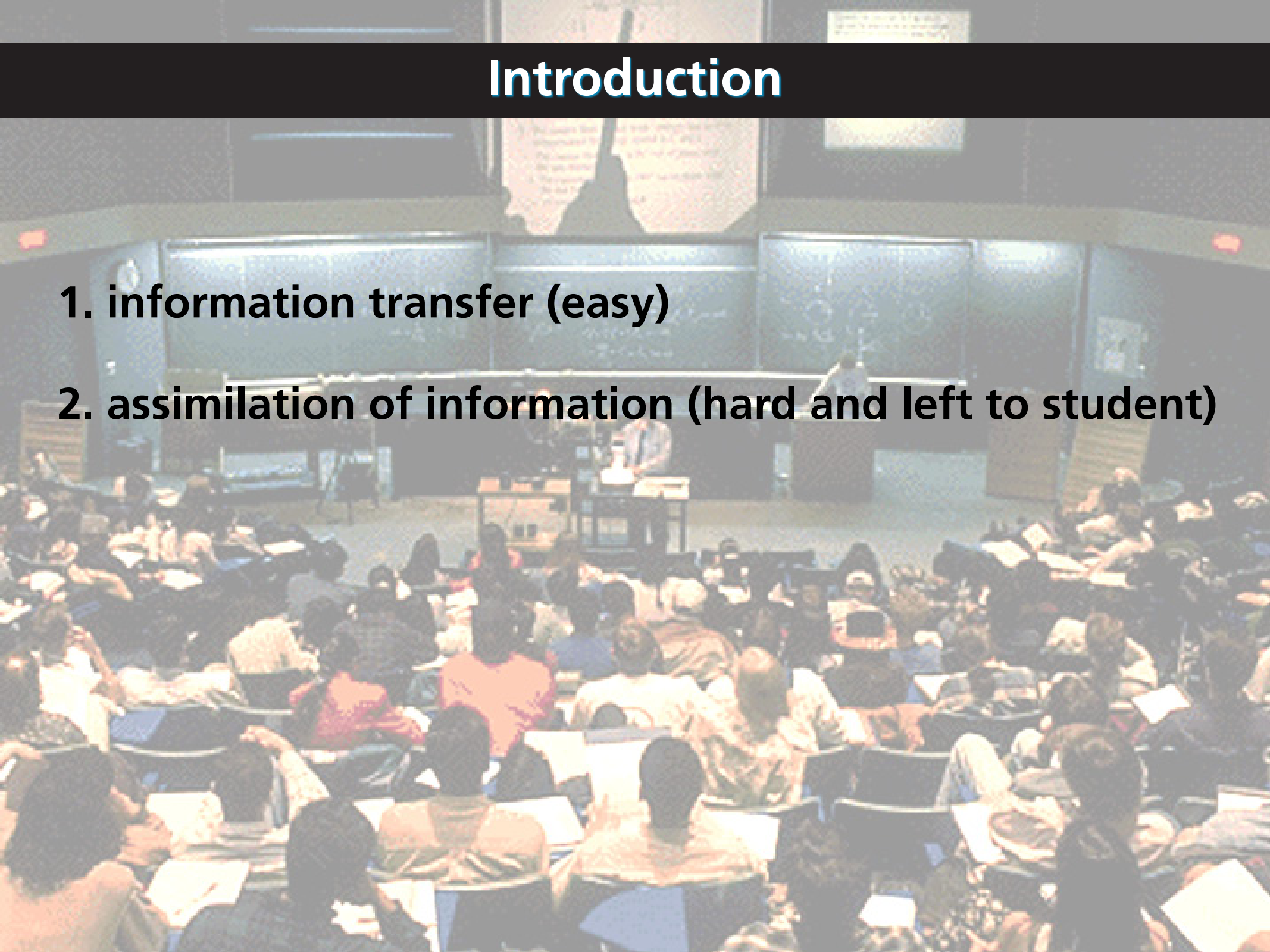
Introduction



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)!

Implementing PI & JiTT

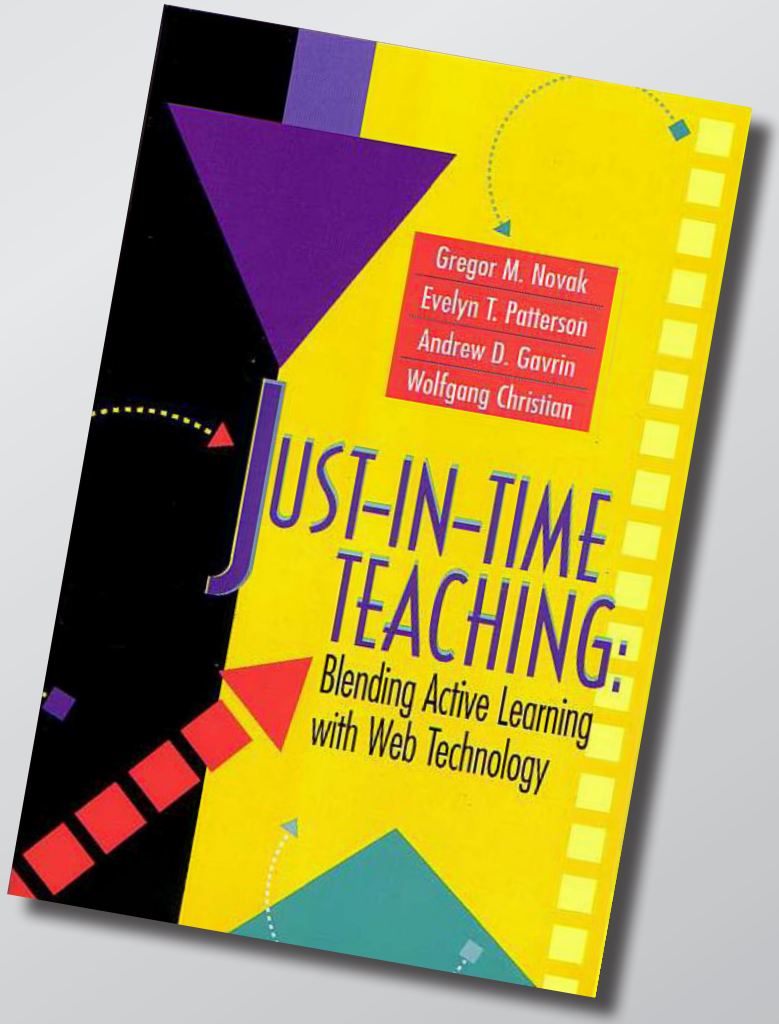
"I do not understand the difference between

Peer Instruction and Just in Time Teaching."

PI & JiTT Overview

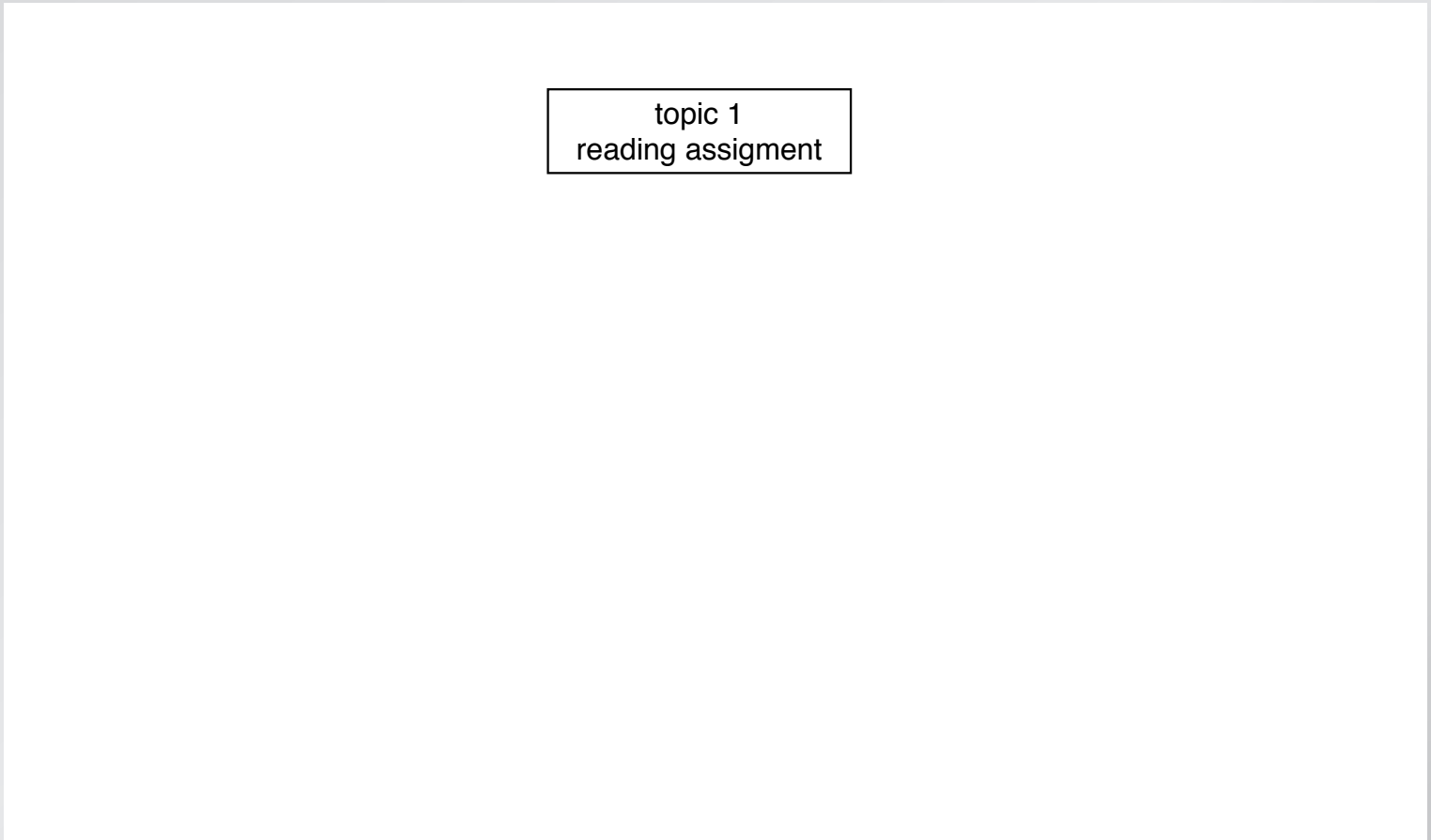
Just-in-time-Teaching (JiTT)

www.jitt.org



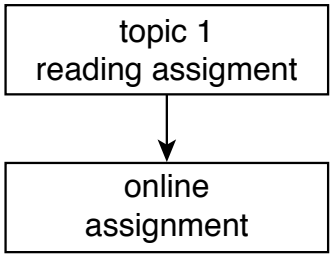
PI & JiTT Overview

JiTT workflow



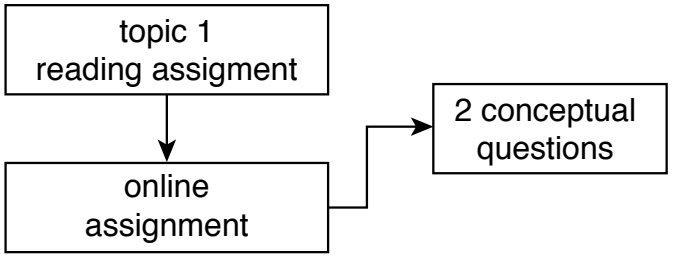
PI & JiTT Overview

JiTT workflow



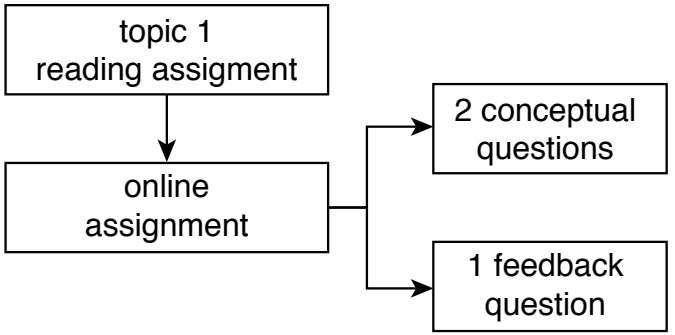
PI & JiTT Overview

JiTT workflow



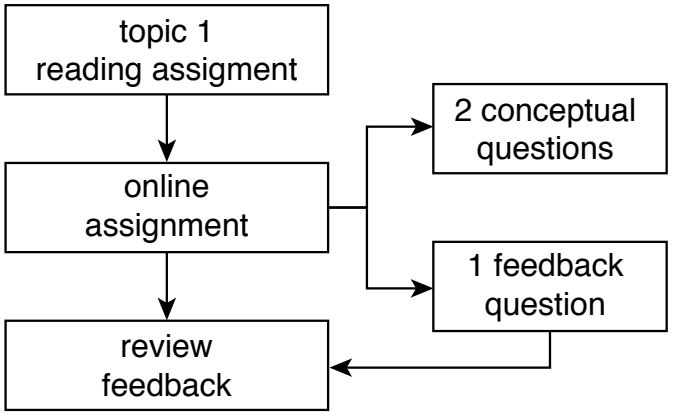
PI & JiTT Overview

JiTT workflow



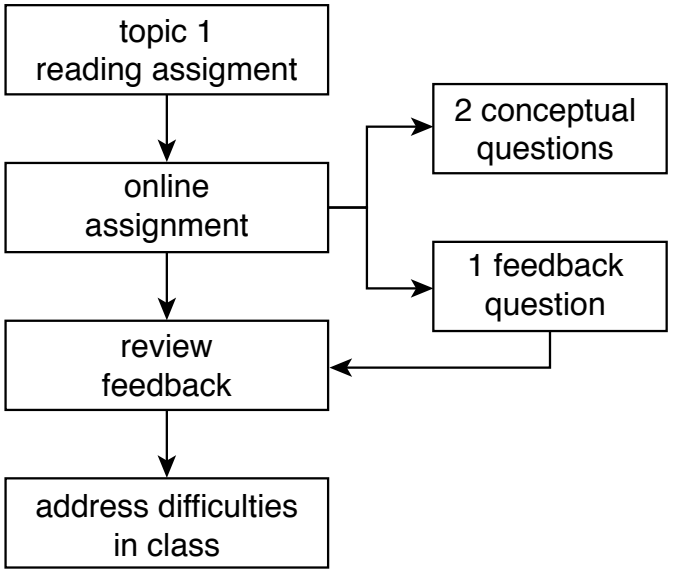
PI & JiTT Overview

JiTT workflow



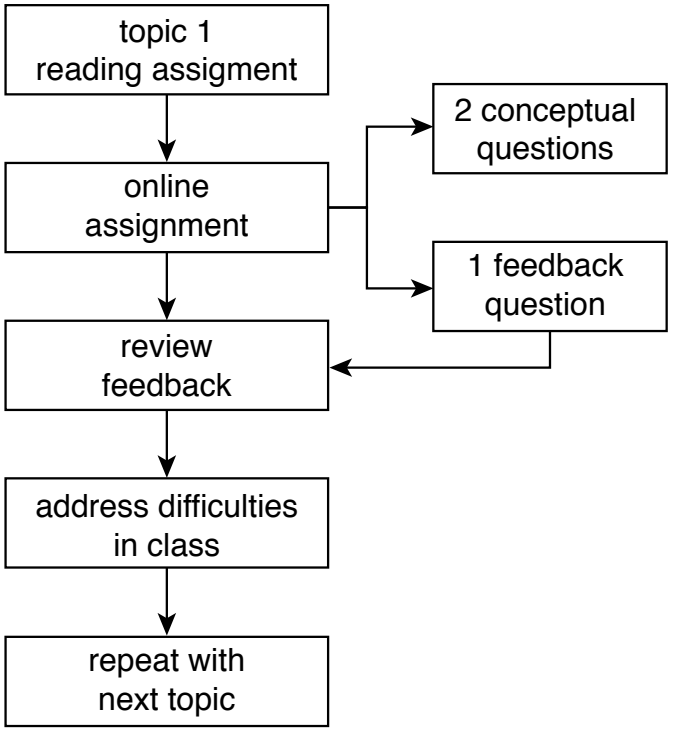
PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

JiTT workflow



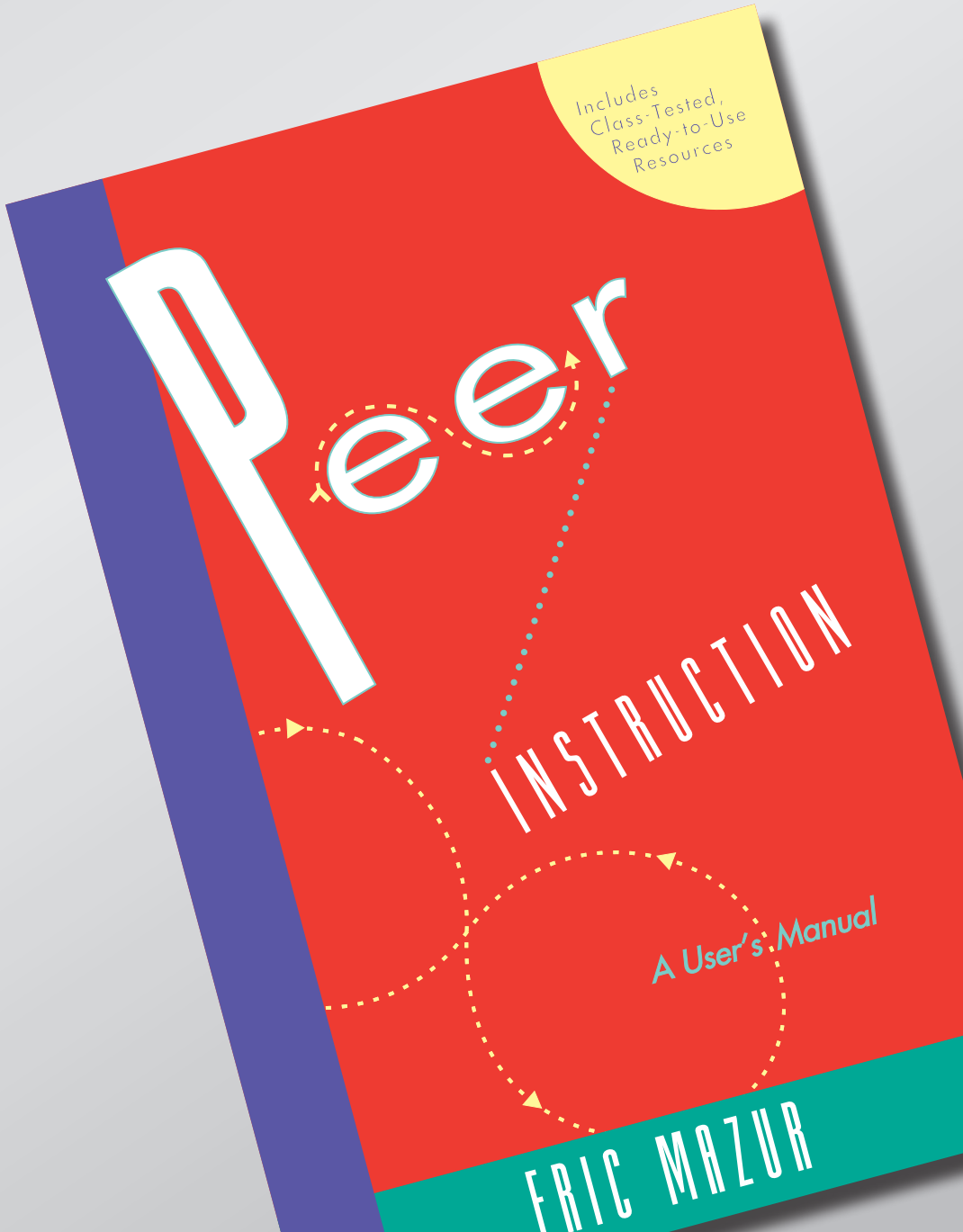
PI & JiTT Overview

JiTT:

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

PI & JiTT Overview

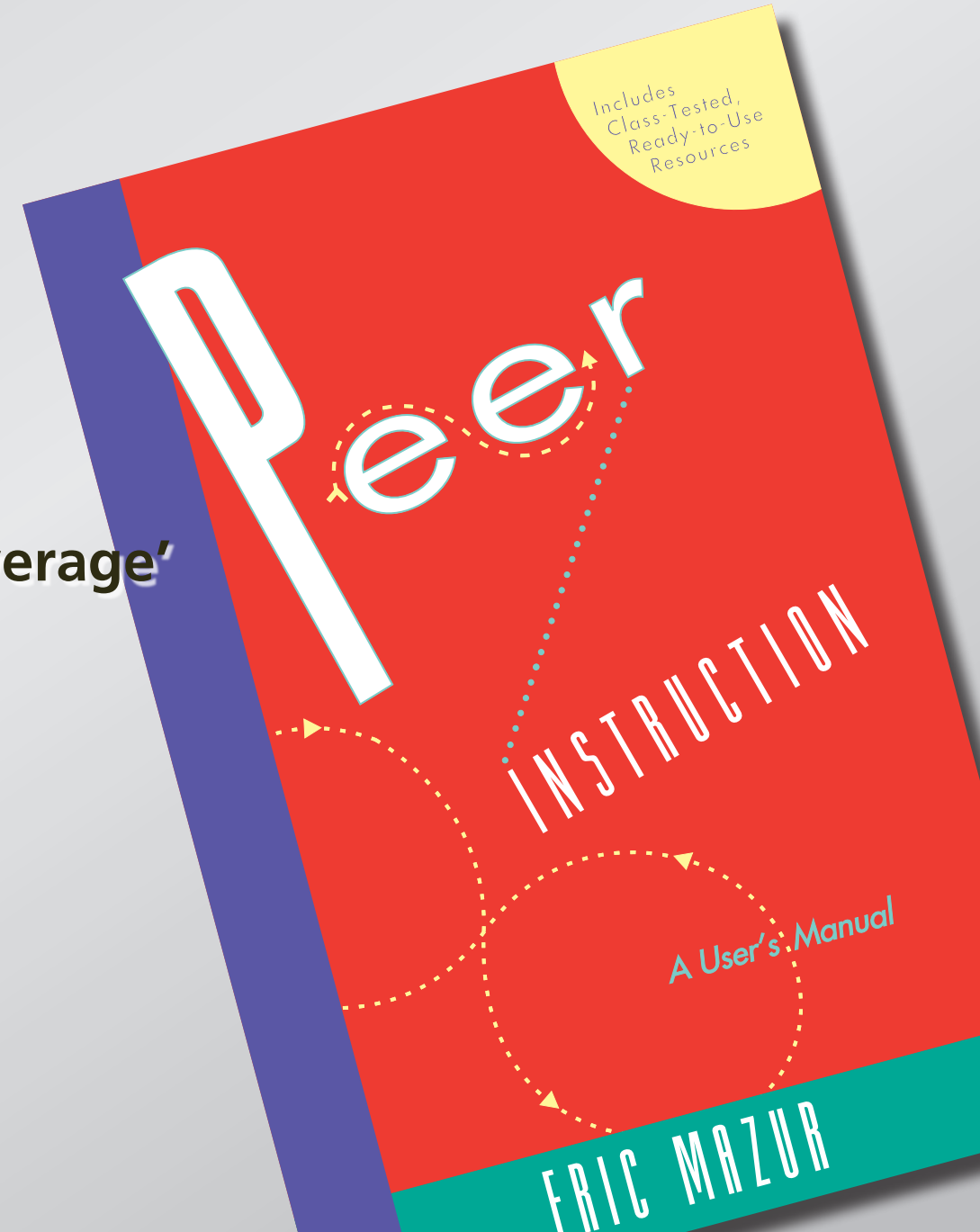
Peer Instruction (PI)



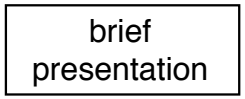
PI & JiTT Overview

Main features:

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



Peer Instruction: a primer



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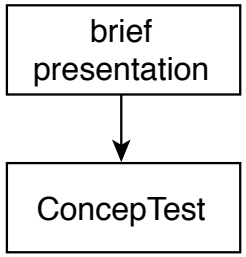

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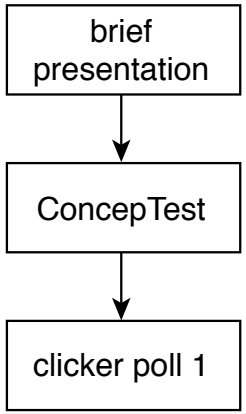

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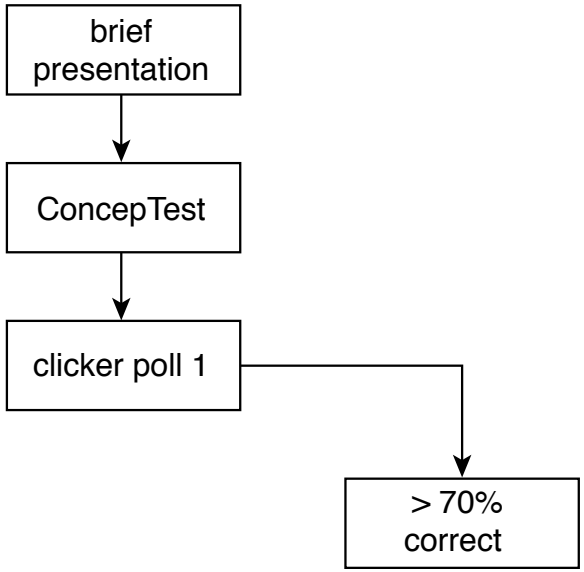

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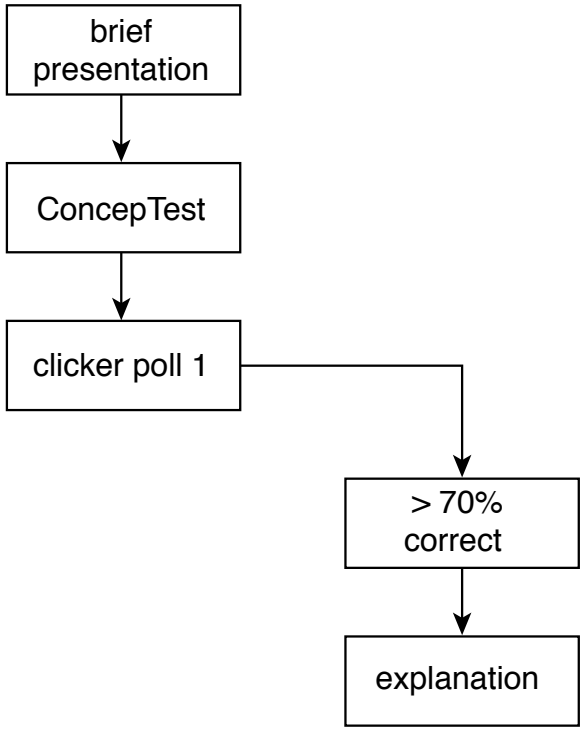

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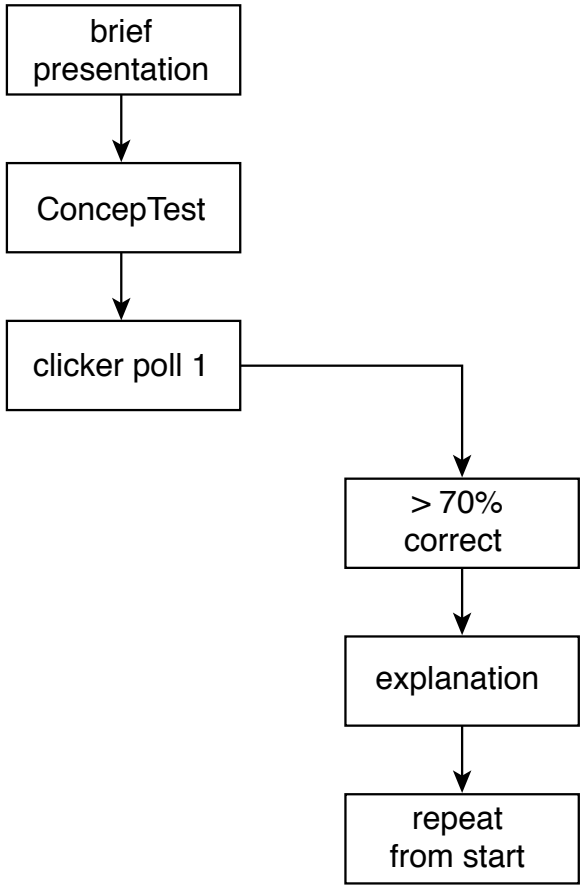

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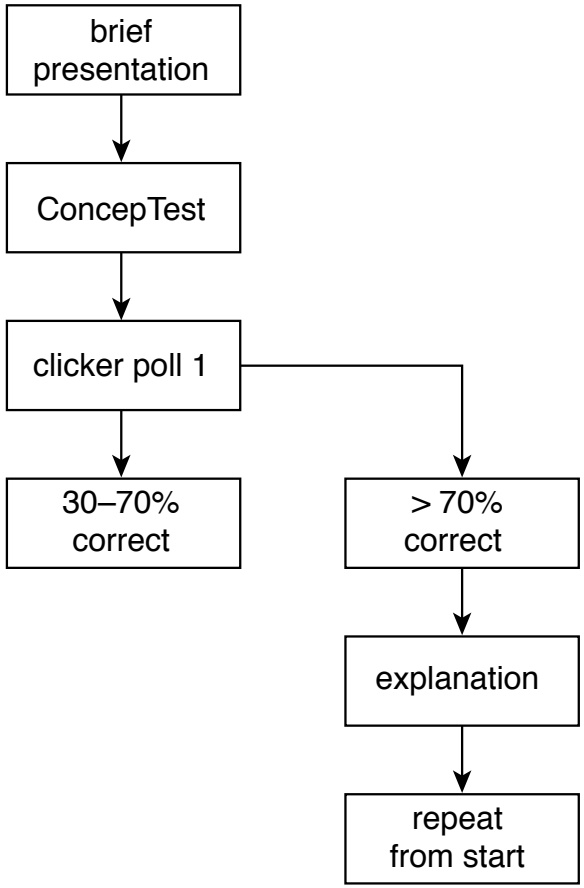

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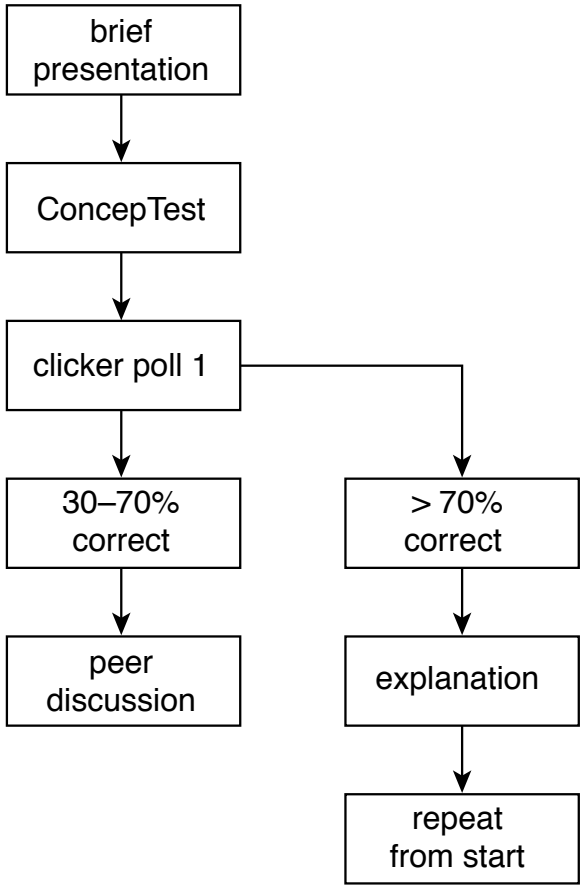

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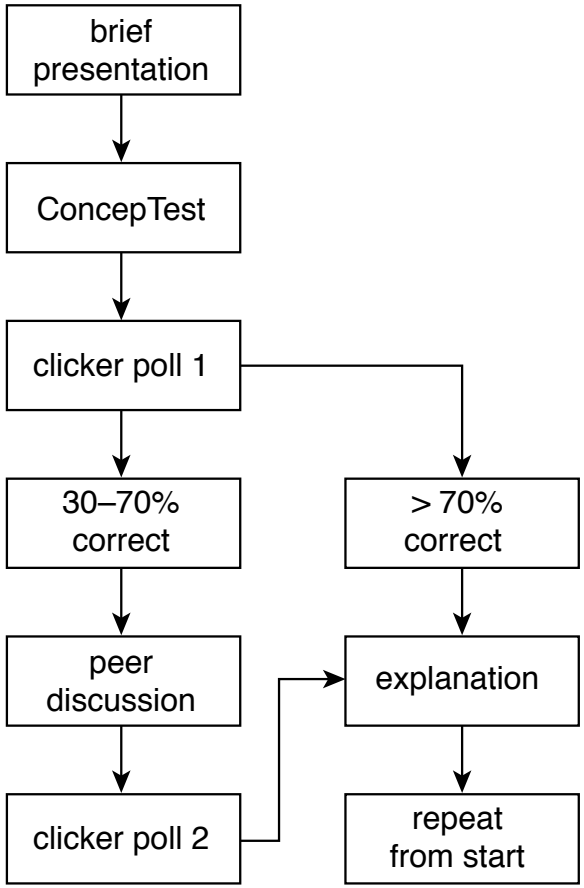

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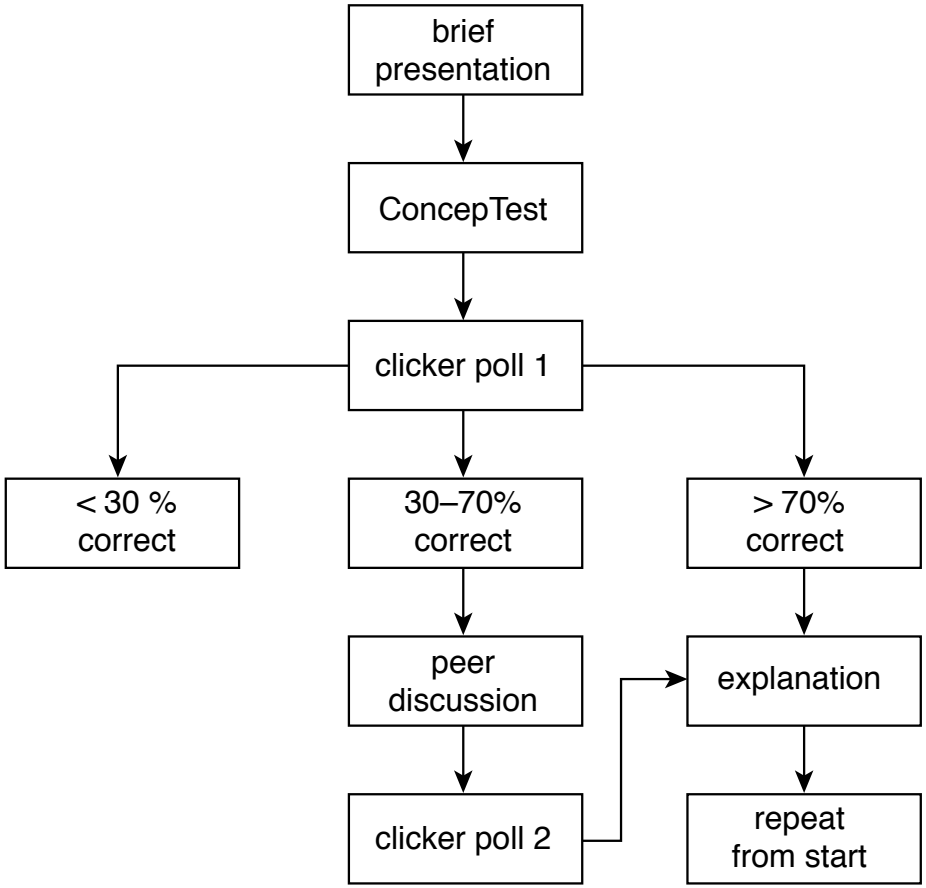

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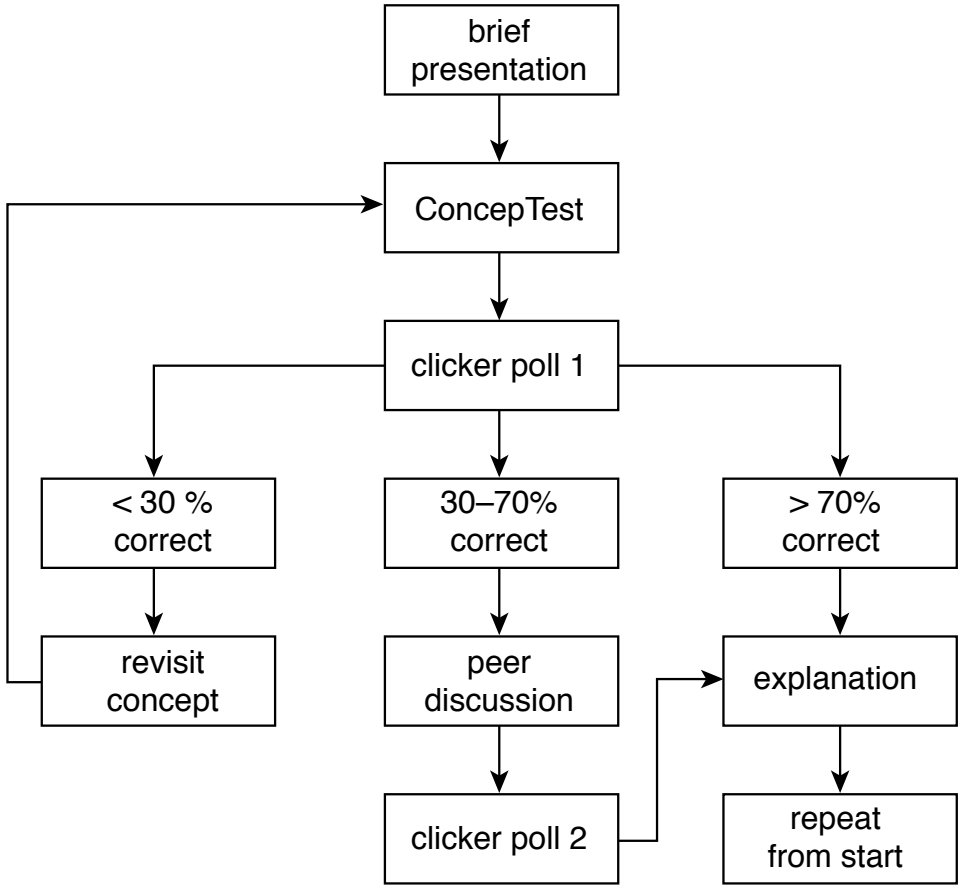

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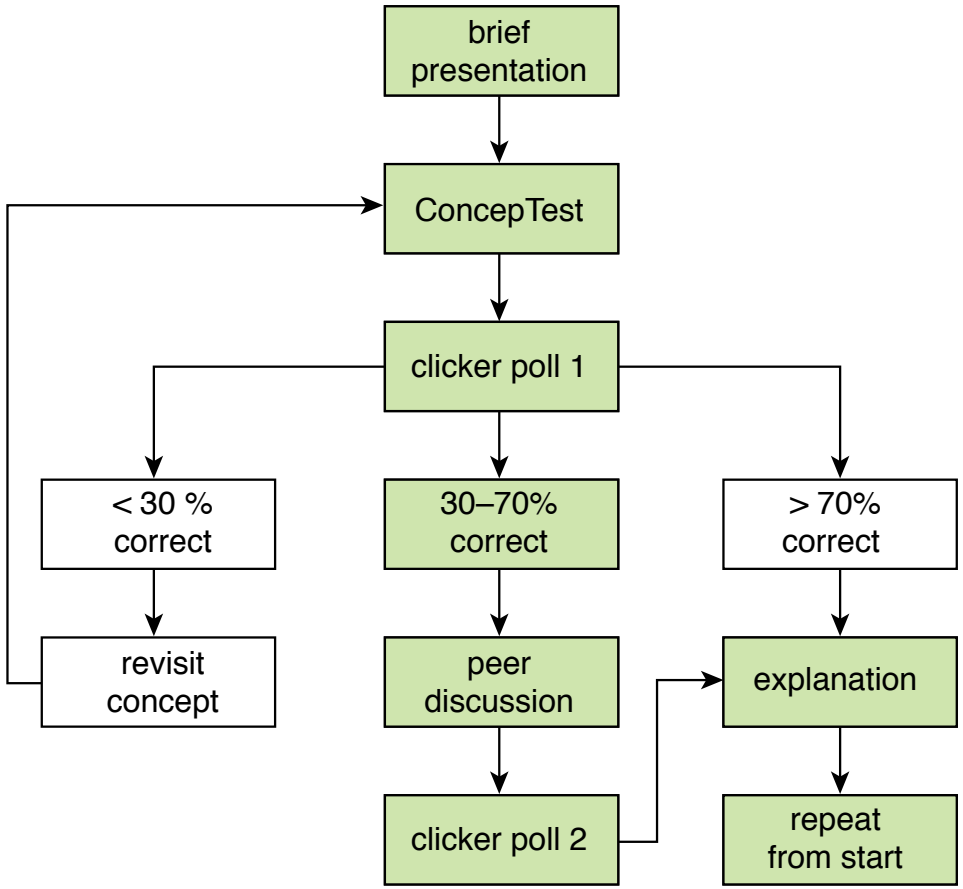


PI & JiTT Overview

PI:

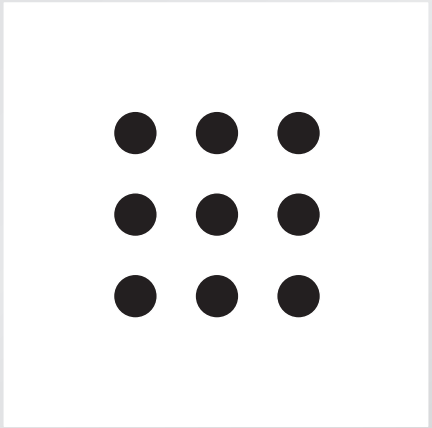
- **helps students overcome difficulties**
- **encourages deep learning**
- **provides depth, not “coverage”**
- **helps you become aware of misconceptions**

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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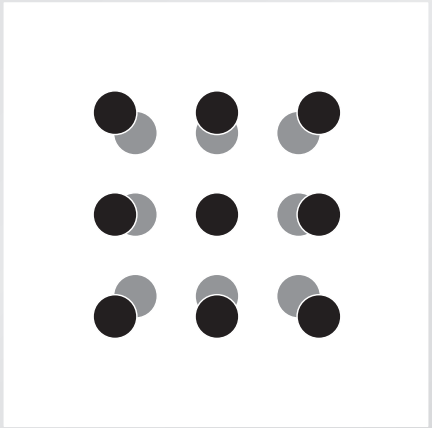
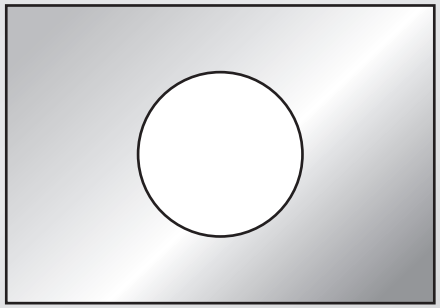


Let's try it!

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



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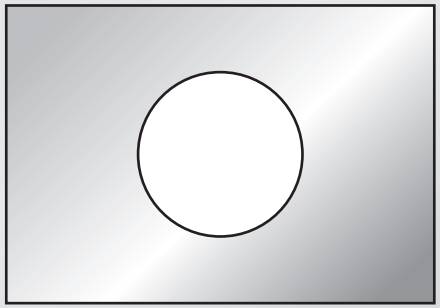


When the plate is uniformly heated, the diameter of the hole

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

Let’s try it!

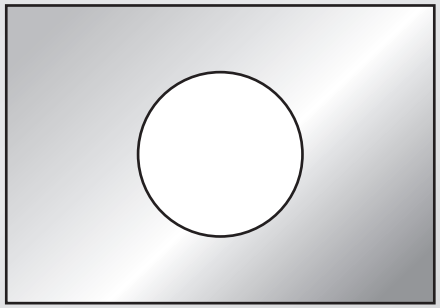
It’s easy to fire up the audience!

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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Let's try it!

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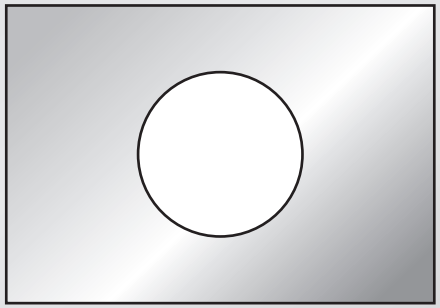
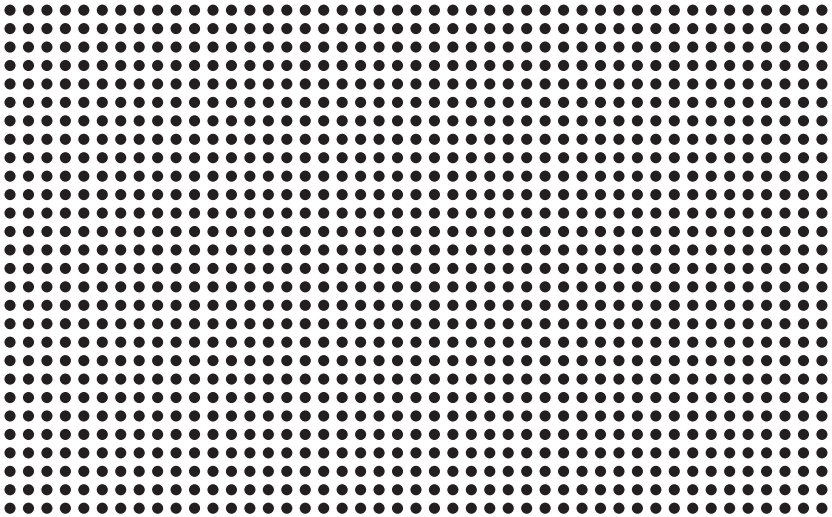


When the plate is uniformly heated, the diameter of the hole

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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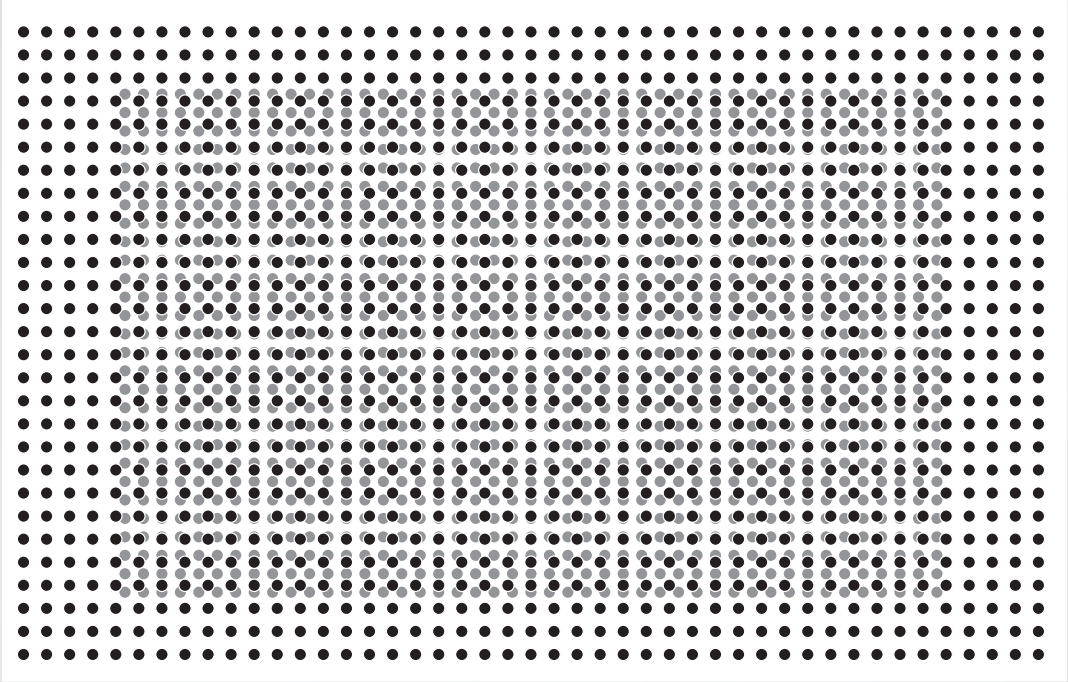
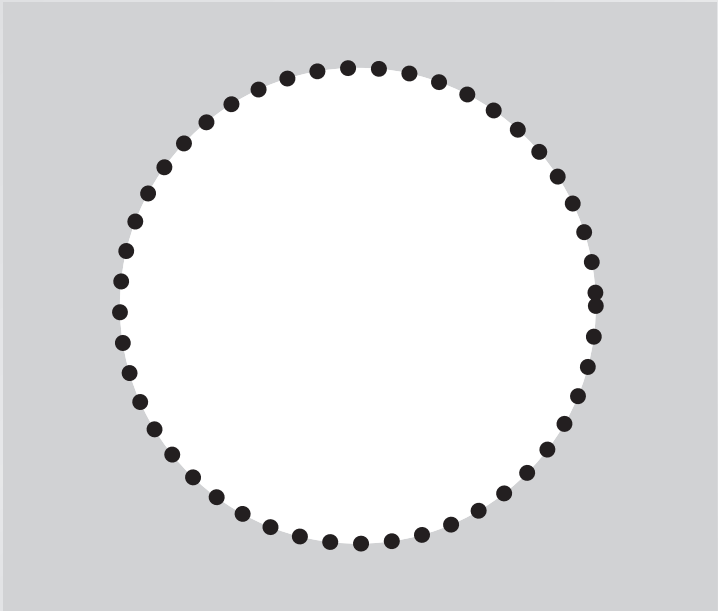


Let's try it!

consider the atoms at the rim of the hole



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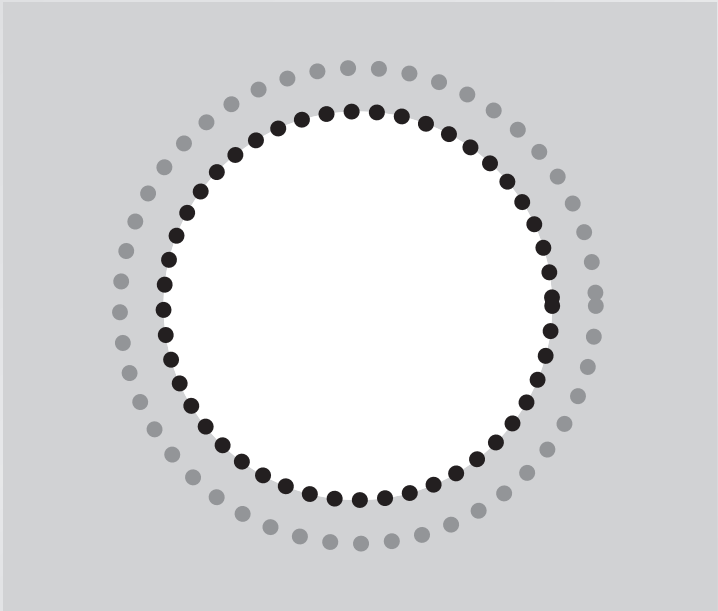

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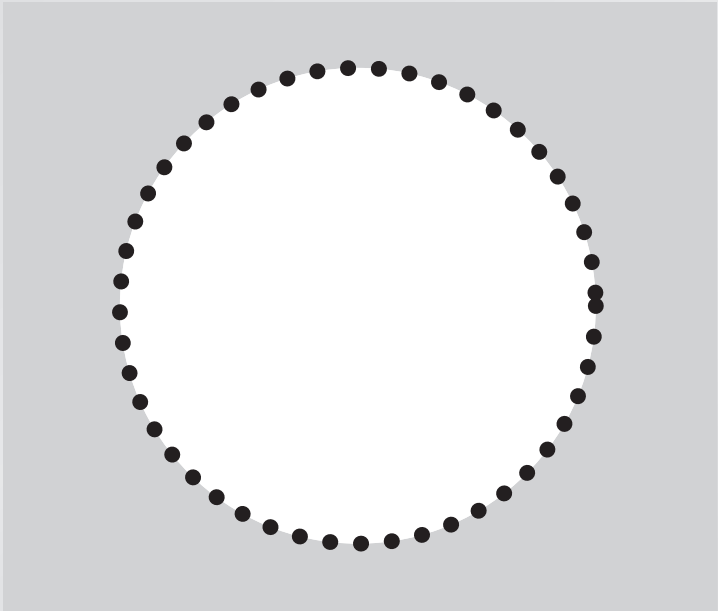

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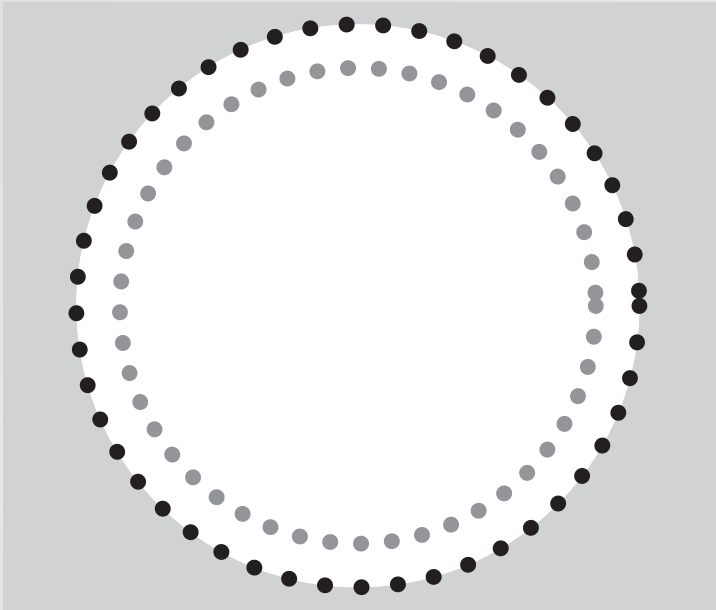


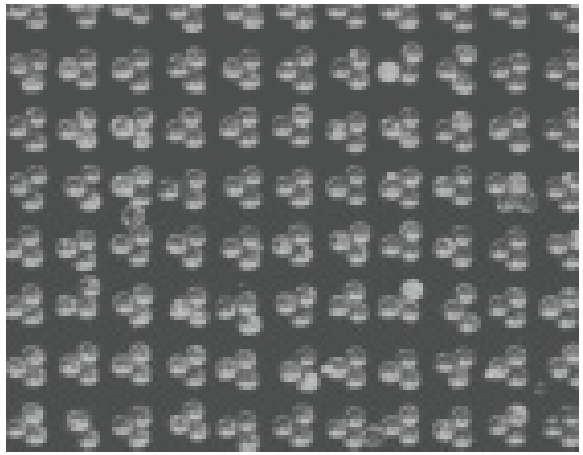
PI & JiTT Overview

Do you need a correct answer?

(or can you use this is social psychology, etc.?)

PI & JiTT Overview

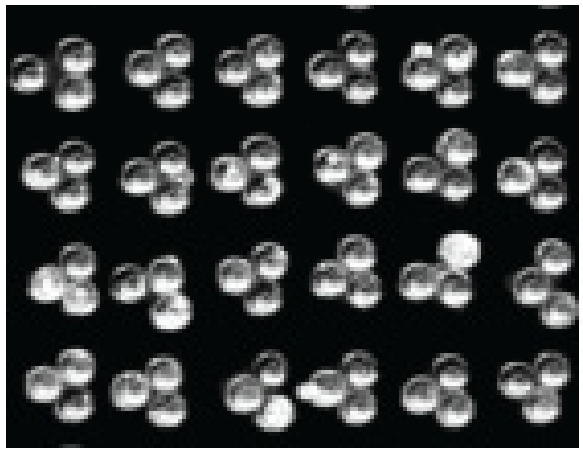
original



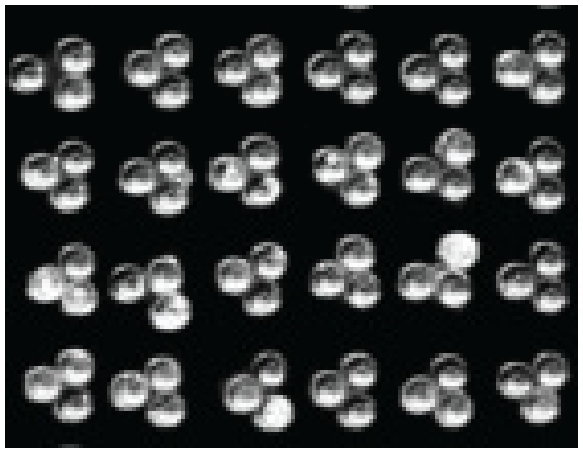
1. adjust contrast

2. remove blemishes

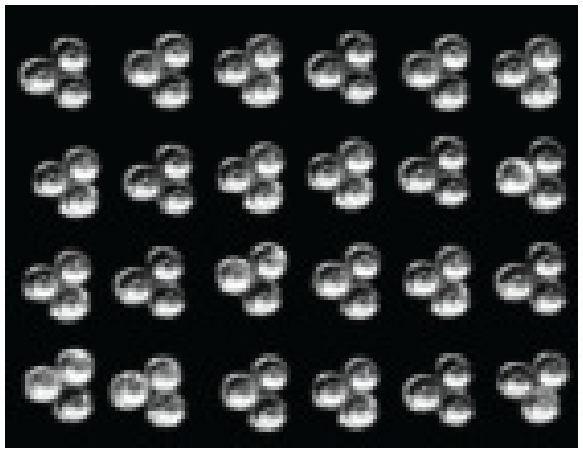
3. crop



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!

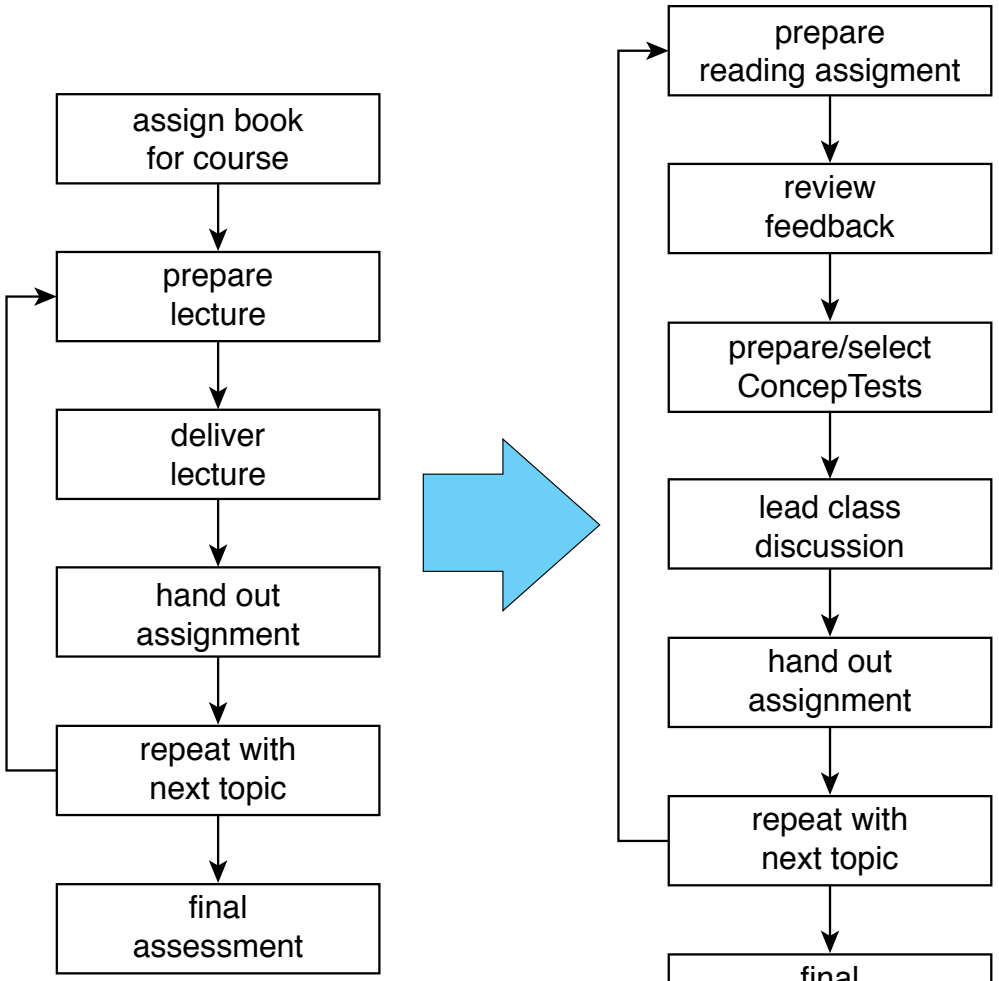
PI & JiTT Overview

Benefits:

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

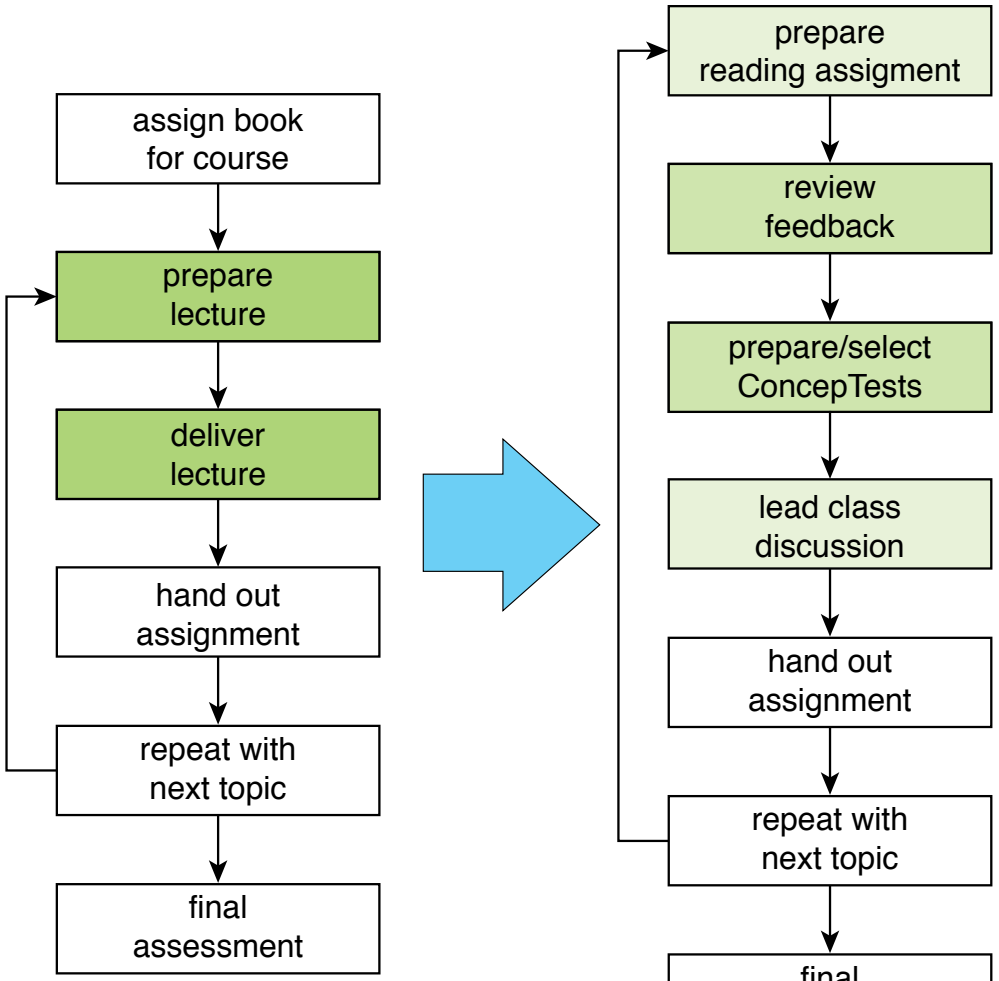
Implementing PI & JiTT

transitioning: where does the effort go?



Implementing PI & JiTT

transitioning: where does the effort go?



Implementing PI & JiTT

“ I haven’t done it, so I am very anxious if I’ll have the time to read students’ answers and immediately work with them. I am very nervous about the implementation and if it will work during class”

Implementing PI & JiTT

New activities:

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

Implementing PI & JiTT

"Can you elaborate on the trade-off between content and the application of Peer instruction"

Implementing PI & JiTT

“How do I use clickers?”

Get your clickers ready!

www.ltichile.cl

Implementing PI & JiTT

"How do I measure or assess students learning that is coherent with this system of 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

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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

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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?)

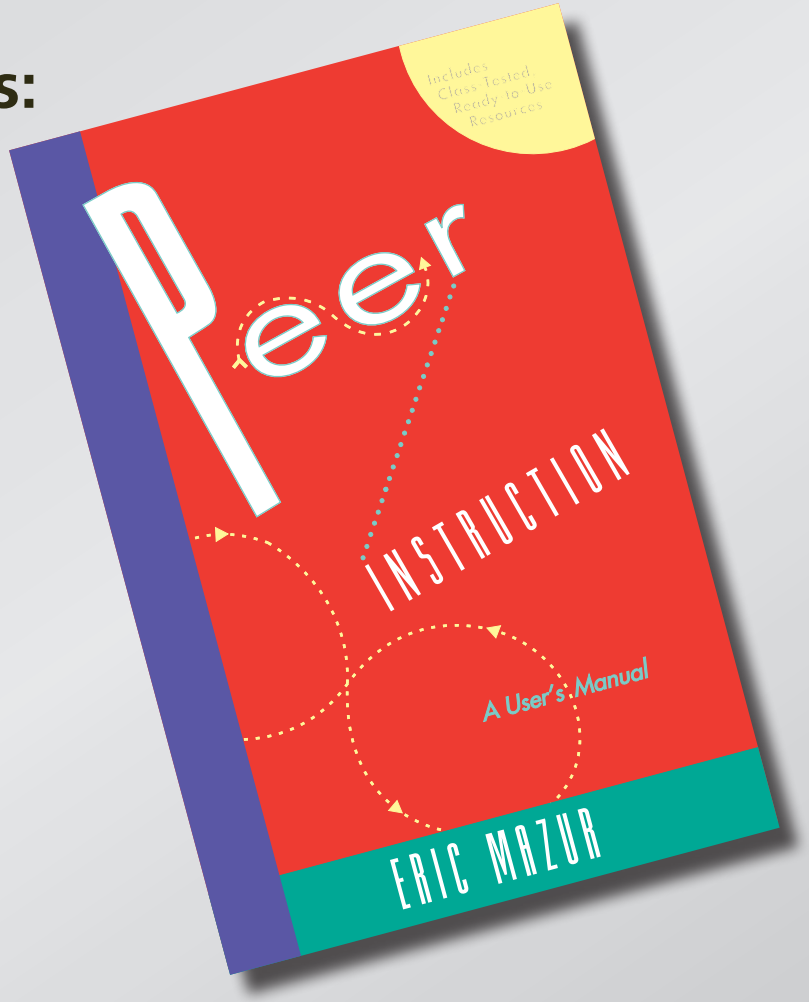
Implementing PI & JiTT

“How do I design effective ConcepTests?”

Finding ConcepTests

Books with ConcepTests:

- **Physics (Prentice Hall)**



Finding ConcepTests

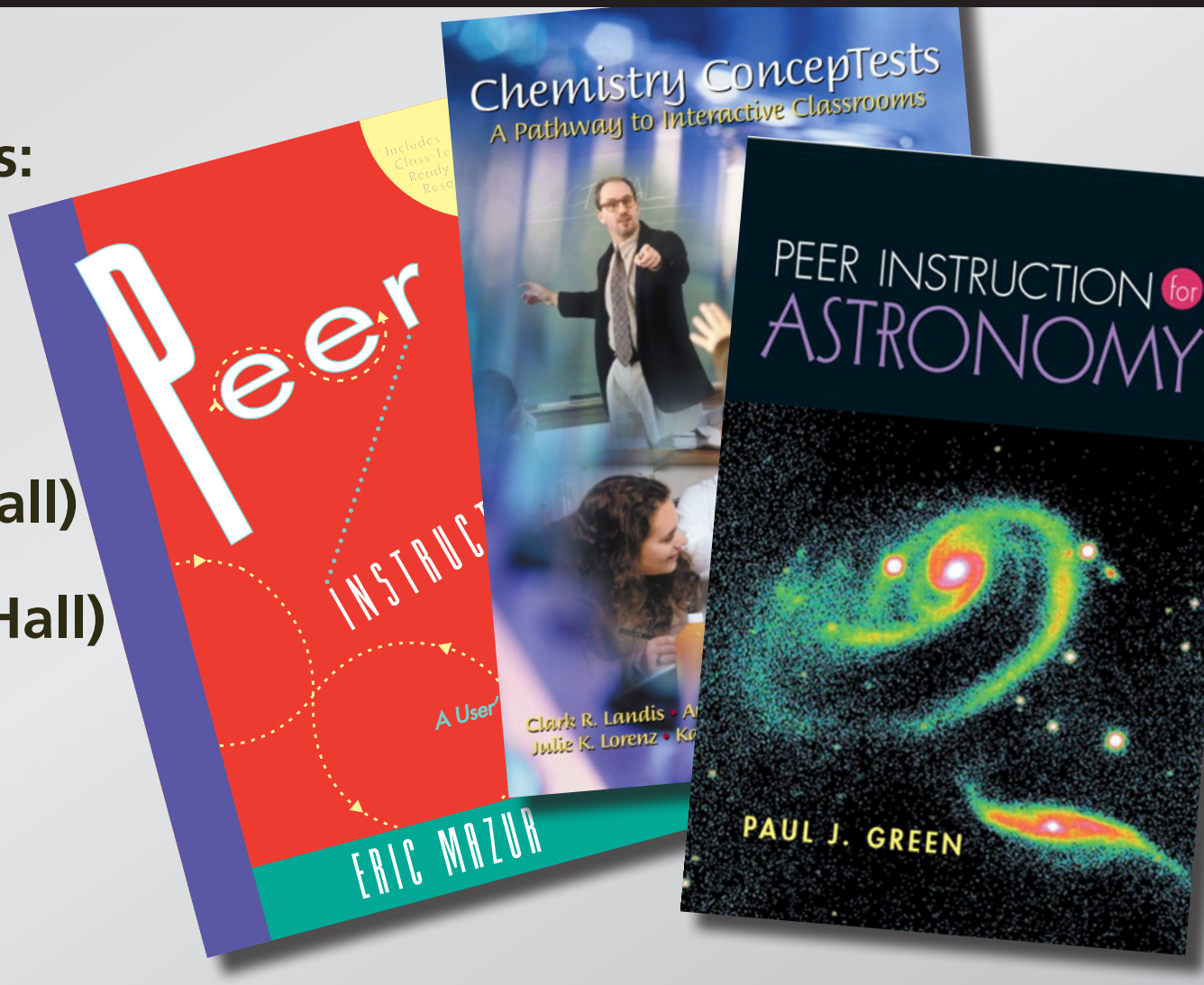
Books with ConcepTests:

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

Finding ConcepTests

Books with ConcepTests:

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



Finding ConcepTests

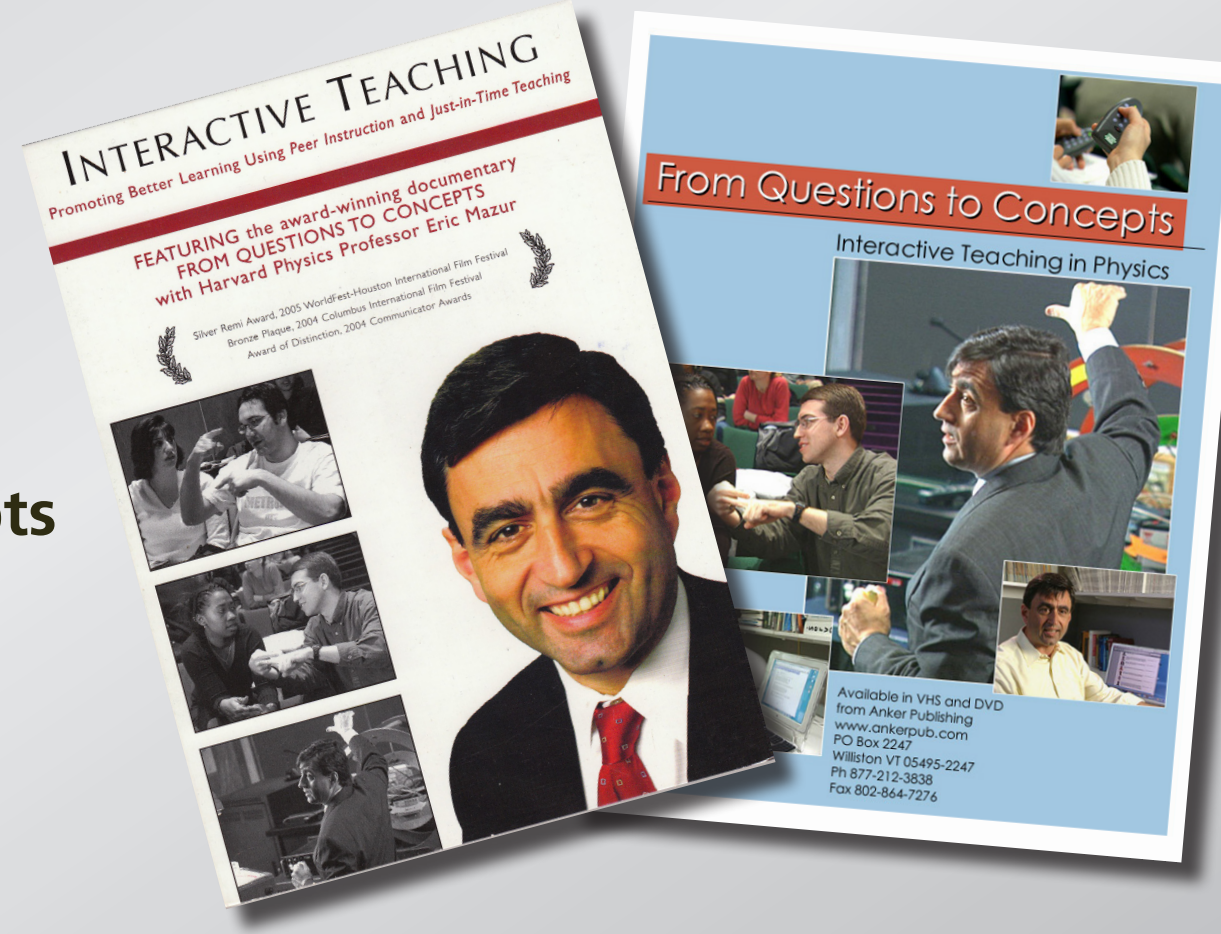
Books with ConcepTests:

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

Finding ConcepTests

Videos:

- **Interactive Teaching DVD**
- **From questions to concepts**



Finding ConcepTests

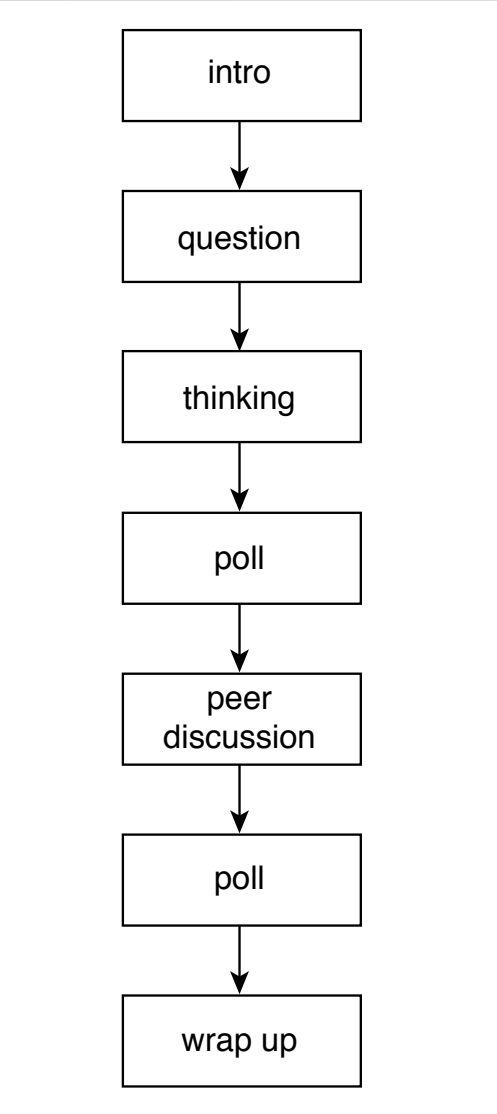
Google:

<your discipline> + ConcepTest

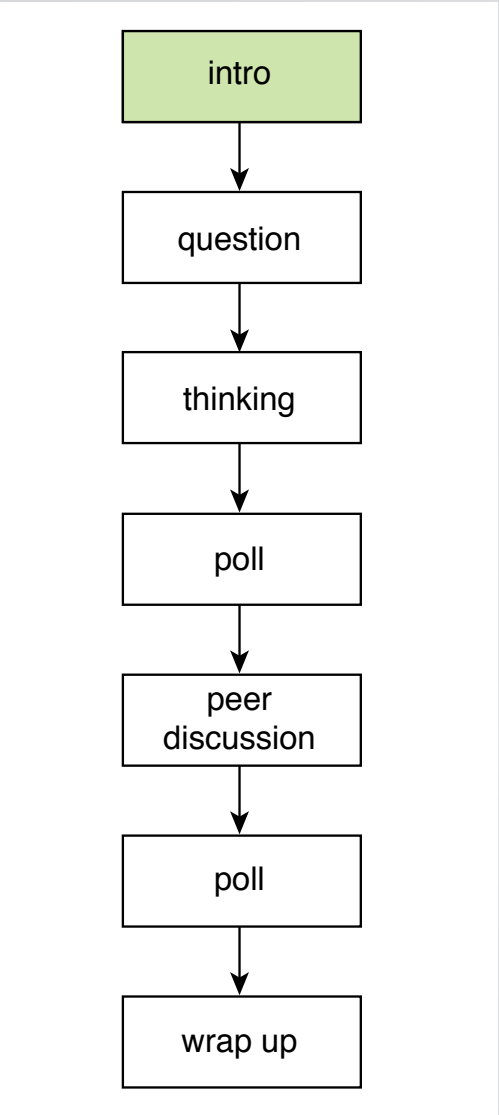
<your discipline> + “Concept Test”

<your discipline + “Peer Instruction”

Anatomy of a ConcepTest

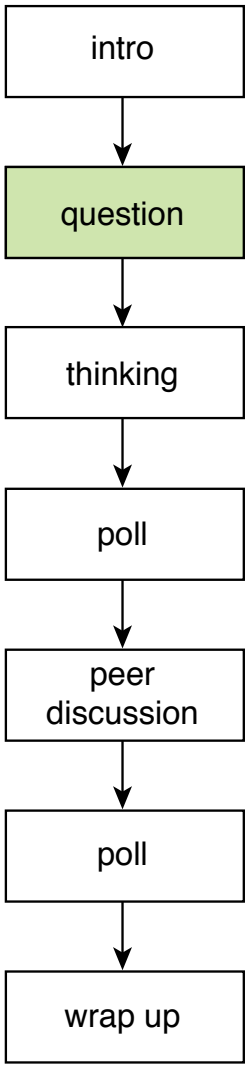


Anatomy of a ConcepTest



setting context

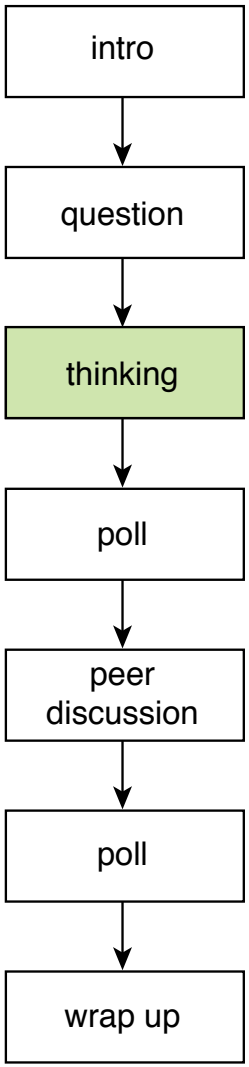
Anatomy of a ConcepTest



setting context

posing question

Anatomy of a ConcepTest

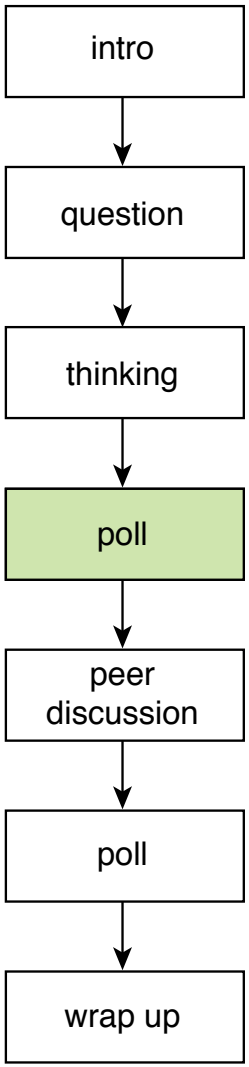


setting context

posing question

reflection

Anatomy of a ConcepTest



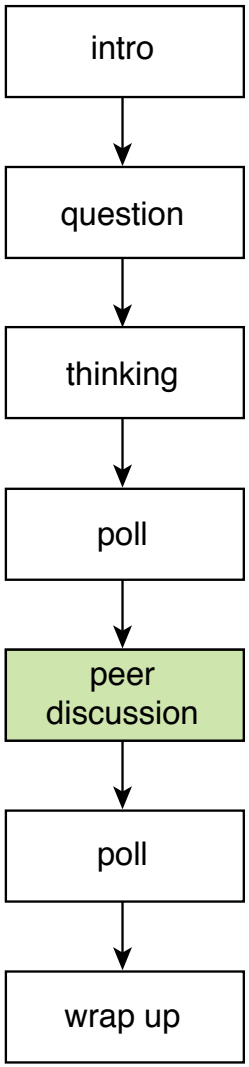
setting context

posing question

reflection

baseline data

Anatomy of a ConcepTest



setting context

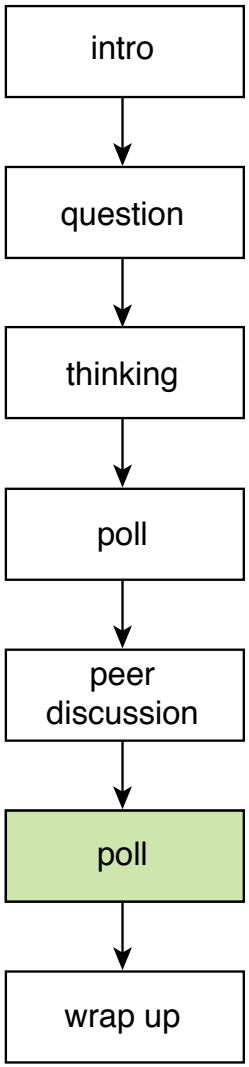
posing question

reflection

baseline data

peer instruction

Anatomy of a ConcepTest



setting context

posing question

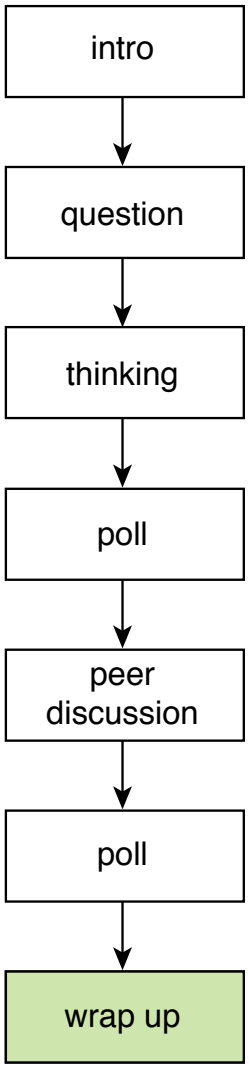
reflection

baseline data

peer instruction

gain data

Anatomy of a ConcepTest



setting context

posing question

reflection

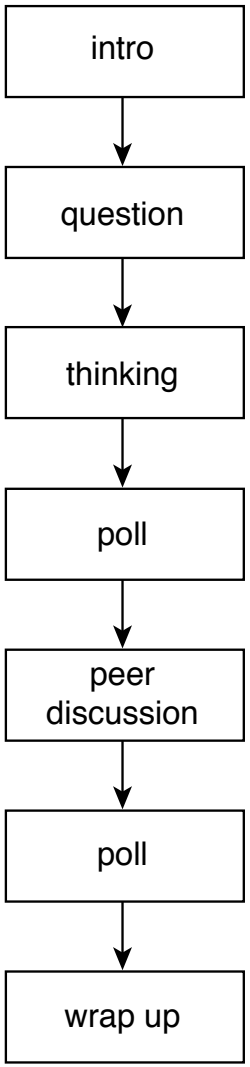
baseline data

peer instruction

gain data

closure

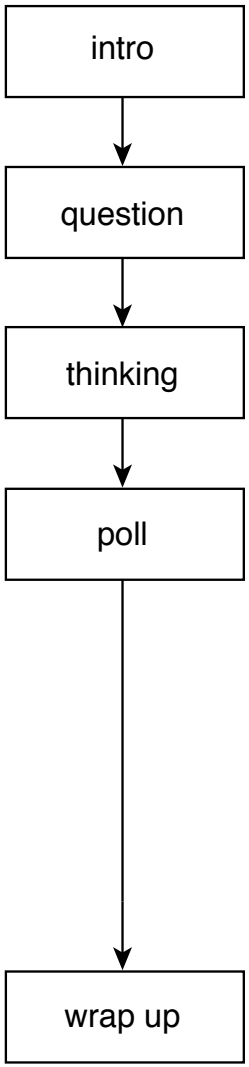
Anatomy of a ConcepTest



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)

Anatomy of a ConcepTest

potential shortcuts

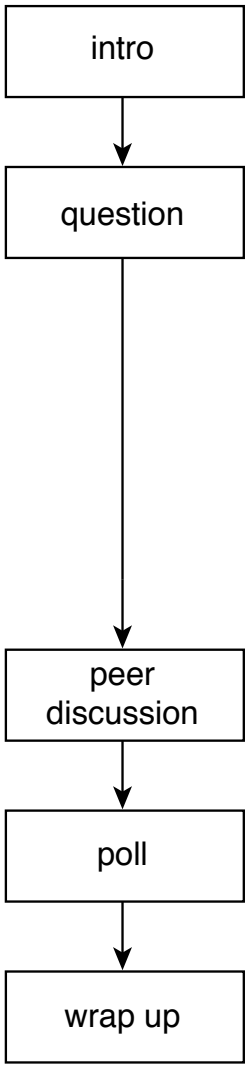


2–3 min saved, but…

takes the “Peer” out of “Peer Instruction”

Anatomy of a ConcepTest

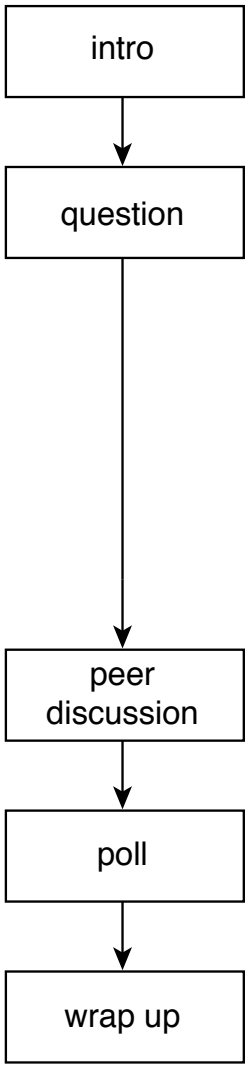
potential shortcuts



launch straight into discussion?

Anatomy of a ConcepTest

potential shortcuts

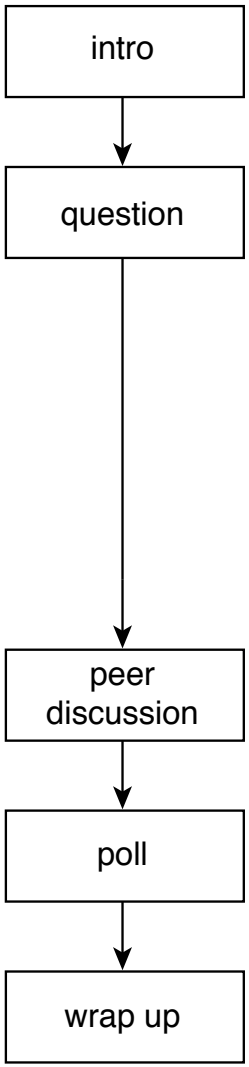


1–2 min saved, but…

no opportunity to commit before discussion

Anatomy of a ConcepTest

potential shortcuts



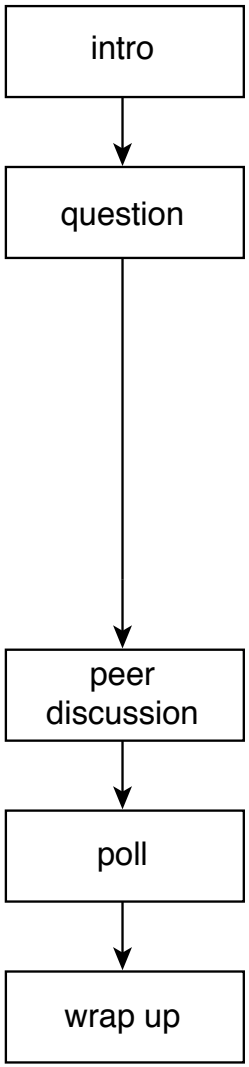
1–2 min saved, but…

no opportunity to commit before discussion

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

Anatomy of a ConcepTest

potential shortcuts



1–2 min saved, but…

no opportunity to commit before discussion

(and no information on effectiveness of CT!)

Anatomy of a ConcepTest

should count on about 15 min per ConcepTest

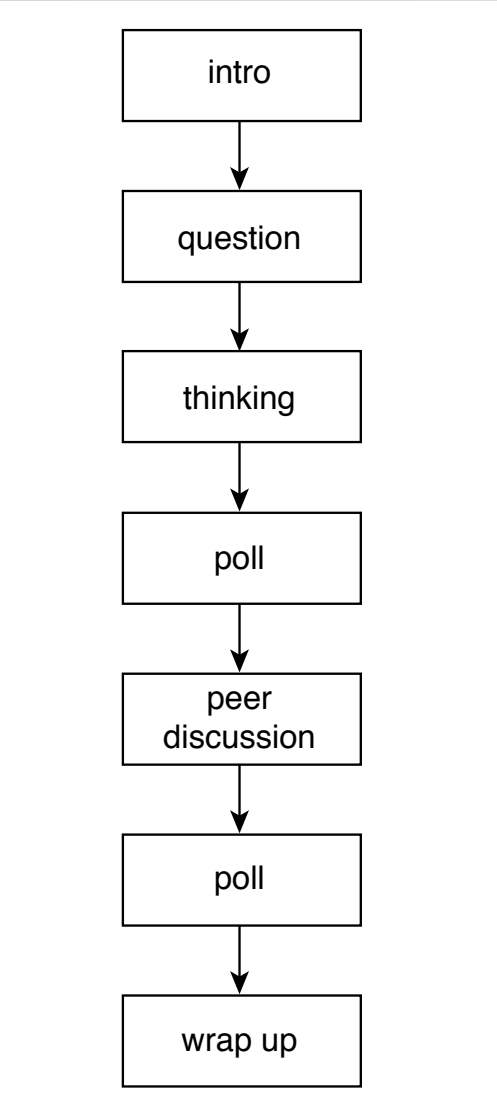
Anatomy of a ConcepTest

should count on about 15 min per ConcepTest

(including two pollings)

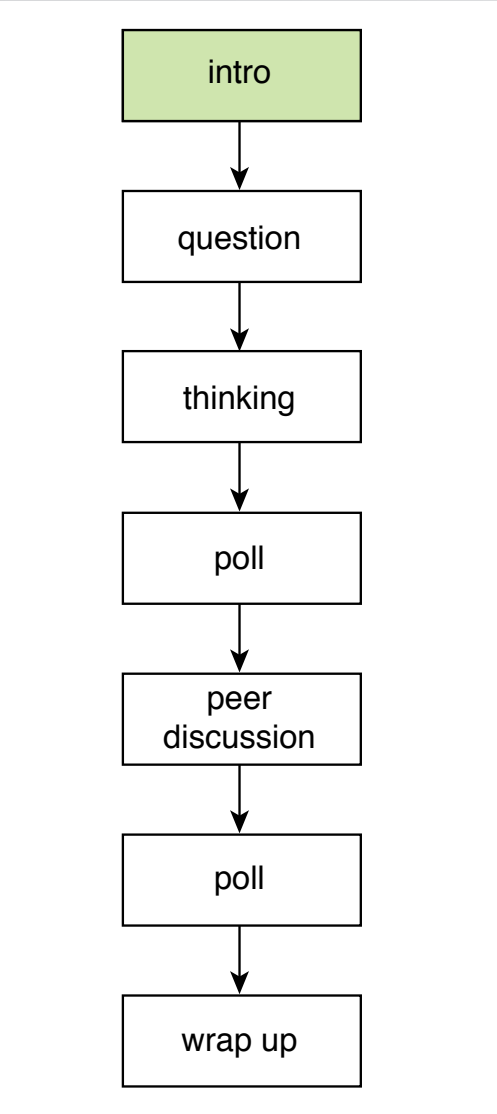
Effective implementation

engendering “deep learning”



Effective implementation

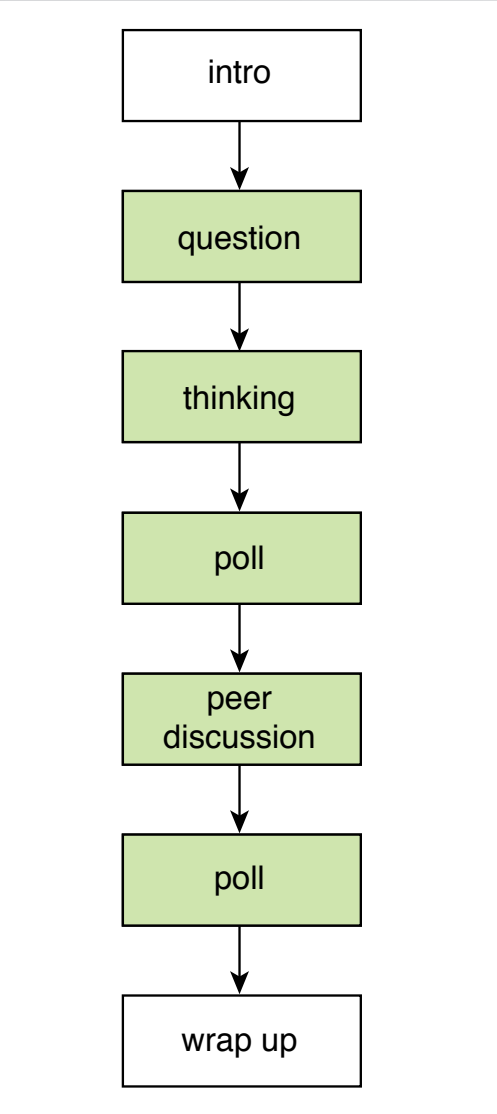
engendering “deep learning”



pre-class activity determines context

Effective implementation

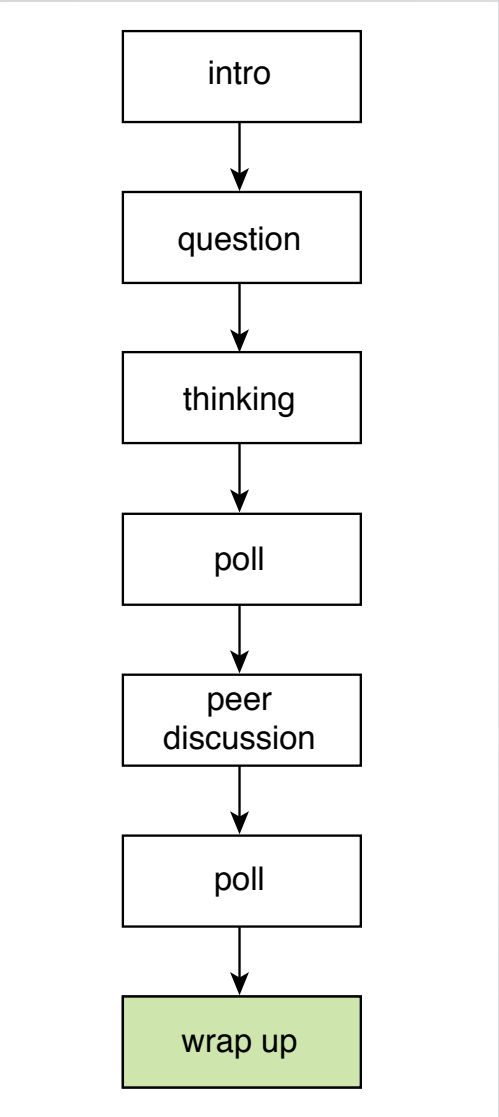
engendering “deep learning”



question transfers concepts to new context

Effective implementation

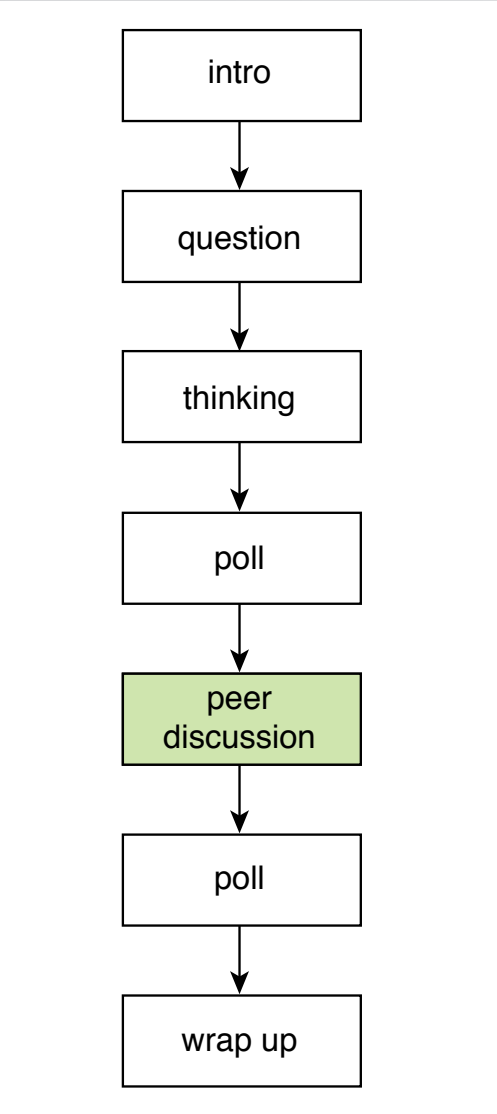
engendering “deep learning”



provide *your* explanation

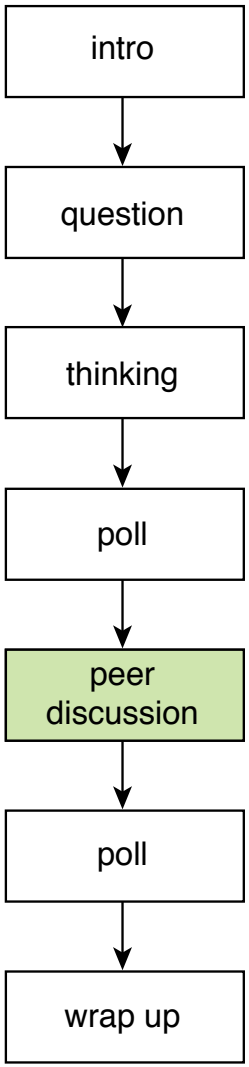
Effective implementation

importance of peer discussion



Effective implementation

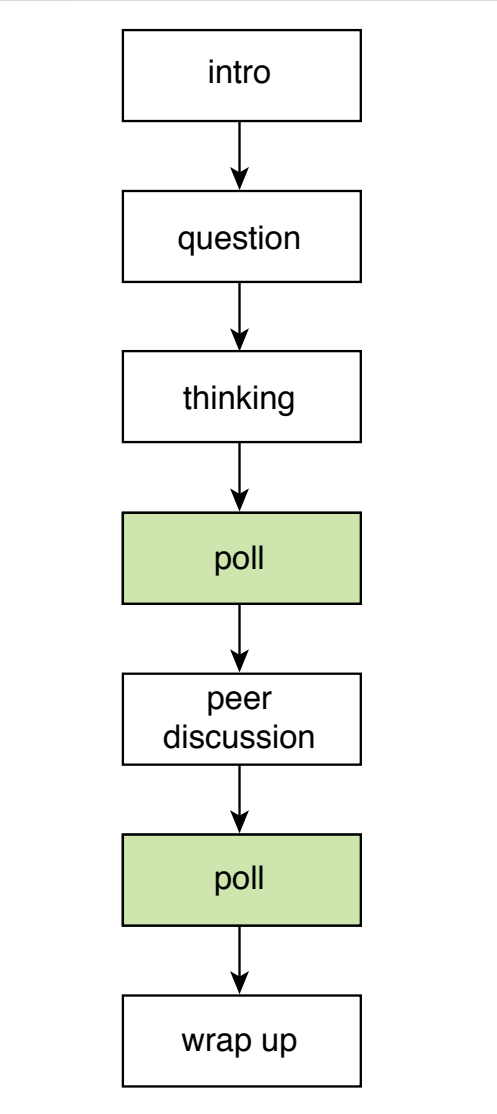
importance of peer discussion



vary activity

Effective implementation

importance of peer discussion



vary activity, measure poll-repoll gain

Effective implementation

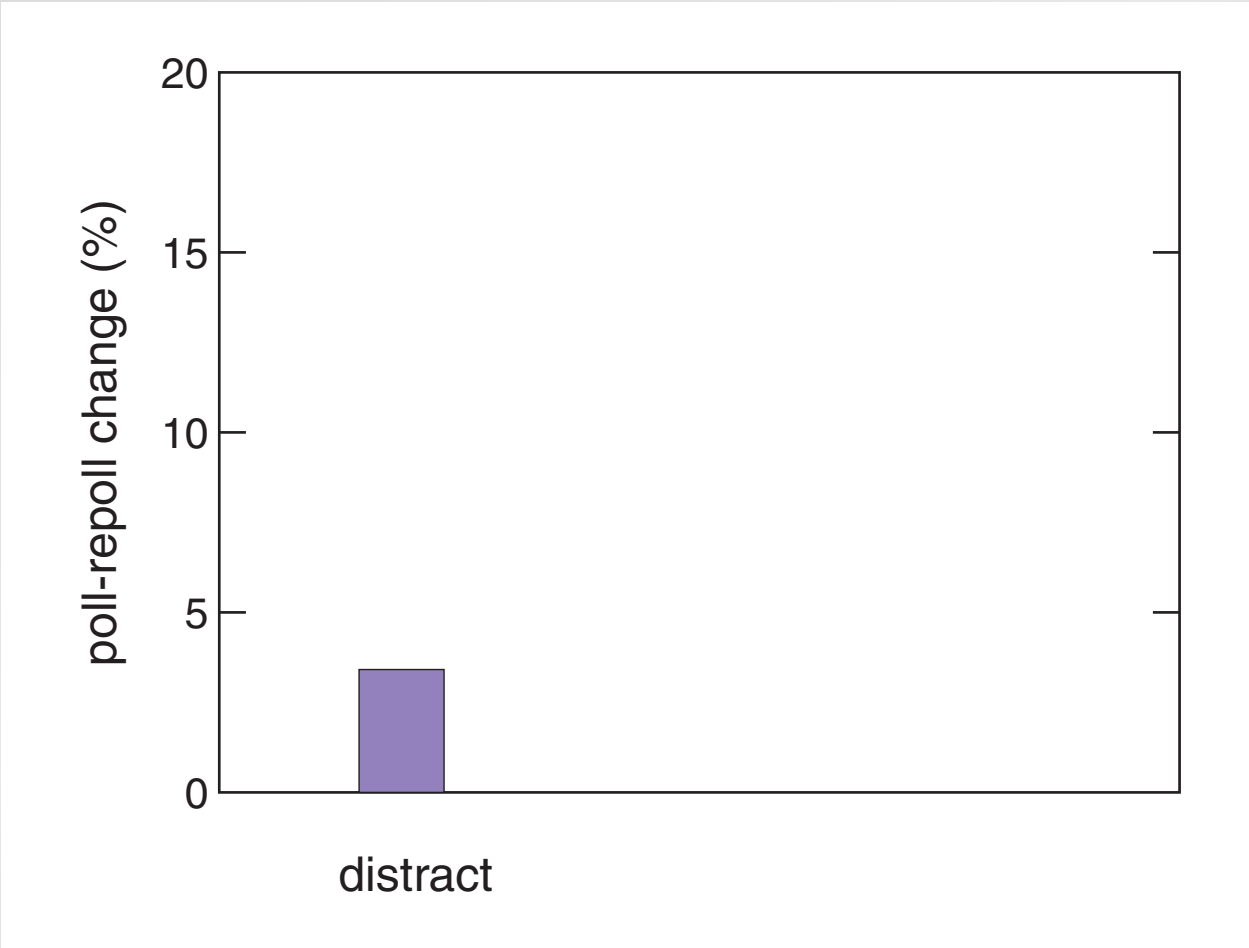
importance of peer discussion

compare poll-repoll gain for 3 activities:

- distract
- reflect
- discuss

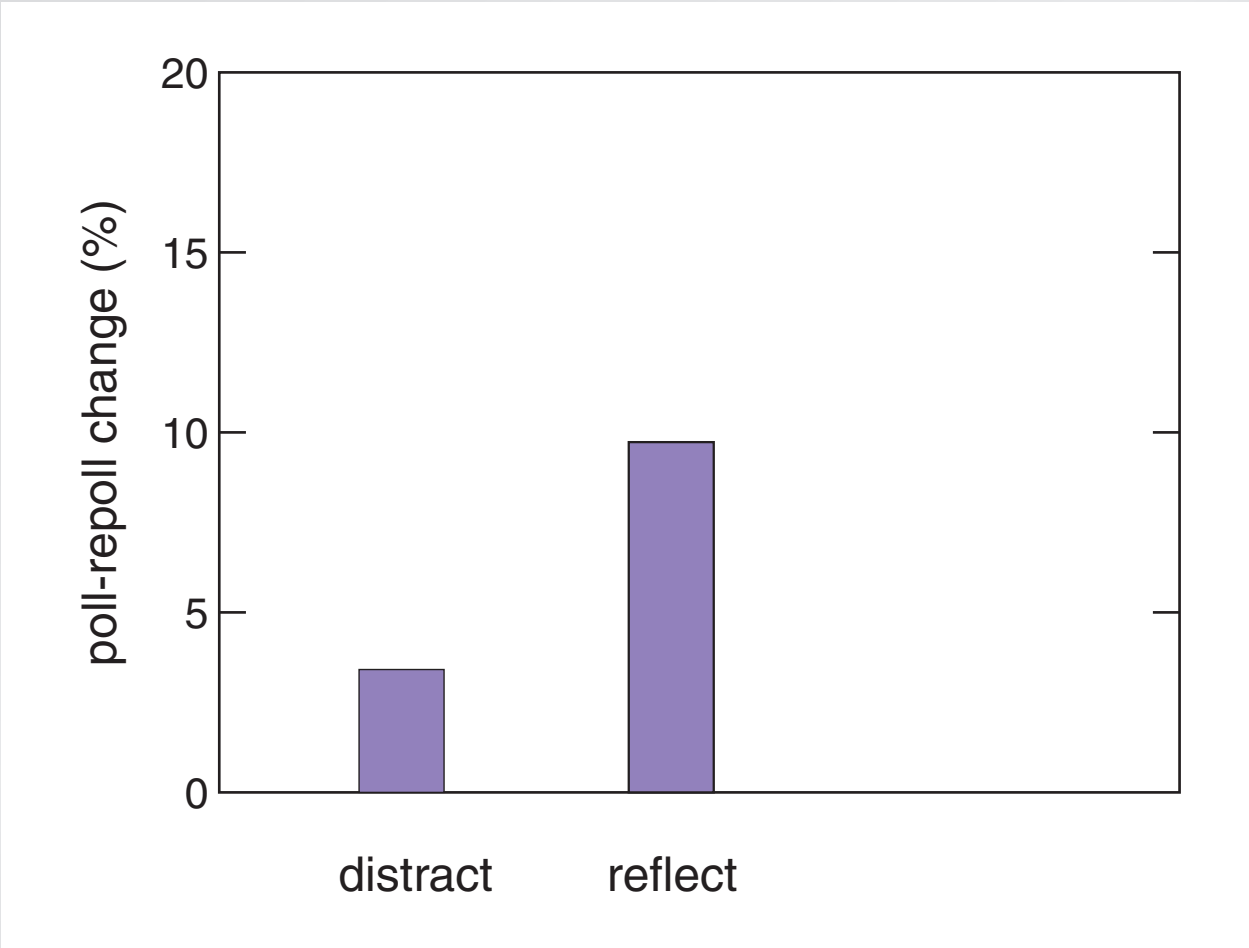
Effective implementation

importance of peer discussion



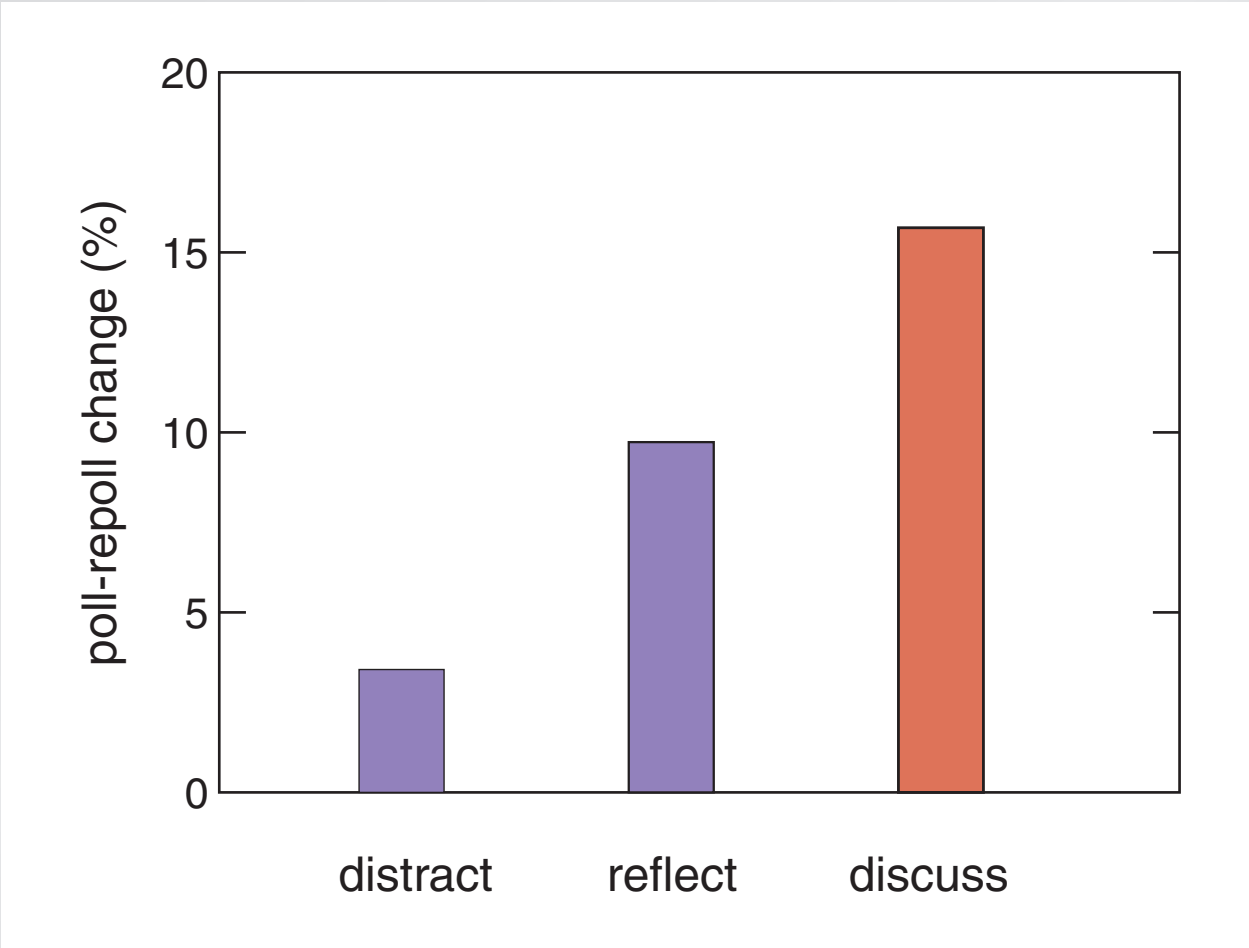
Effective implementation

importance of peer discussion



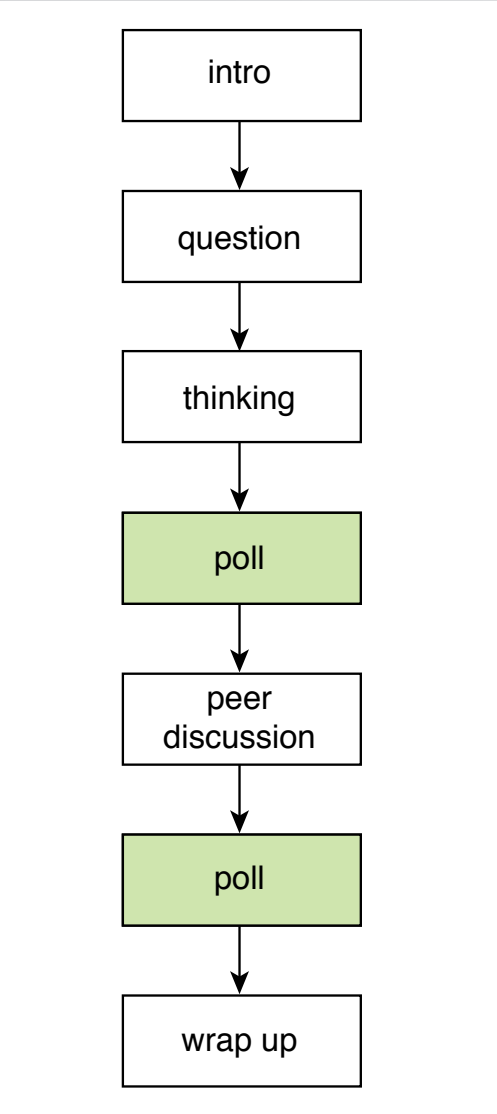
Effective implementation

importance of peer discussion



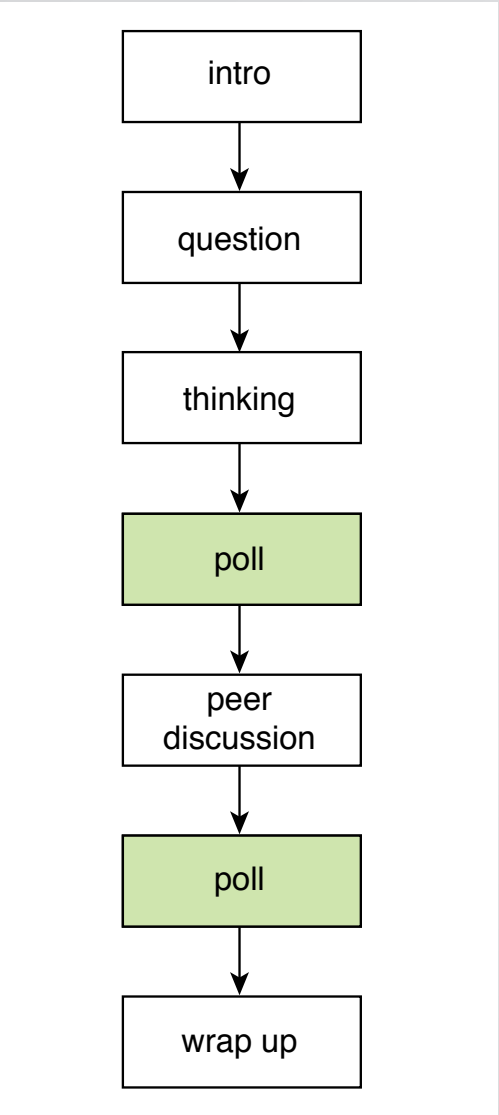
Effective implementation

technology important?



Effective implementation

technology important?



normalized FCI gain:

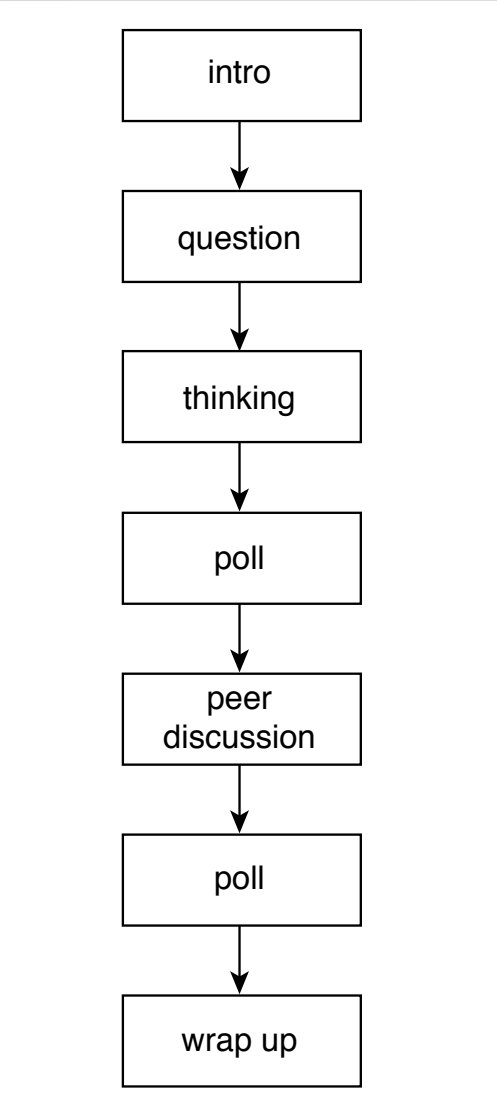
flashcards: 0.47

clickers: 0.44

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

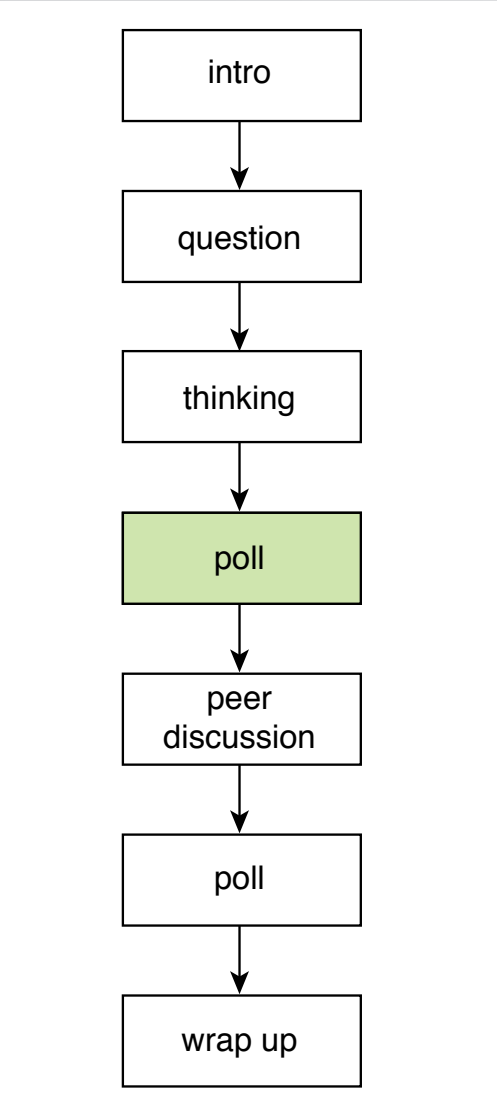
Effective implementation

show histograms?



Effective implementation

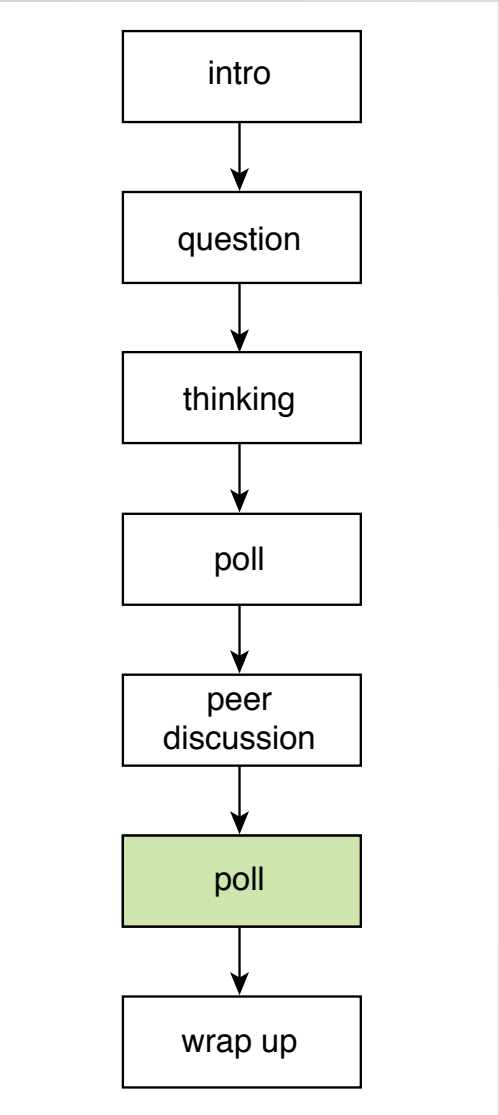
show histograms?



no — biases discussion

Effective implementation

show histograms?

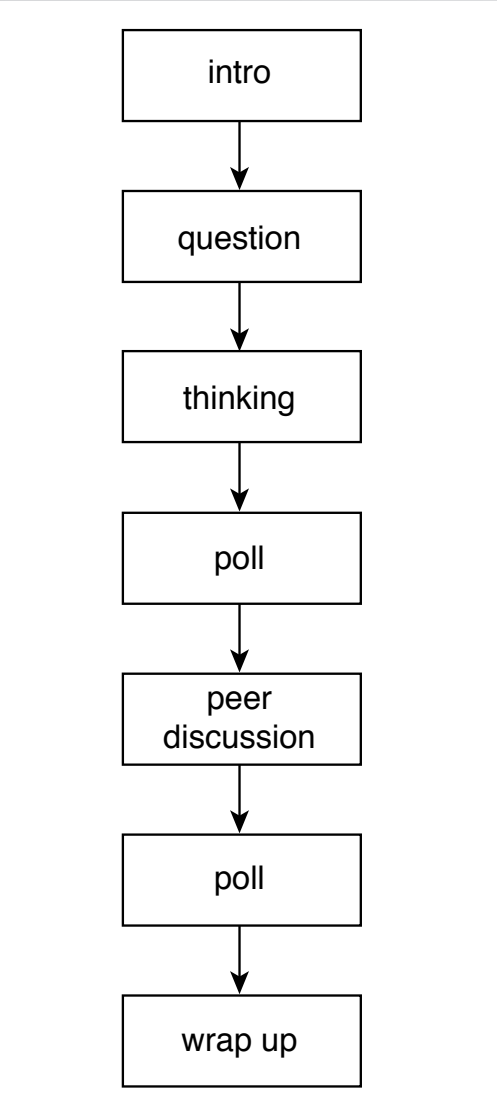


no — biases discussion

yes — helps bring closure

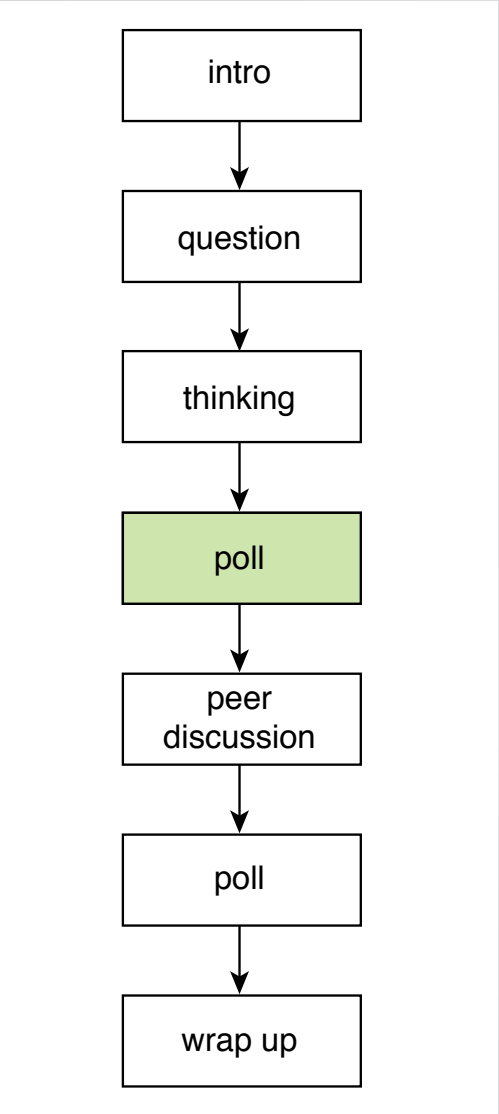
Effective implementation

have individual students defend choices?



Effective implementation

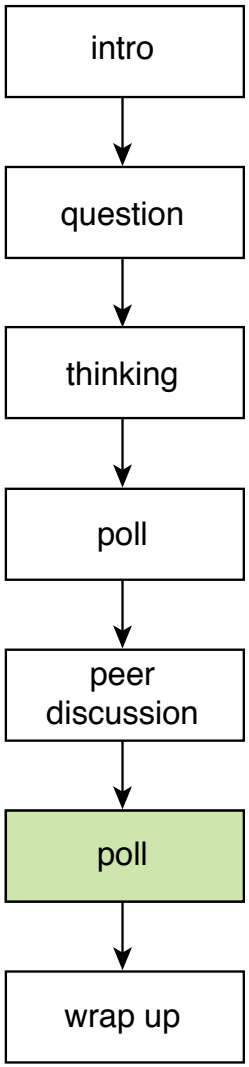
have individual students defend choices?



provides additional insights for discussion

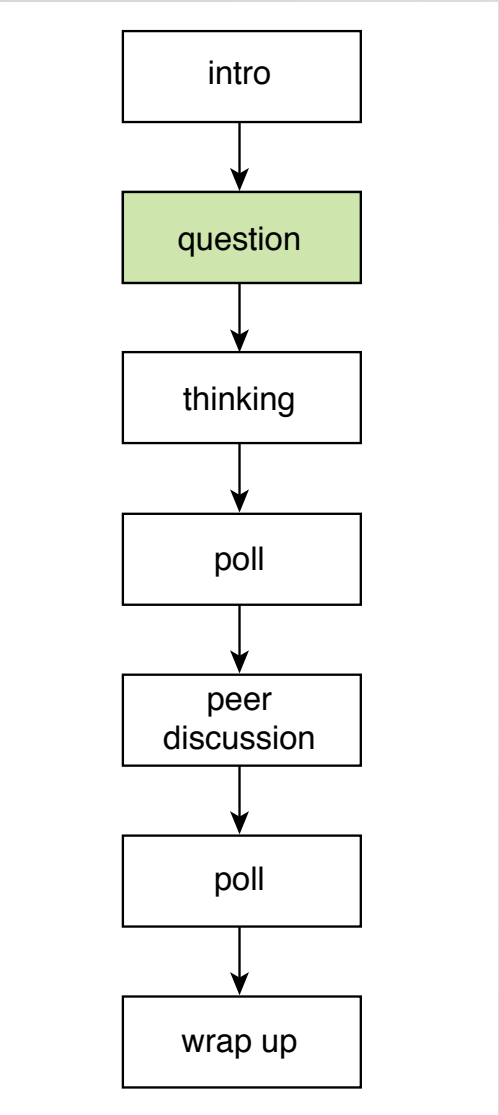
Effective implementation

have individual students defend choices?



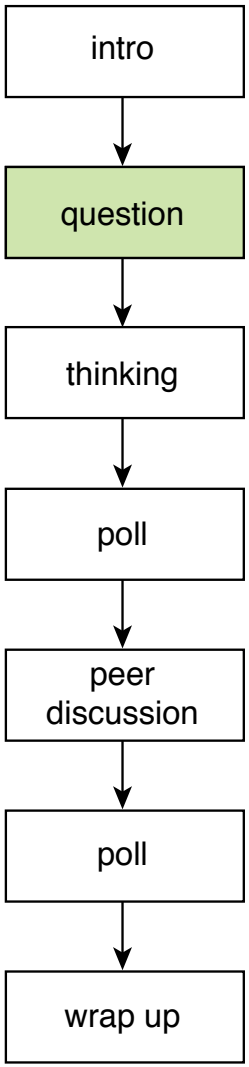
involves students in wrap up

Creating ConcepTests



what constitutes an effective ConcepTest?

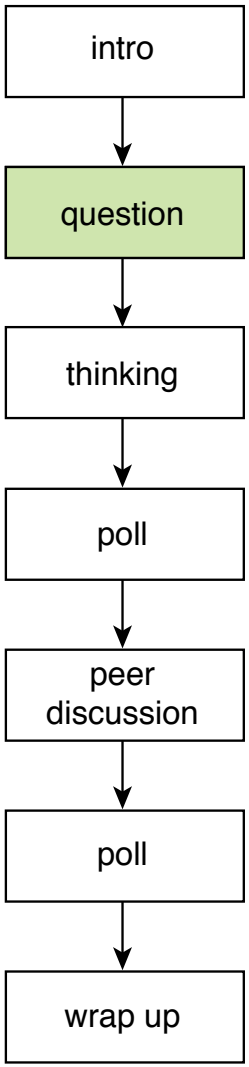
Creating ConcepTests



An effective ConcepTest…

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

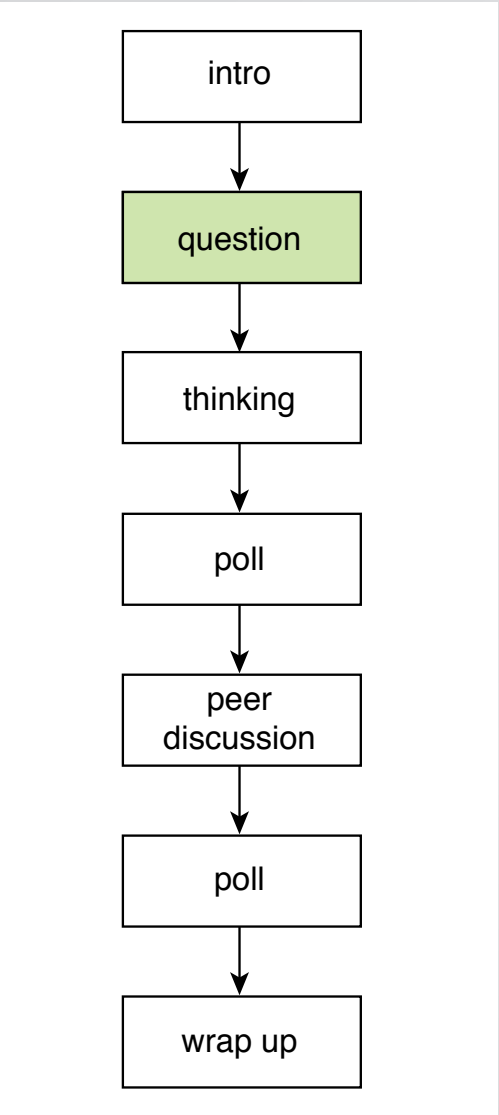
Creating ConcepTests



Sources of ConcepTests:

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

Creating ConcepTests



You can start with free response questions!

Creating ConcepTests

Types of questions

- survey
- discussion
- model testing
- select from list

Creating 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.

Creating 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.

Creating ConcepTests

hole in plate

microscopy image

airline

model

discussion

fact

Creating ConcepTests

hole in plate

model

microscopy image

discussion

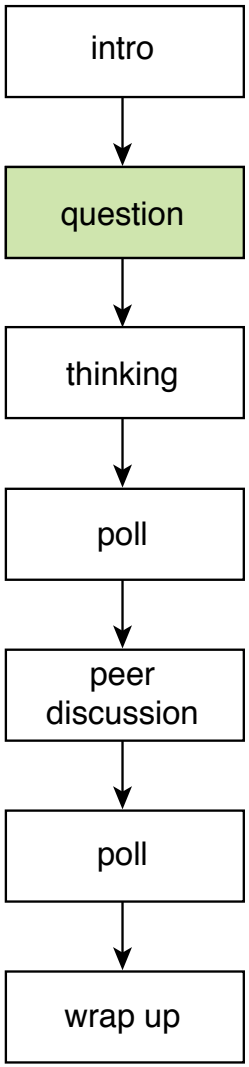
airline

fact

fact-recall not engaging

Creating ConcepTests

some basic design rules

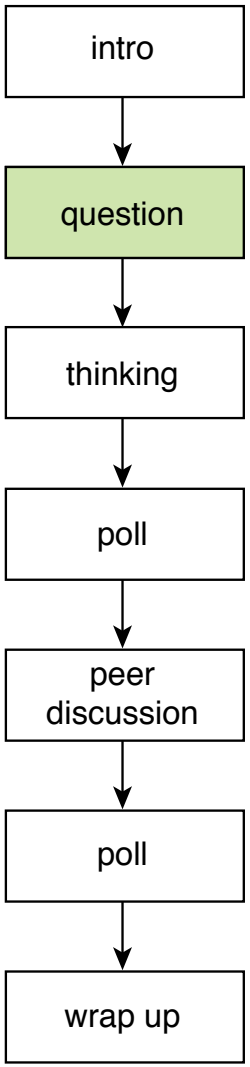


Remove:

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

Creating ConcepTests

some basic design rules

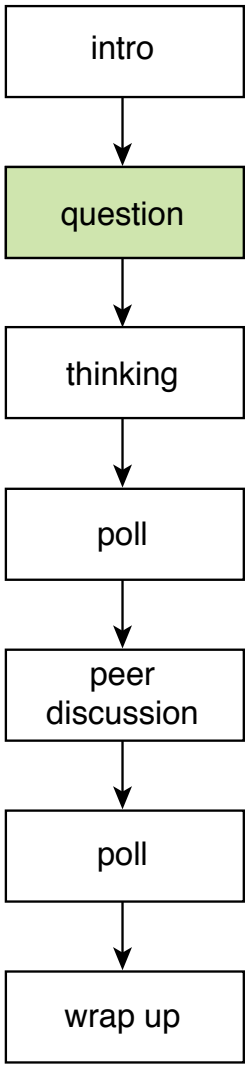


General tips:

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

Creating ConcepTests

some basic design rules

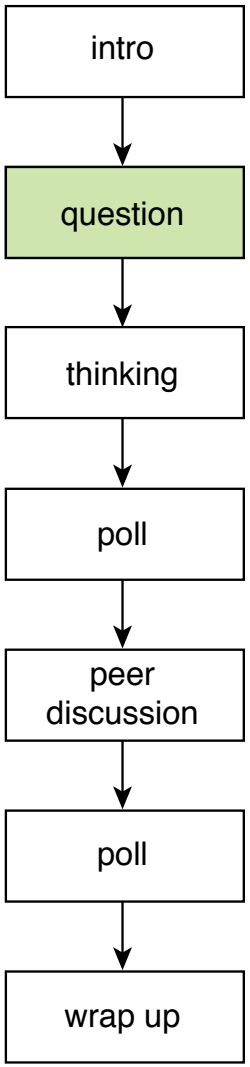


Writing good "stems":

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

Creating ConcepTests

some basic design rules

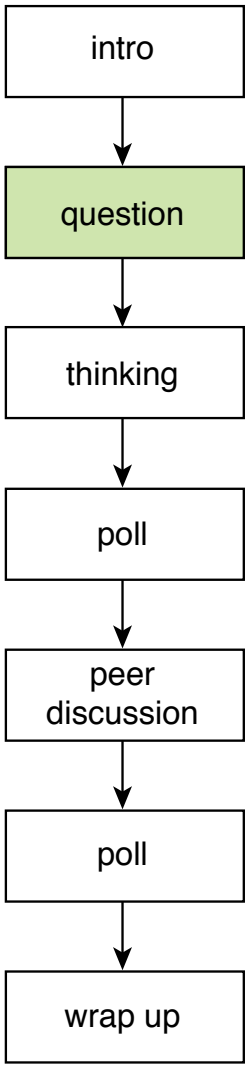


Writing good answer choices:

- 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”

Creating 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.

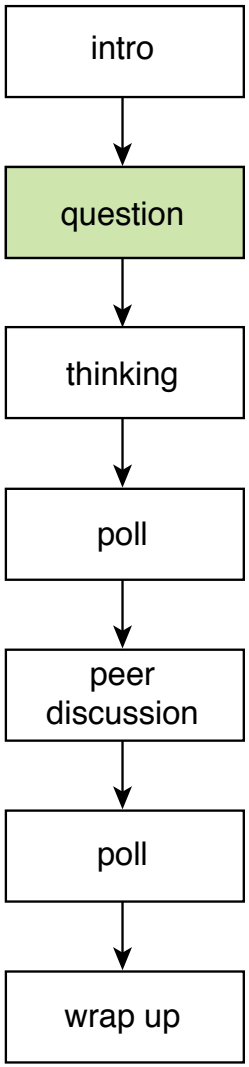
B. Only when *jushespora* change color.

C. When *jushespora* draw into a circle.

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

Creating ConcepTests

Example: another nonsense question



What is the color of *ermazoa*?

A. Blue.

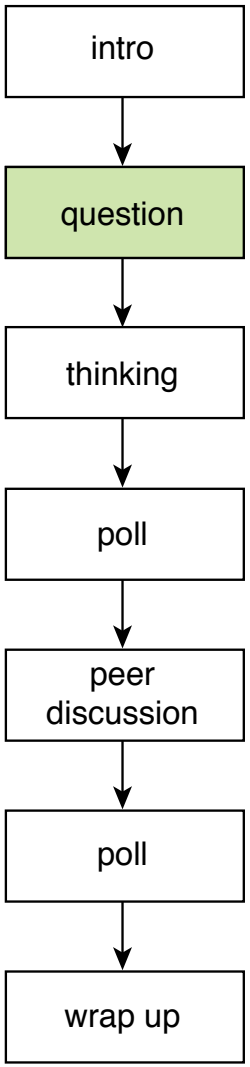
B. Red.

C. Green.

D. Yellow.

Creating ConcepTests

Example: a well-crafted question



Which statement refers to measurement as opposed to evaluation?

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

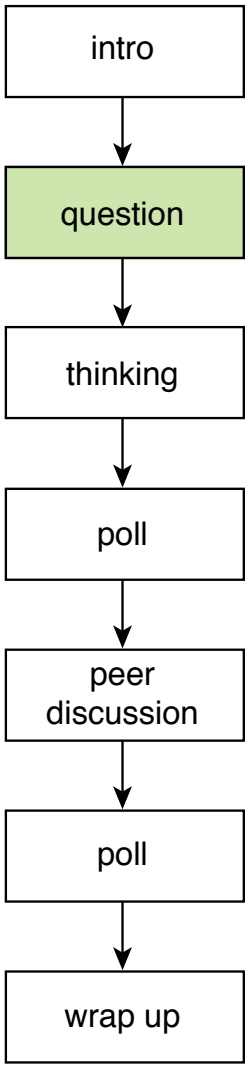
B. Mary's test scores have increased satisfactorily this year.

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.

Creating ConcepTests

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



1. context

2. question

3. closure

Creating ConcepTests

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

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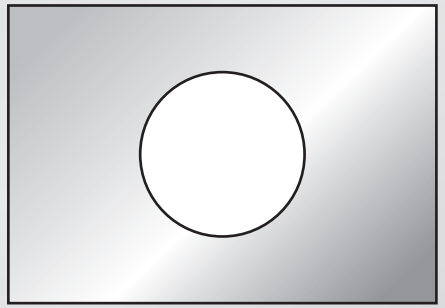
Consider a rectangular metal plate with a circular hole in it.



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

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

QUESTION

Creating ConcepTests

consider the atoms at the rim of the hole

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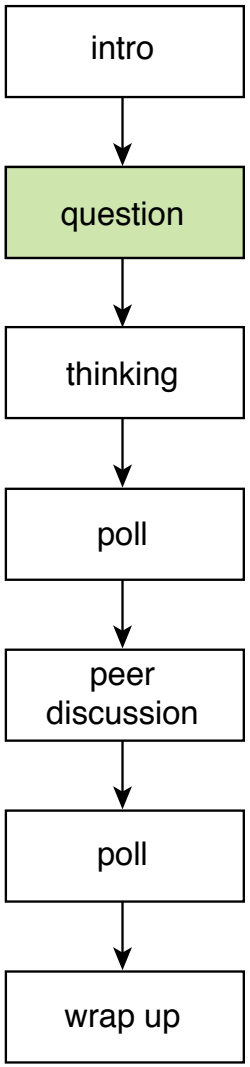

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