Before we start, please sign on to the online polling system (1 person/device):

1. Go to learningcatalytics.com/demo
2. Enter info, click “Start”
3. Join session 123456789

Also, be sure to sit near someone else so you have a discussion partner during the interactive parts.

Engaging Students One-on-One, All At Once

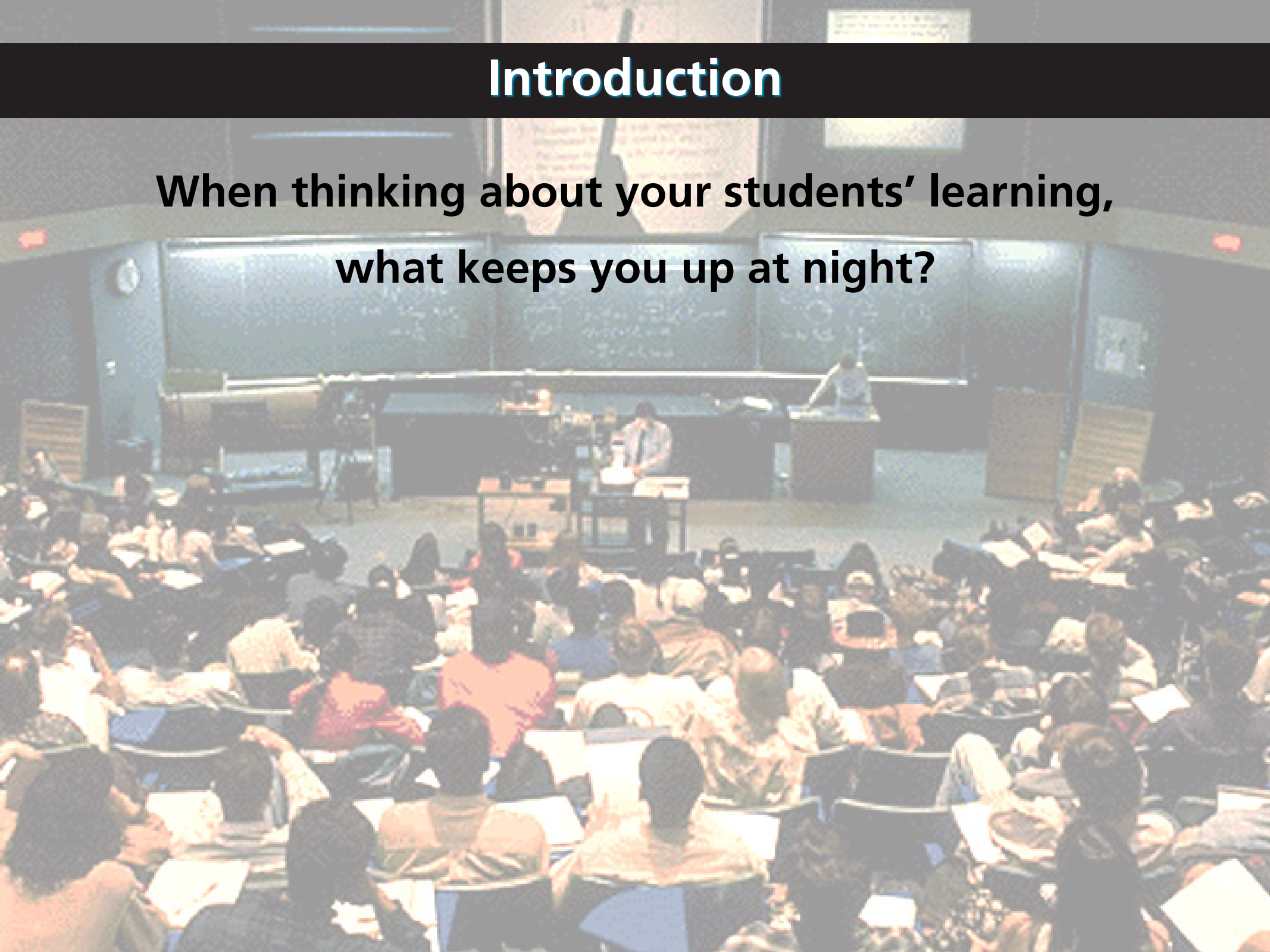
Peer Instruction Online Course
Singapore Polytechnic
12 November 2014

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

Peer Instruction Online Course
Singapore Polytechnic
12 November 2014

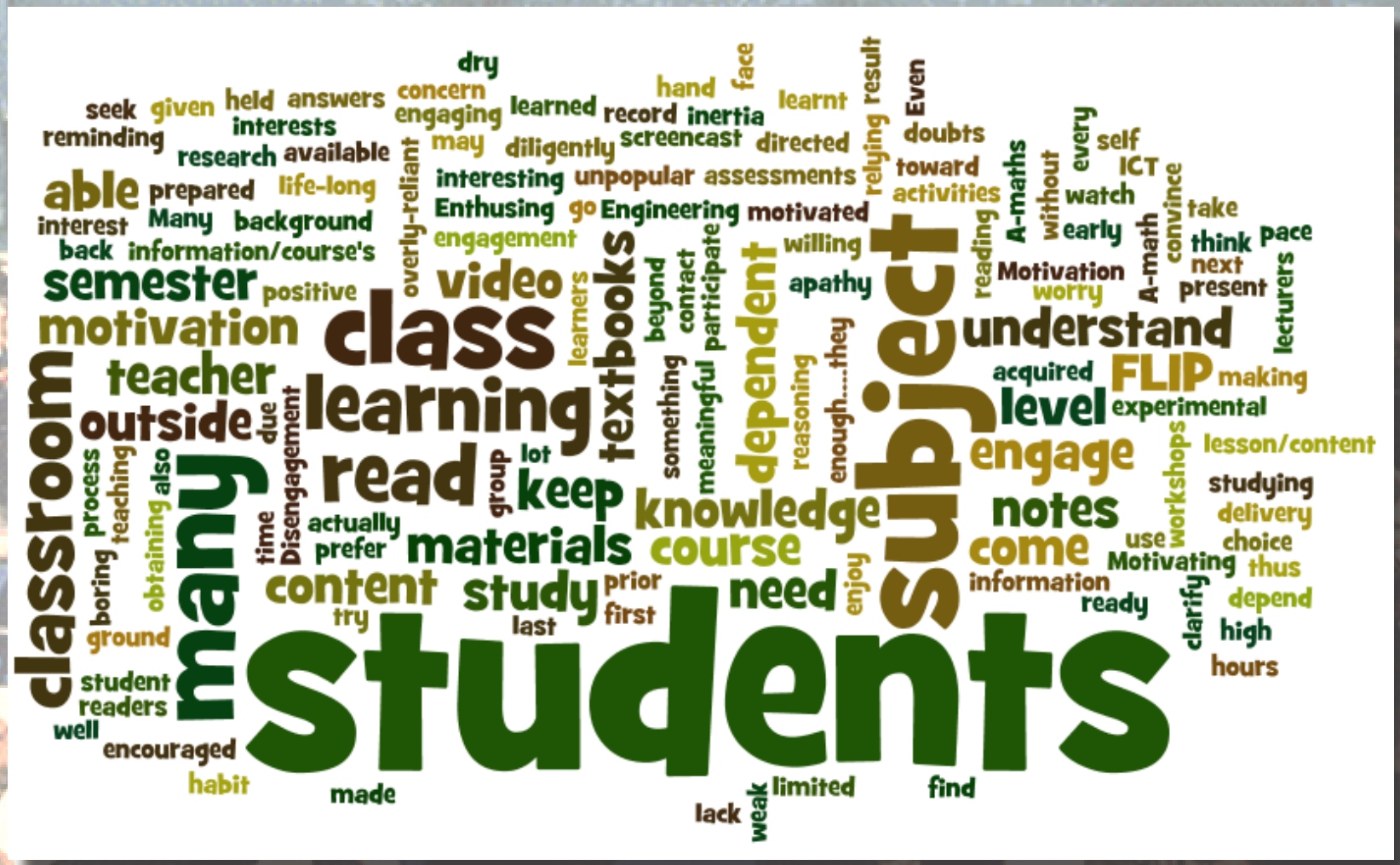
Introduction

When thinking about your students' learning, what keeps you up at night?

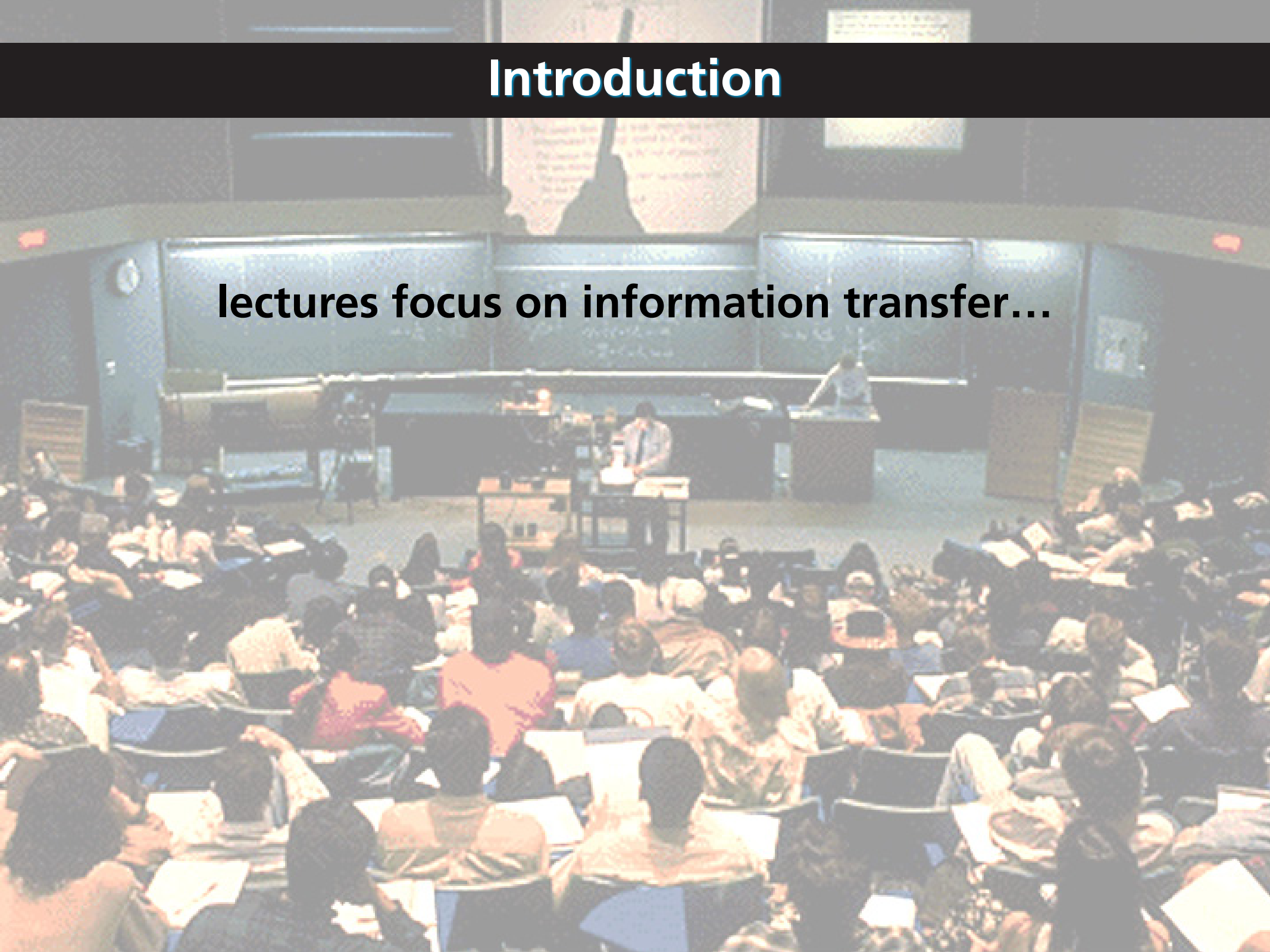


Introduction

When thinking about your students' learning, what keeps you up at night?

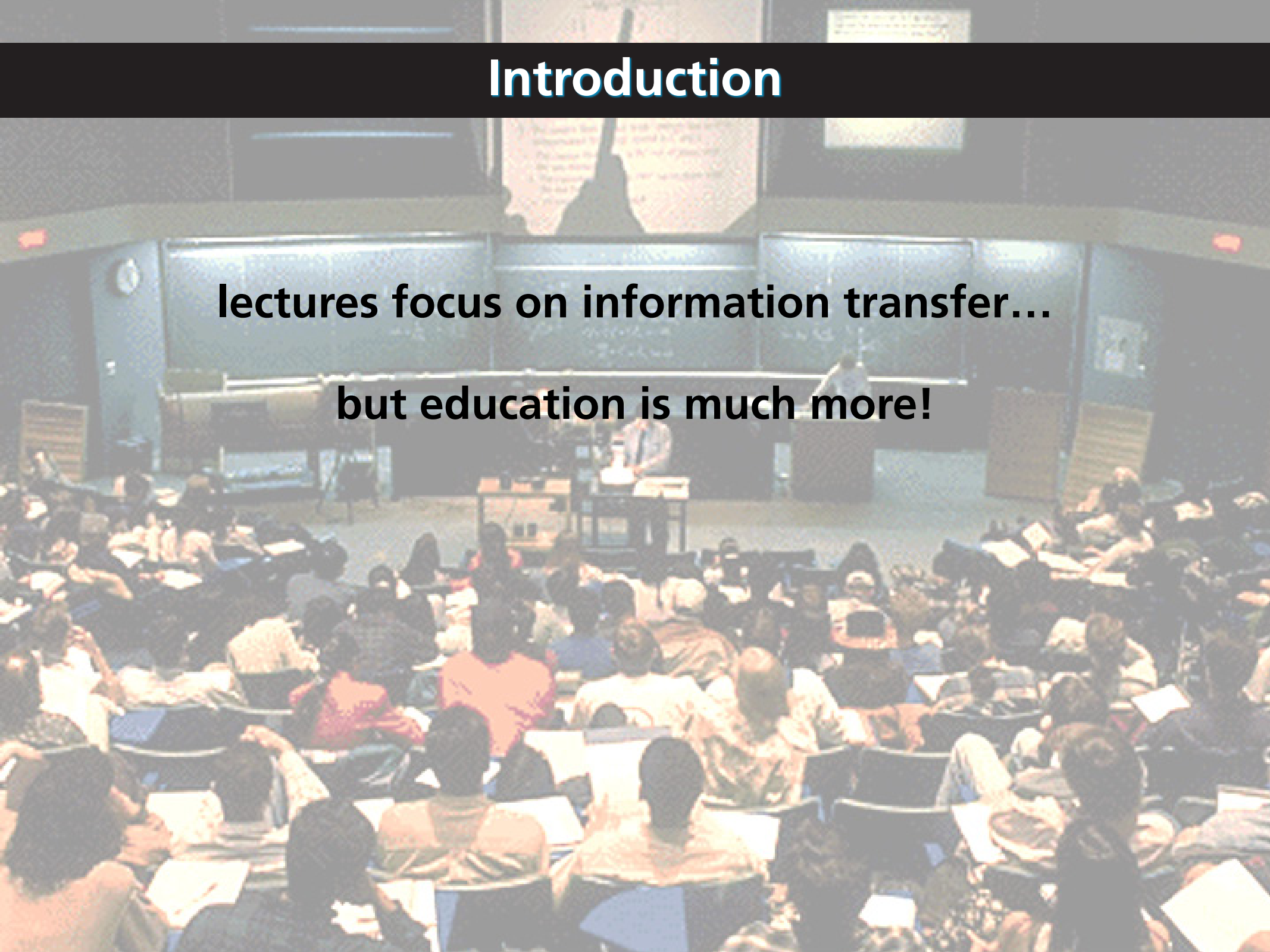


Introduction



lectures focus on information transfer…

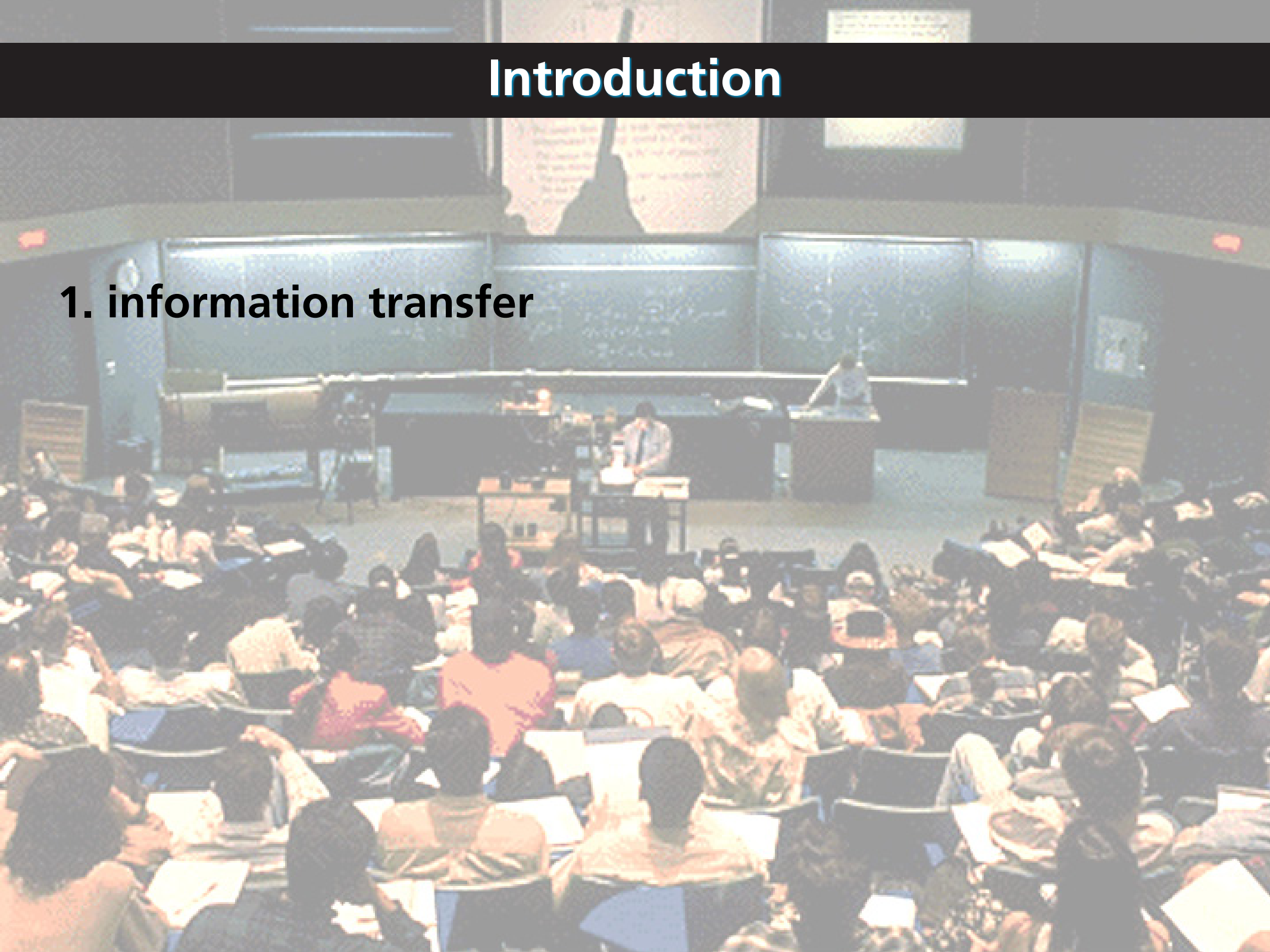
Introduction



lectures focus on information transfer…

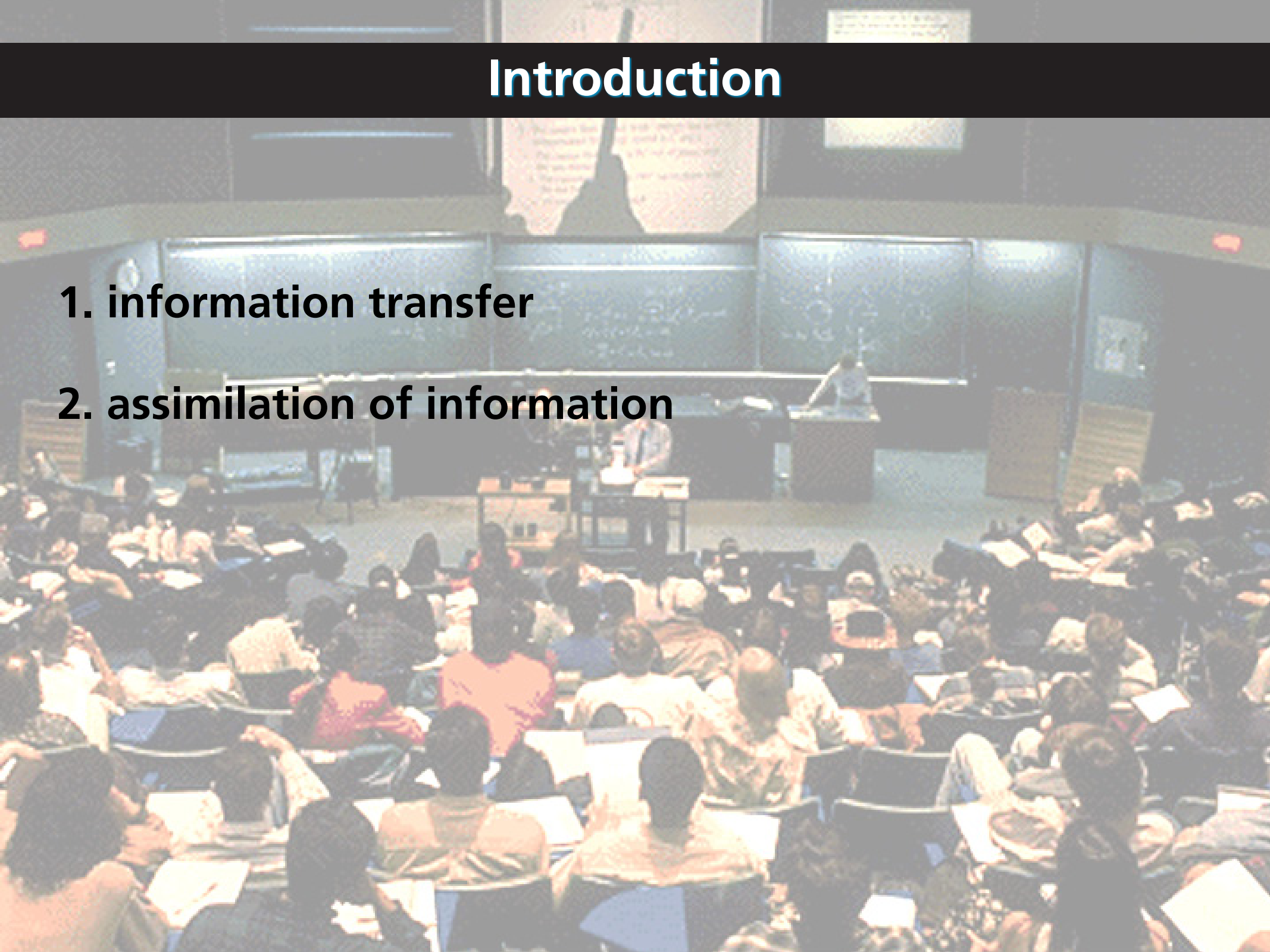
but education is much more!

Introduction



1. information transfer

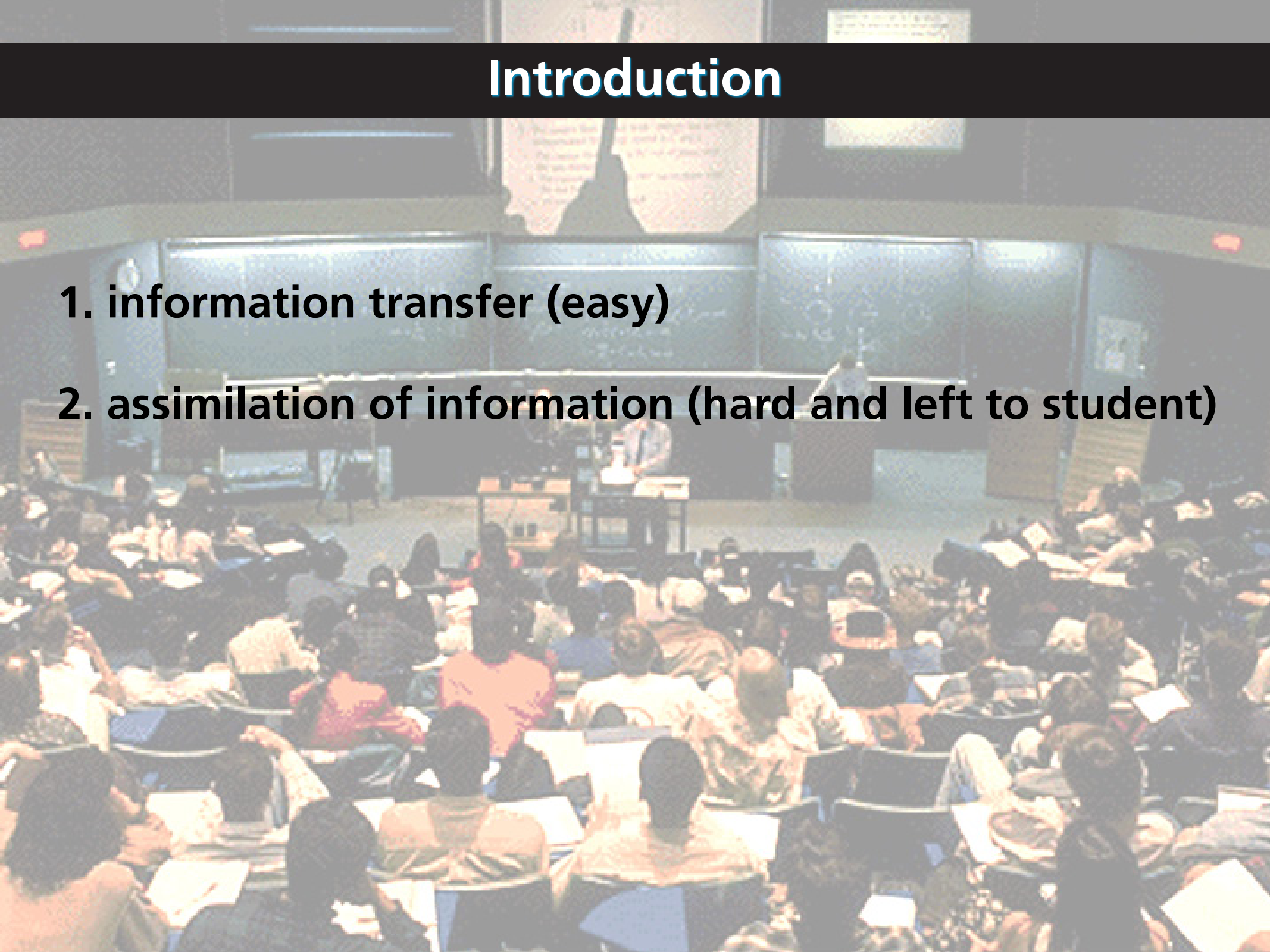
Introduction



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

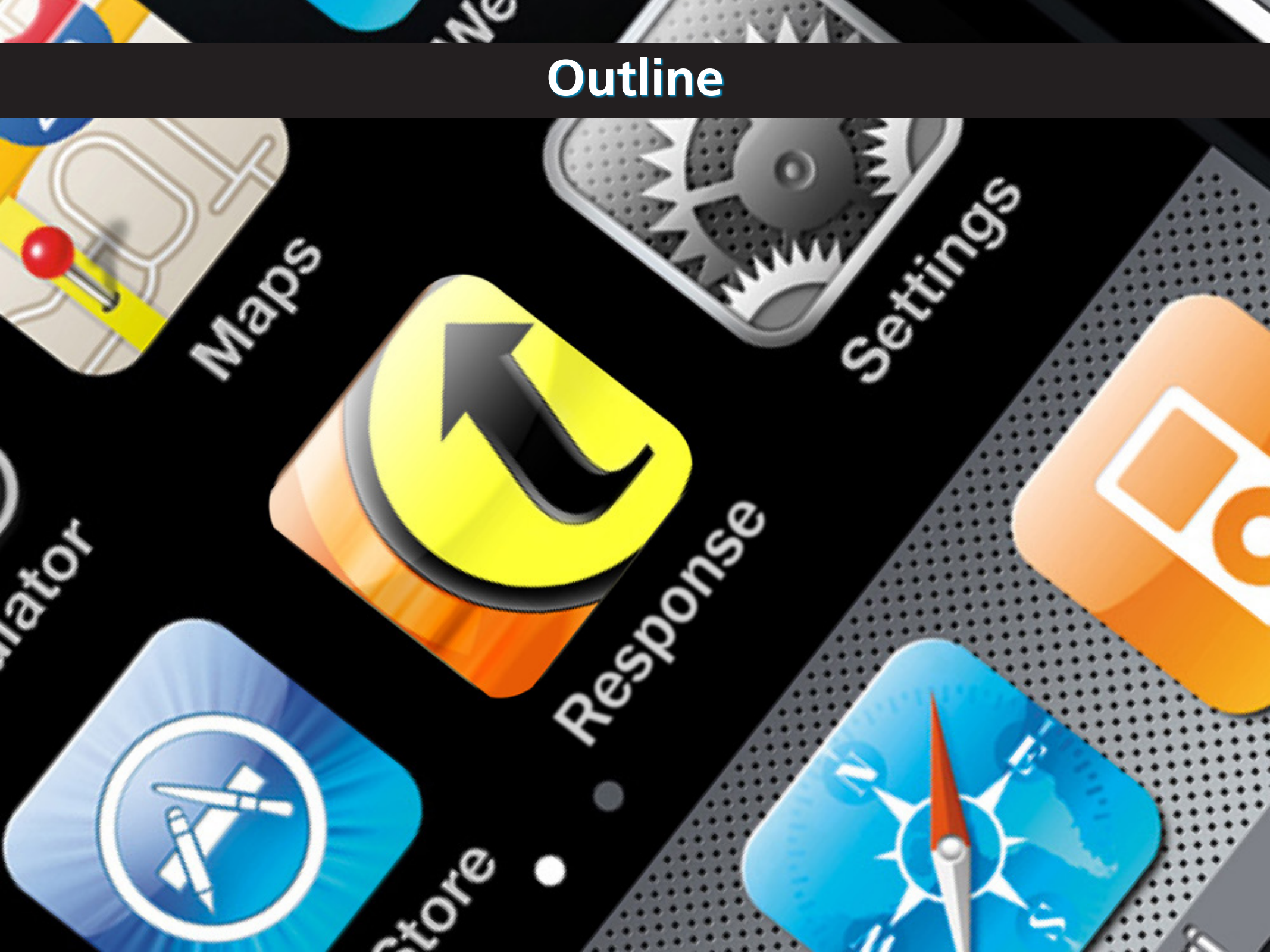
How to move information transfer out of classroom?

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

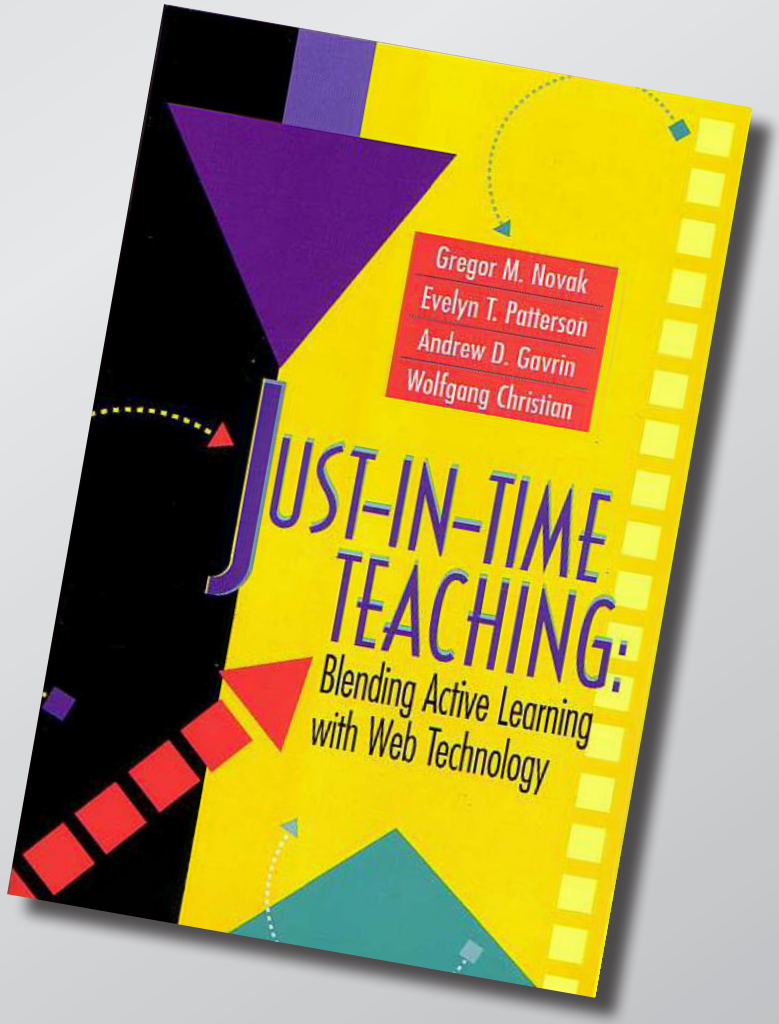
PI & JiTT Overview

"How to encourage the unmotivated students to read before class and motivate them to attend class to learn more?"

PI & JiTT Overview

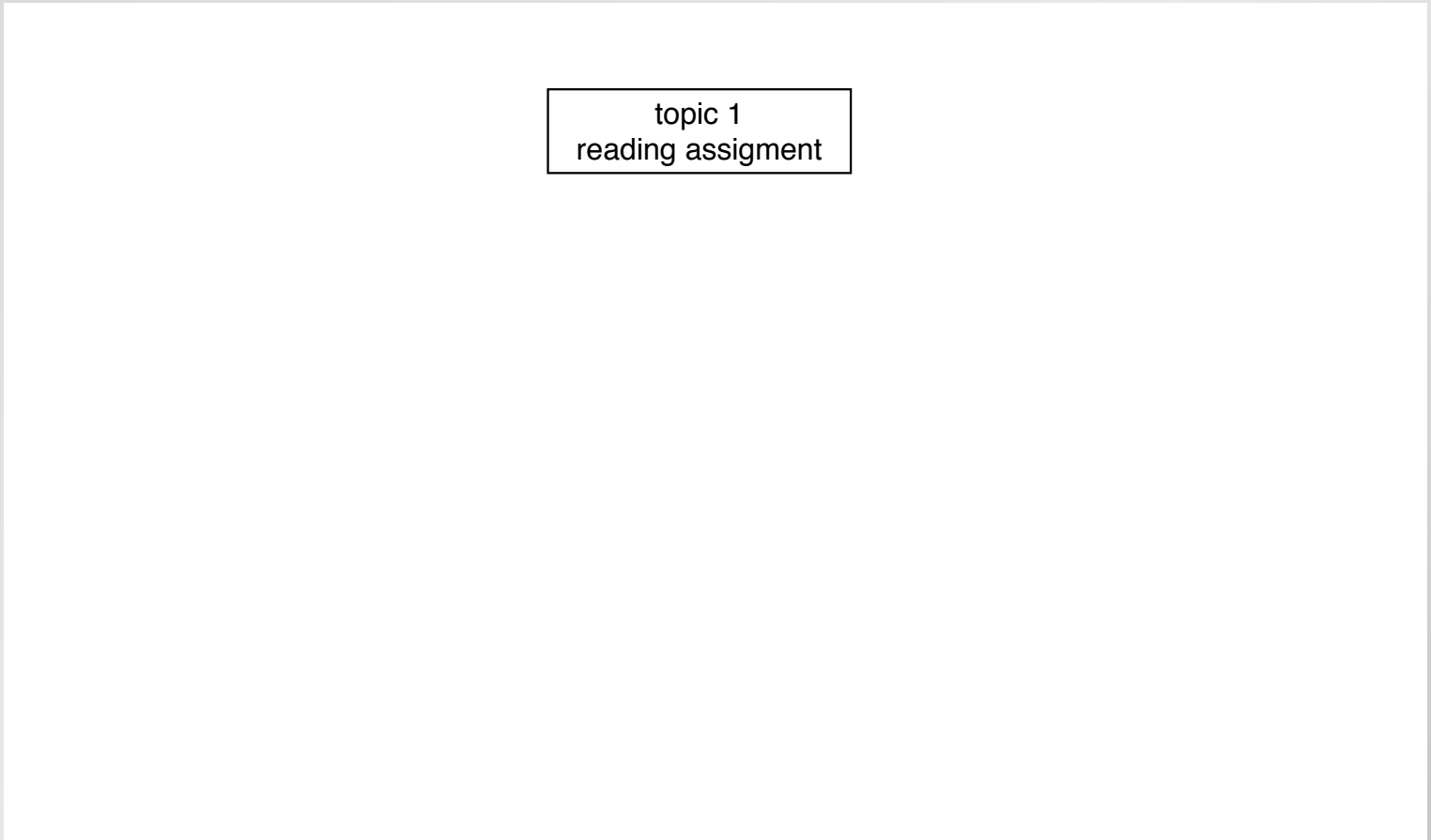
Just-in-time-Teaching (JiTT)

www.jitt.org



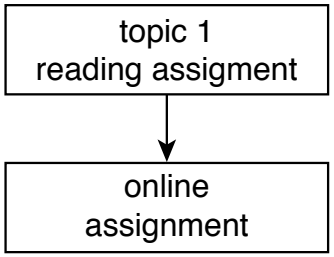
PI & JiTT Overview

JiTT workflow



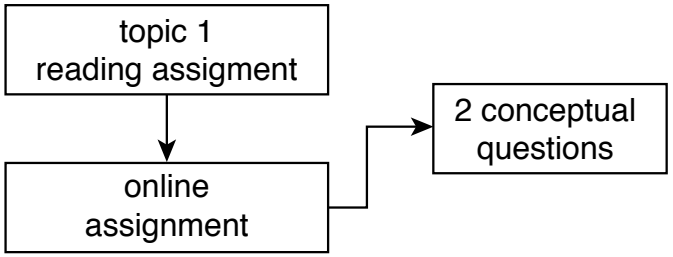
PI & JiTT Overview

JiTT workflow



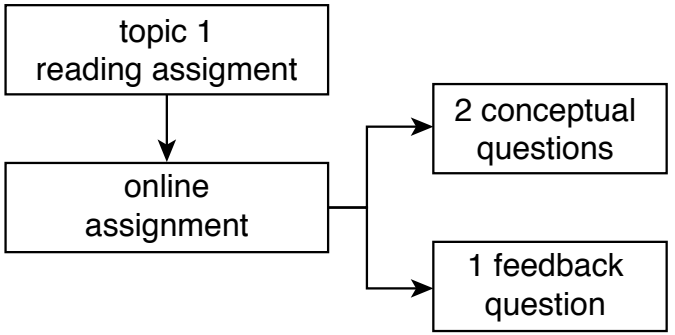
PI & JiTT Overview

JiTT workflow



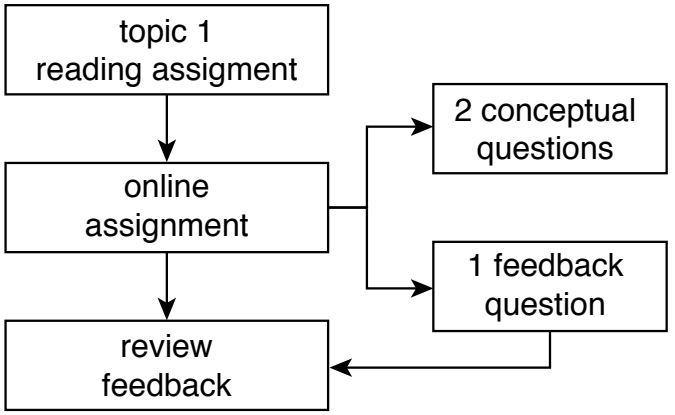
PI & JiTT Overview

JiTT workflow



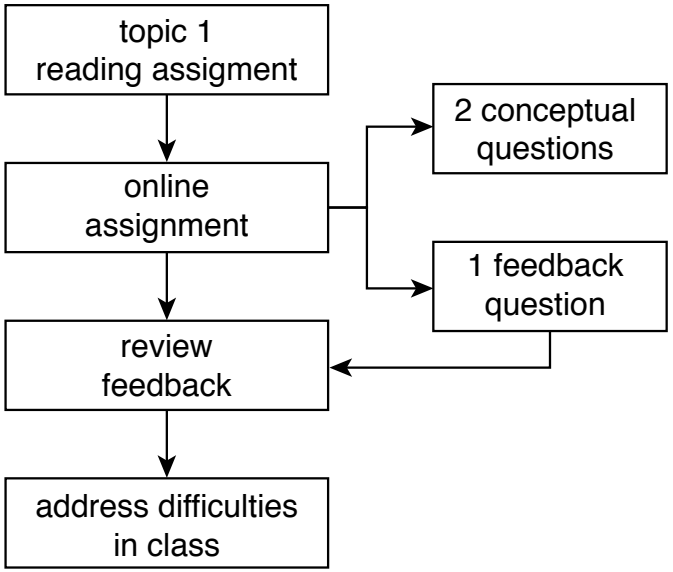
PI & JiTT Overview

JiTT workflow



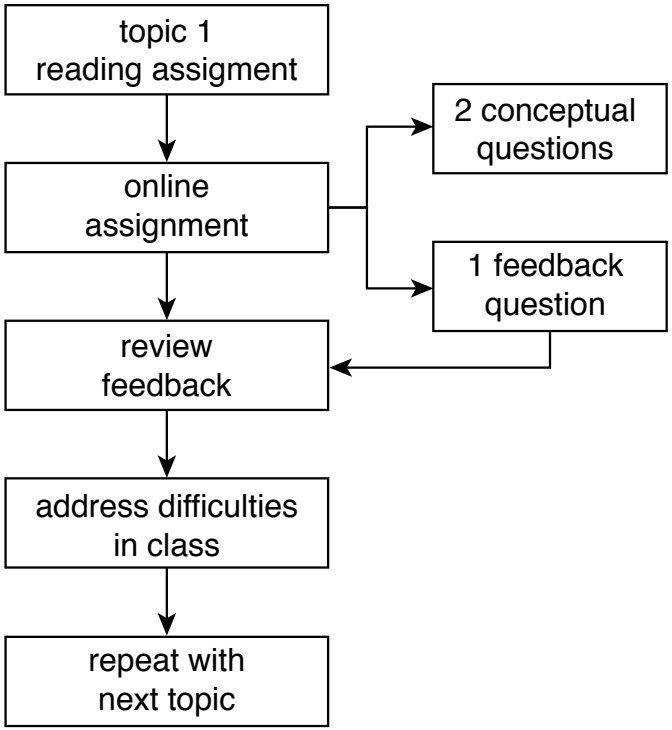
PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

"How high-level can the JiTT questions be given that students read the material on their own?"

PI & JiTT Overview

“How long before the class do you release the materials to gain maximum mileage?”

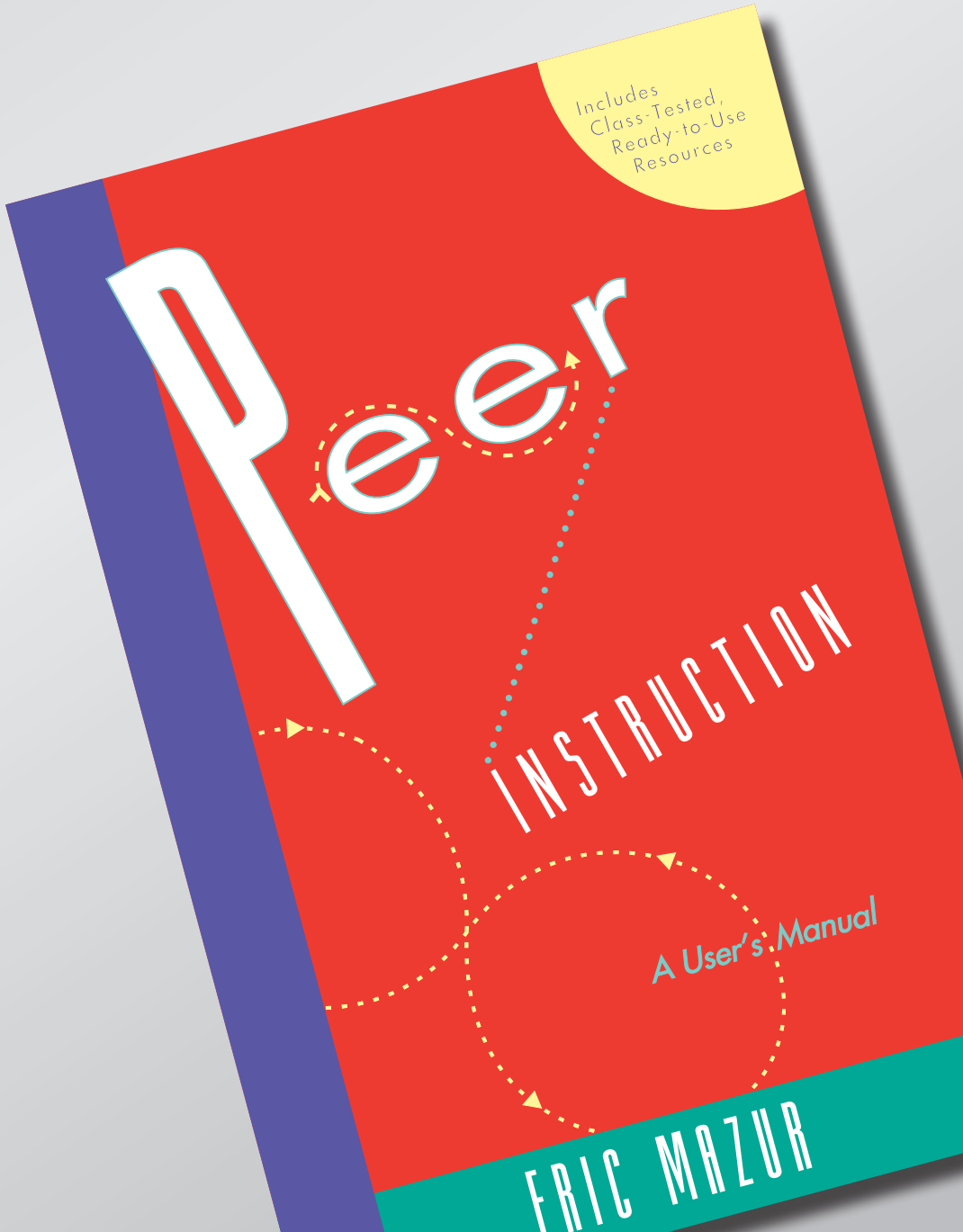
PI & JiTT Overview

JiTT:

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

PI & JiTT Overview

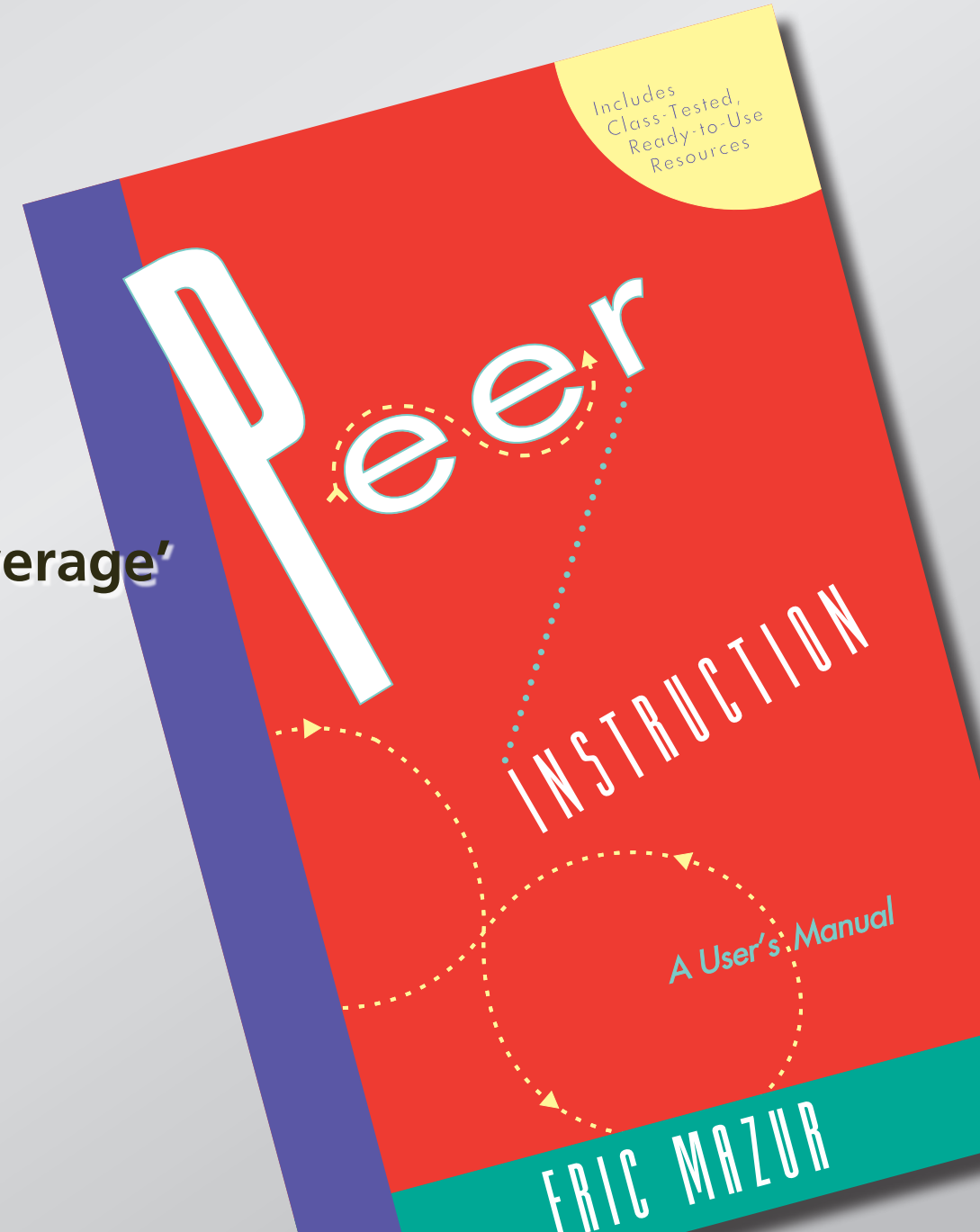
Peer Instruction (PI)



PI & JiTT Overview

Main features:

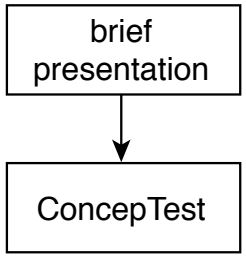
- **pre-class reading**
- **in-class: depth, not 'coverage'**
- **ConcepTests**



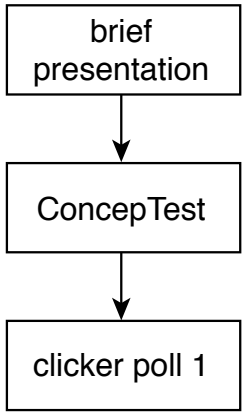
PI & JiTT Overview

brief
presentation

PI & JiTT Overview



PI & JiTT Overview



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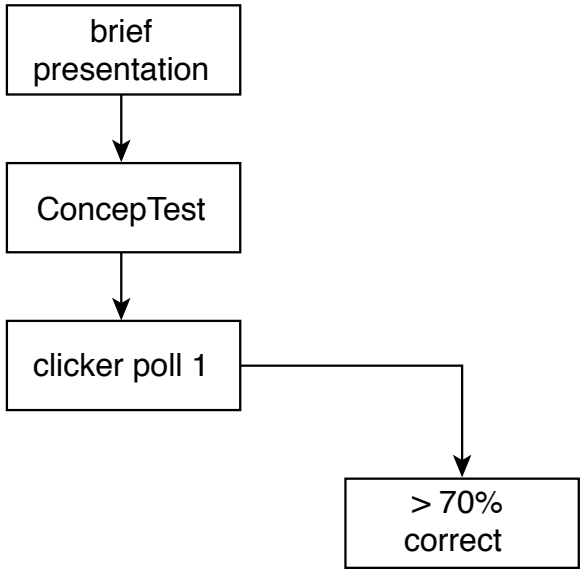

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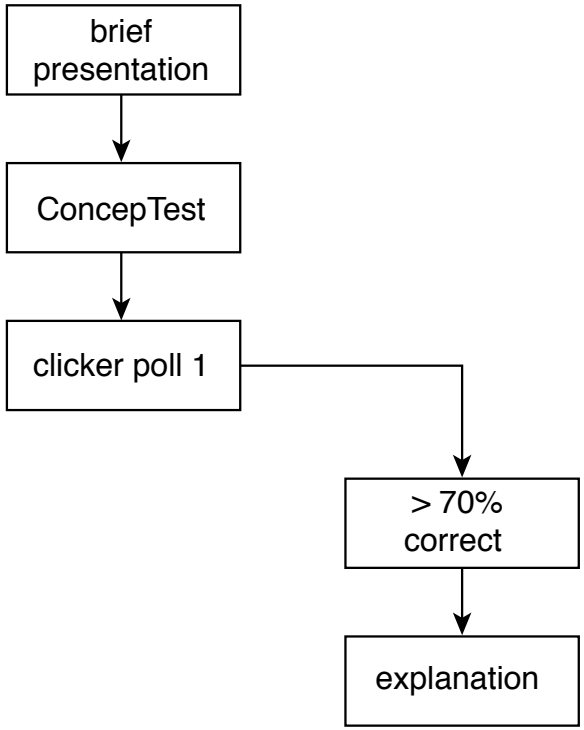

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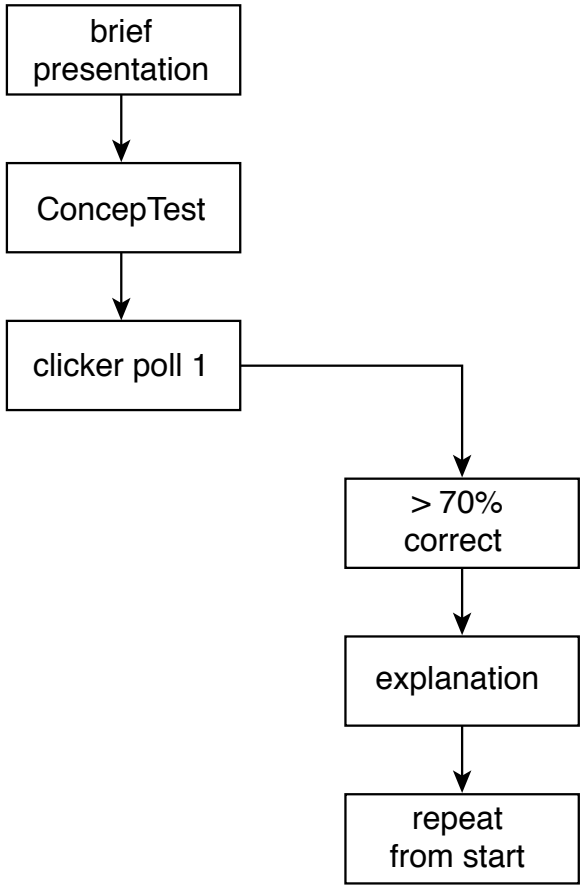

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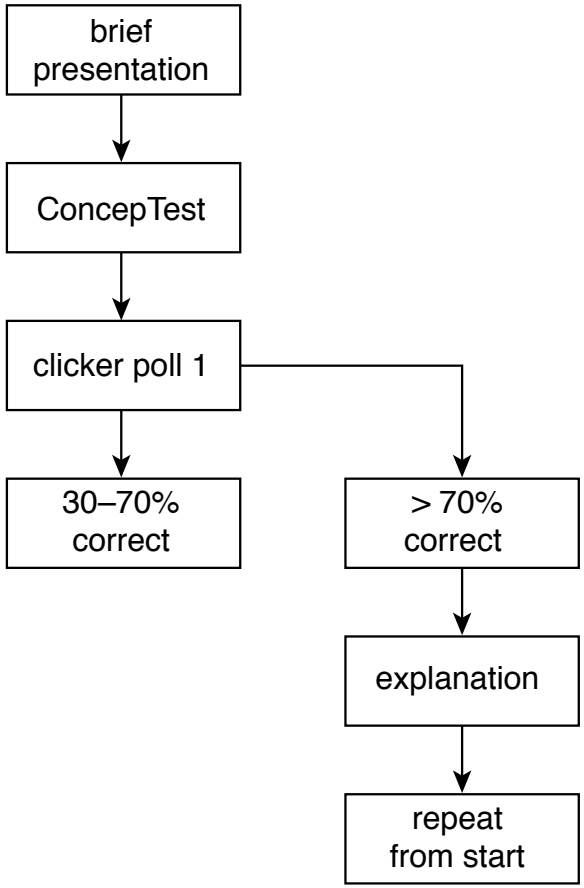

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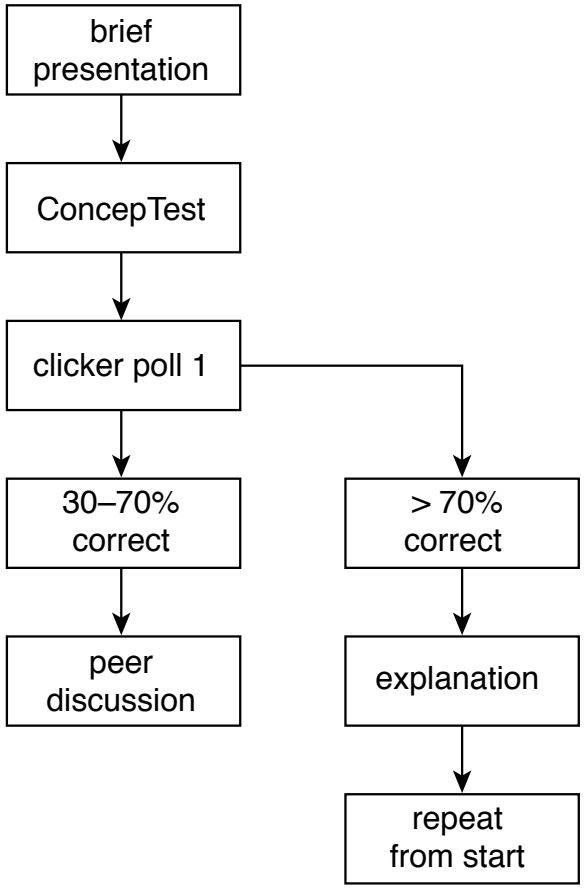

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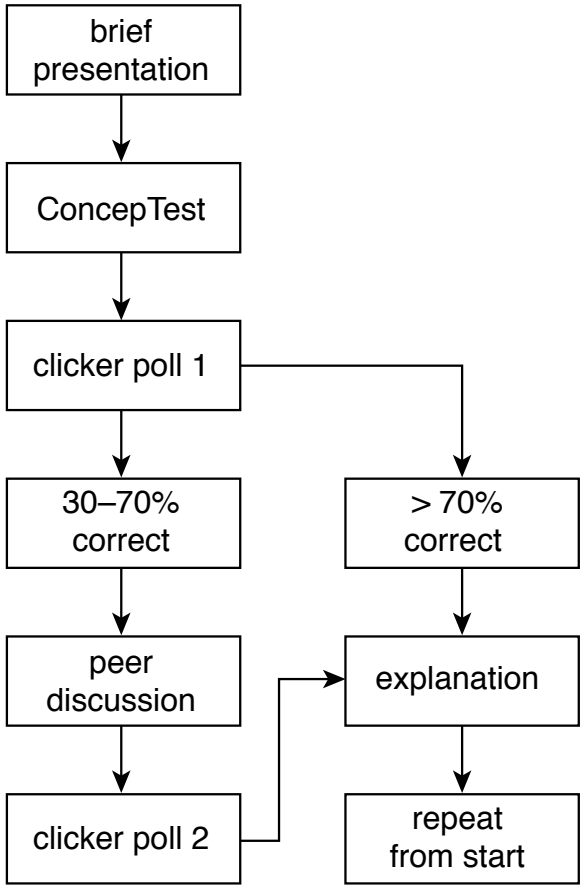

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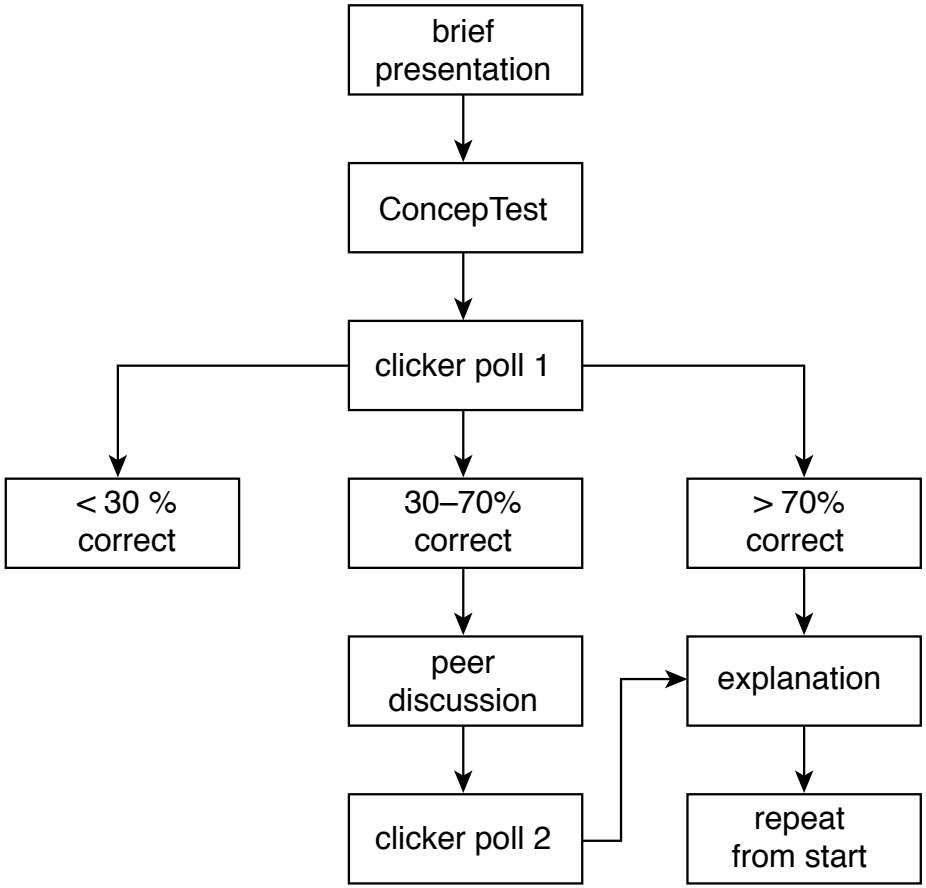

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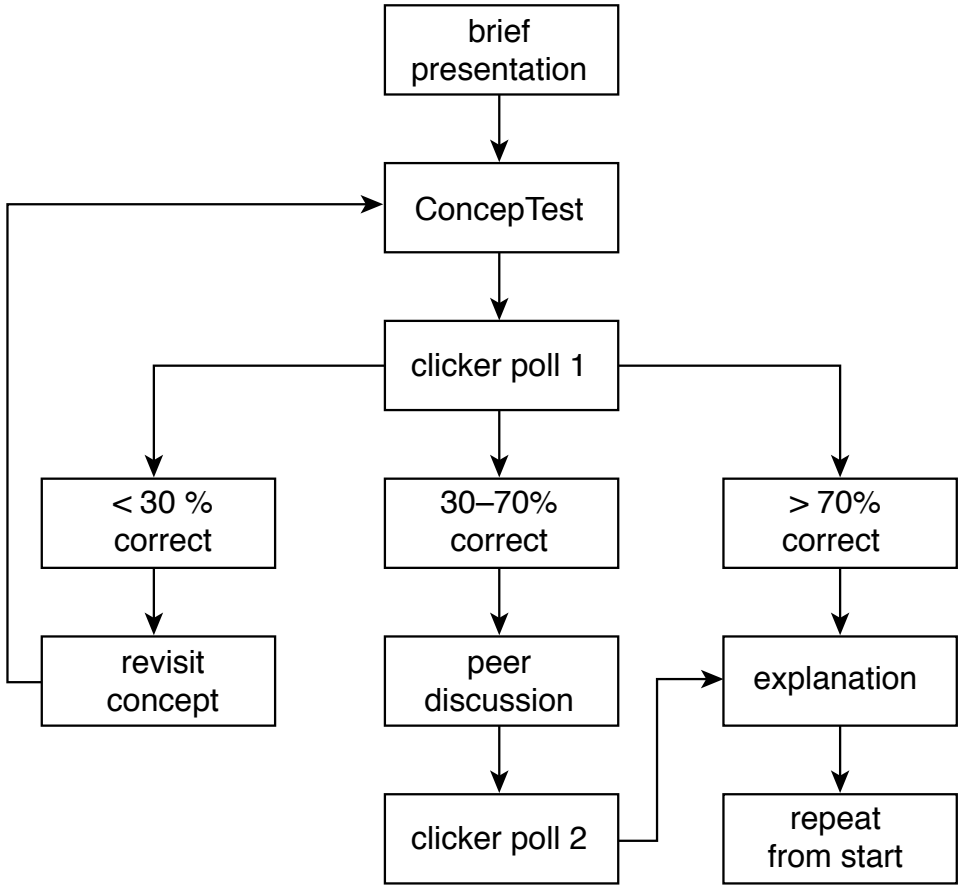
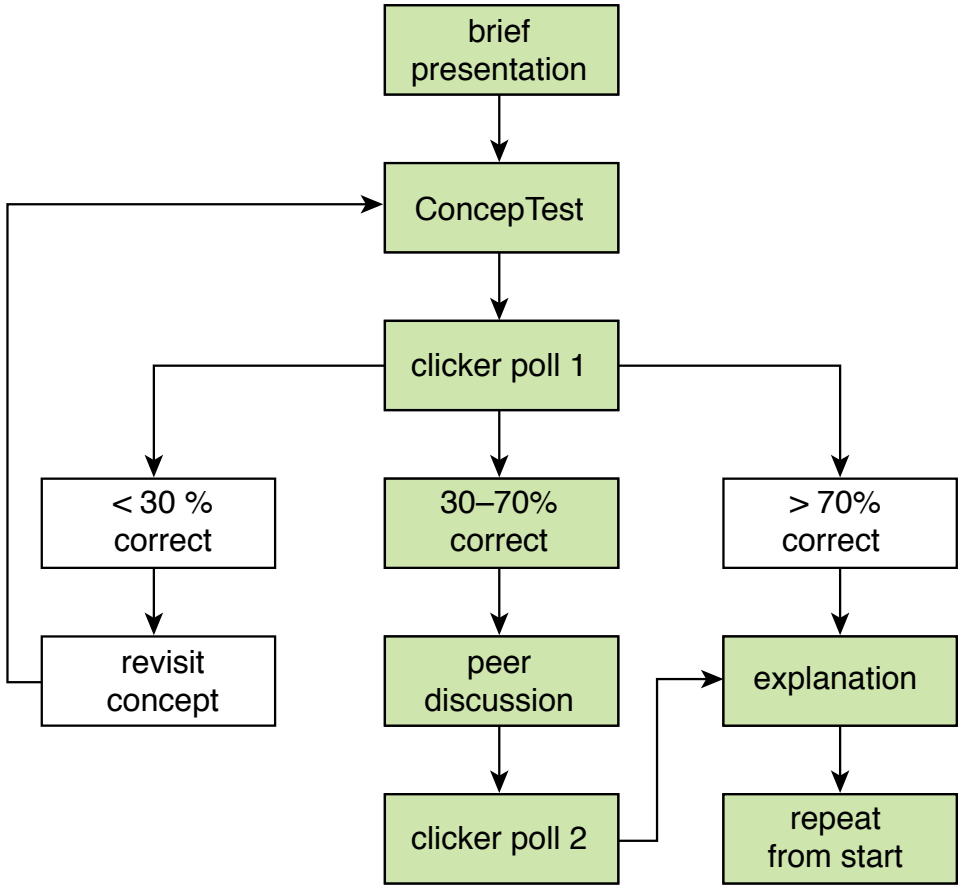


PI & JiTT Overview



PI & JiTT Overview

" If less than 30% students give correct answers to the ConcepTest, we revisit the concept.

Then do students take the same ConcepTest again?"

PI & JiTT Overview

"How does PI work when learners are from different levels?

This might be the case in mixed groups learning."

PI & JiTT Overview

“How to implement PI with not motivated students?”

PI & JiTT Overview

"How do you monitor student discussion? At the end of the day, if there are still students who have poor conceptual understanding after JITT and PI, what can instructors do?"

PI & JiTT Overview

PI:

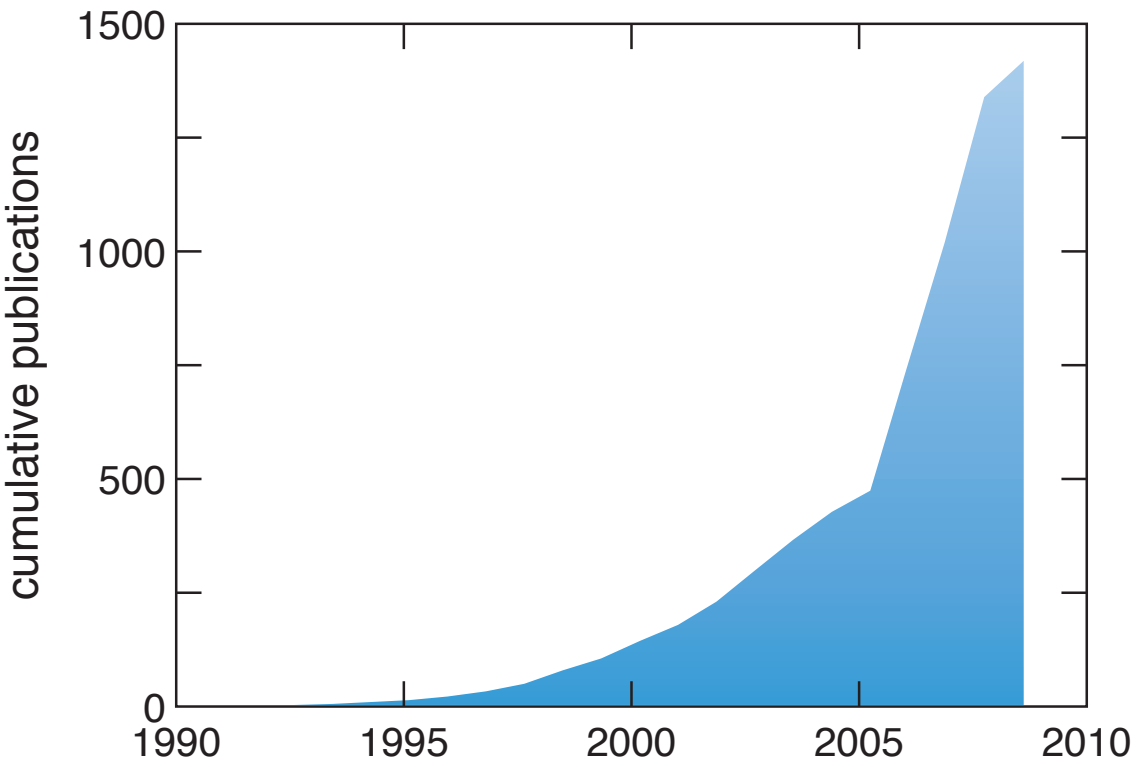
- **helps students overcome difficulties**
- **encourages deep learning**
- **provides depth, not “coverage”**
- **helps you become aware of misconceptions**

PI & JiTT Overview

"What is the percentage of success of PI?"

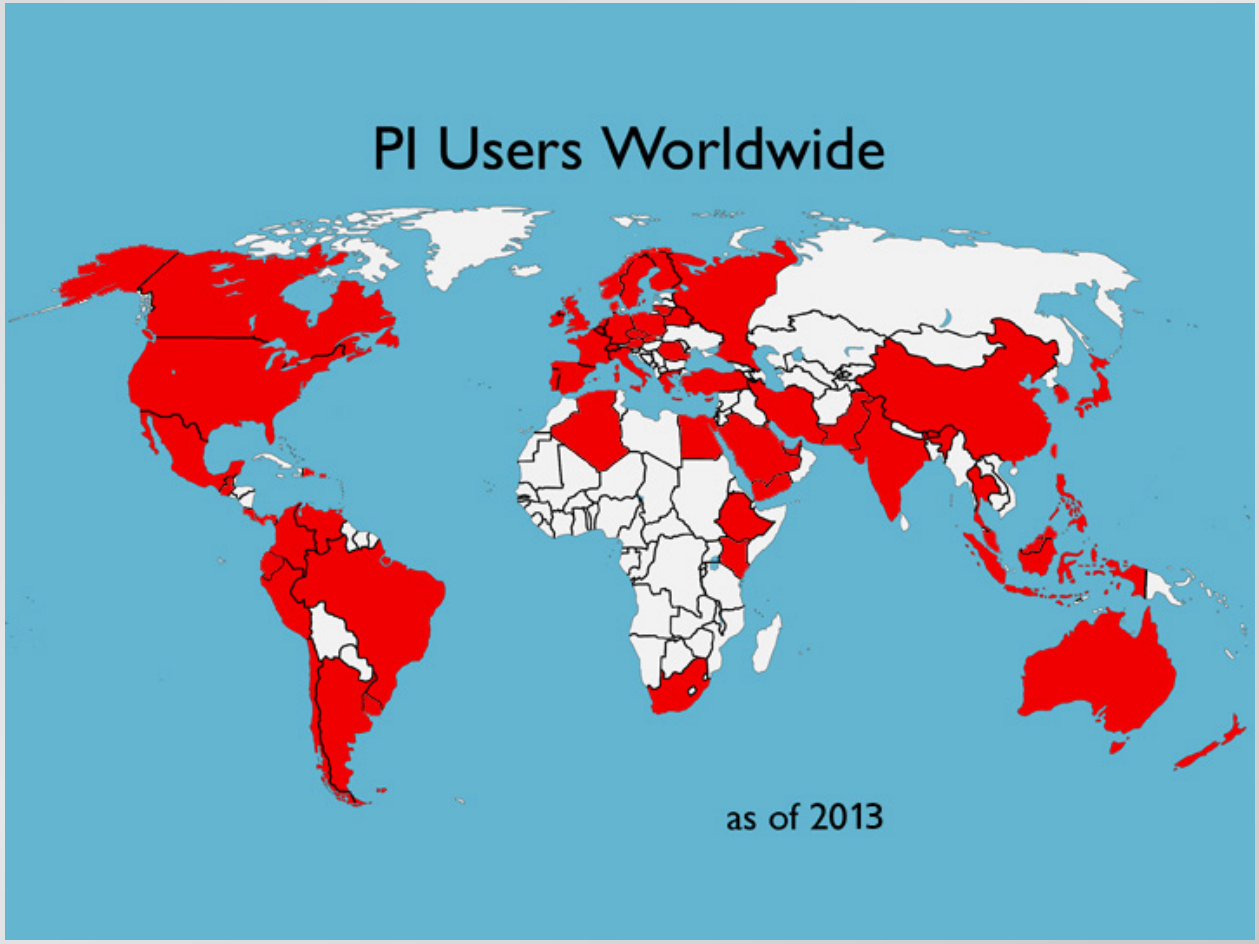
PI & JiTT Overview

publications mentioning PI



PI & JiTT Overview

registered PI users



PI & JiTT Overview

"What to do if students who know the answer sit together and students who don't know the answer sit together?"

PI & JiTT Overview

find someone with a *different* answer

Let's try it!

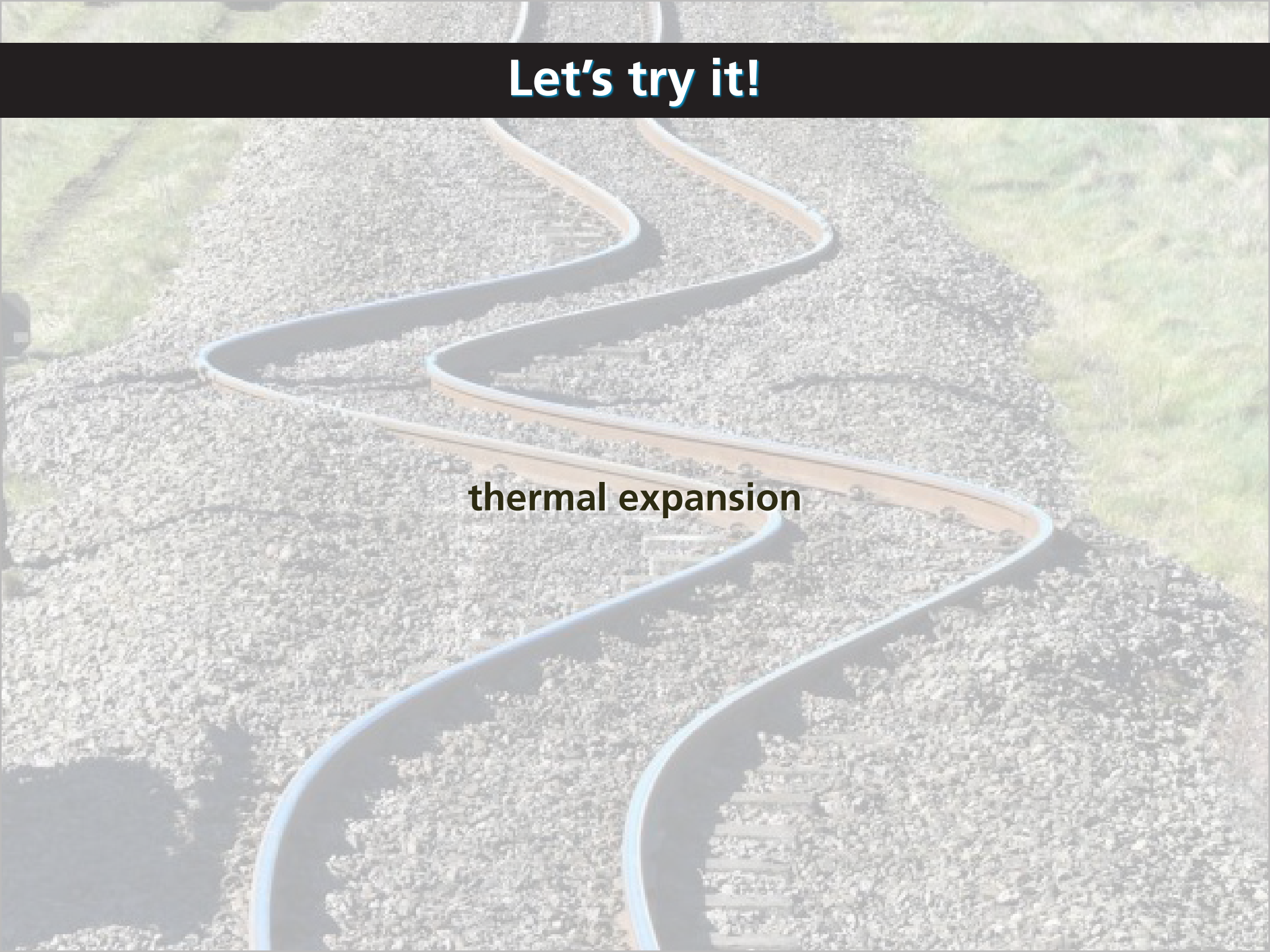
Online Polling System

1. Go to learningcatalytics.com/demo

2. Enter info, click "Start"

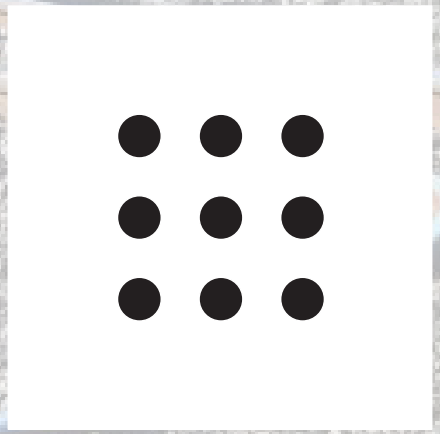
3. Join session 123456789

Let's try it!



Let's try it!

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



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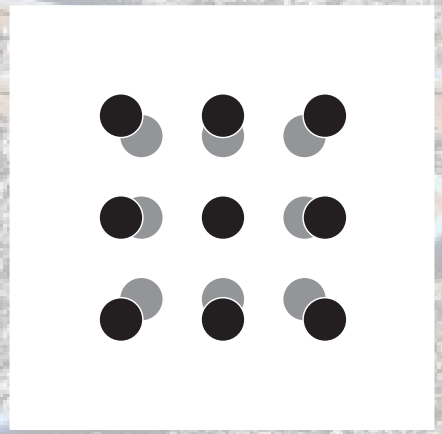
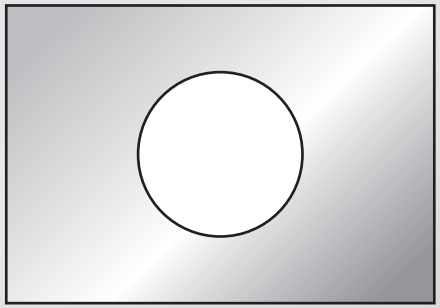


Let's try it!

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

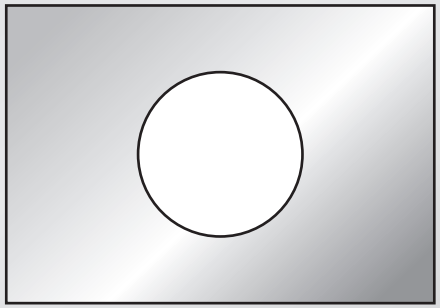
Let's try it!

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



Let's try it!

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.

Let's try it!

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

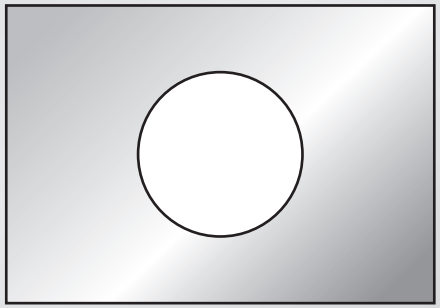
When the plate is uniformly heated, the diameter of the hole

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

you got all fired up!

Let's try it!

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



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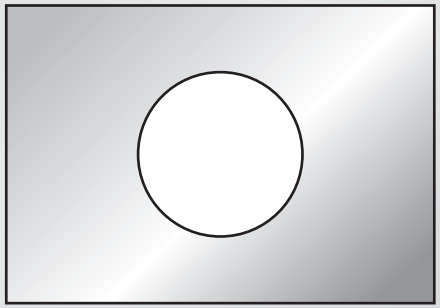


When the plate is uniformly heated, the diameter of the hole

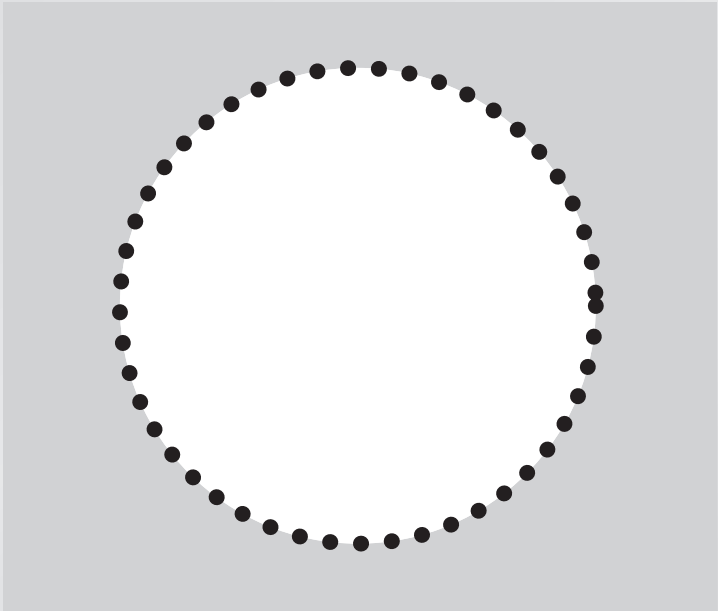
1. increases. ✔

2. stays the same.

3. decreases.

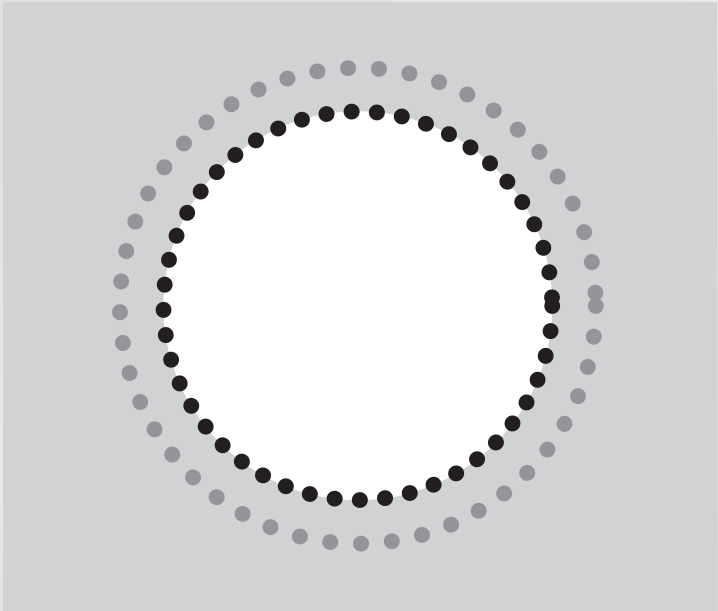
Let's try it!

consider the atoms at the rim of the hole



Let's try it!

consider the atoms at the rim of the hole



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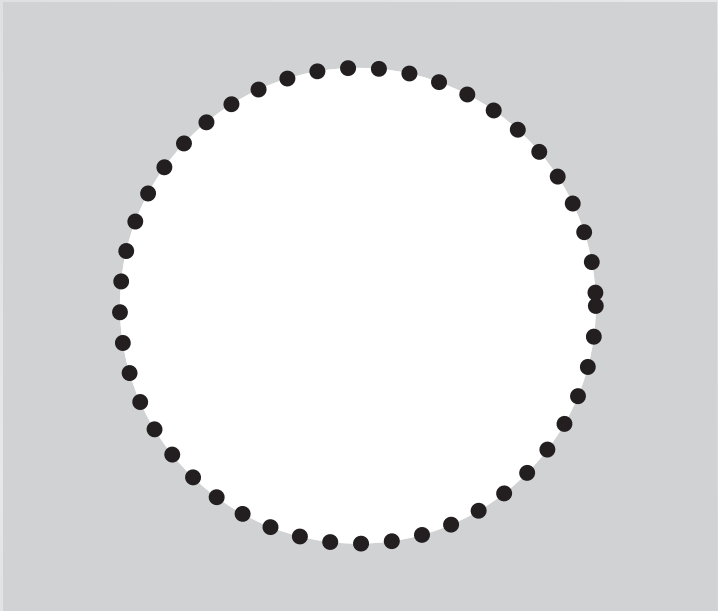

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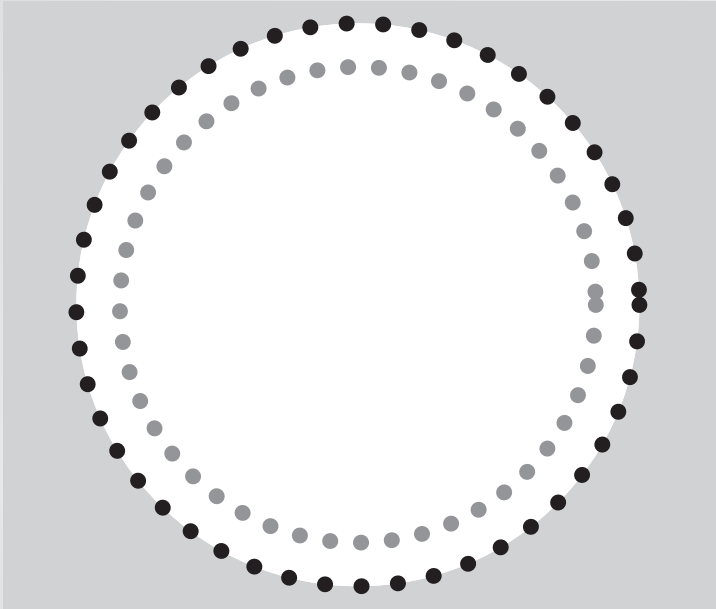
consider the atoms at the rim of the hole



Let's try it!

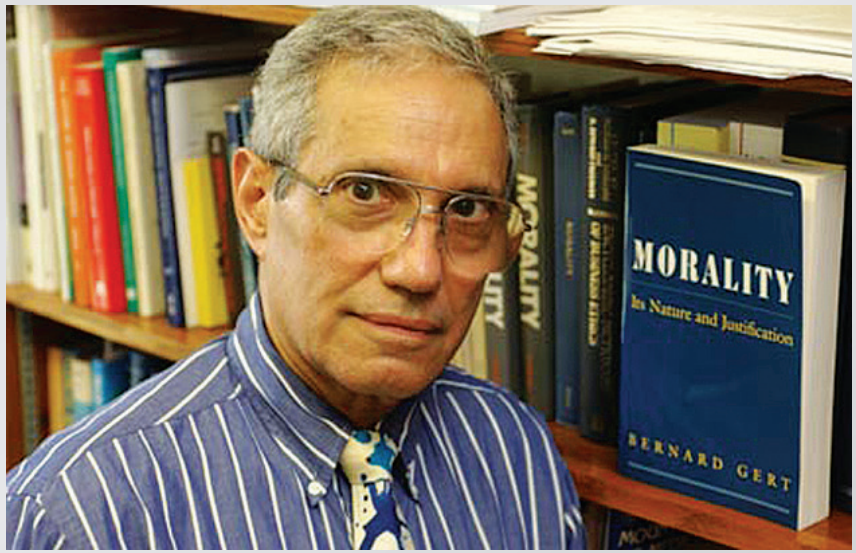
consider the atoms at the rim of the hole

PI & JiTT Overview

“Can we use PI when there are no right or wrong answers?”

Let's try it!

Bernard Gert (1934 – 2011)

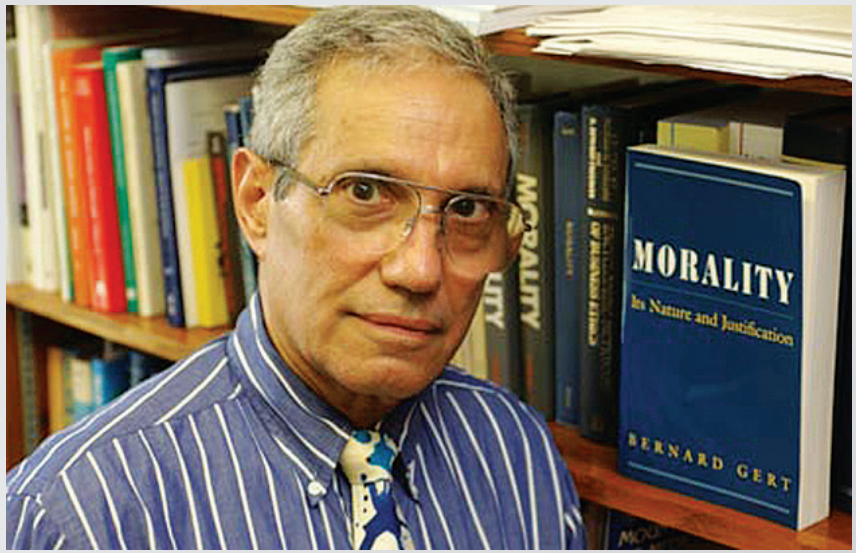


Moral philospher
Professor at Dartmouth

"Morality is an informal public system applying to all rational persons, governing behavior that affects others, and includes what are commonly known as the moral rules, ideals, and virtues and has the lessening of evil or harm as its goal."

Let's try it!

Bernard Gert (1934 – 2011)



Moral philospher

Professor at Dartmouth

Let's try it!

Bernard Gert's moral system created by 10 rules:

1. Do not kill
2. Do not cause pain
3. Do not disable
4. Do not deprive of freedom
5. Do not deprive of pleasure
6. Do not deceive
7. Keep your promises
8. Do not cheat
9. Obey the law
10. Do your duty (as required by job, circumstances).

Let's try it!

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

Let's try it!

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

Let's try it!

Bernard Gert's moral system created by 10 rules:

1. Do not kill
2. Do not cause pain
3. Do not disable
4. Do not deprive of freedom
5. Do not deprive of pleasure
6. Do not deceive
7. Keep your promises
8. Do not cheat
9. Obey the law
10. Do your duty (as required by job, circumstances).

Let's try it!

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

1. Yes
2. No

Let's try it!

Bernard Gert's moral system created by 10 rules:

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10. Do your duty (as required by job, circumstances).

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

1. Yes
2. No

you got all engaged!

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

“Is this similar to flipped class learning?”

Implementing PI & JiTT

"How do I deal with non completion of pre-class assignments?"

Implementing PI & JiTT

"How to motivate students to do pre-assignment especially if it requires them to read articles. Singapore students just do not want to read. Besides awarding them participation marks (extrinsic ways) for doing their pre-assignments/concept test, are there other ways (intrinsic ways) of motivating them?"

Implementing PI & JiTT

“How much time is actually needed to read and process the JiTT results?”

Implementing PI & JiTT

"PI starts with a mini lecture. Is this mini lecture similar to the pre-reading assignments?"

Implementing PI & JiTT

"Does PI work in high school classes, where the content is conceptually not very in-depth, and we also have to work on helping students in the basics, e.g. getting their reading and arithmetic sorted out (which often what we have to do at Singapore Polytechnic)?"

Implementing PI & JiTT

"Have PI and JiTT been tested in a design studio type learning environment? Results and challenges?"

Implementing PI & JiTT

"To successfully implement PI, is it a pre-requisite for instructors to embrace and use facilitation skills in class?"

Implementing PI & JiTT

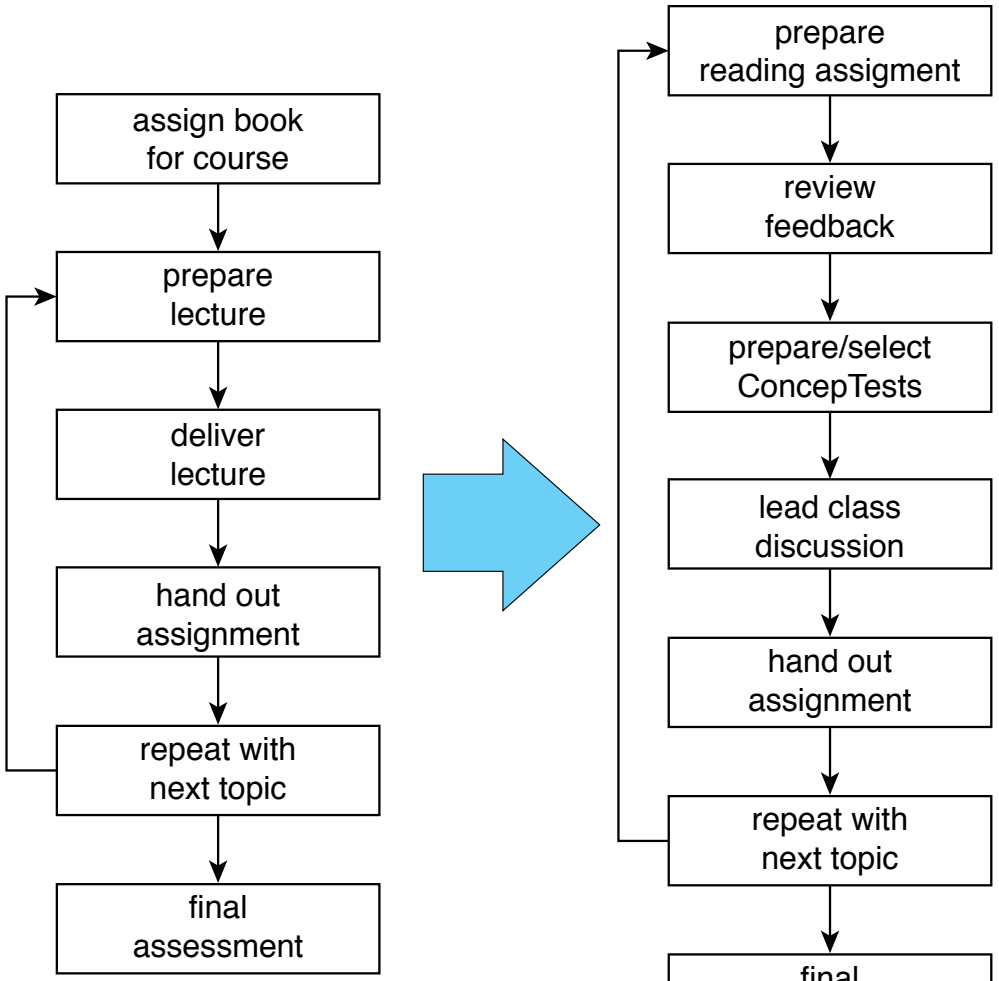
"Will we be taught how to design ConcepTests since it is the heart of PI?"

Implementing PI & JiTT

"How demanding is this approach on the time of instructor?"

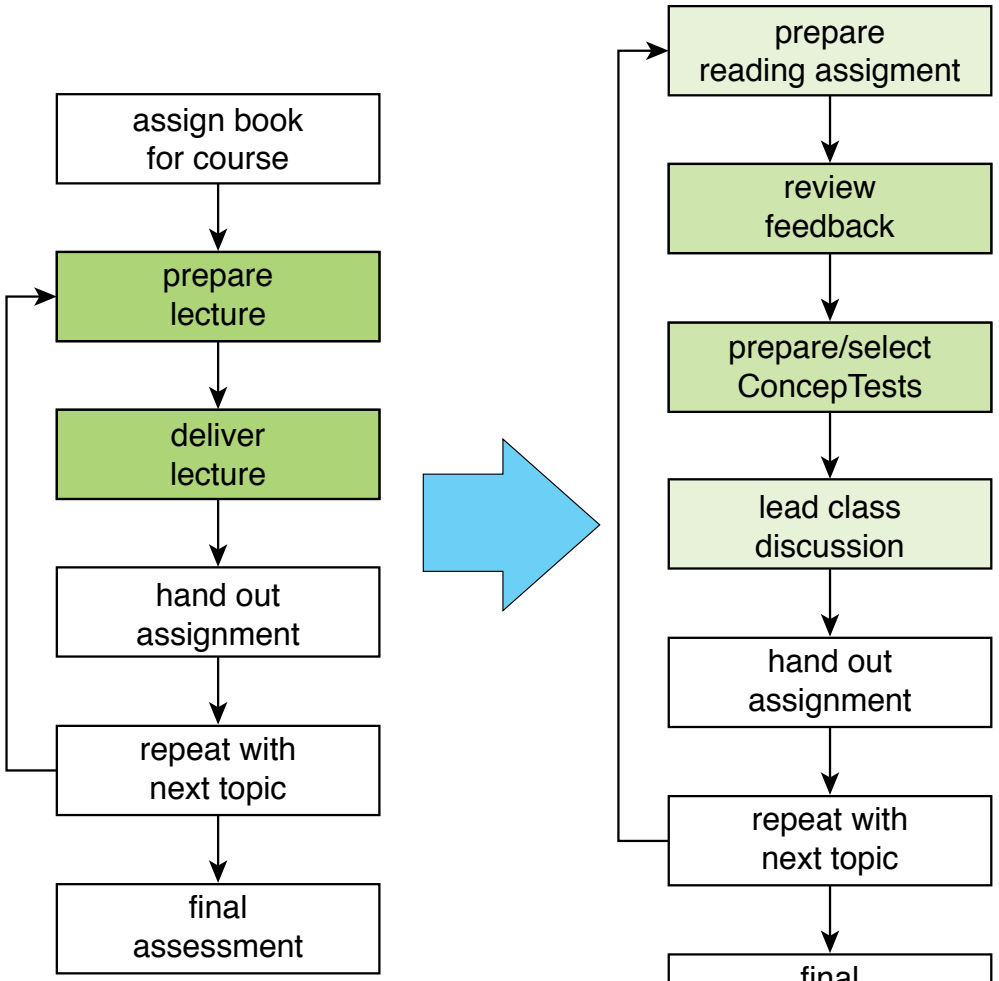
Implementing PI & JiTT

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 to efficiently review answers to JiTT questions in a class with 100-200 students?"

Implementing PI & JiTT

"Can curriculum be covered within time constraints?"

Implementing PI & JiTT

"Presumably we want to give extra credit to those who participate. What technological tools are available that help us track the participation?"

Implementing PI & JiTT

"In the times I have tried, I don't get 100% participation, as I saw some students not willing to commit to an answer when they had no clue. Some did not discuss with their neighbours when asked to. Others waited for an answer. Is "I don't know" a valid option in a ConcepTest?"

"How much time do we give students to answer a ConcepTest? Ittook me something like 45 minutes to cover seven questions. Do we close the polling after a fixed time limit? "

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

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Requires:

Developing a model
Applying that model

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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?"

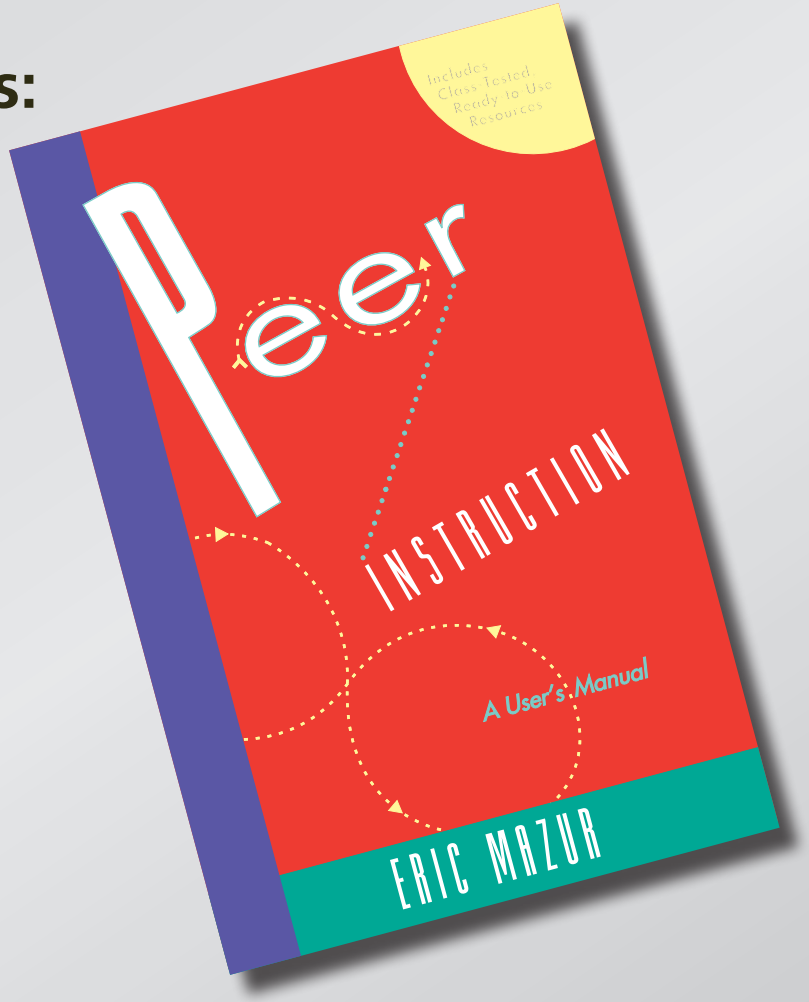
ConcepTests

"Would you mind to share your experience of designing a good ConcepTest?"

ConcepTests

Books with ConcepTests:

- **Physics (Prentice Hall)**



ConcepTests

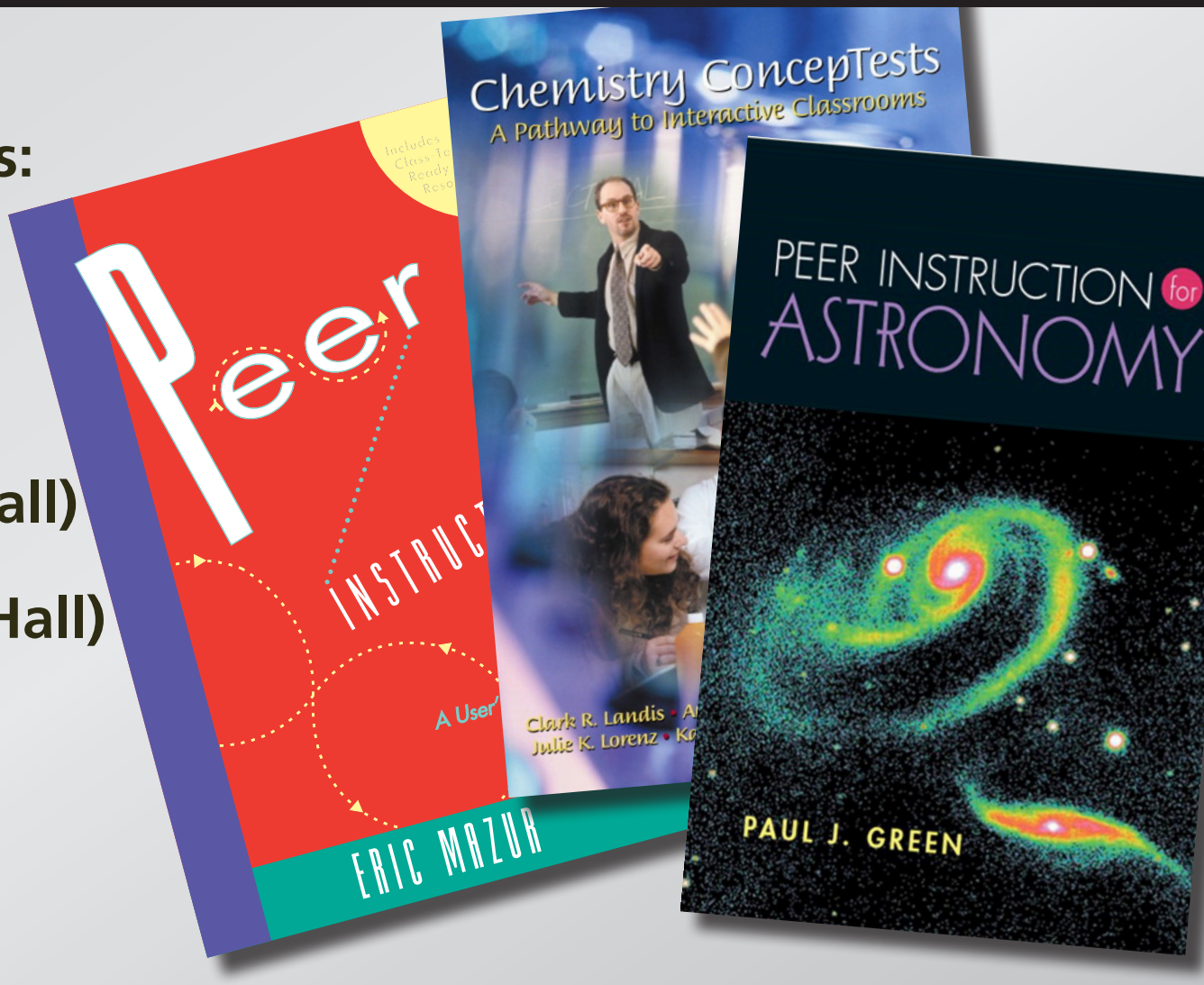
Books with ConcepTests:

- 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)

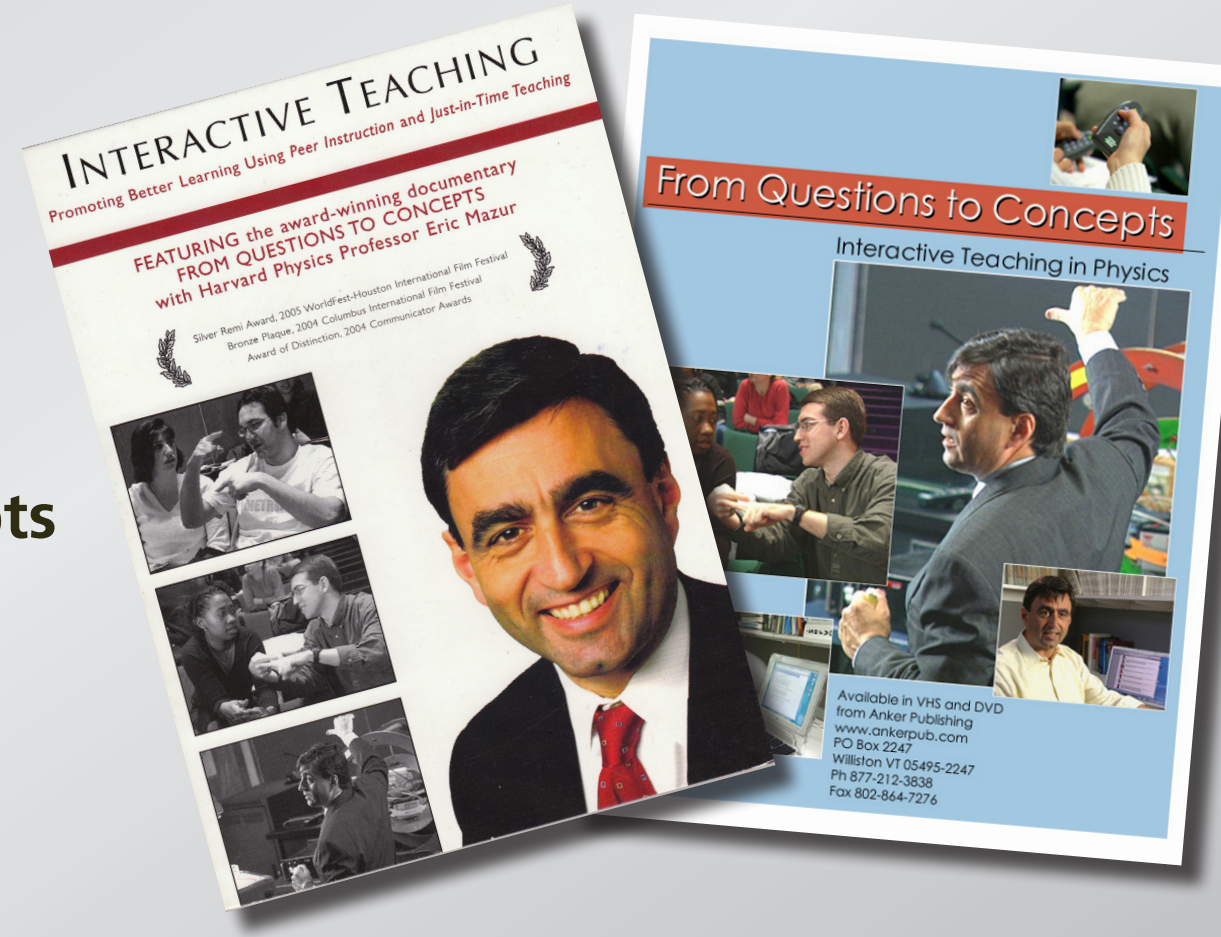
ConcepTests

"Are there helpful short films
that can help us learn more about Peer Instruction?"

ConcepTests

Videos:

- Interactive Teaching DVD
- From questions to concepts



ConcepTests

Google:

<your discipline> ConcepTest

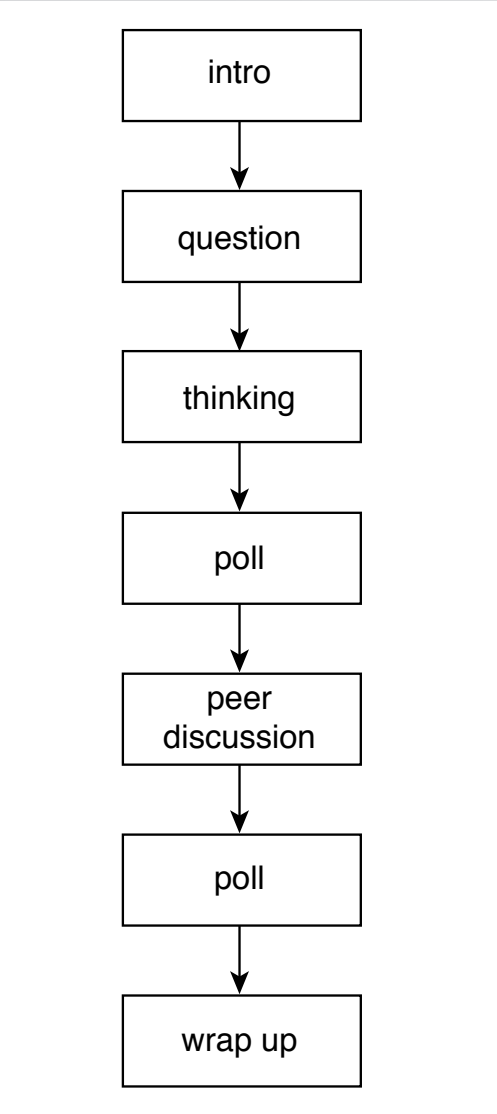
<your discipline> “Concept Test”

<your discipline> “Peer Instruction”

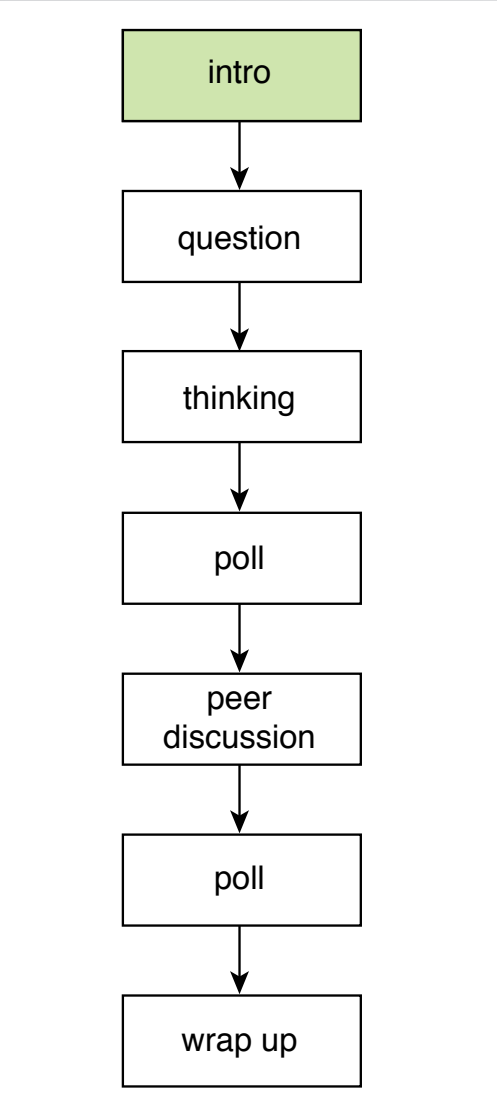
ConcepTests

"What are the important parts of a ConcepTest?"

ConcepTests

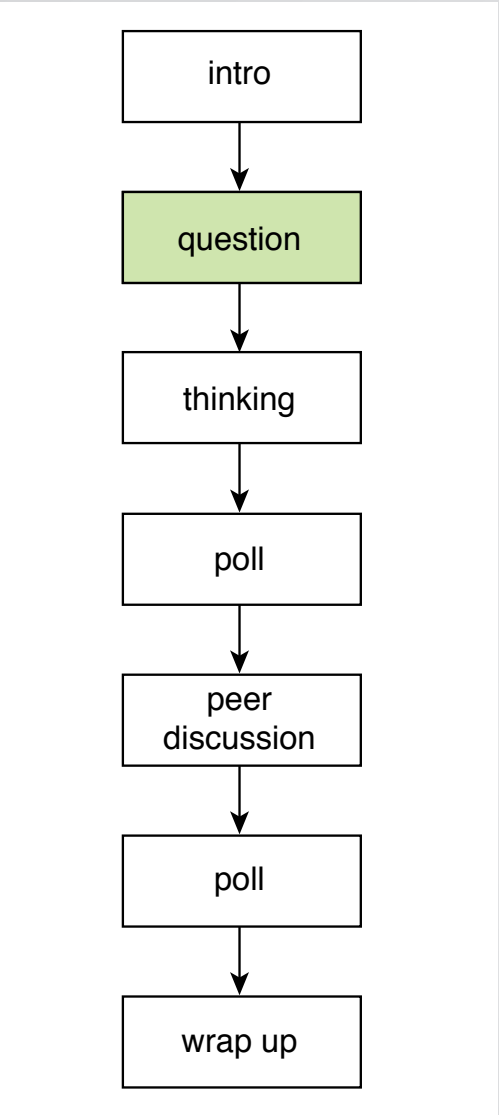


ConcepTests



setting context

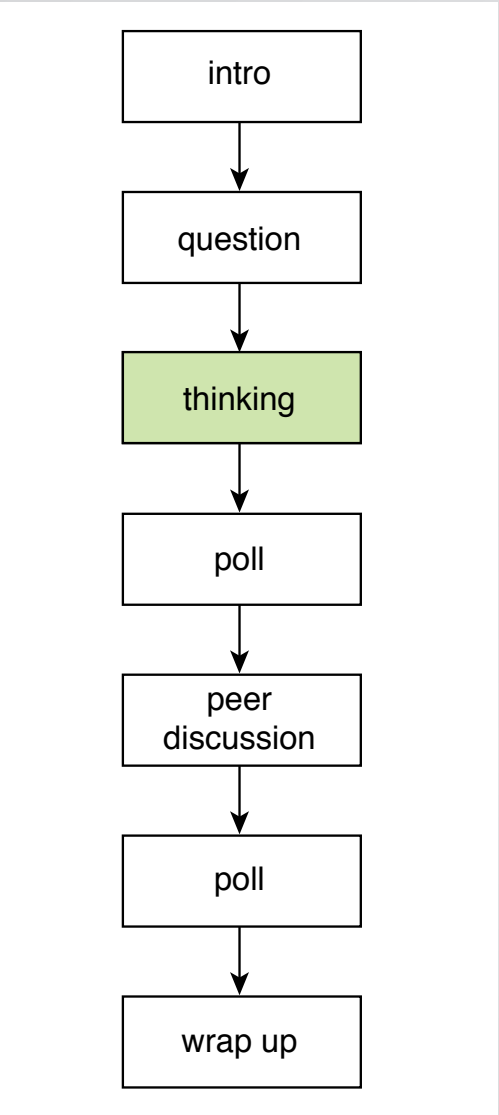
ConcepTests



setting context

posing question

ConcepTests

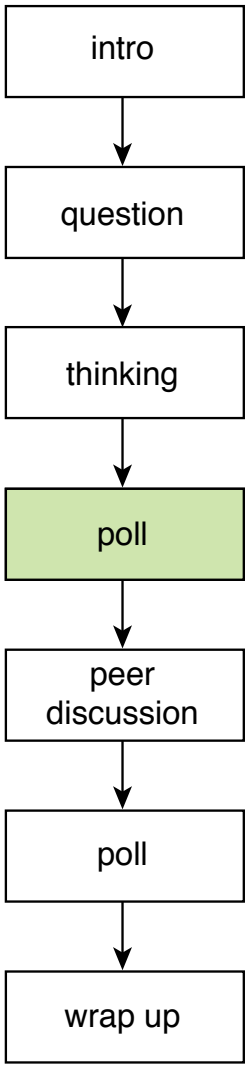


setting context

posing question

reflection

ConcepTests



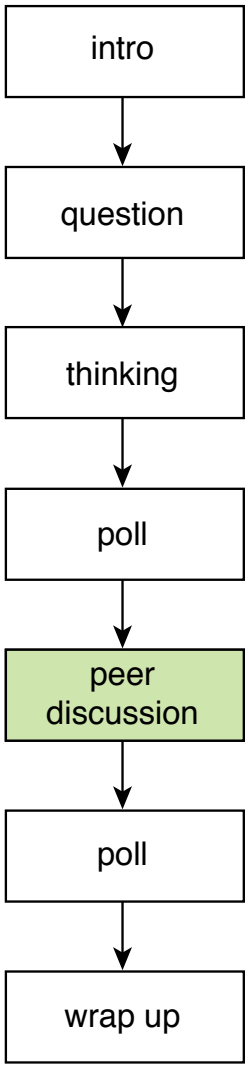
setting context

posing question

reflection

baseline data

ConcepTests



setting context

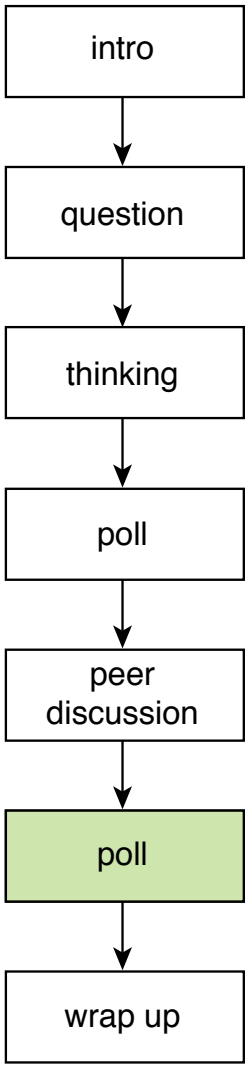
posing question

reflection

baseline data

peer instruction

ConcepTests



setting context

posing question

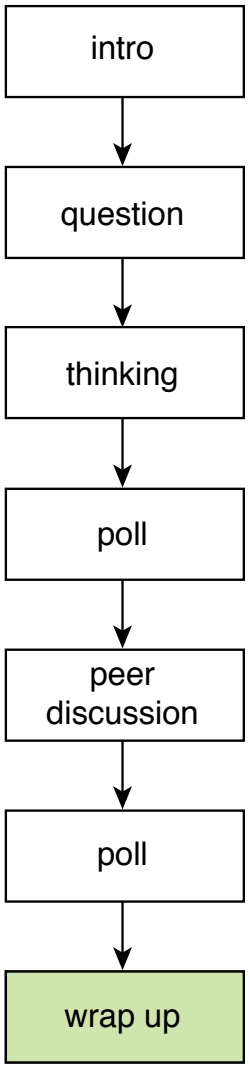
reflection

baseline data

peer instruction

gain data

ConcepTests



setting context

posing question

reflection

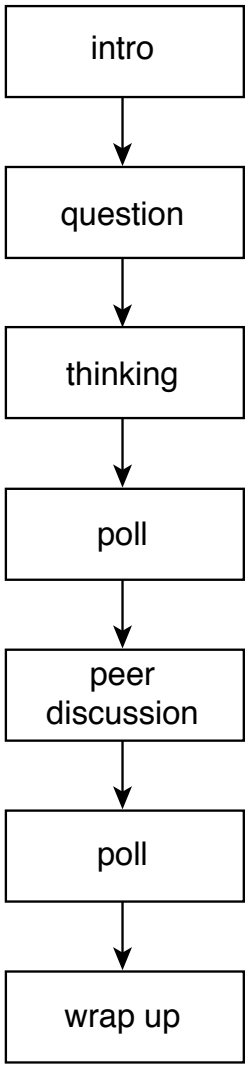
baseline data

peer instruction

gain data

closure

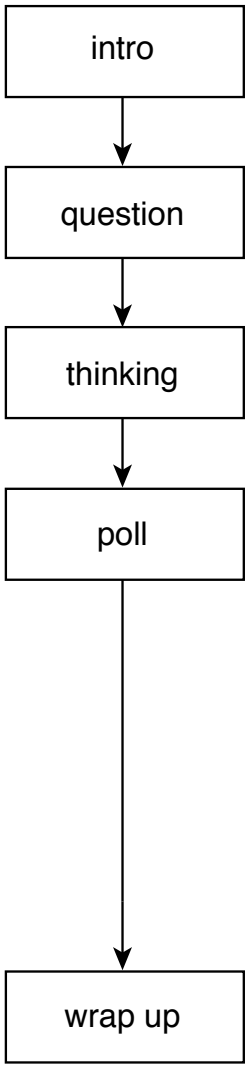
ConcepTests



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

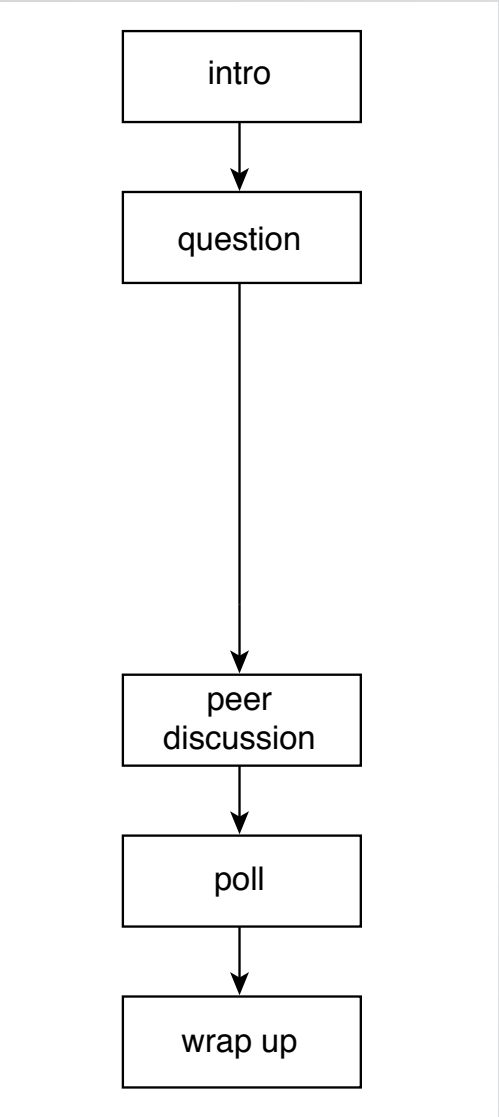


2–3 min saved, but…

takes the “Peer” out of “Peer Instruction”

ConcepTests

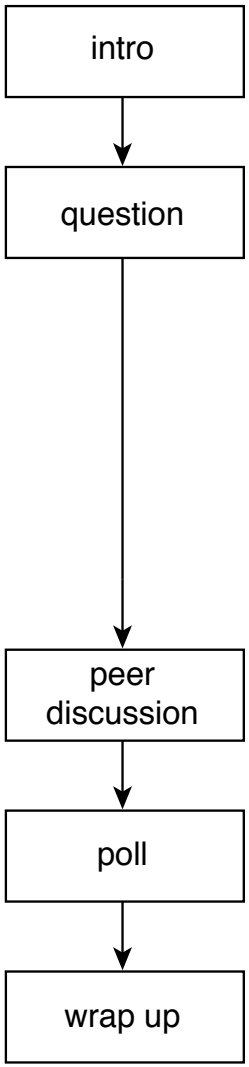
potential shortcuts



launch straight into discussion?

ConcepTests

potential shortcuts

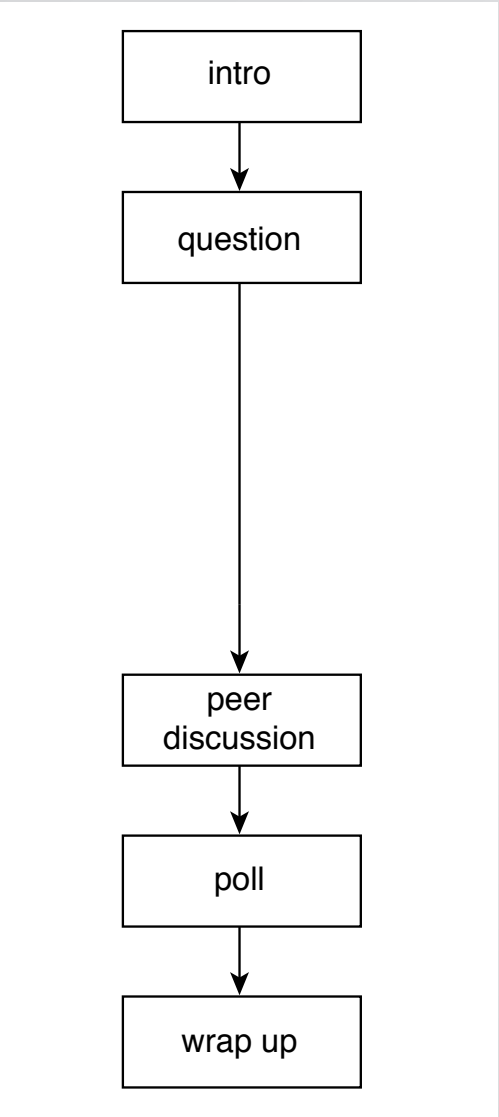


1–2 min saved, but…

no opportunity to commit before discussion

ConcepTests

potential shortcuts



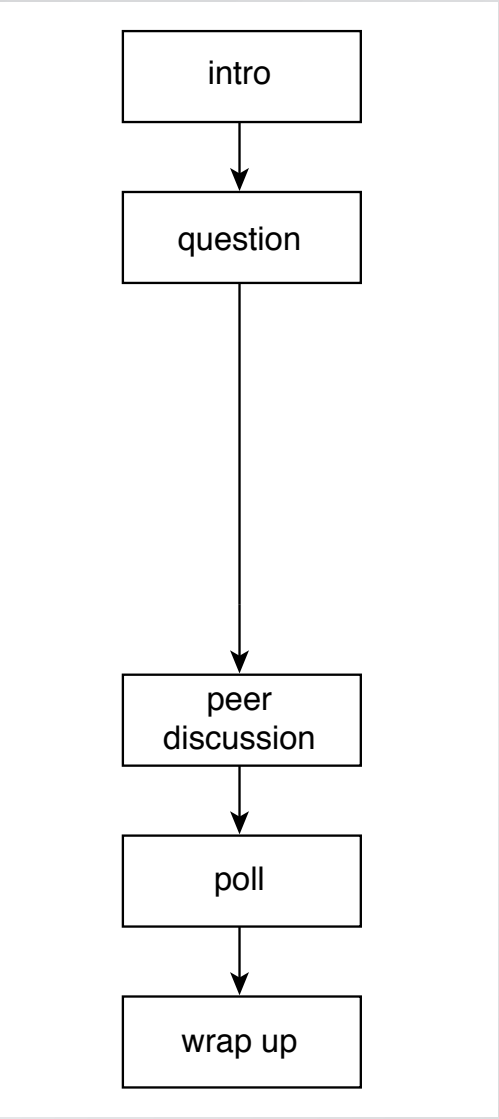
1–2 min saved, but…

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 much time do you allocate in a two-hour lecture for the use of Peer Instruction?"

ConcepTests

should count on about 15 min per ConcepTest

ConcepTests

should count on about 15 min per ConcepTest

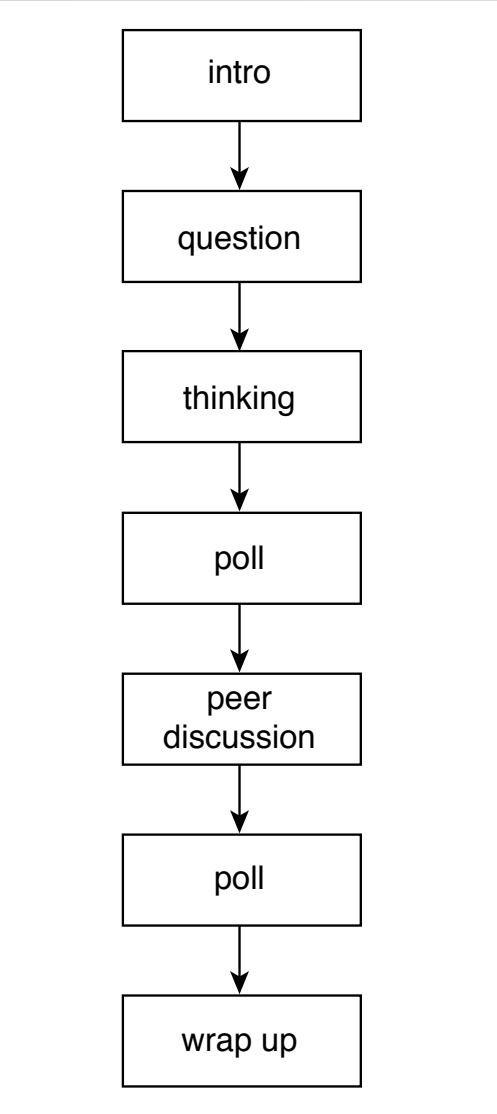
(including two pollings)

ConcepTests

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

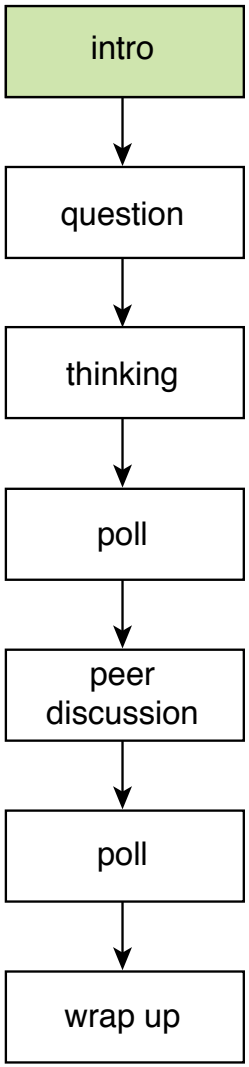
ConcepTests

engendering “deep learning”



ConcepTests

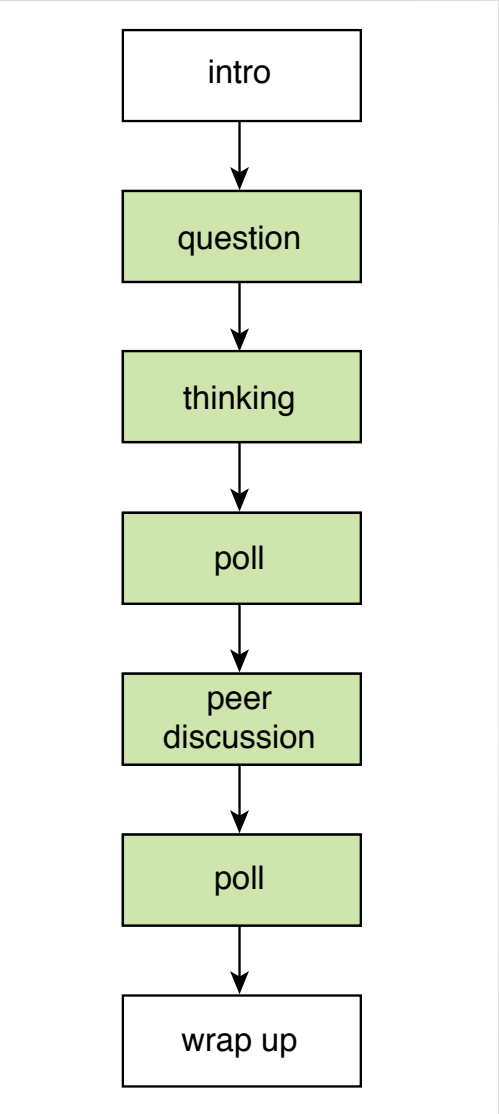
engendering “deep learning”



pre-class activity determines context

ConcepTests

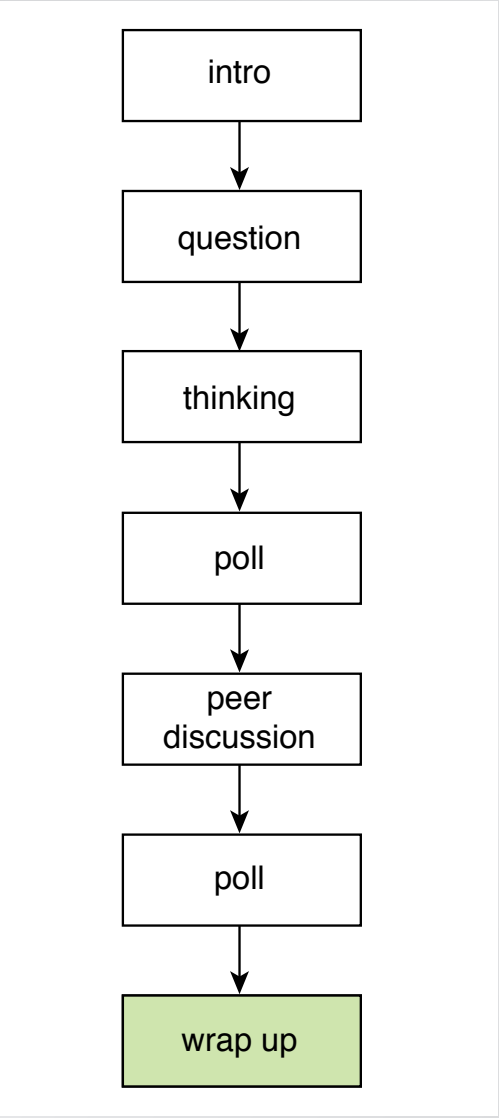
engendering “deep learning”



question transfers concepts to new context

ConcepTests

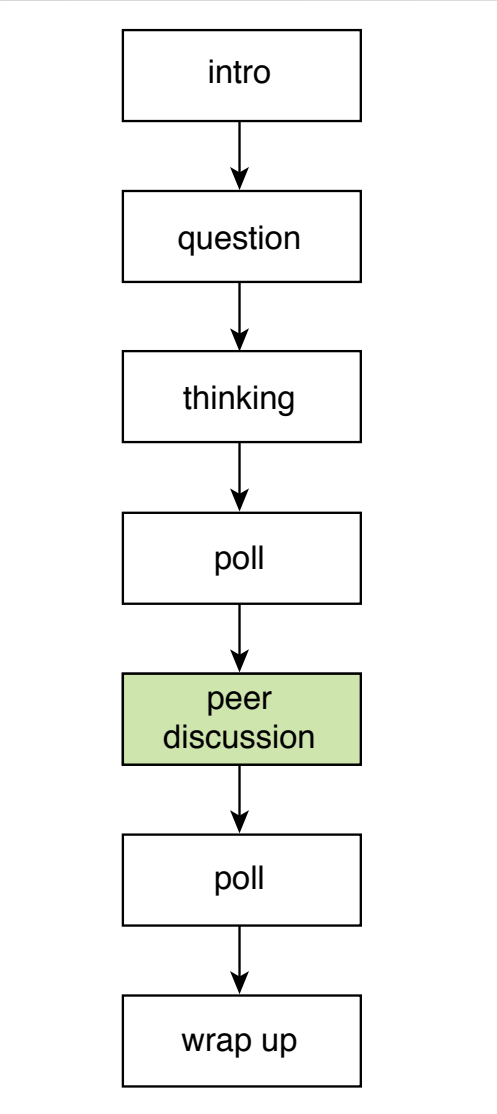
engendering “deep learning”



provide *your* explanation

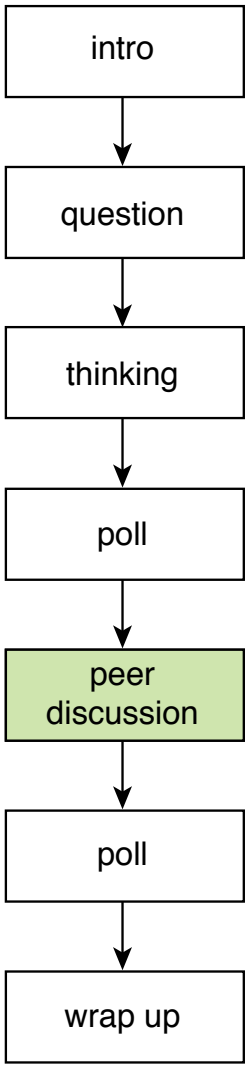
ConcepTests

importance of peer discussion



ConcepTests

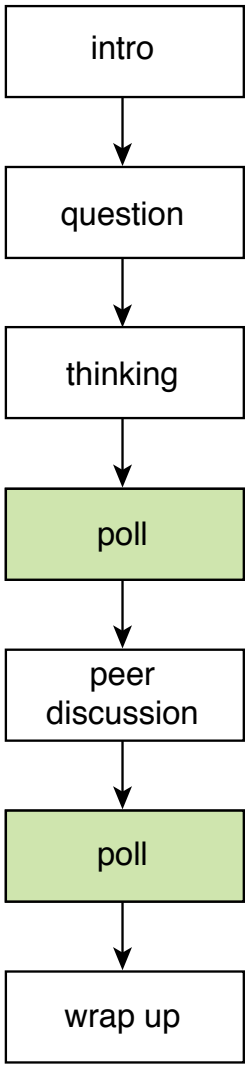
importance of peer discussion



vary activity

ConcepTests

importance of peer discussion



vary activity, measure poll-repoll gain

ConcepTests

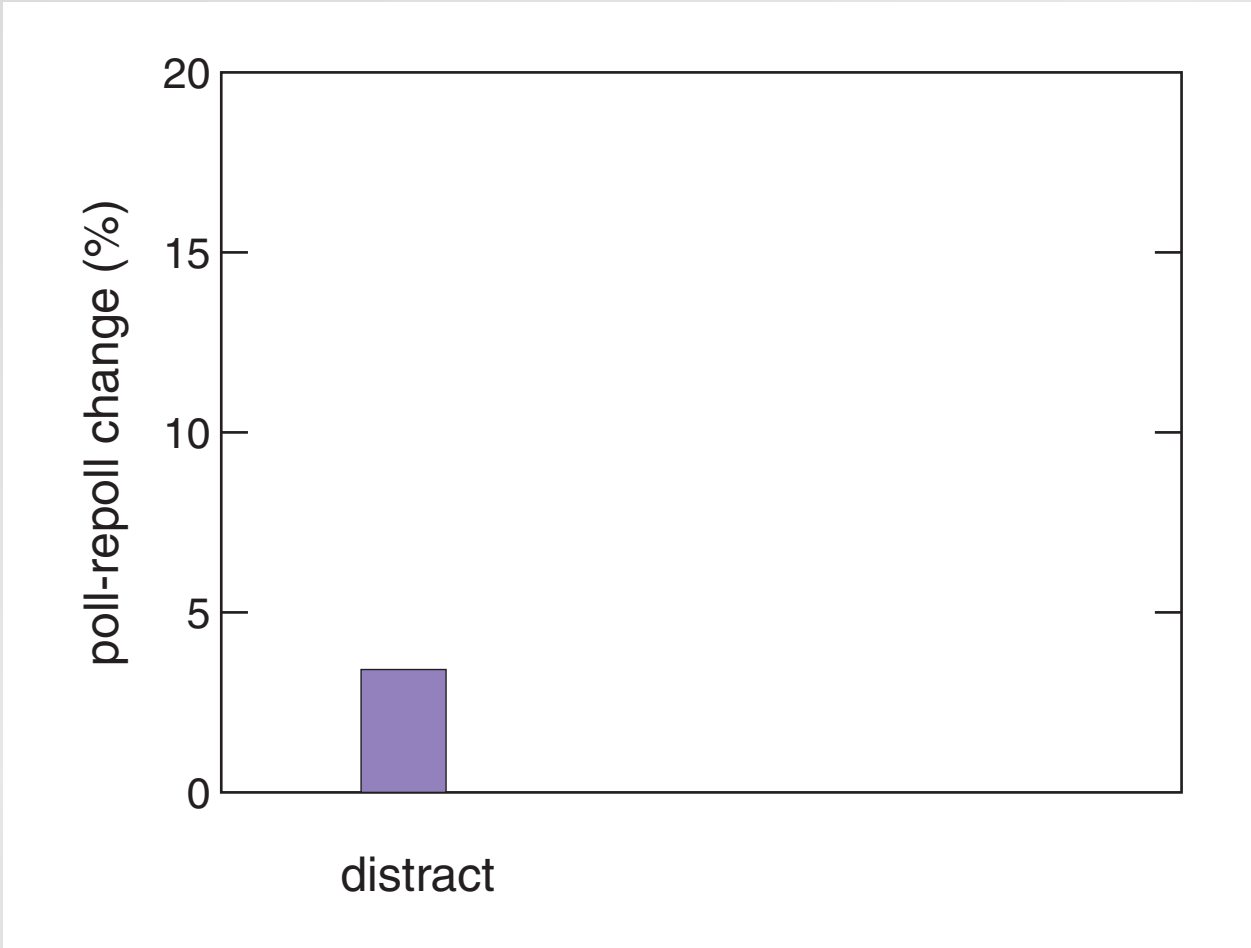
importance of peer discussion

compare poll-repoll gain for 3 activities:

- distract
- reflect
- discuss

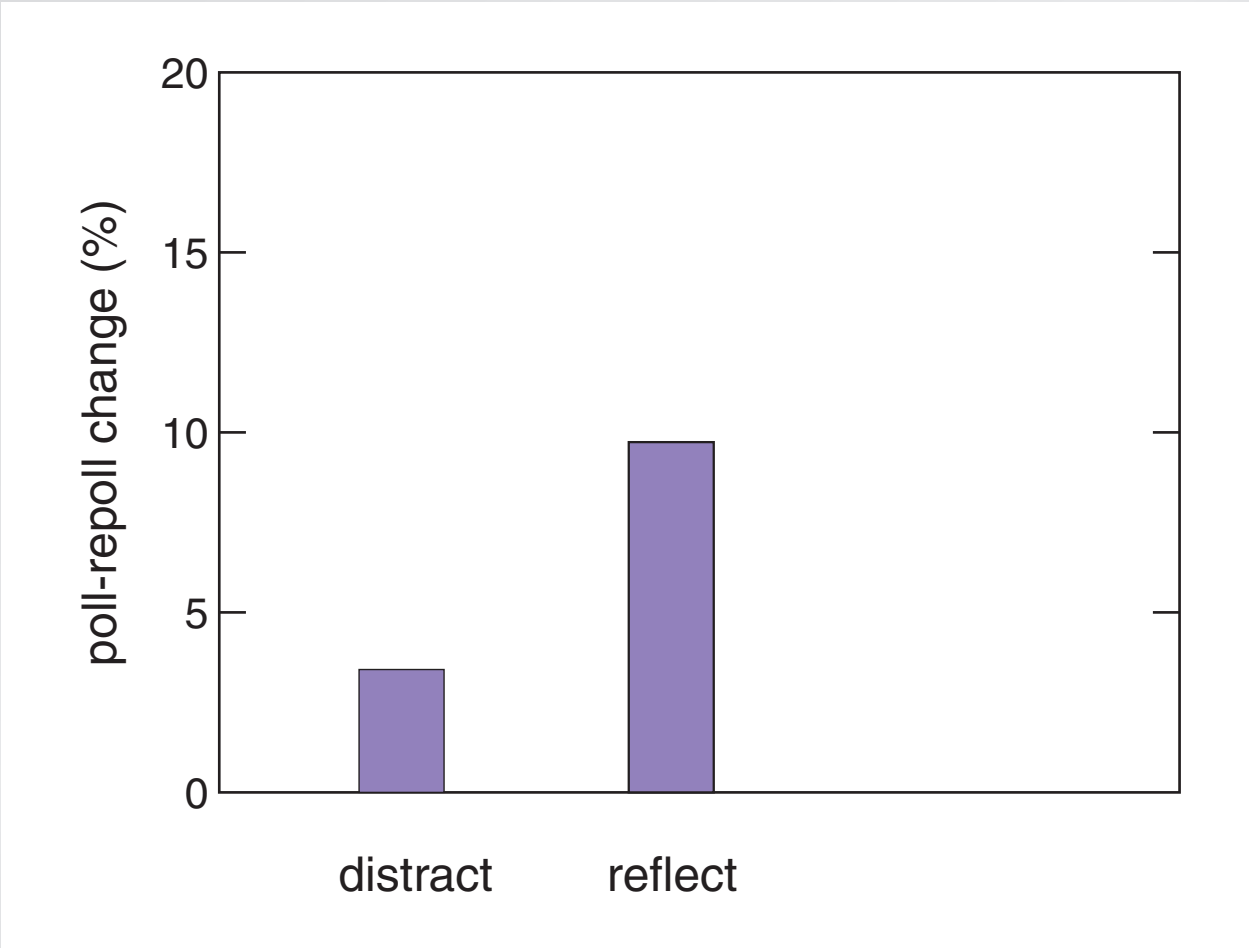
ConcepTests

importance of peer discussion



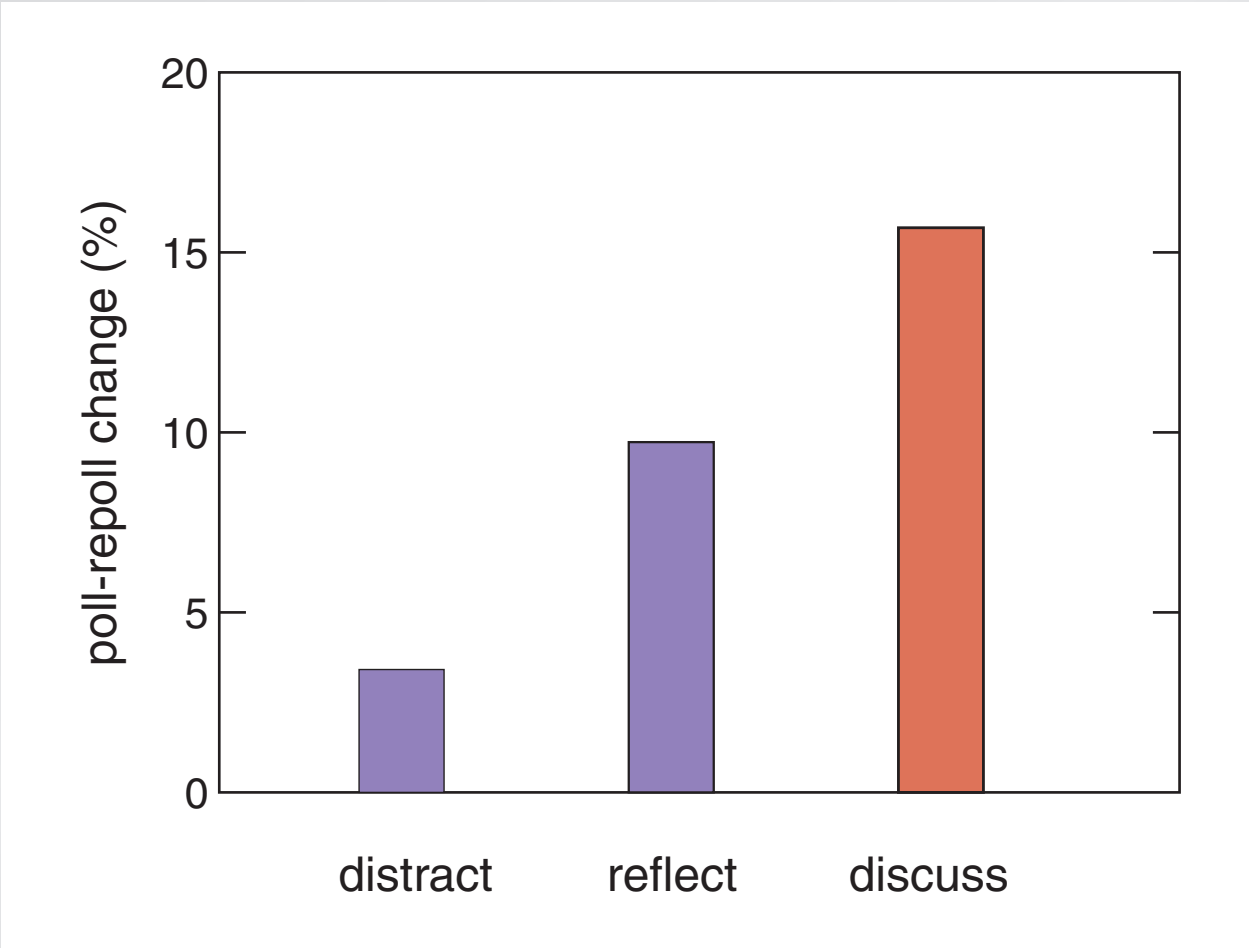
ConcepTests

importance of peer discussion



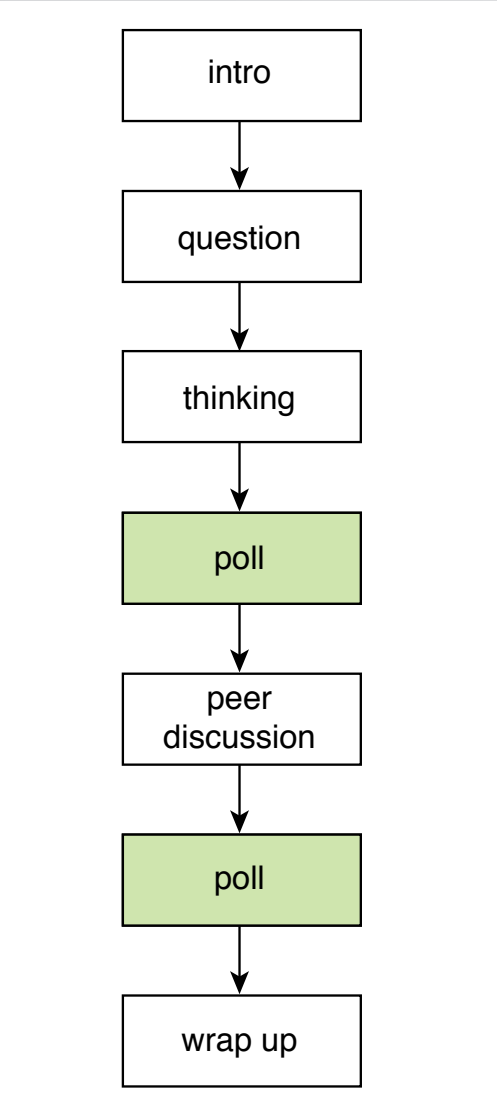
ConcepTests

importance of peer discussion



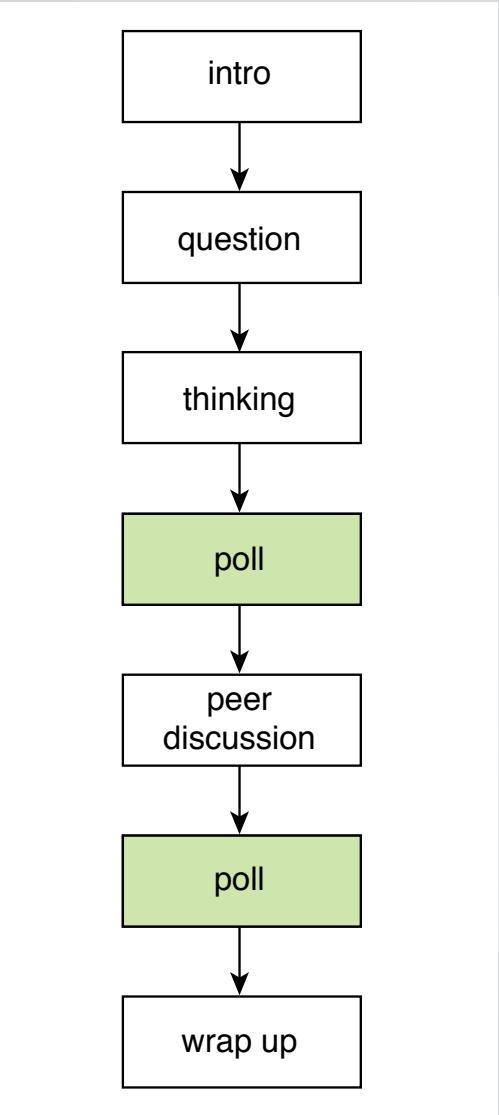
ConcepTests

Are clickers required?



ConcepTests

Are clickers required?



normalized FCI gain:

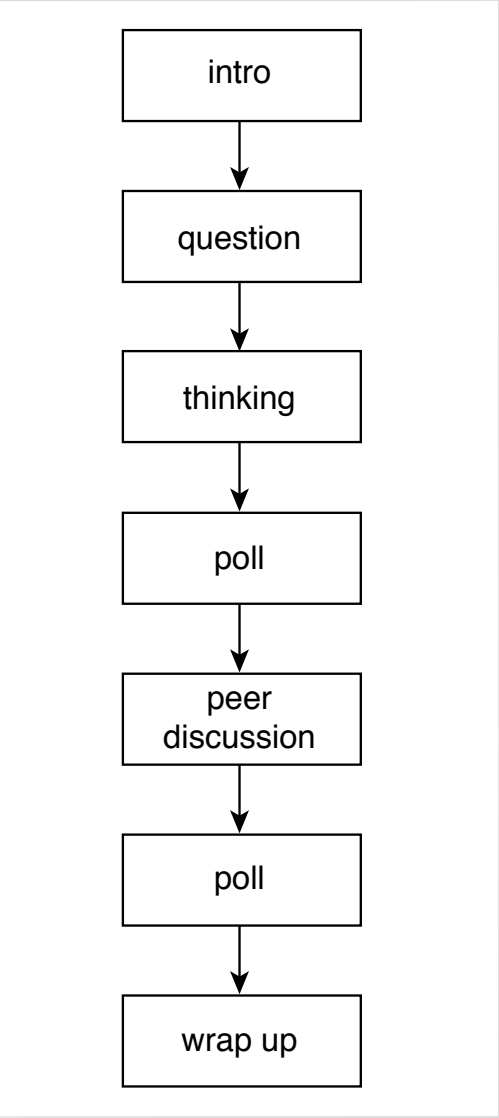
flashcards: 0.47

clickers: 0.44

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

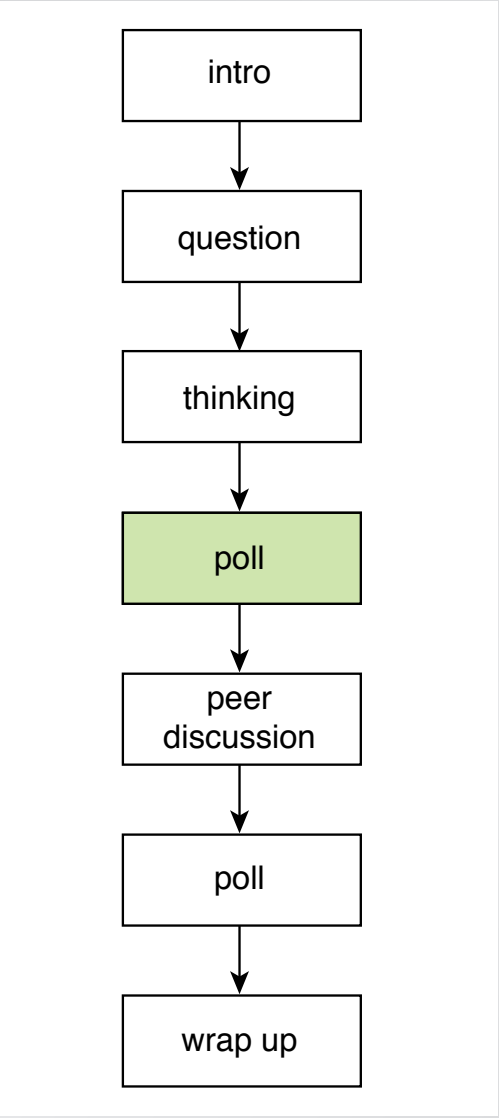
ConcepTests

show histograms?



ConcepTests

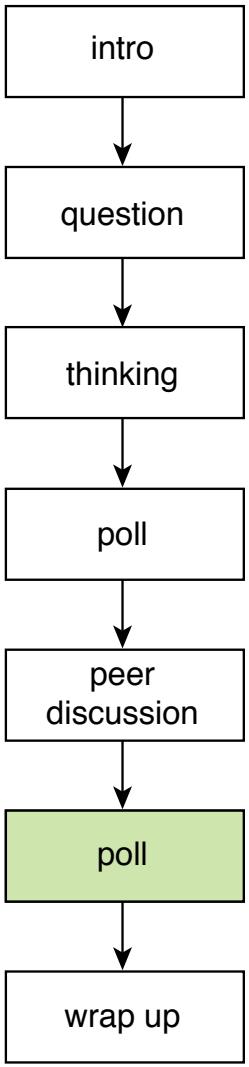
show histograms?



no — biases discussion

ConcepTests

show histograms?

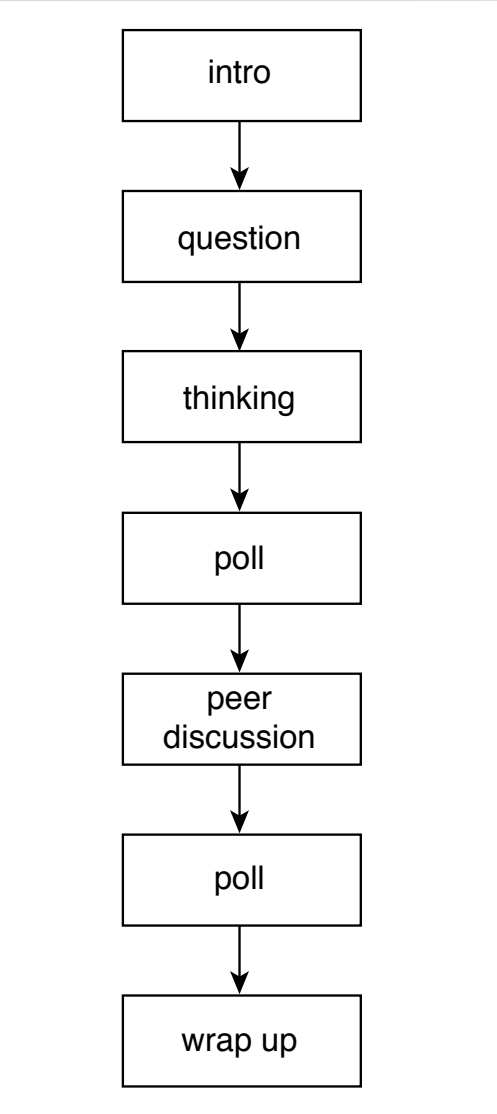


no — biases discussion

yes — helps bring closure

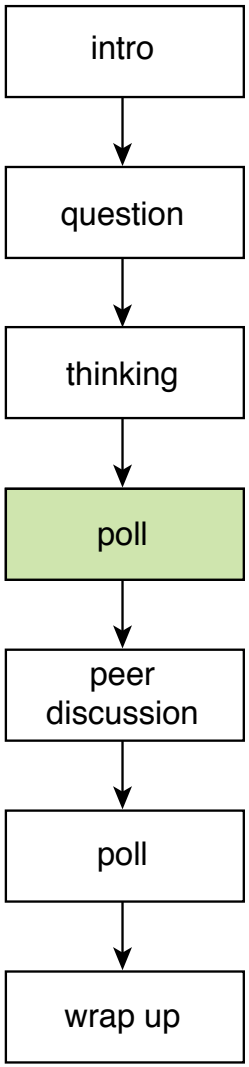
ConcepTests

have individual students defend choices?



ConcepTests

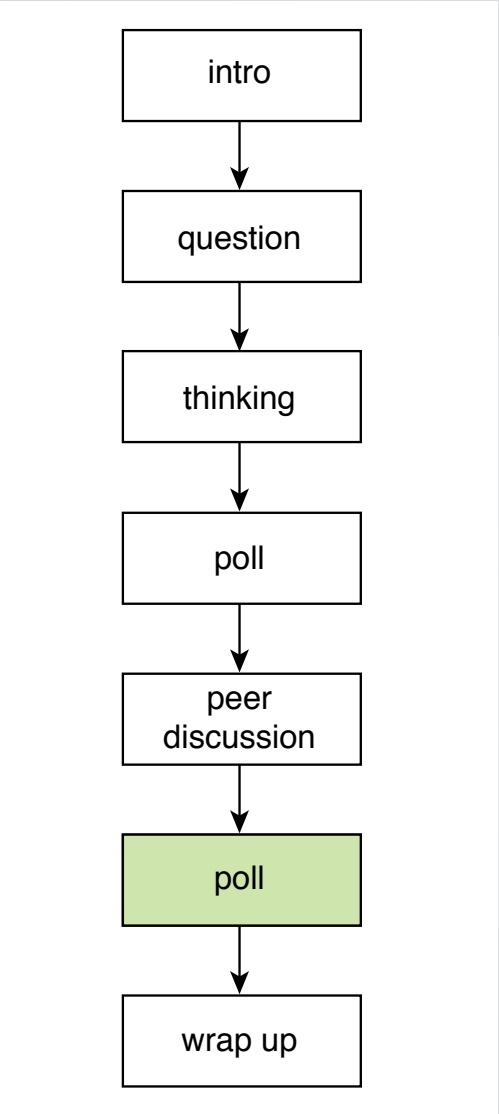
have individual students defend choices?



provides additional insights for discussion

ConcepTests

have individual students defend choices?

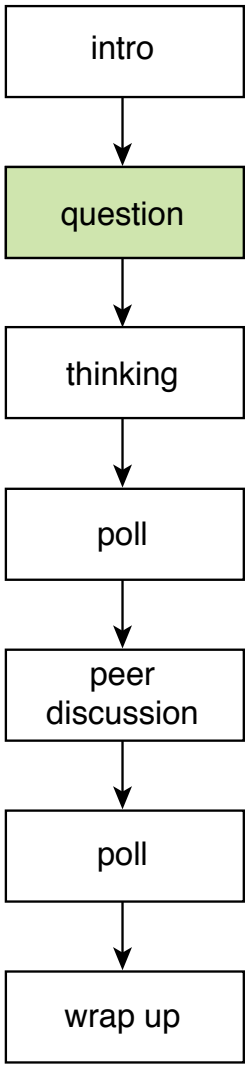


involves students in wrap up

ConcepTests

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

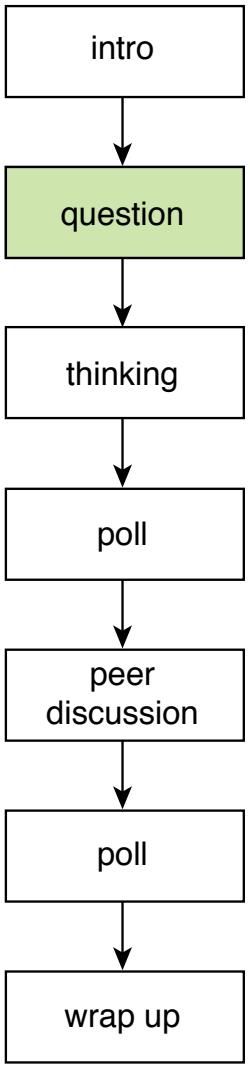
ConcepTests



An effective ConcepTest…

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

ConcepTests



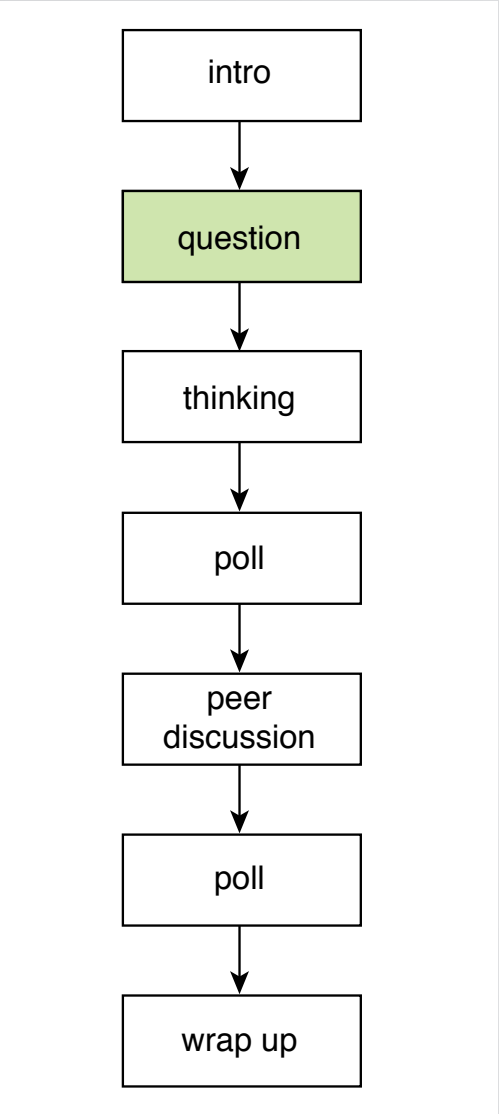
Sources of ConcepTests:

- 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

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ConcepTests

hole in plate	model
moral reasoning	discussion
airline	fact

ConcepTests

hole in plate

model

moral reasoning

discussion

airline

fact

fact-recall not engaging

Outline

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

In closing…

"Experience from those who have used PI?
Anyone in my subject (partial differential equations)?"

In closing…

"Experience from those who have used PI?
Anyone in my subject (partial differential equations)?"

"Are there any institutions in Singapore
that use PI for teaching?"

In closing…

"How do I deal with resistance from the students?"

In closing…

"How do I deal with resistance from the students?"

(to be discussed next session!)

Assignment

To do before next online session:

1. learn more about Peer Instruction
2. identify resources/ConcepTests in your discipline
3. find PI Users in your discipline
4. review & score ConcepTests
5. create a ConcepTest in your field (optional)

ConcepTests

To identify resources in your discipline Google:

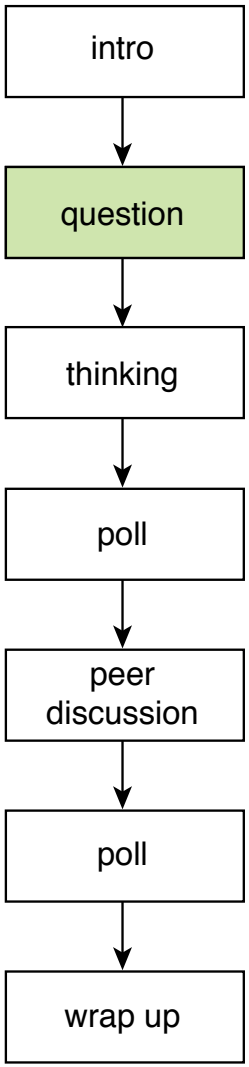
<your discipline> ConcepTest

<your discipline> “Concept Test”

<your discipline> “Peer Instruction”

Assignment

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



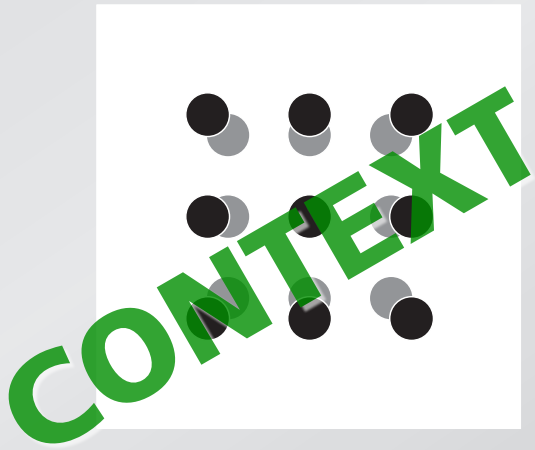
1. context

2. question

3. closure

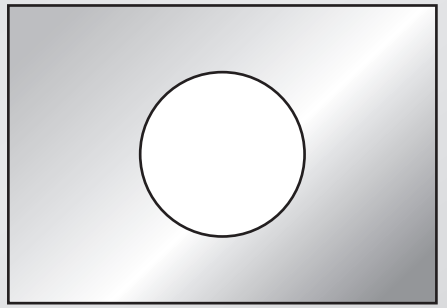
Assignment

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.



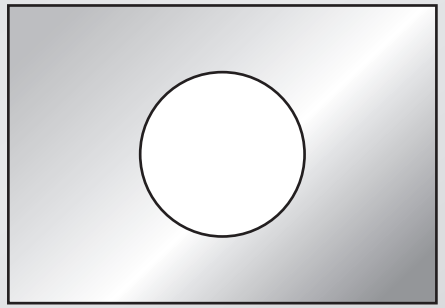
When the plate is uniformly heated, the diameter of the hole

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

QUESTION

Assignment

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



stem

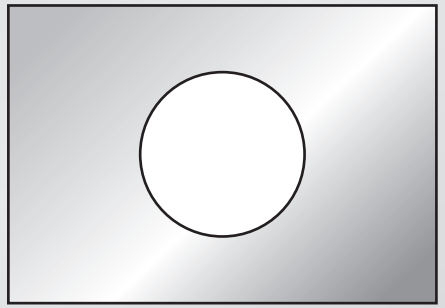
When the plate is uniformly heated, the diameter of the hole

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.

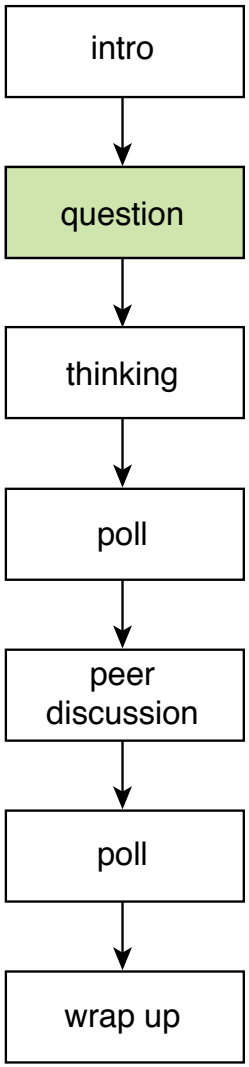
QUESTION

Assignment

consider the atoms at the rim of the hole

Assignment

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



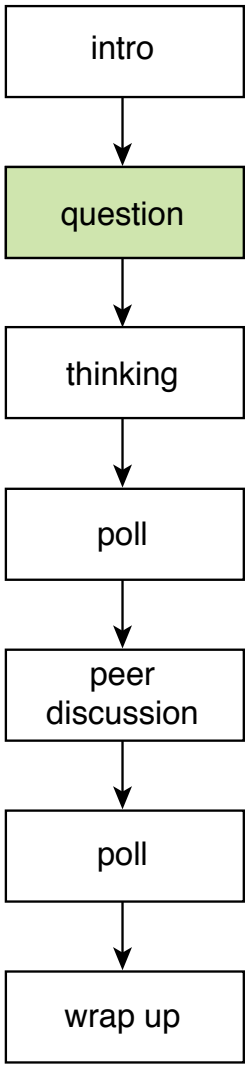
1. context

2. question

3. closure

Assignment

some basic design rules

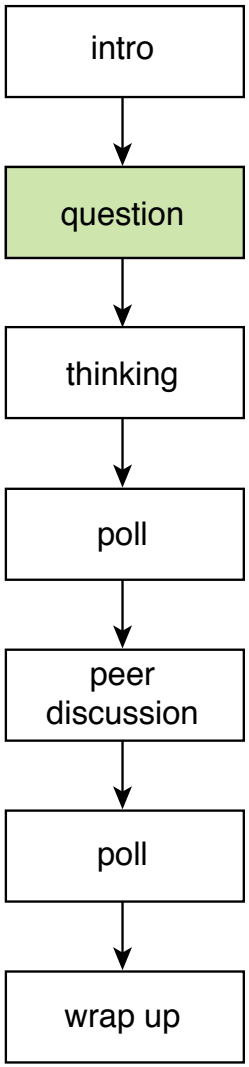


General tips:

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

Assignment

some basic design rules

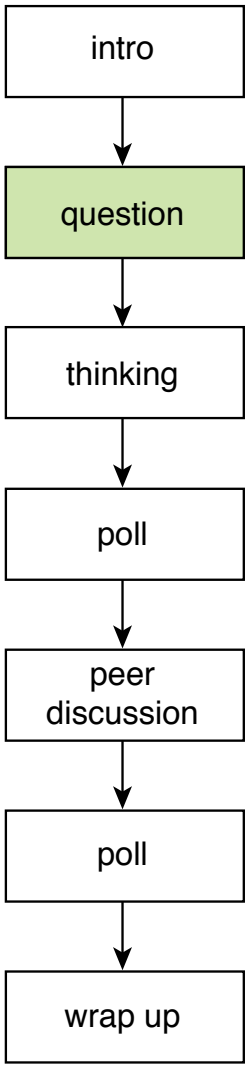


Remove:

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

Assignment

some basic design rules

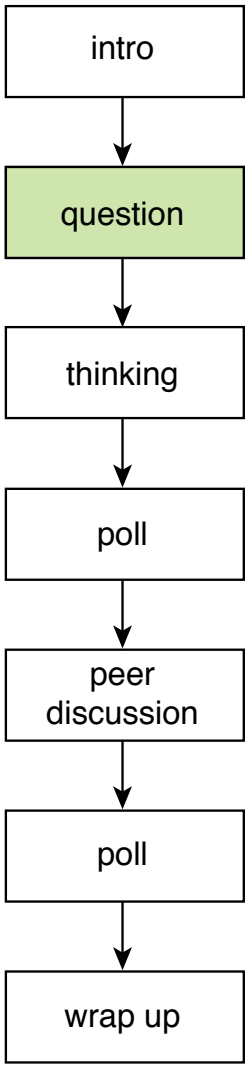


Writing good “stems”:

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

Assignment

some basic design rules

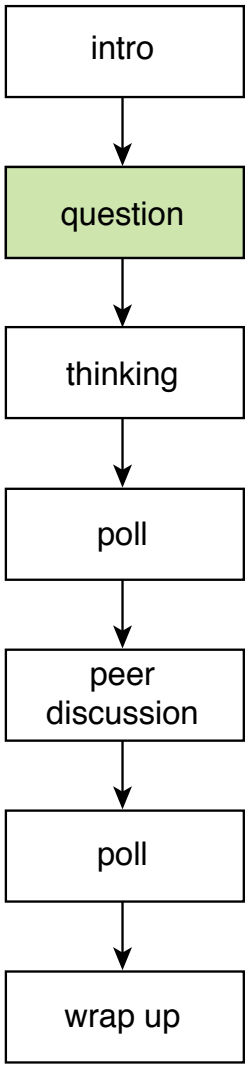


Writing good answer choices:

- 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.

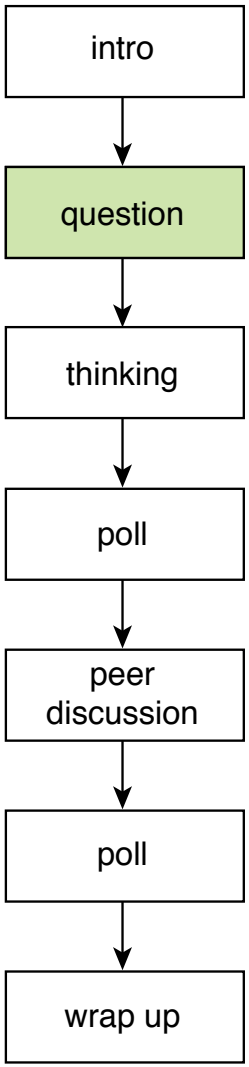
B. Only when *jushespora* change color.

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.

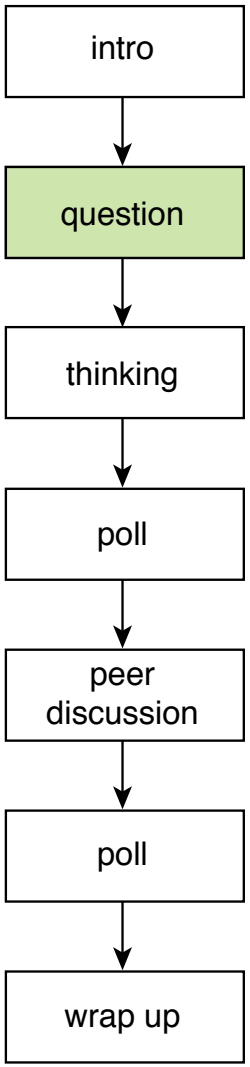
B. Red.

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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