Engaging students one-on-one, all at once
Online Session 1

Online Short Course
The University of Pretoria in South Africa
August 19, 2010

How do we learn?

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

How do we learn?

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

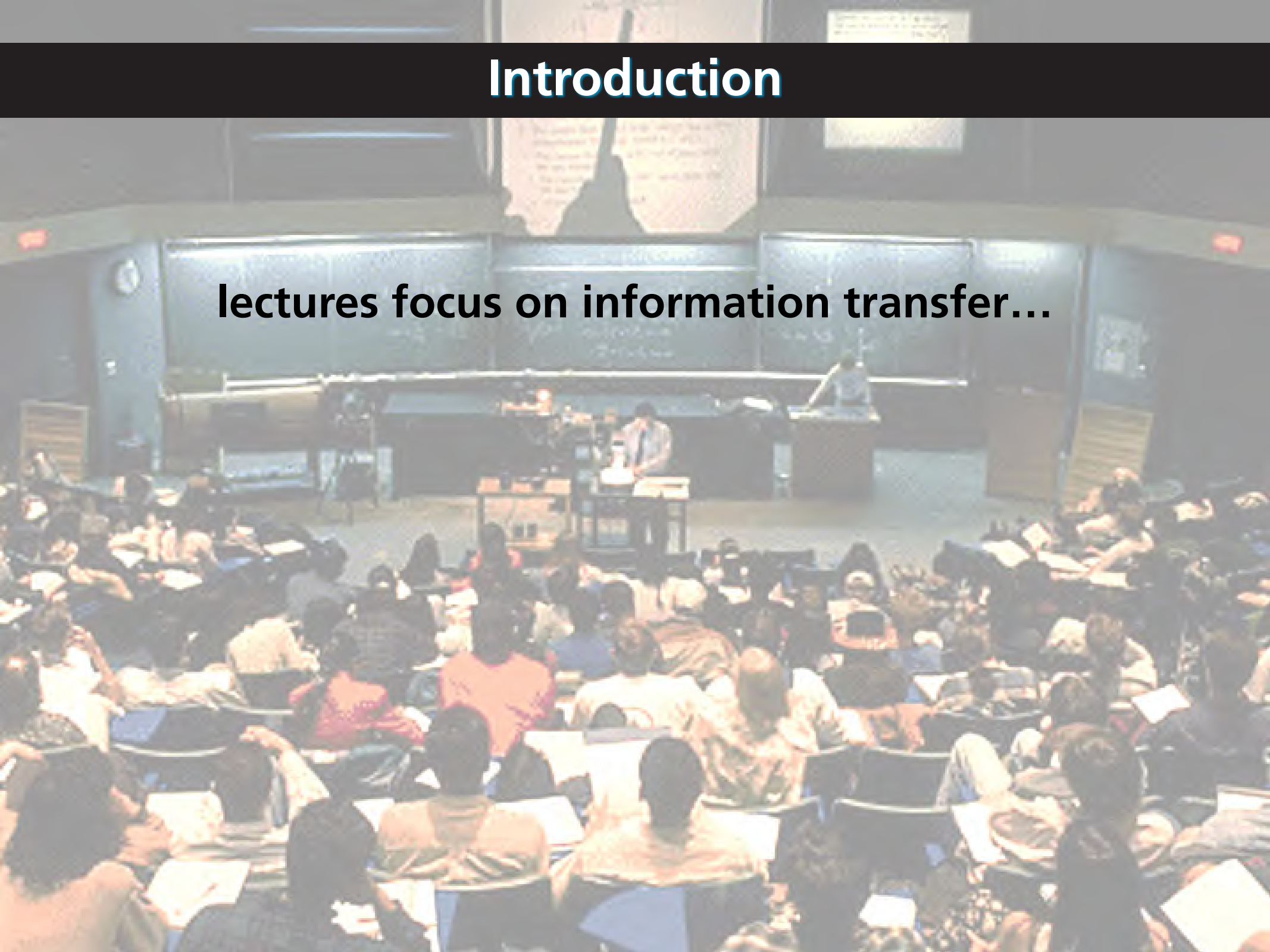
***How* did you become good at this?**

How do we learn?

I learned it:

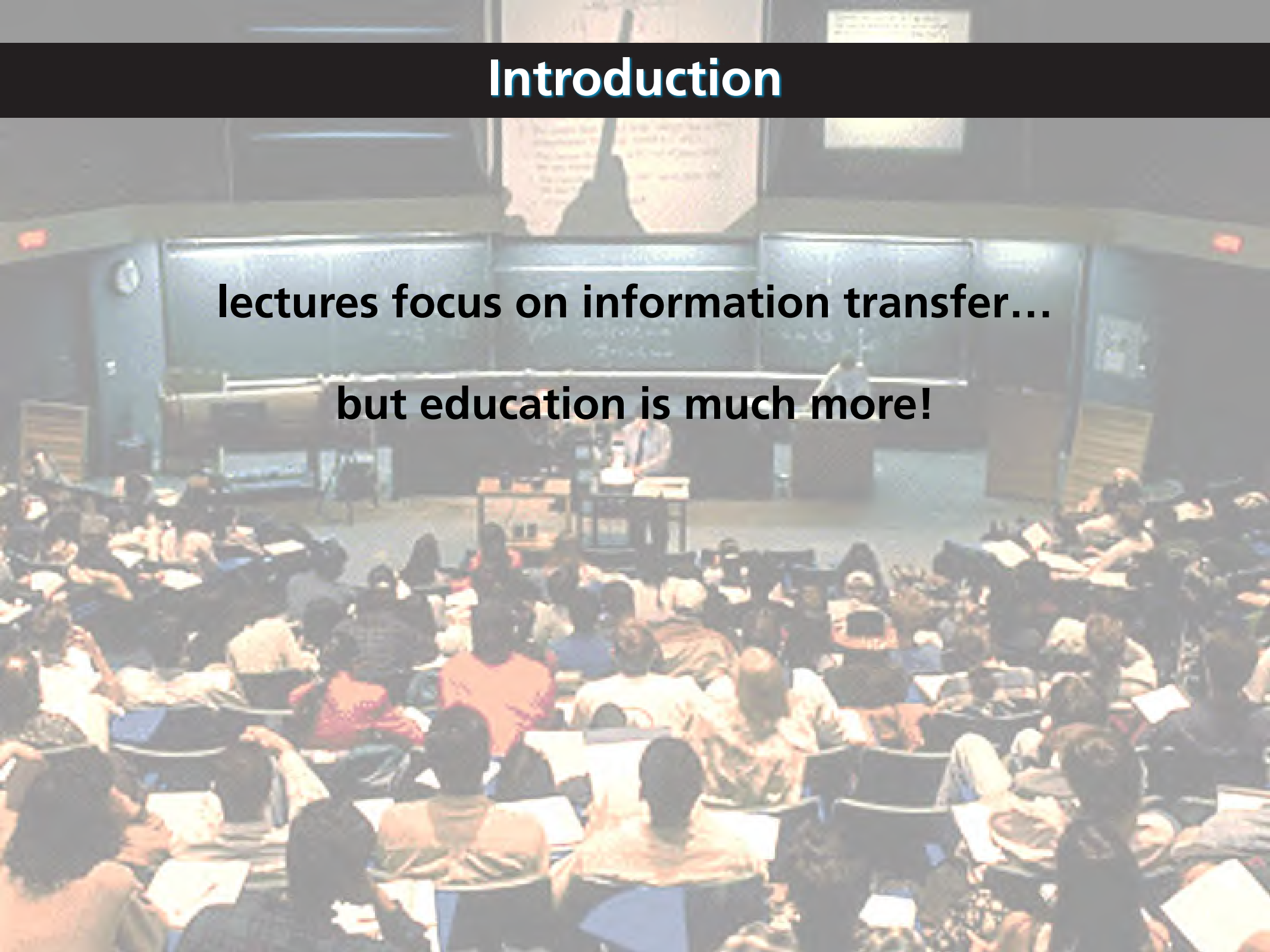
A. by practicing
B. in lectures
C. by doing it (trial and error)
D. other

Introduction



lectures focus on information transfer…

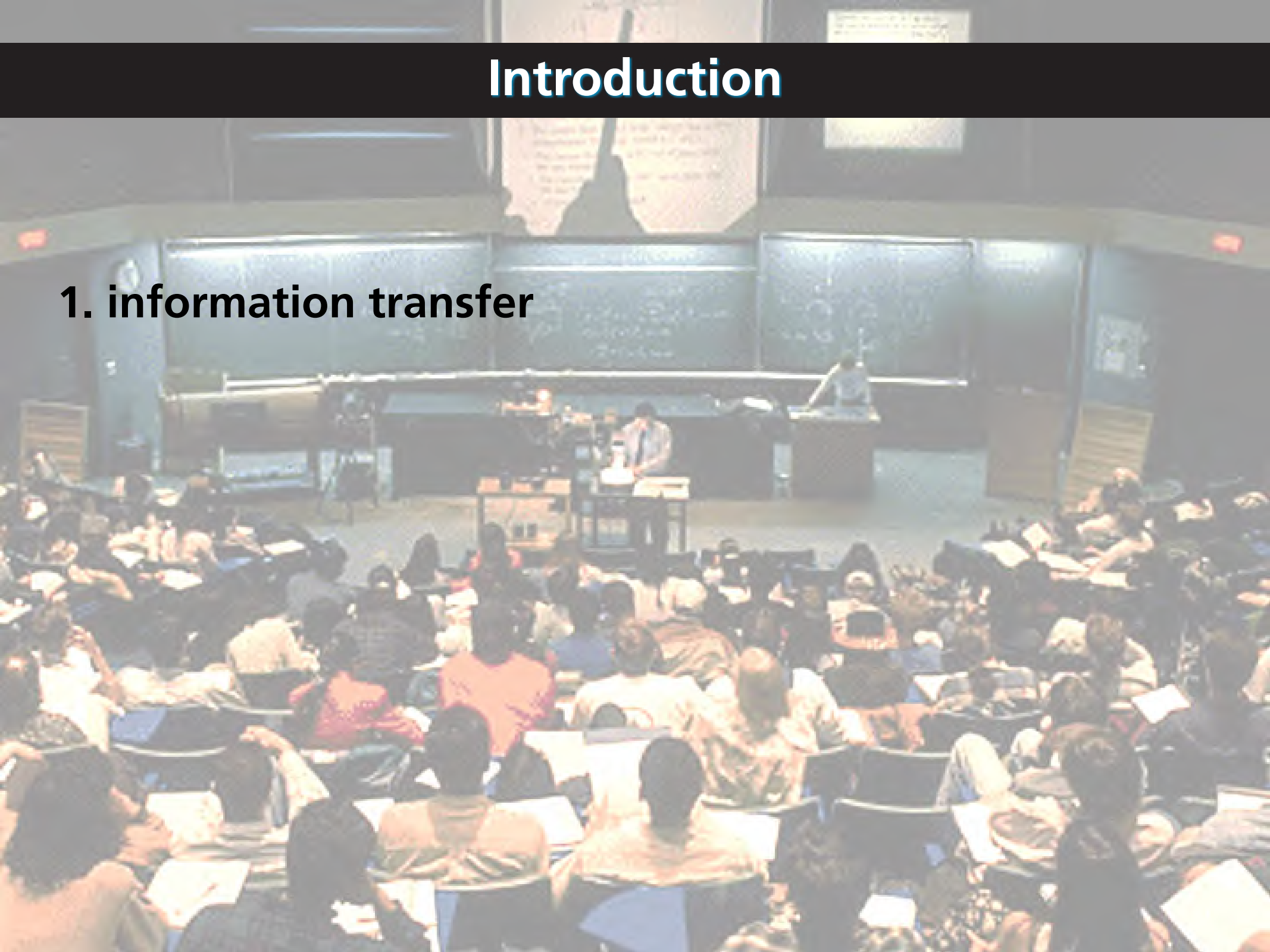
Introduction



lectures focus on information transfer…

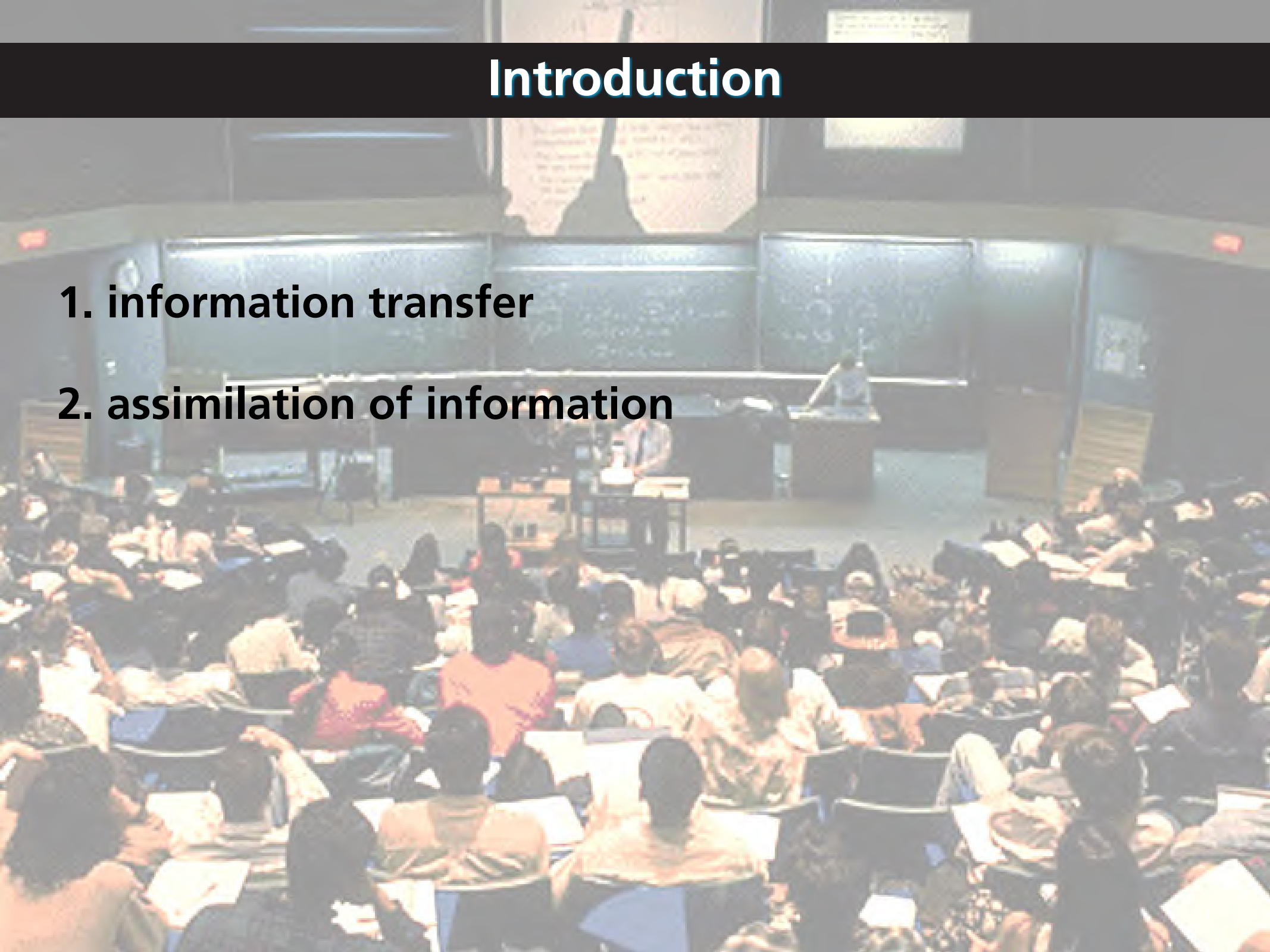
but education is much more!

Introduction



1. information transfer

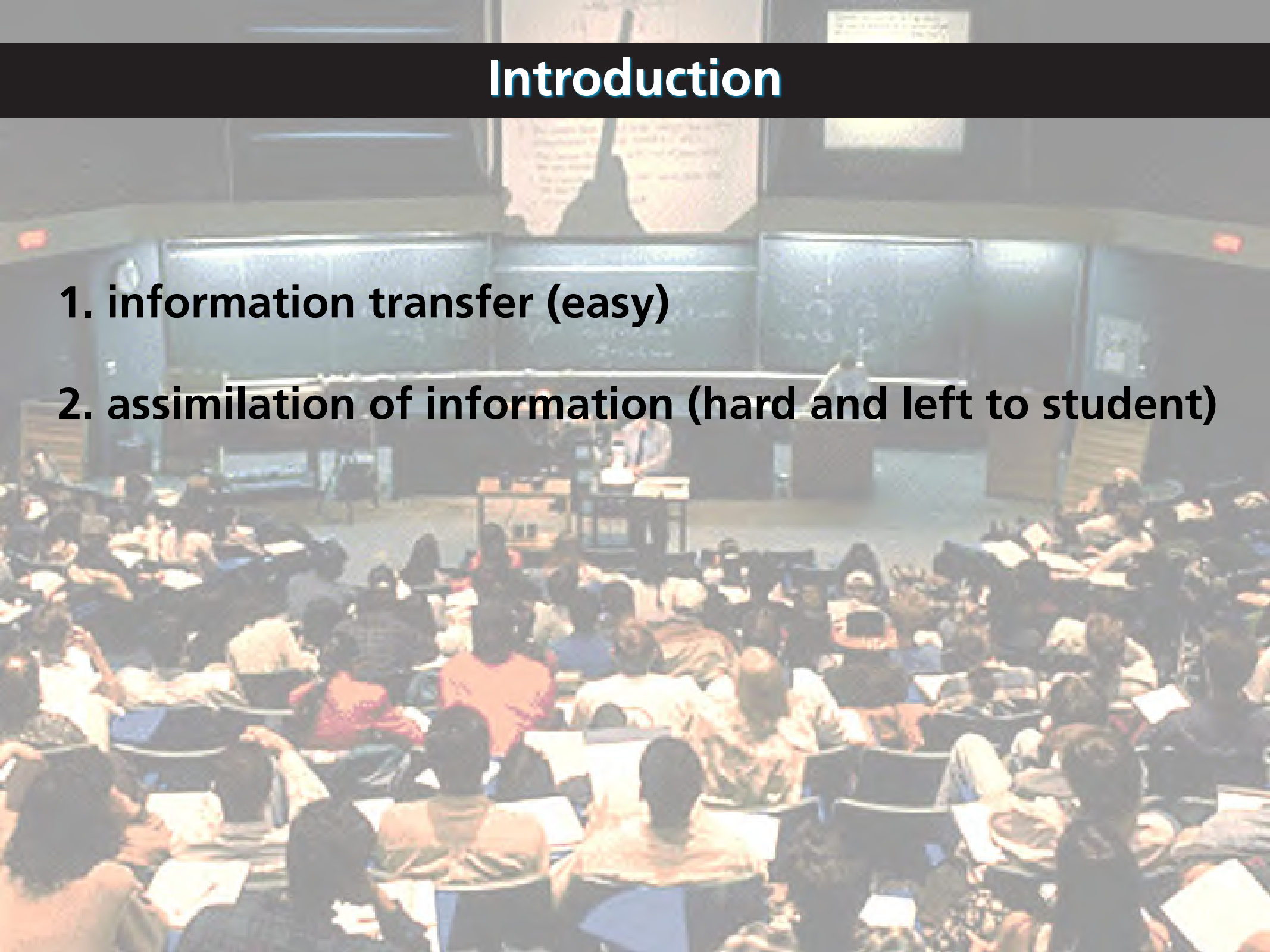
Introduction



1. information transfer

2. assimilation of information

Introduction



1. information transfer (easy)

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

Introduction

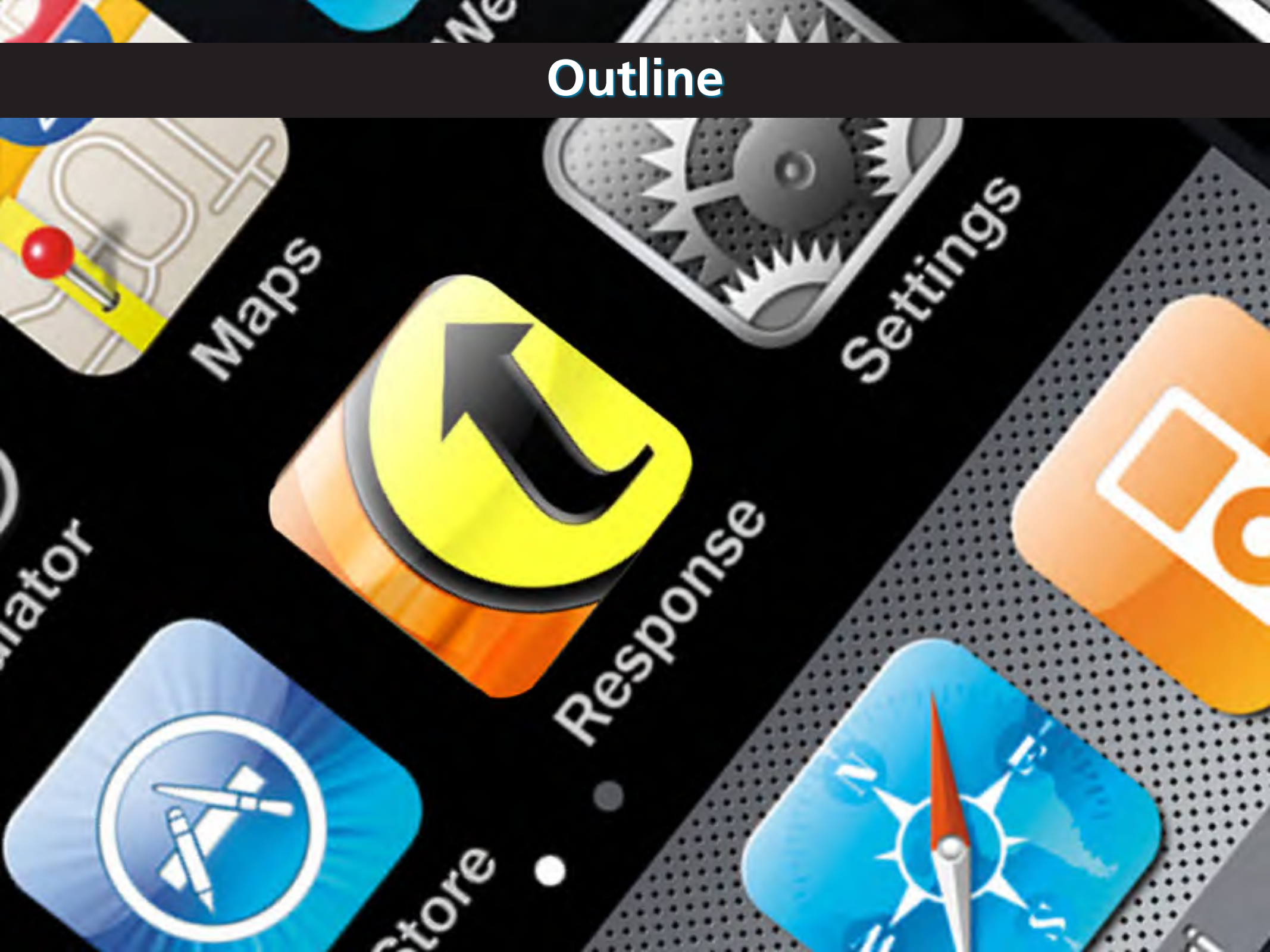
Solution: move information transfer out of classroom!

Introduction

Solution: move information transfer out of classroom!

(so we can help students assimilate the information in class)

Outline

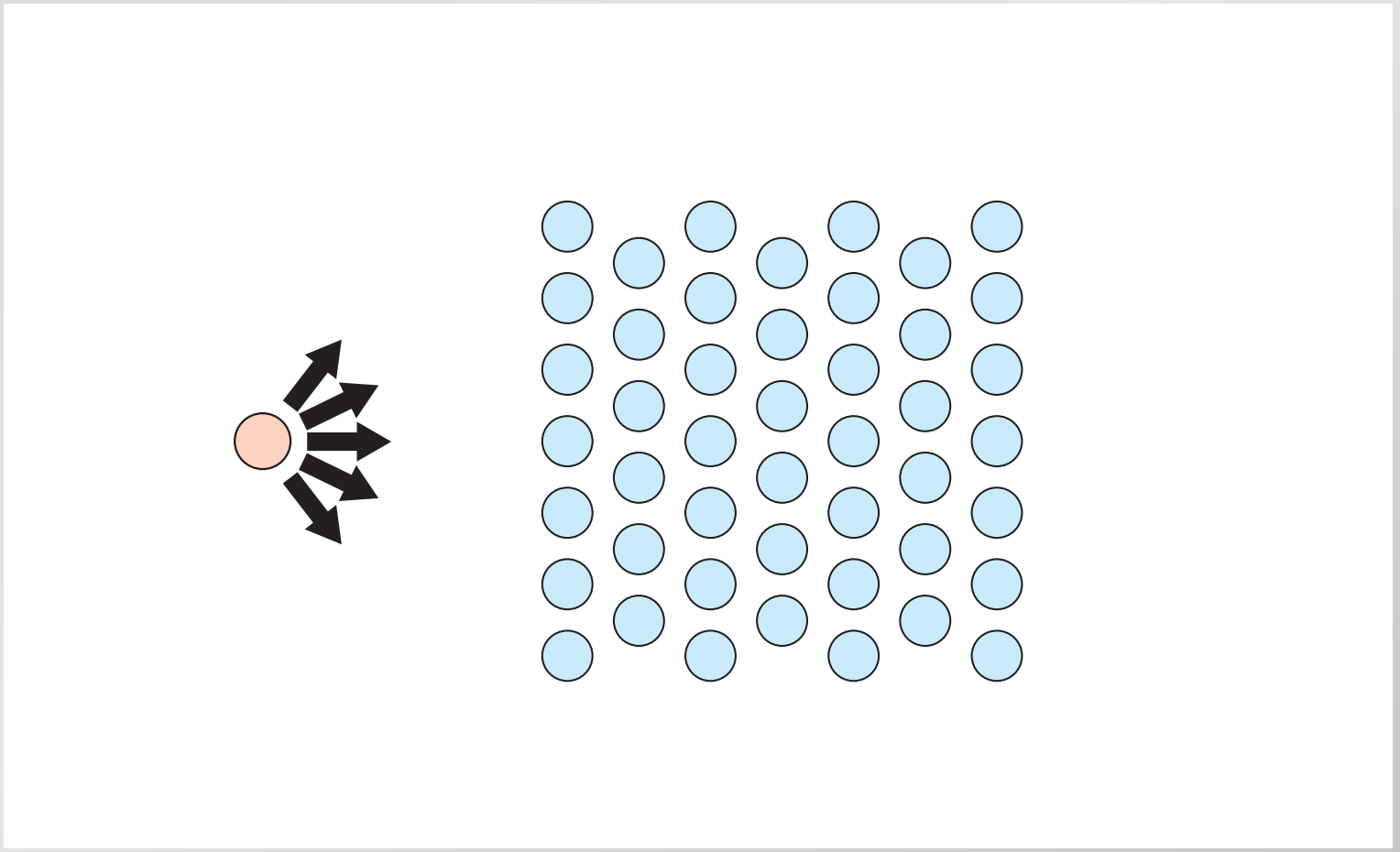


Outline

- PI & JiTT overview
- Implementing PI & JiTT
- Discussion

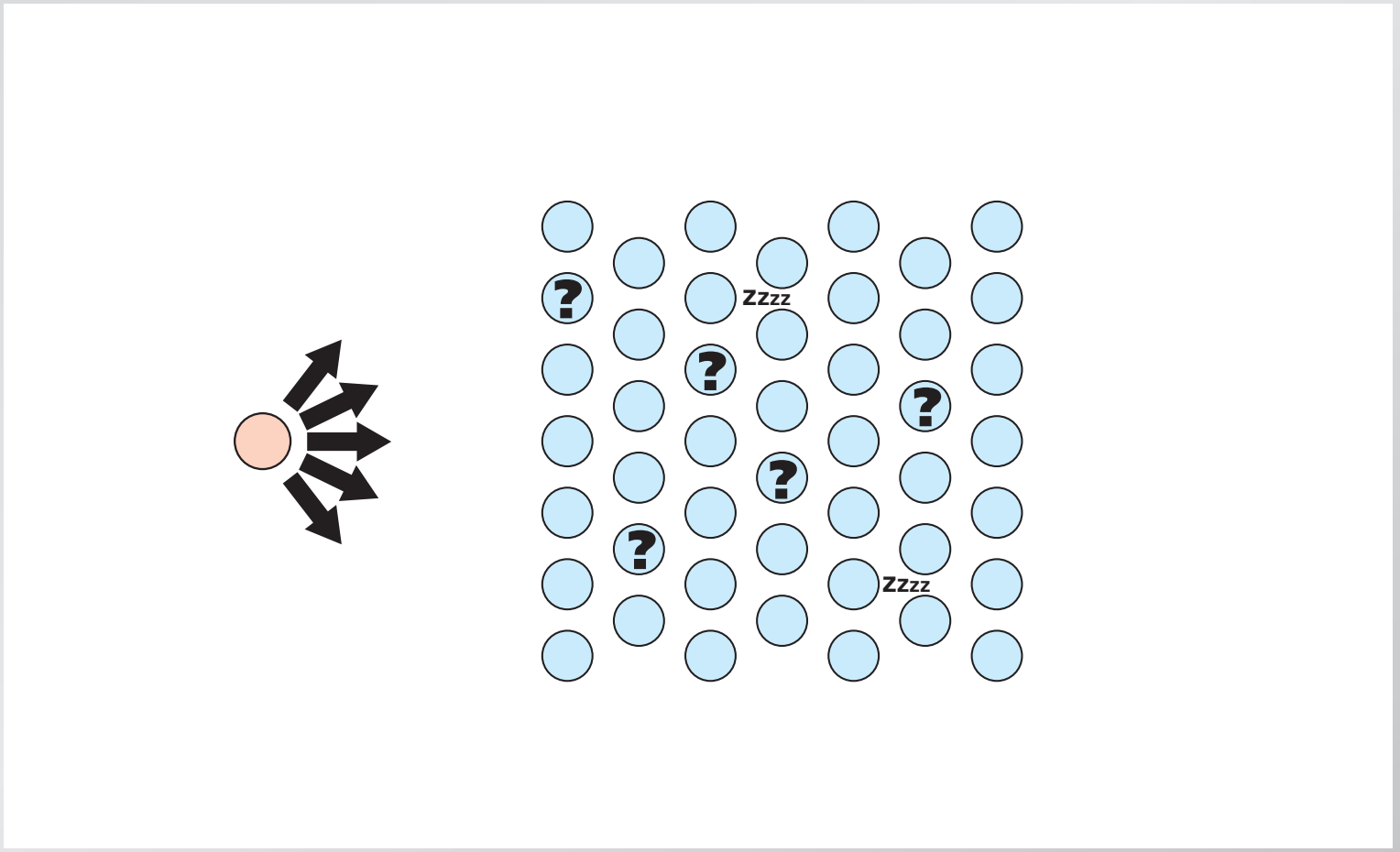
PI & JiTT Overview

traditional approach: one-way flow of information



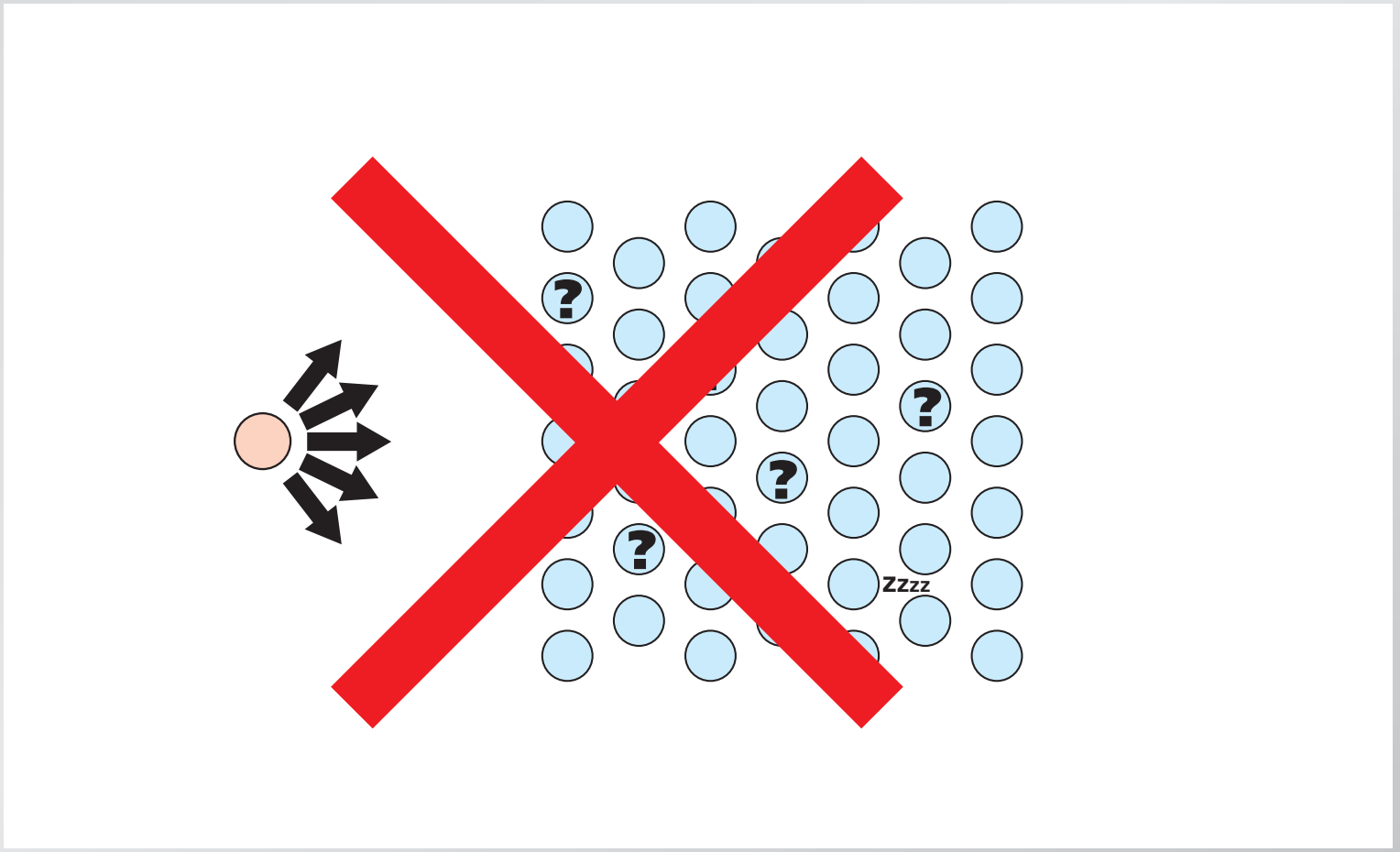
PI & JiTT Overview

traditional approach: one-way flow of information



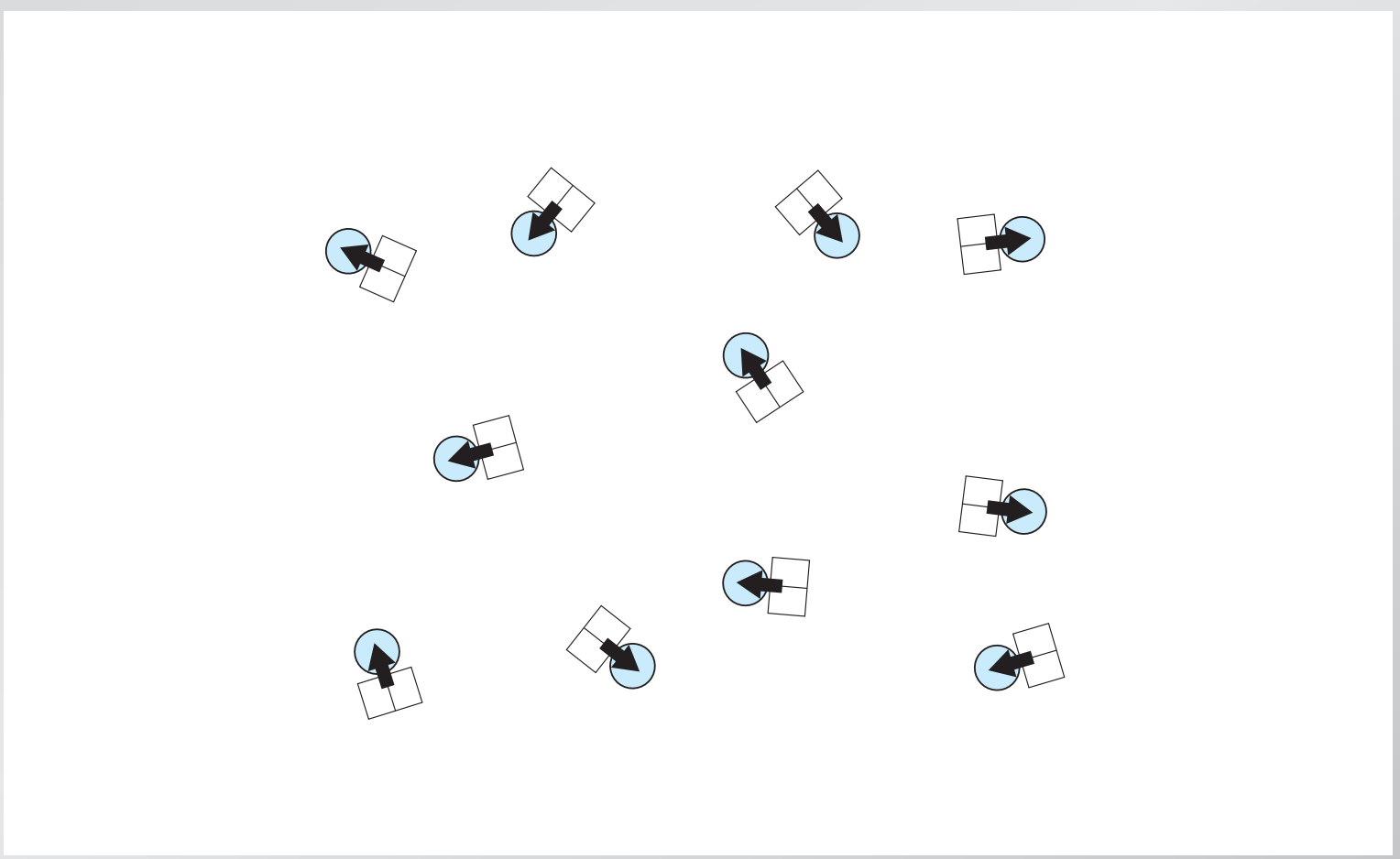
PI & JiTT Overview

no learning



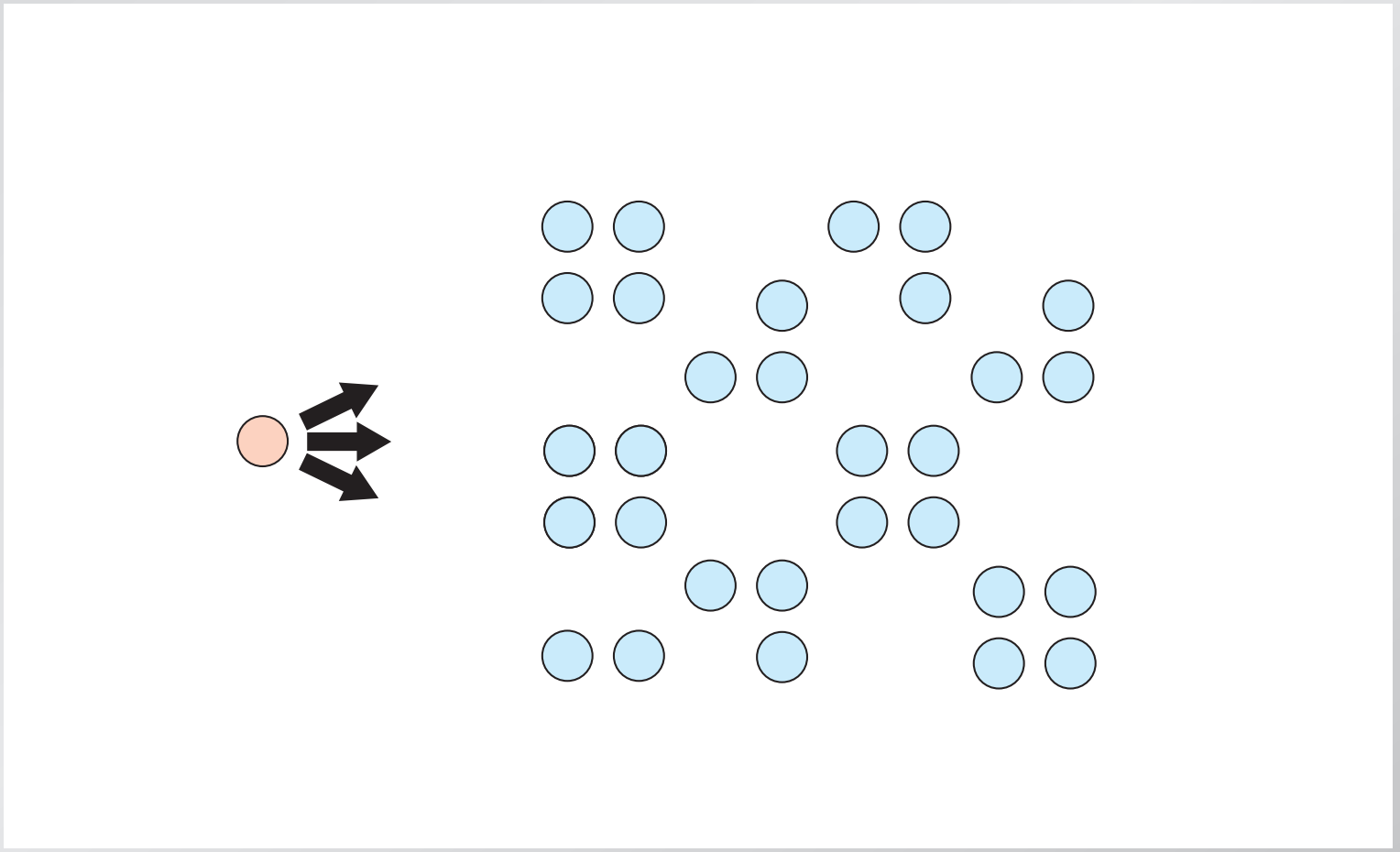
PI & JiTT Overview

instead: assign reading (JiTT)



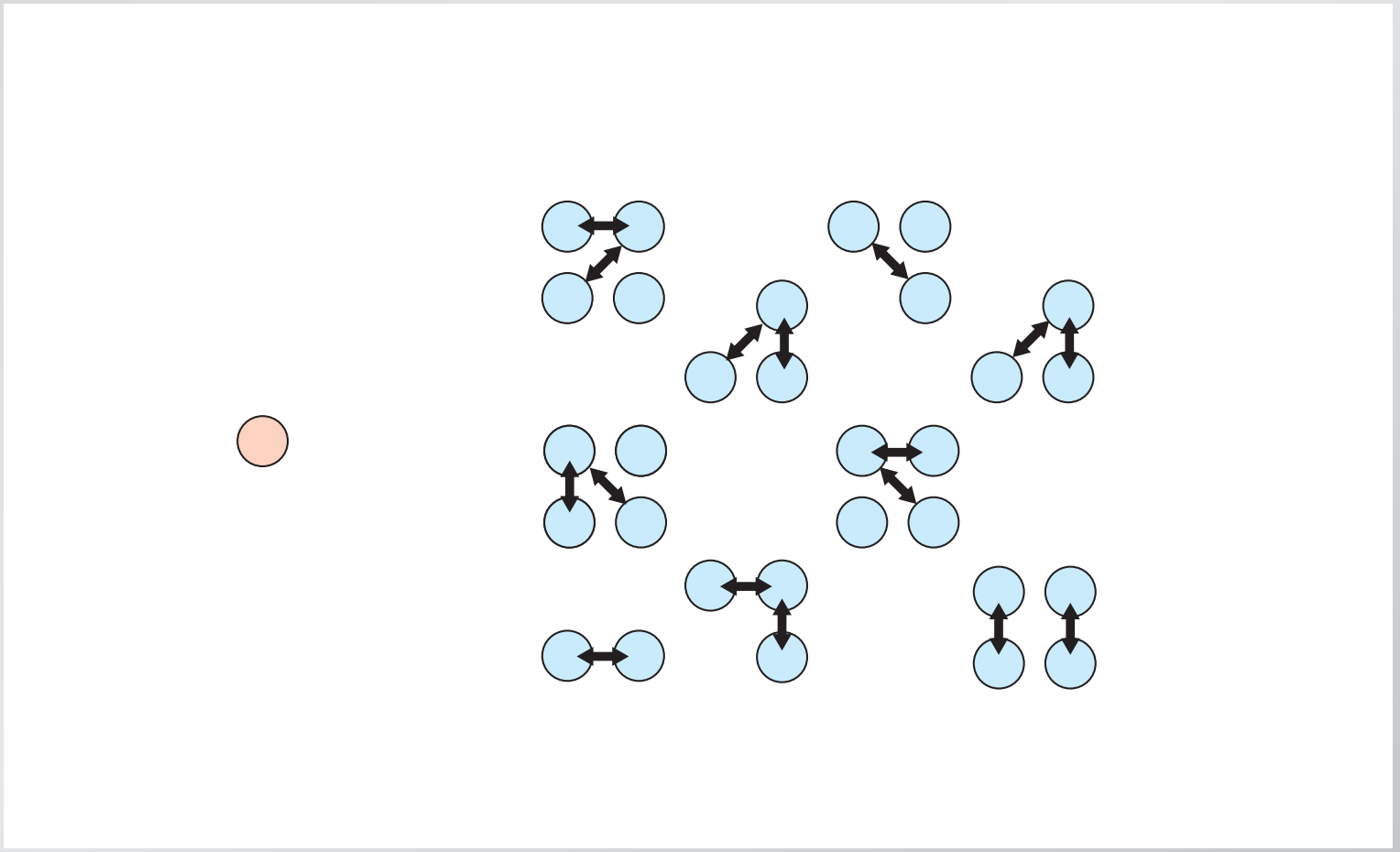
PI & JiTT Overview

lecture a little…



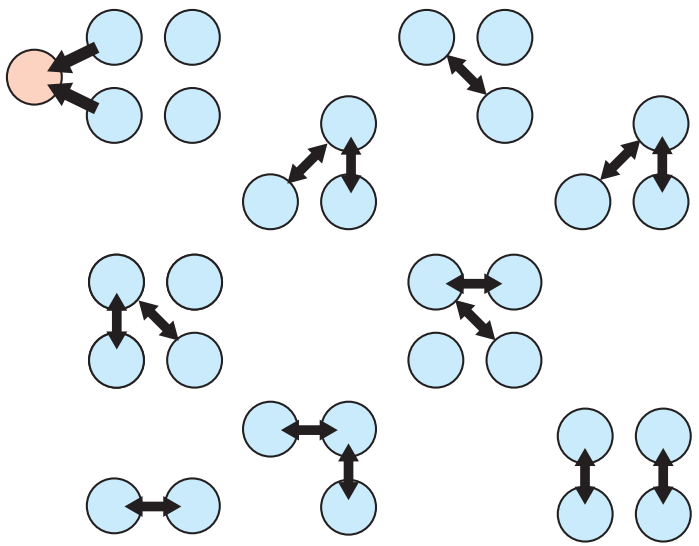
PI & JiTT Overview

…and have students discuss and learn (PI)



PI & JiTT Overview

information flows two ways



PI & JiTT Overview

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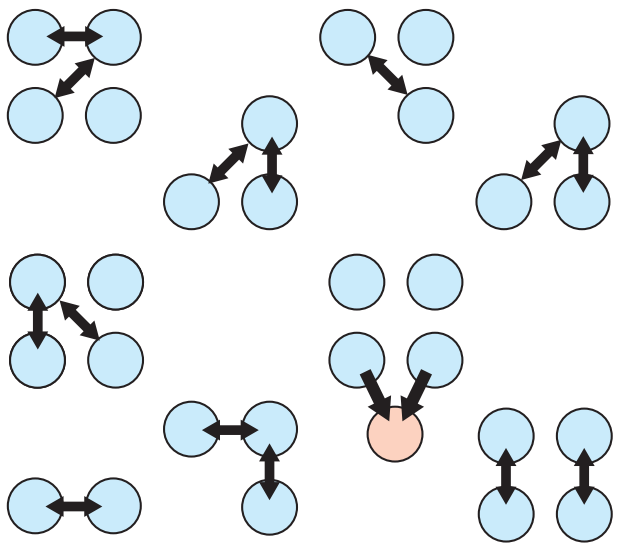

PI & JiTT Overview

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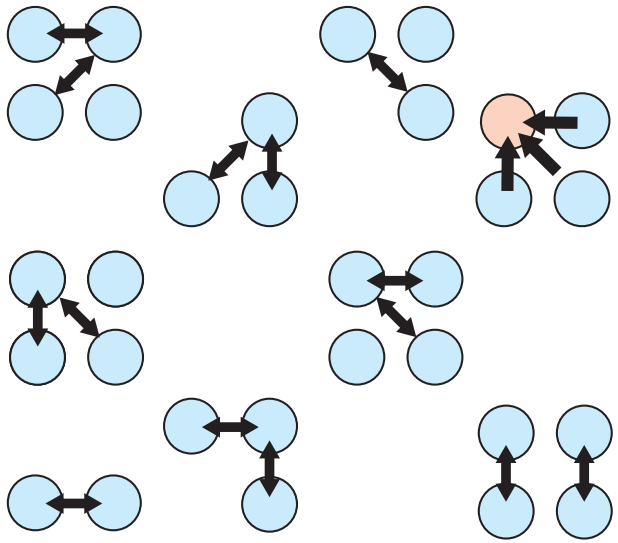
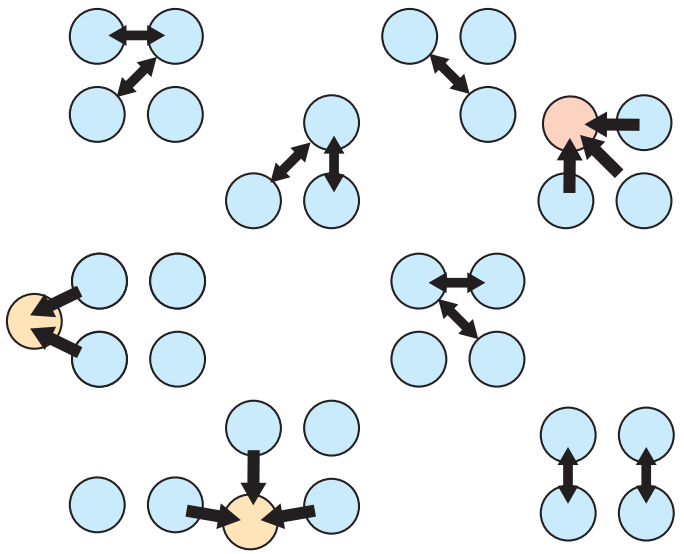


PI & JiTT Overview

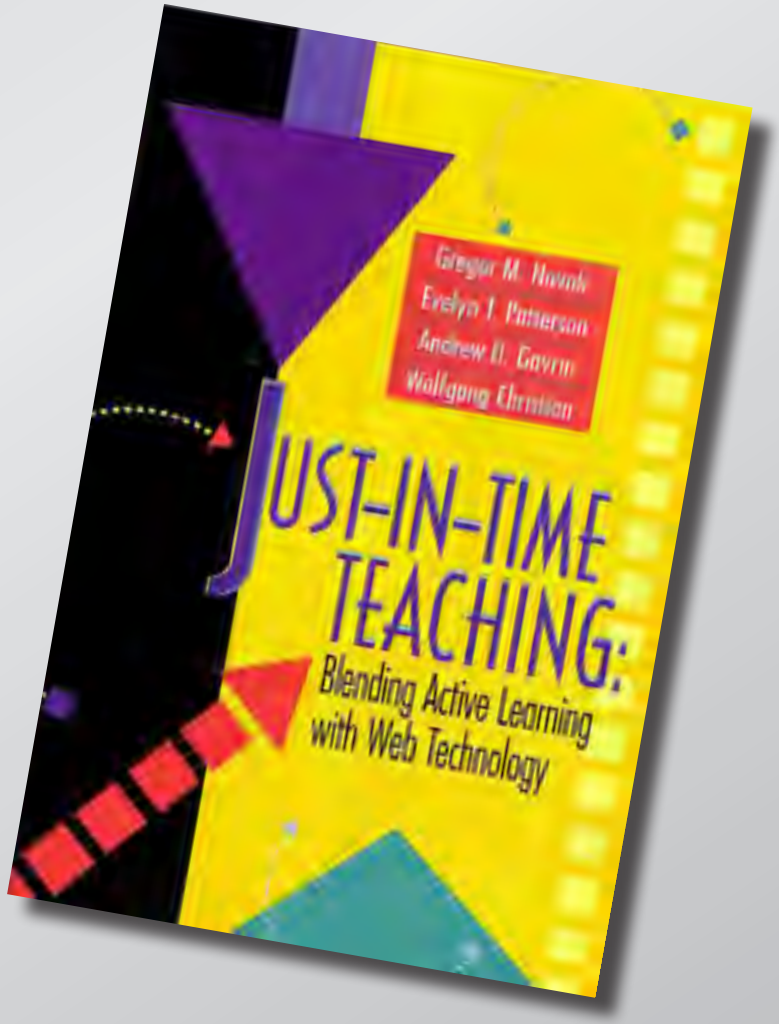
(bring in your assistants too!)



PI & JiTT Overview

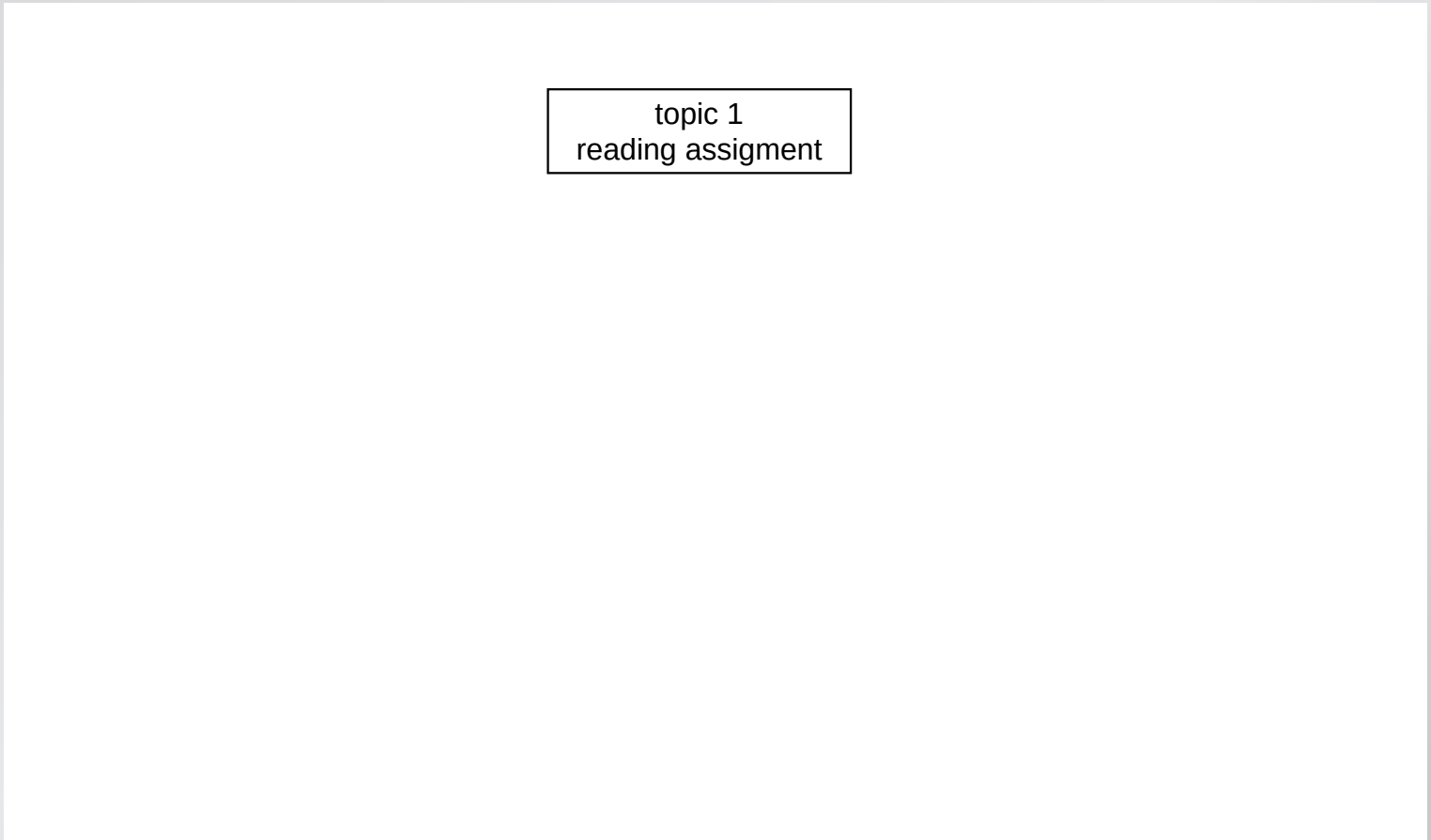
Just-in-time-Teaching (JiTT)

www.jitt.org



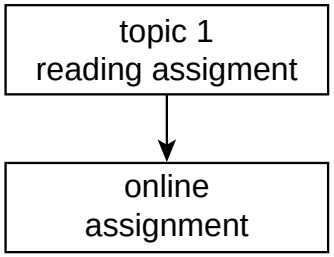
PI & JiTT Overview

JiTT workflow



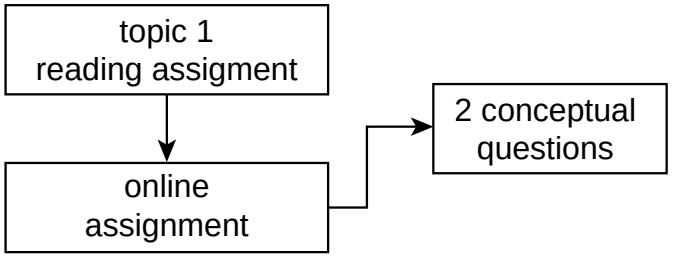
PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

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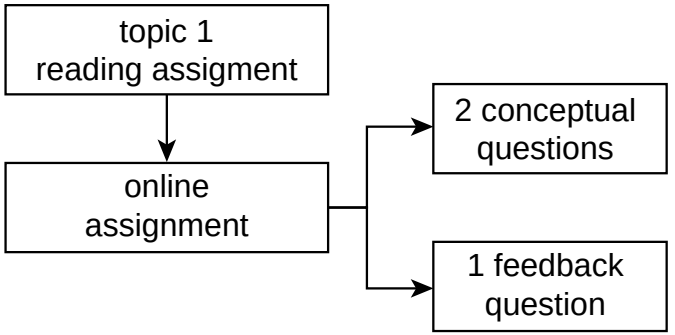
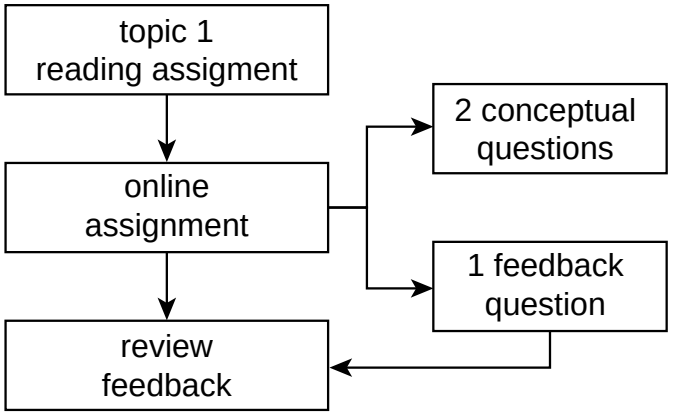


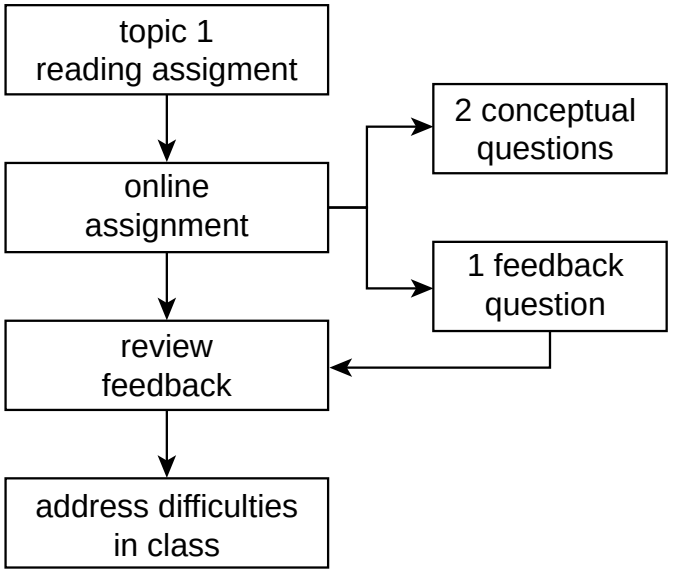
PI & JiTT Overview

JiTT workflow



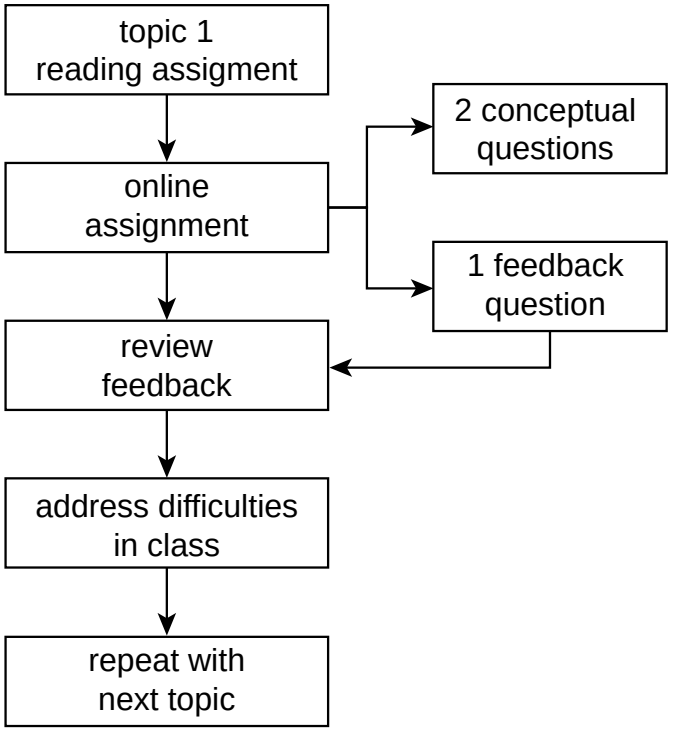
PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

JiTT workflow



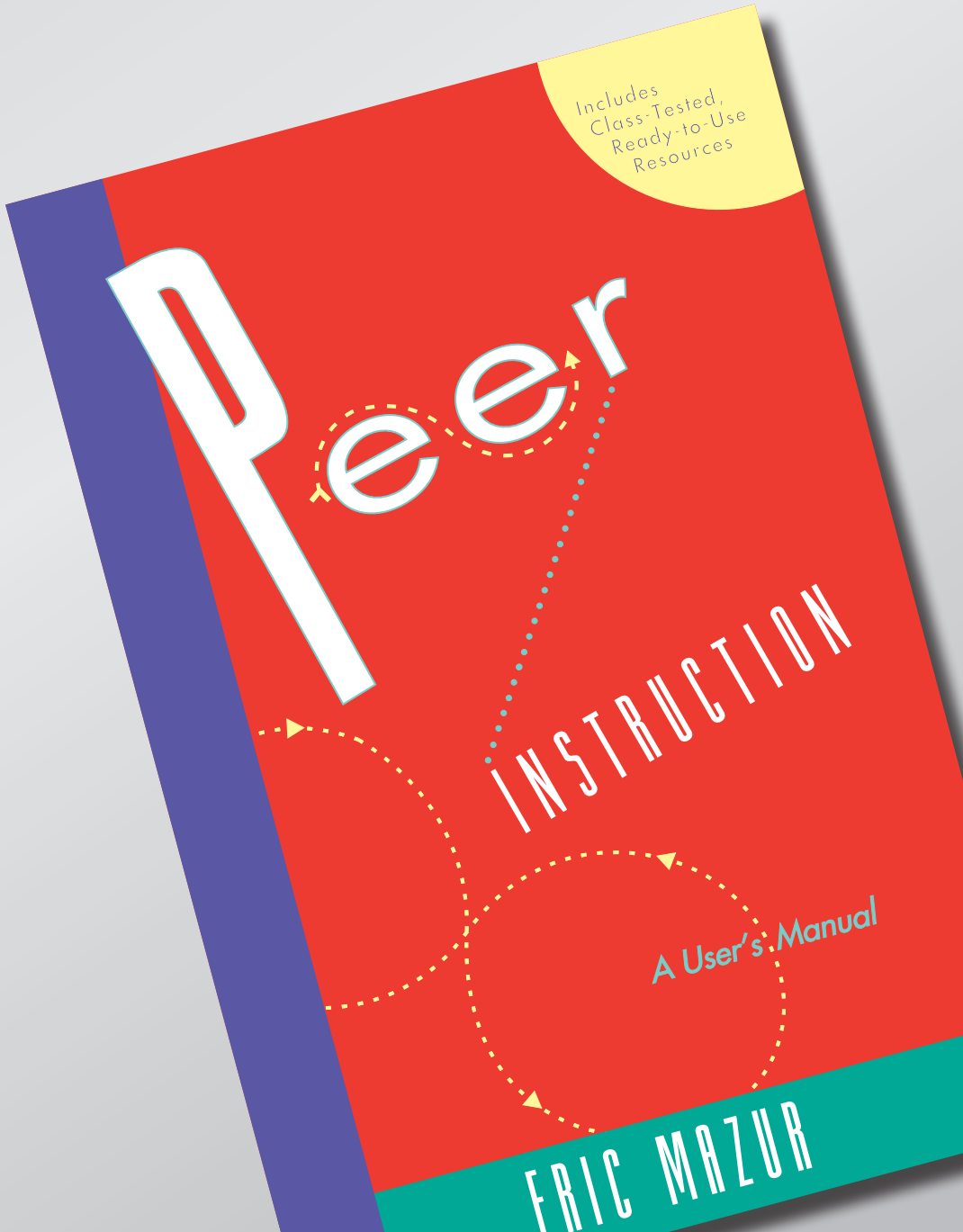
PI & JiTT Overview

JiTT:

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

PI & JiTT Overview

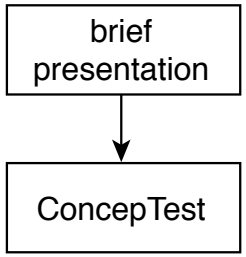
Peer Instruction (PI)



PI & JiTT Overview

brief
presentation

PI & JiTT Overview



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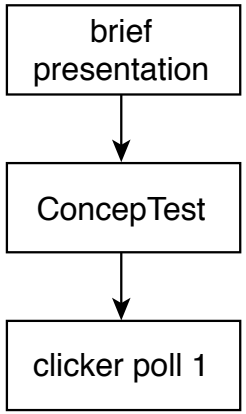

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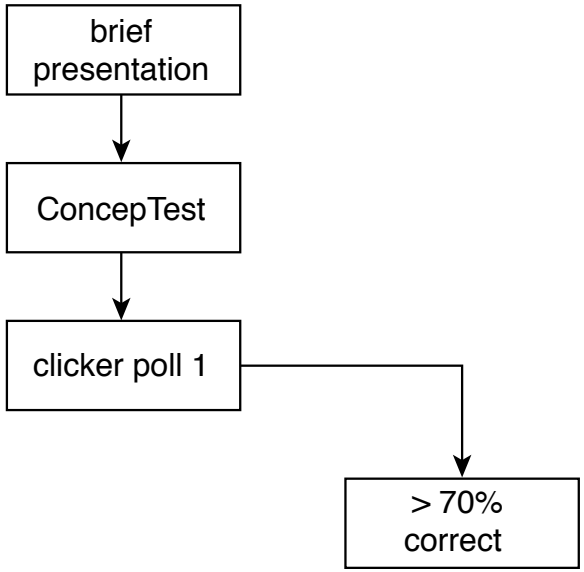

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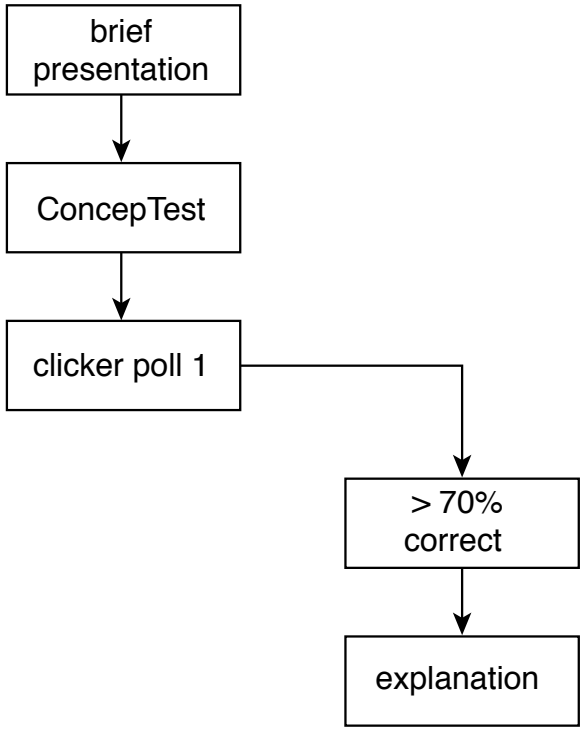

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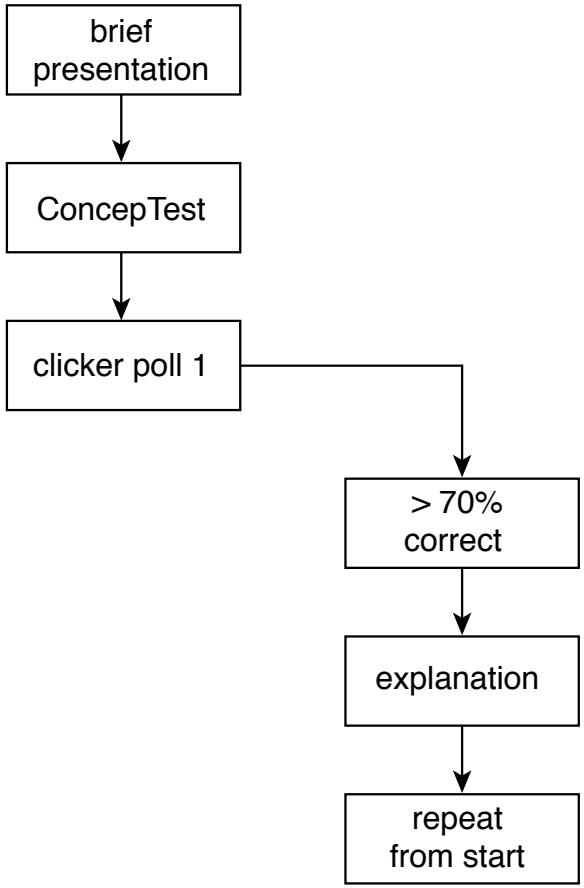

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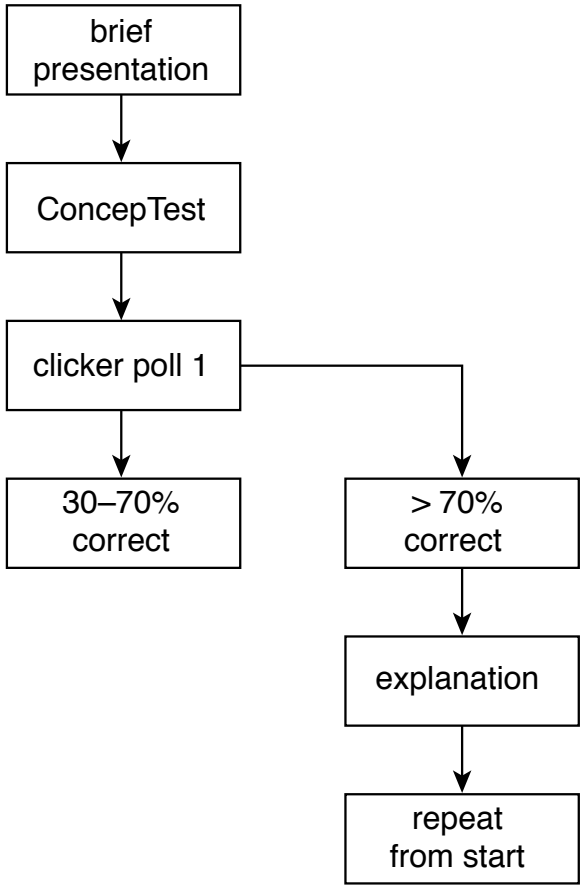

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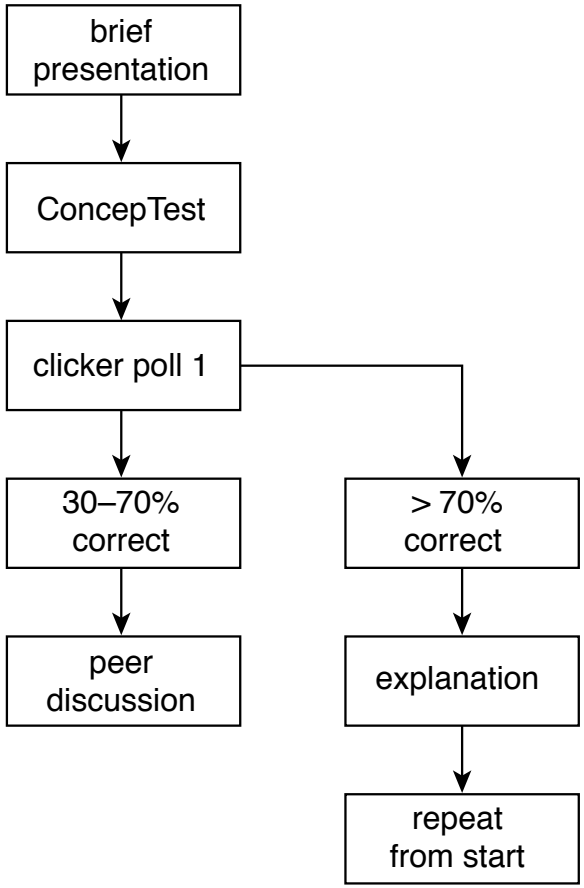

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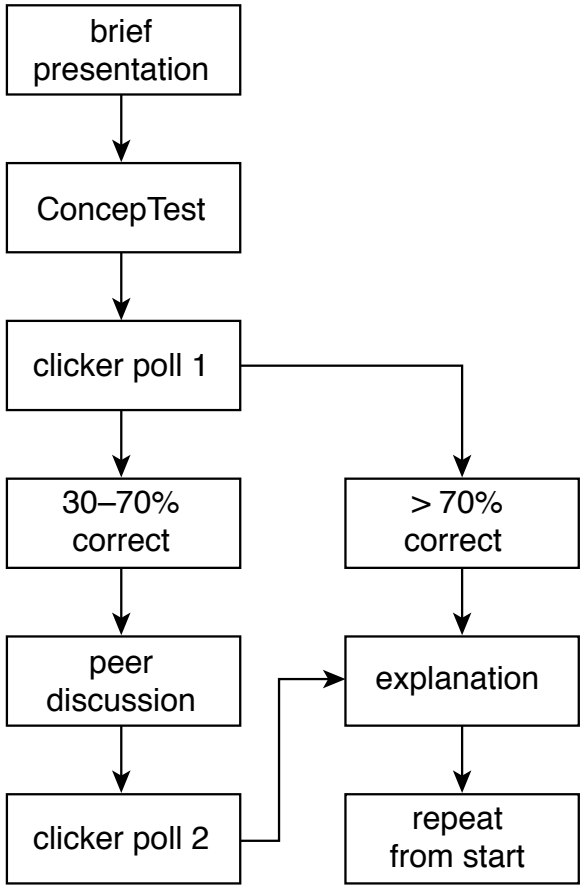

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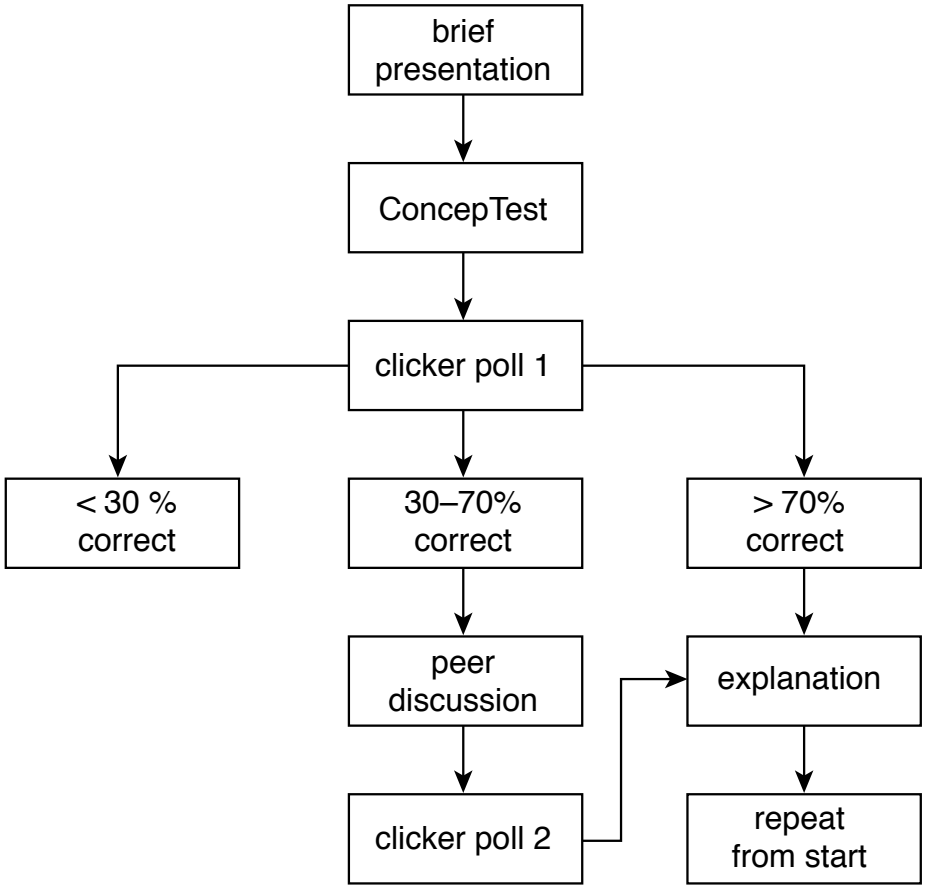

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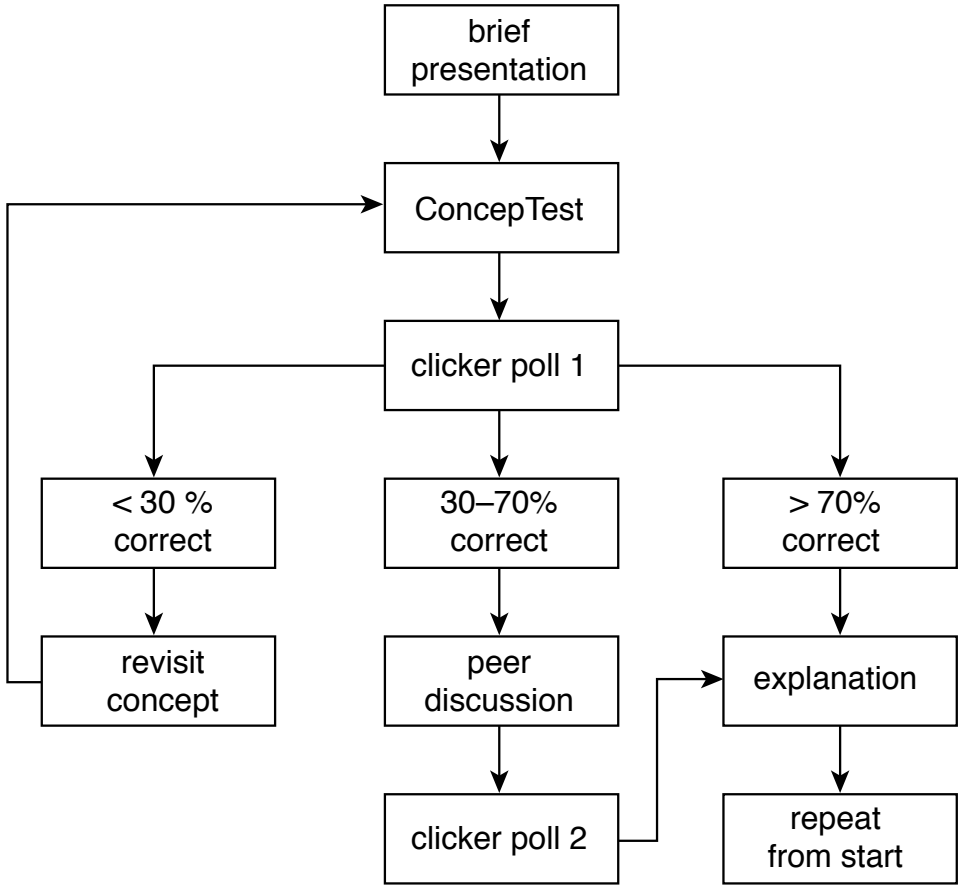

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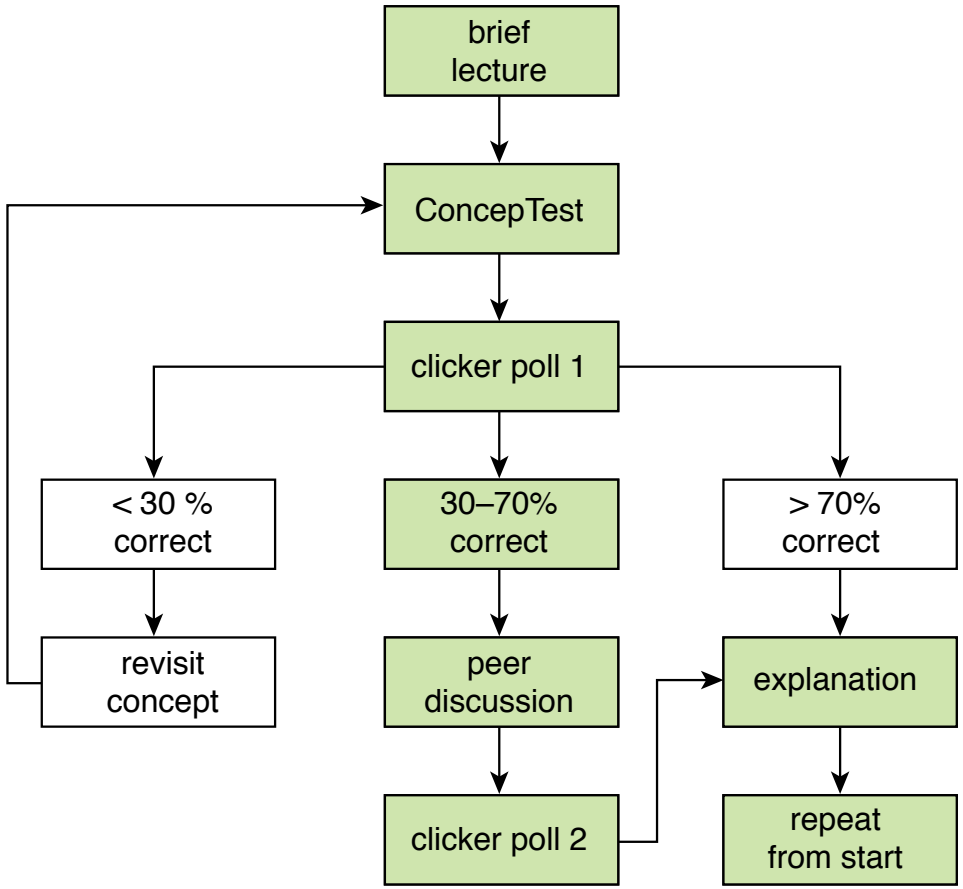


PI & JiTT Overview

PI:

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

Let's try it!

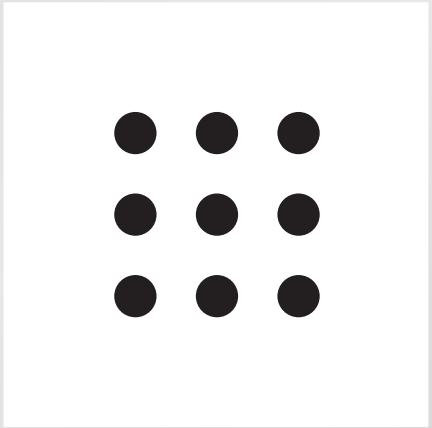
Quick survey

I am participating in this session…

A. alone.
B. with one other person.
C. with two other people.
D. with three other people.
E. with more then three others.

Let's try it!

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



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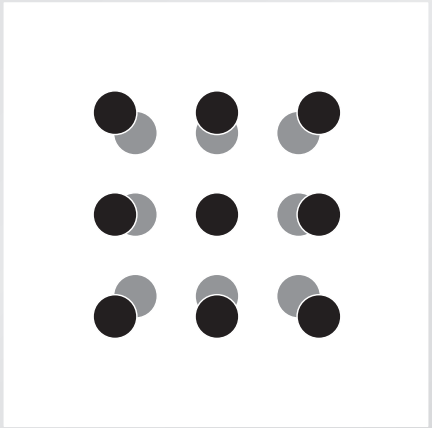
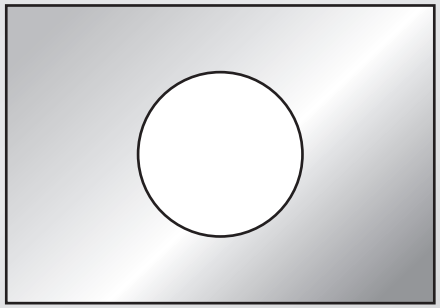


Let's try it!

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



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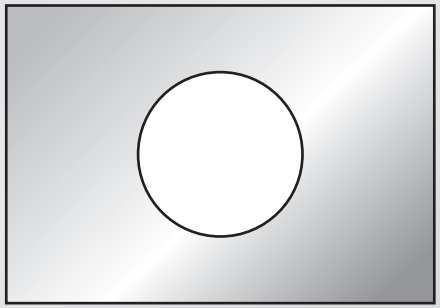
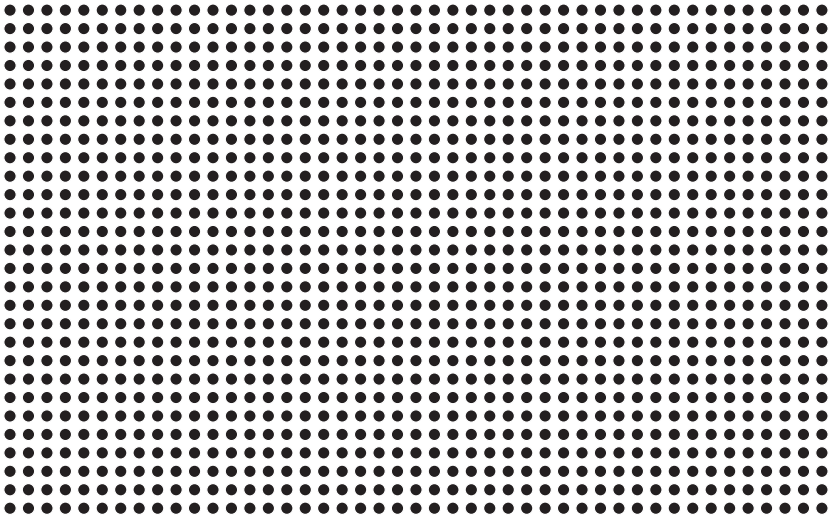


When the plate is uniformly heated, the diameter of the hole

A. increases.
B. stays the same.
C. decreases.

Let's try it!

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



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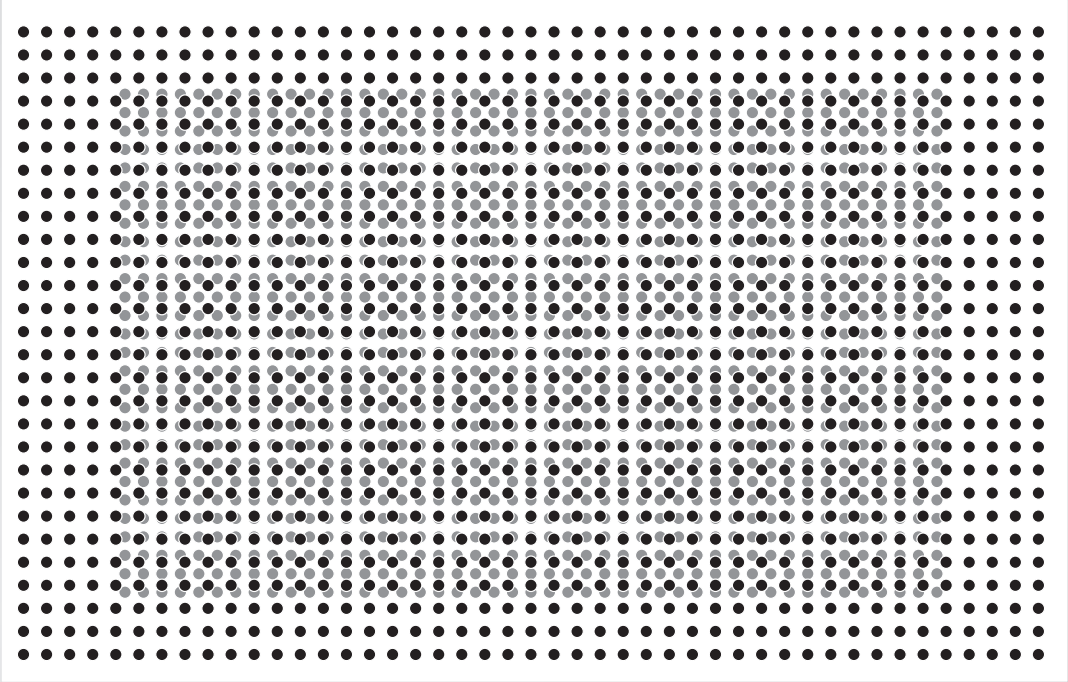
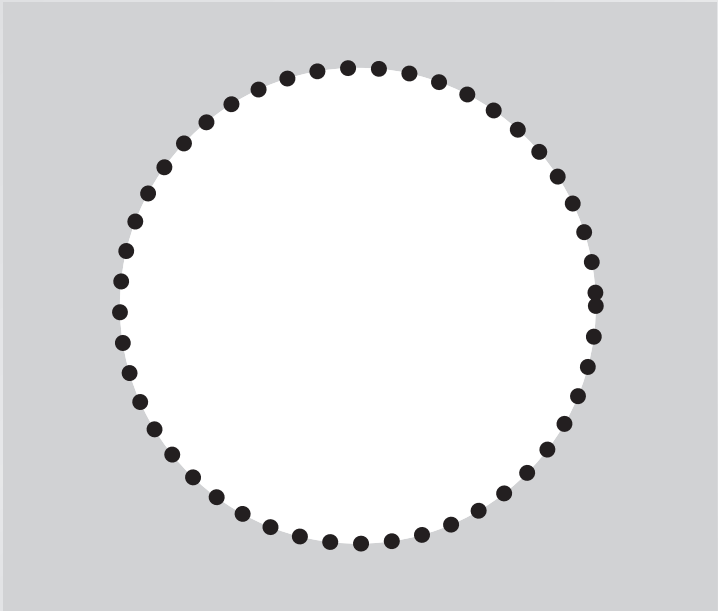


Let's try it!

consider the atoms at the rim of the hole



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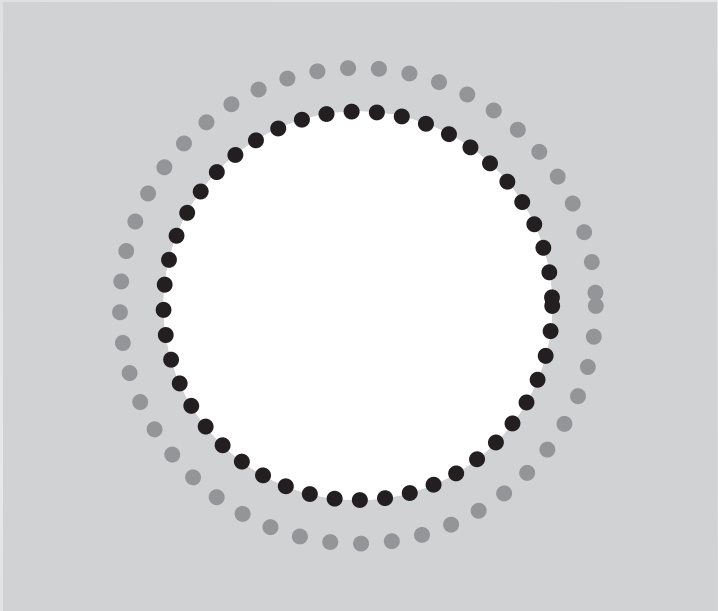

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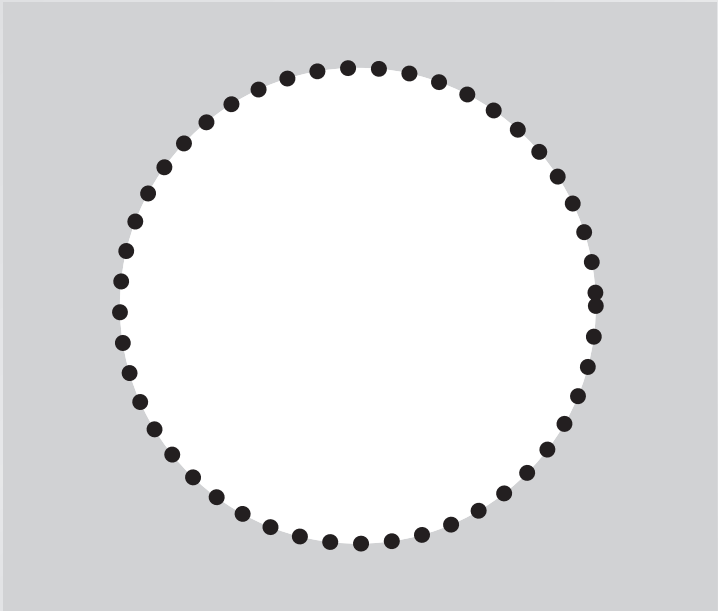

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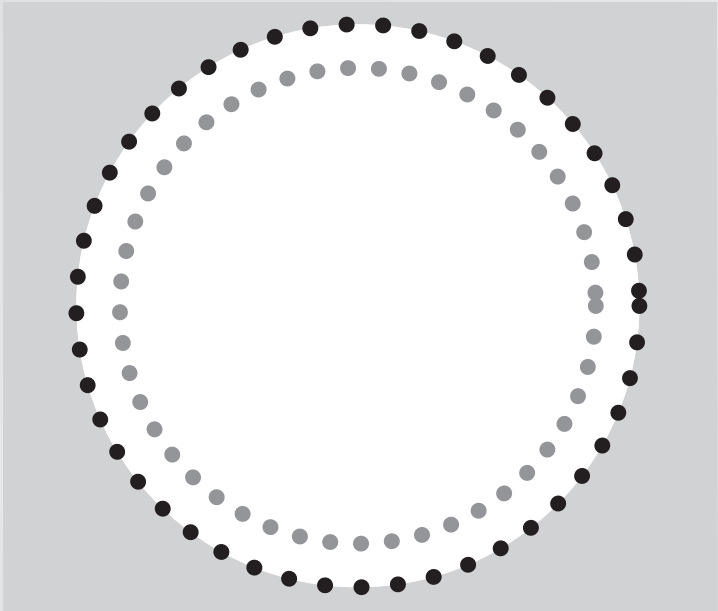


PI & JiTT Overview

Benefits:

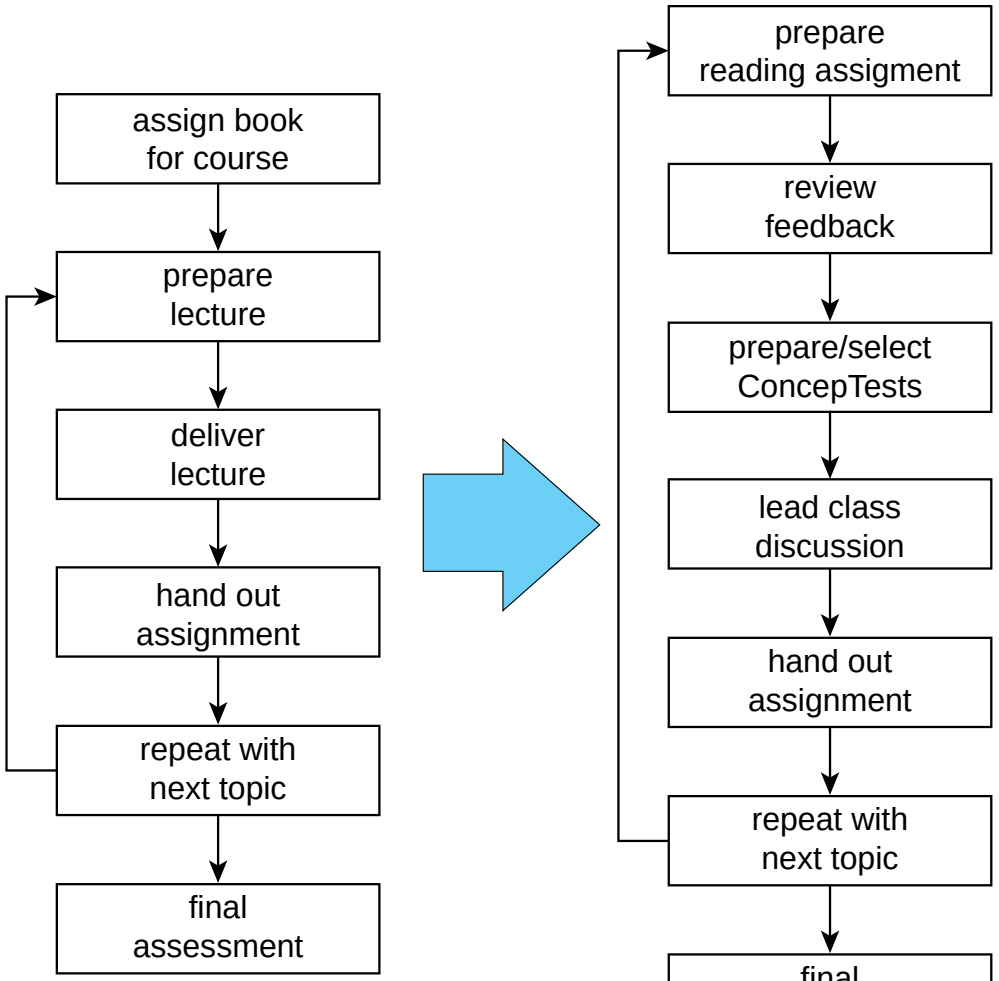
- **helps develop conceptual models**
- **solidifies understanding**
- **provides feedback**
- **empowers students**

Outline

- PI & JiTT Overview
- **Implementing PI & JiTT**
- Discussion

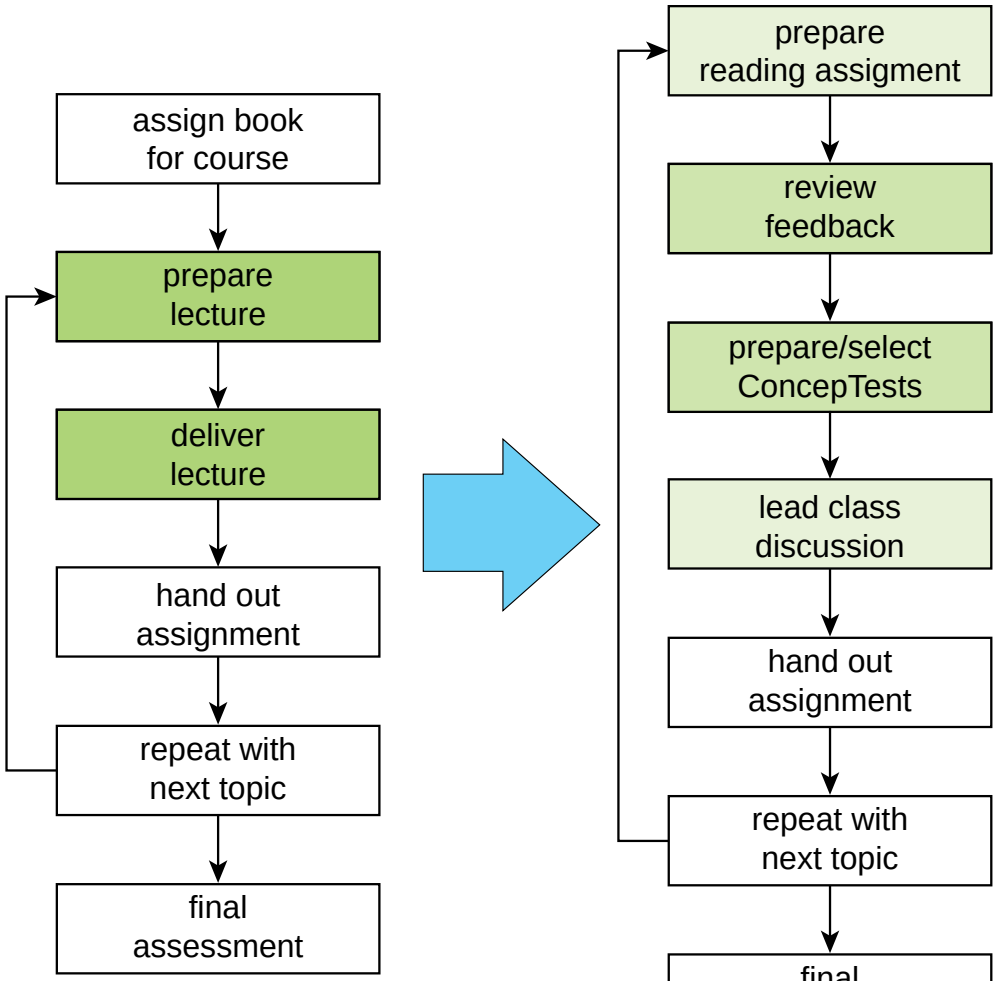
Implementing PI & JiTT

transitioning: where does the effort go?



Implementing PI & JiTT

transitioning: where does the effort go?



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

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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

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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

A good reading assignment question…

- relates to the reading assignment
- cannot be copied from the text
- tests a concept in the book in a new context
- lets students demonstrate familiarity with text

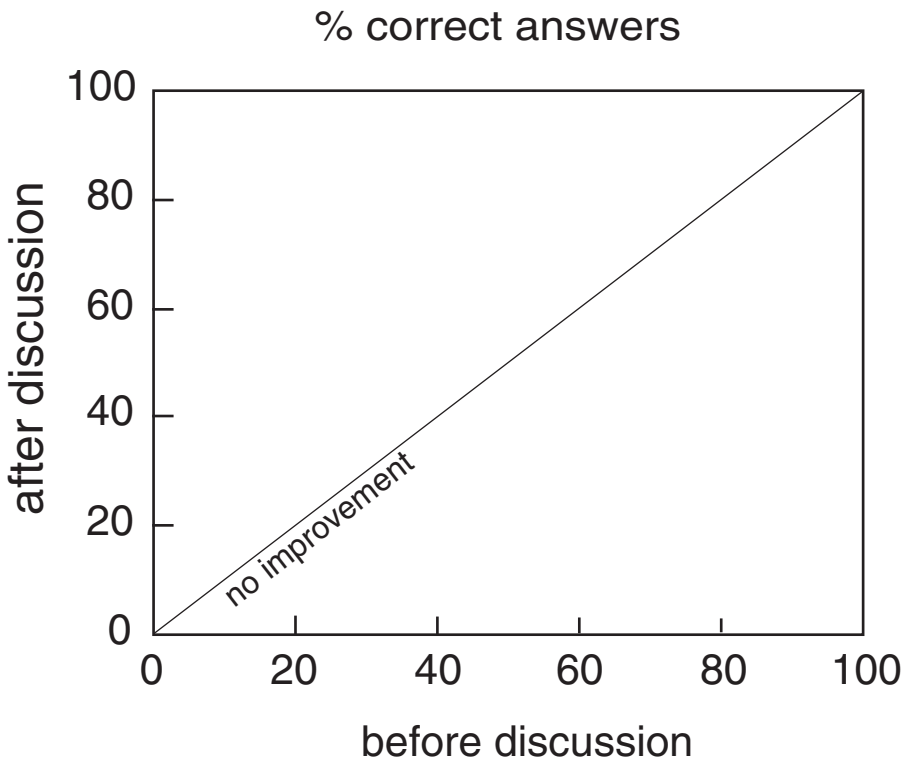
Implementing PI & JiTT

A good ConcepTest…

- helps develop mental models (or stimulate discussion)
- tests undestanding, not memorization
- is just challenging enough (30–70% rule)
- has appropriate distractors

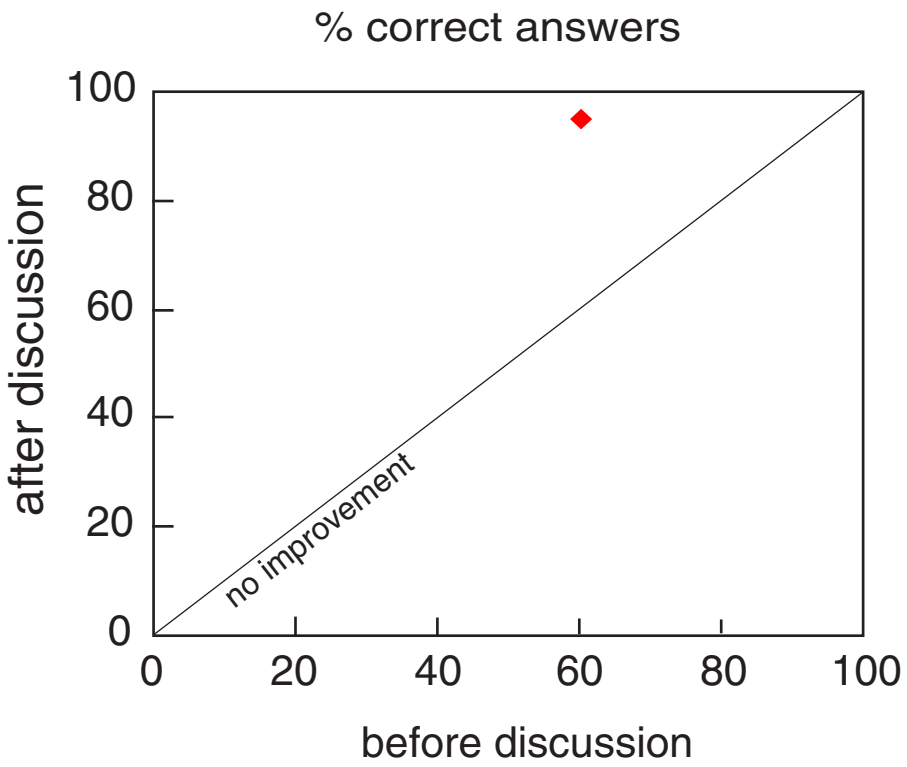
Implementing PI & JiTT

ConcepTest data



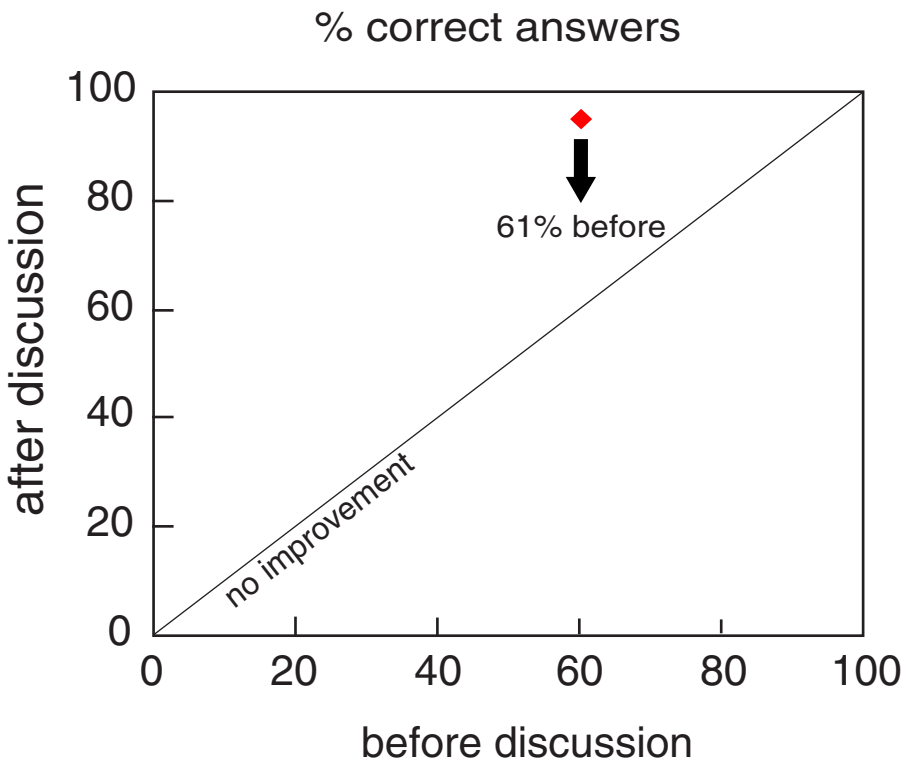
Implementing PI & JiTT

ConcepTest data



Implementing PI & JiTT

ConcepTest data



Implementing PI & JiTT

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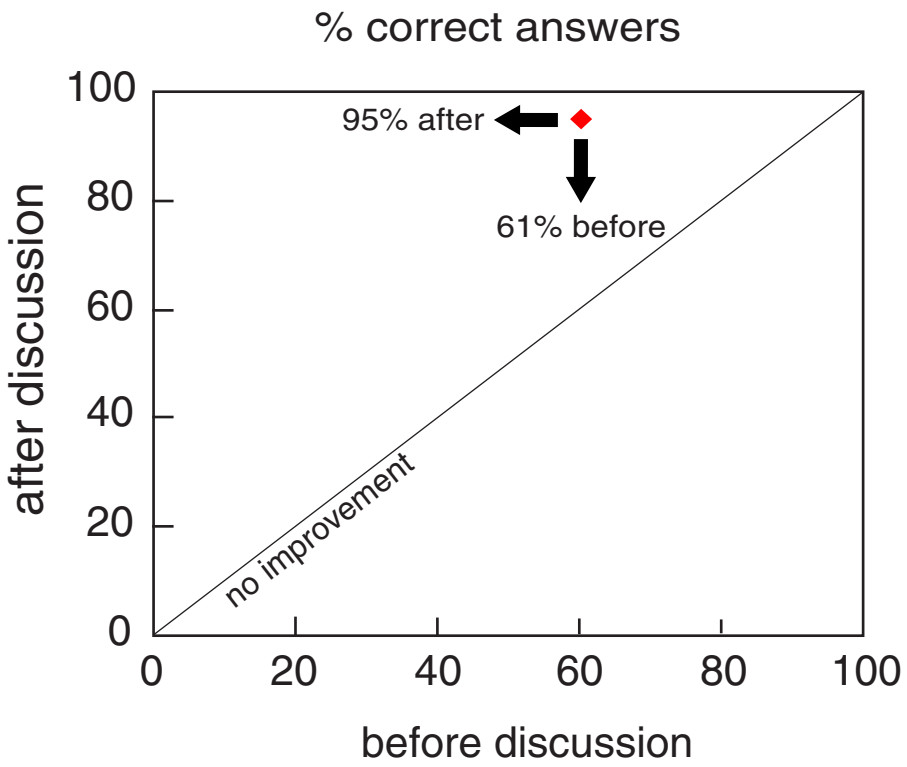

Implementing PI & JiTT

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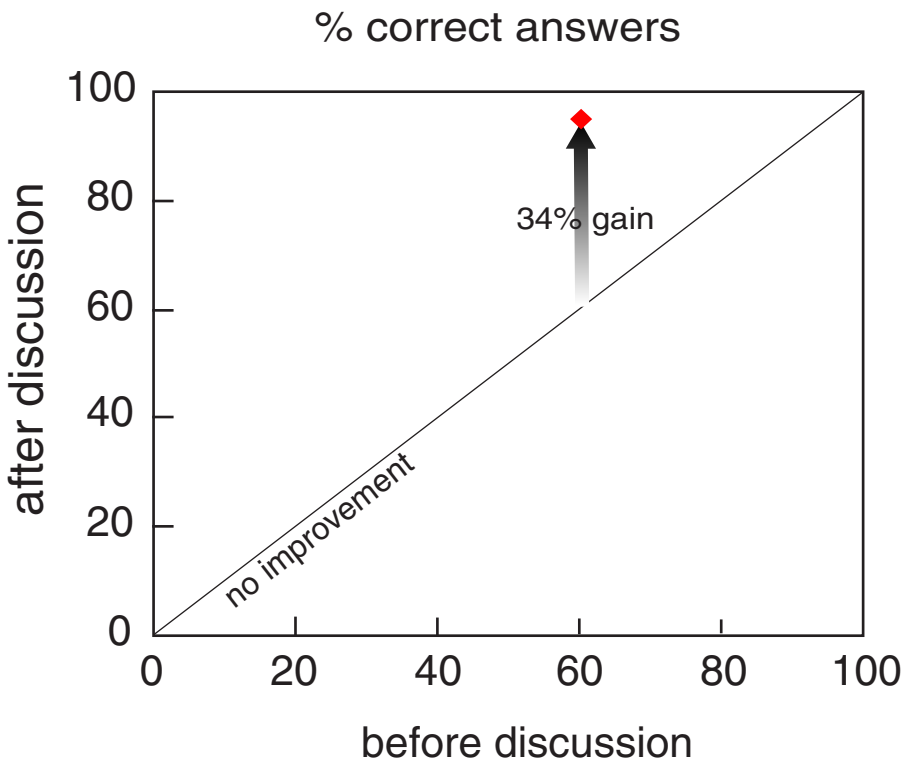

Implementing PI & JiTT

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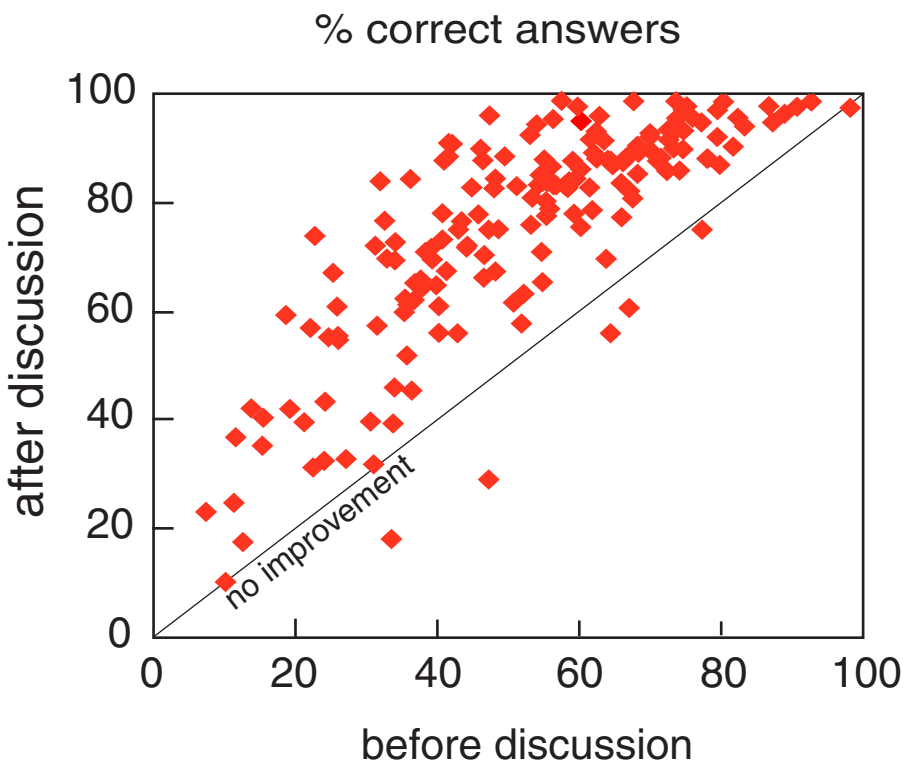
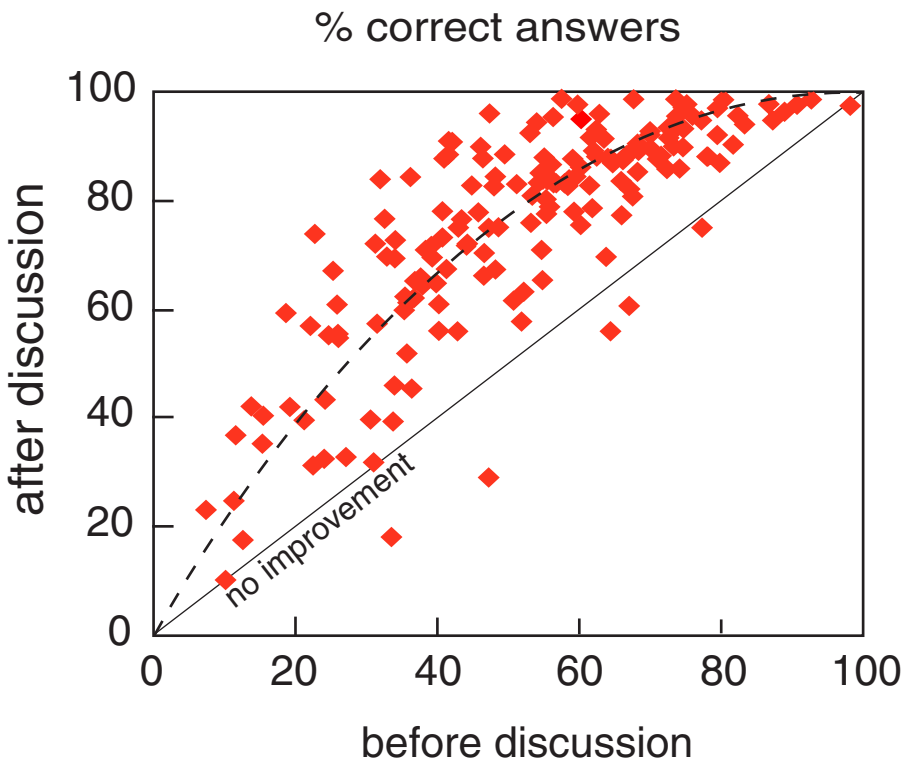


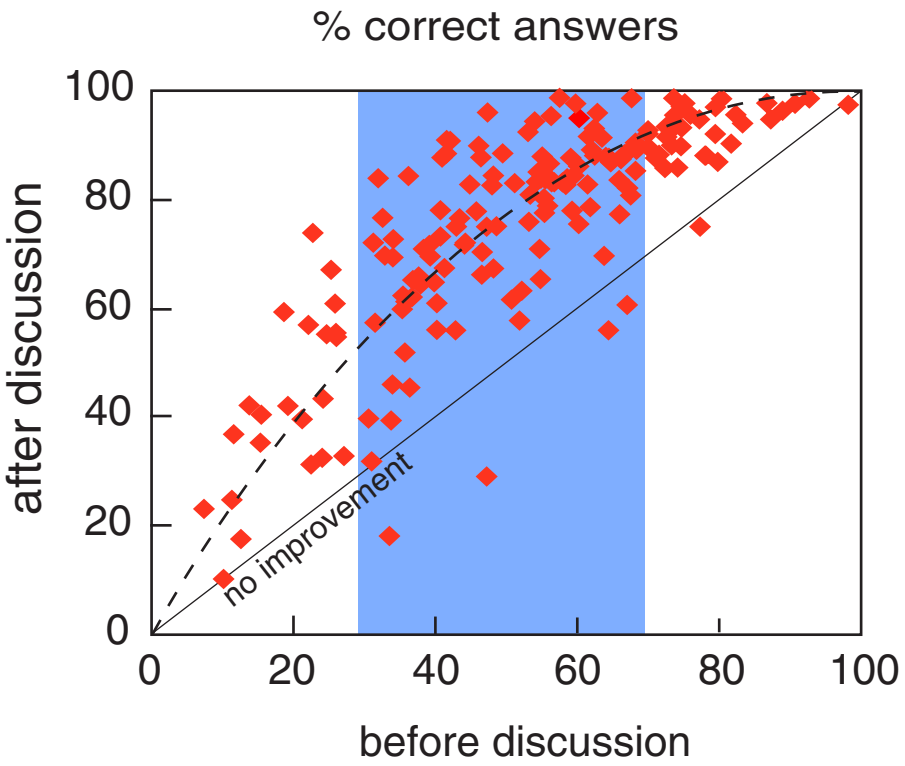
Implementing PI & JiTT

ConcepTest data

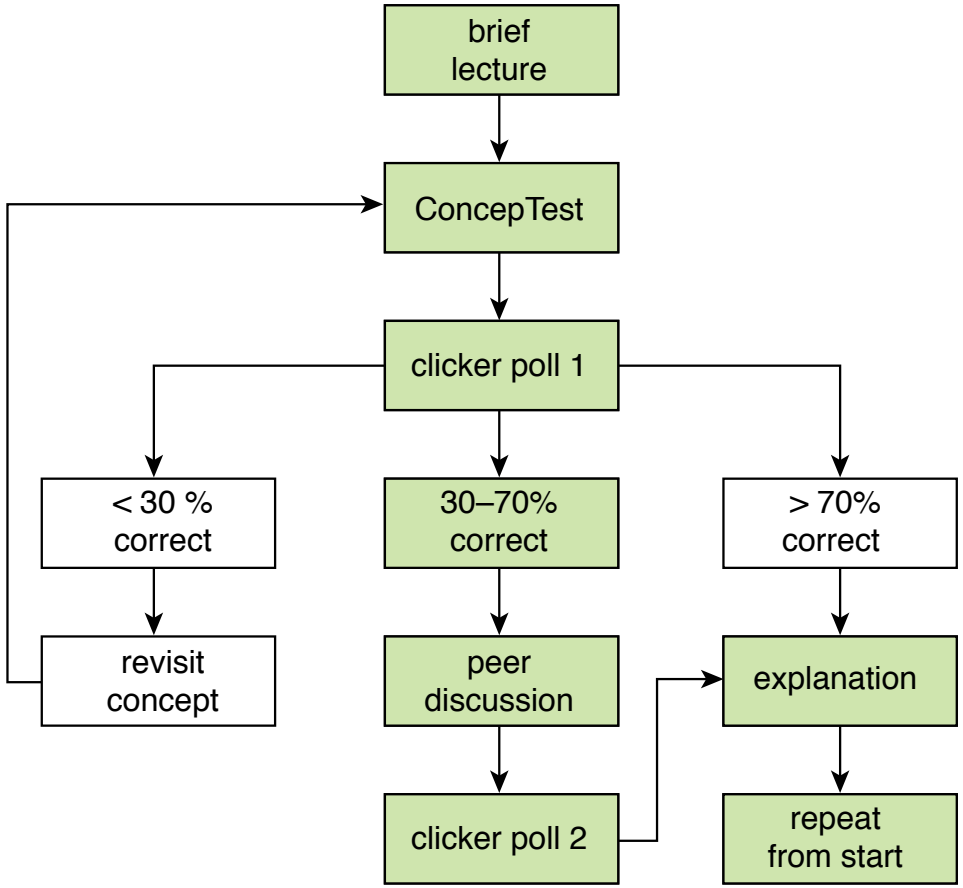


Implementing PI & JiTT

ConcepTest data



Implementing PI & JiTT



Implementing PI & JiTT

A good ConcepTest…

- needs not be multiple choice
- needs not have a correct answer

Outline

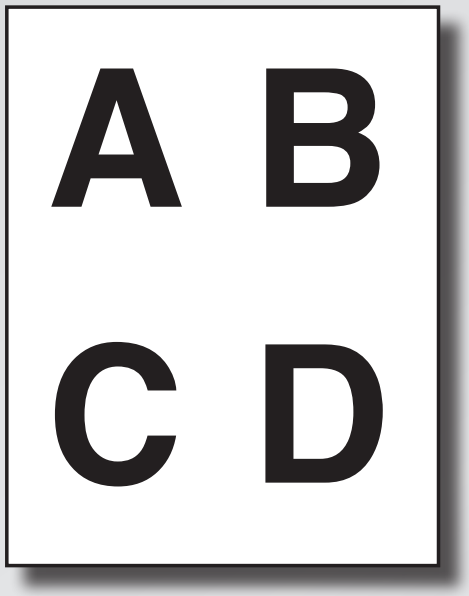
- PI & JiTT Overview
- Implementing PI & JiTT
- Discussion

Discussion

Are clickers a required resource?

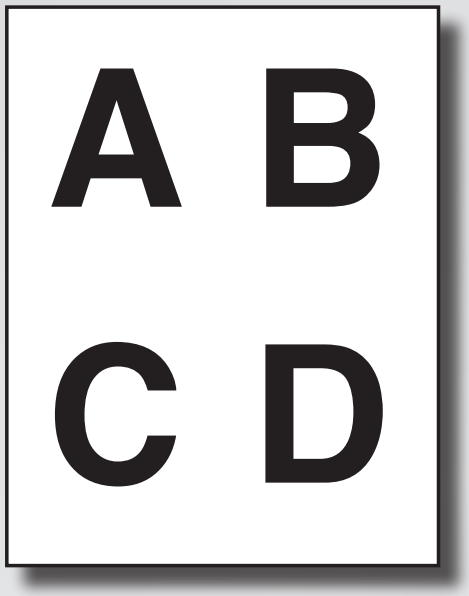
Discussion

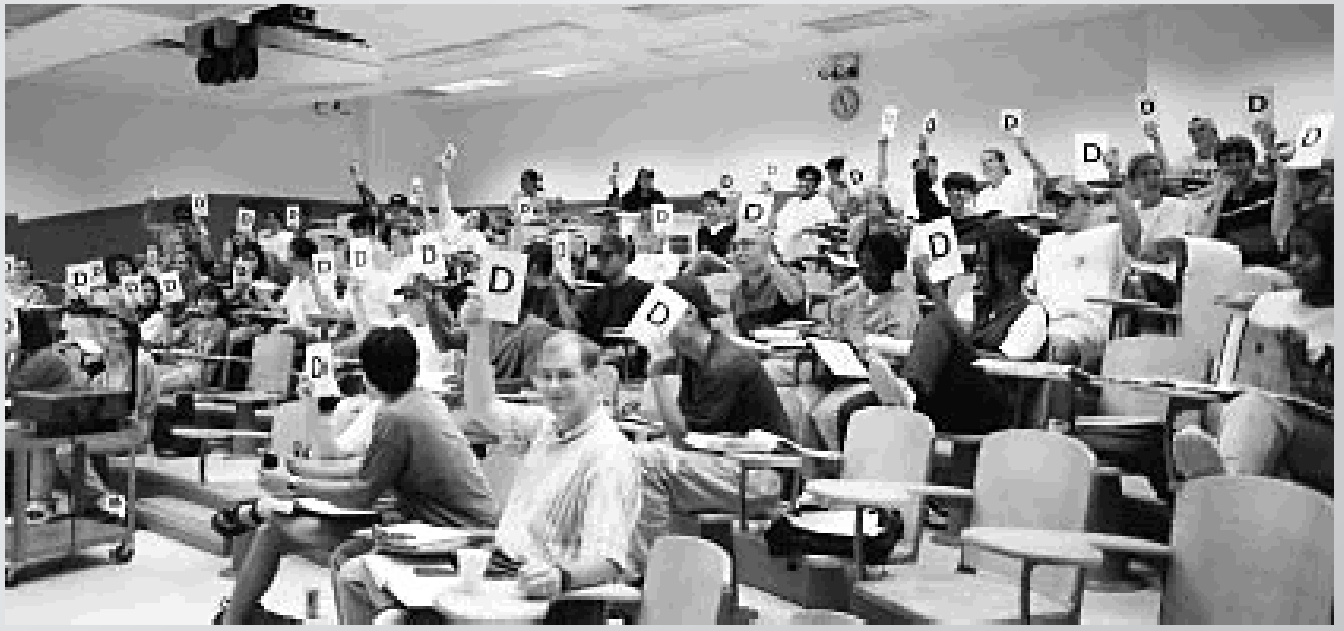
Flashcards: simple and effective



Discussion

Flashcards: simple and effective





Meltzer and Mannivanan, South Eastern Louisiana University

Discussion

It’s not the technology, but the pedagogy!

Discussion

What about coverage?

Discussion

	“lectures”	PI
coverage	complete	partial

Discussion

	“lectures”	PI
coverage	complete	partial
material learned	little	substantial

Discussion

	“lectures”	PI
coverage	complete	partial
material learned	little	substantial

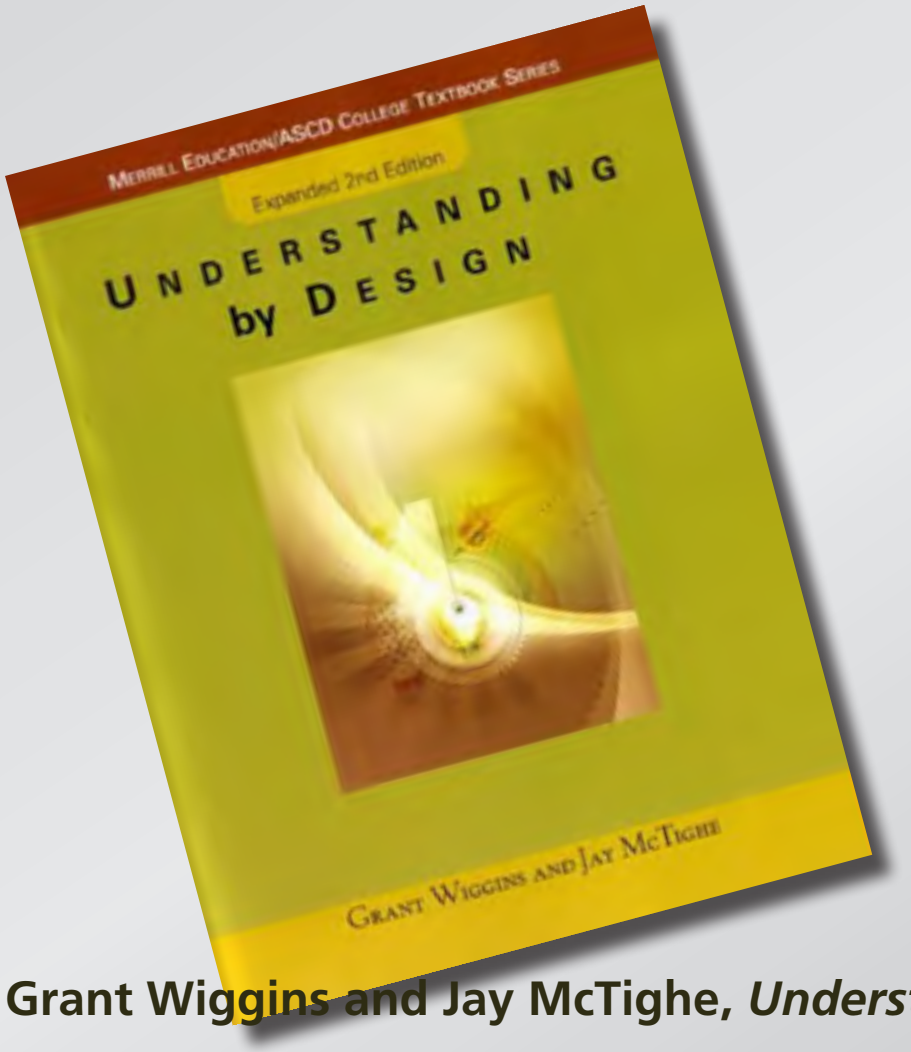
what does coverage mean if little is retained?

Looking ahead

Improve course by setting learning goals

Course design

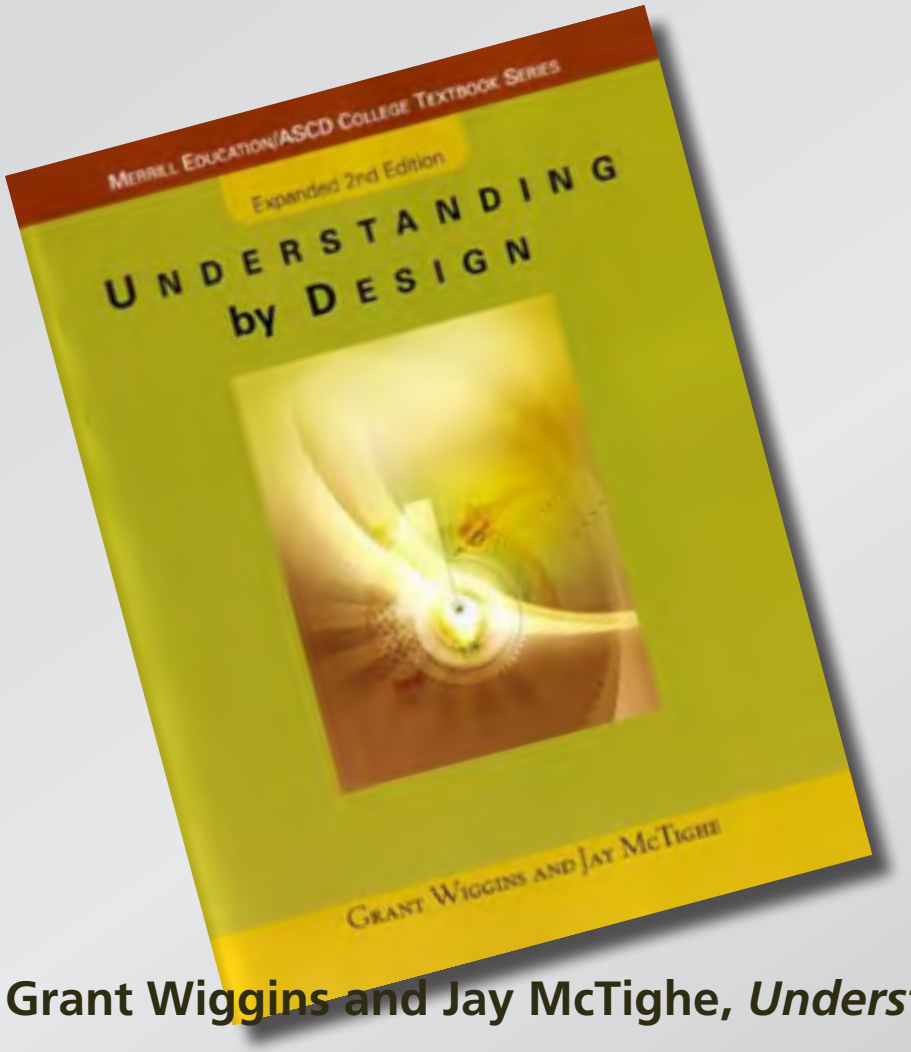
Setting learning goals



Grant Wiggins and Jay McTighe, *Understanding by Design* (Prentice Hall, 2001)

Course design

Setting learning goals

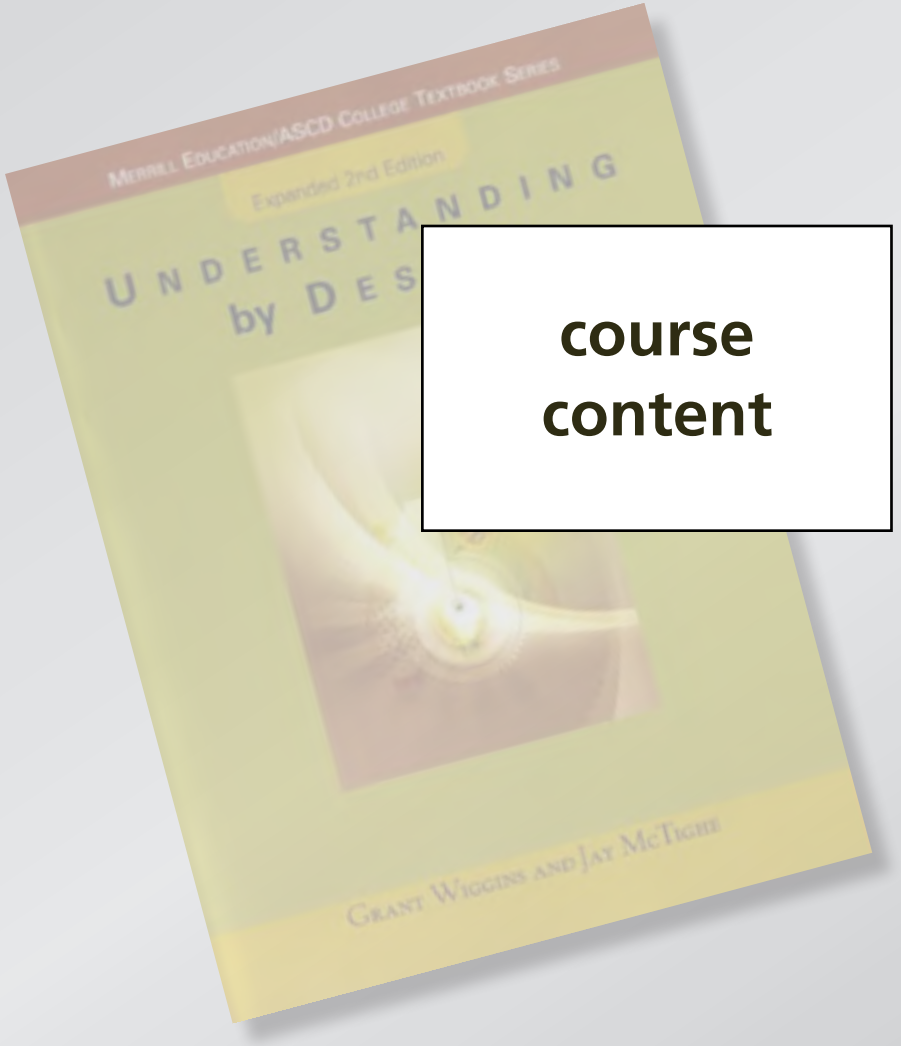


- approach, not content
- focus on understanding
- backward design

Grant Wiggins and Jay McTighe, *Understanding by Design* (Prentice Hall, 2001)

Course design

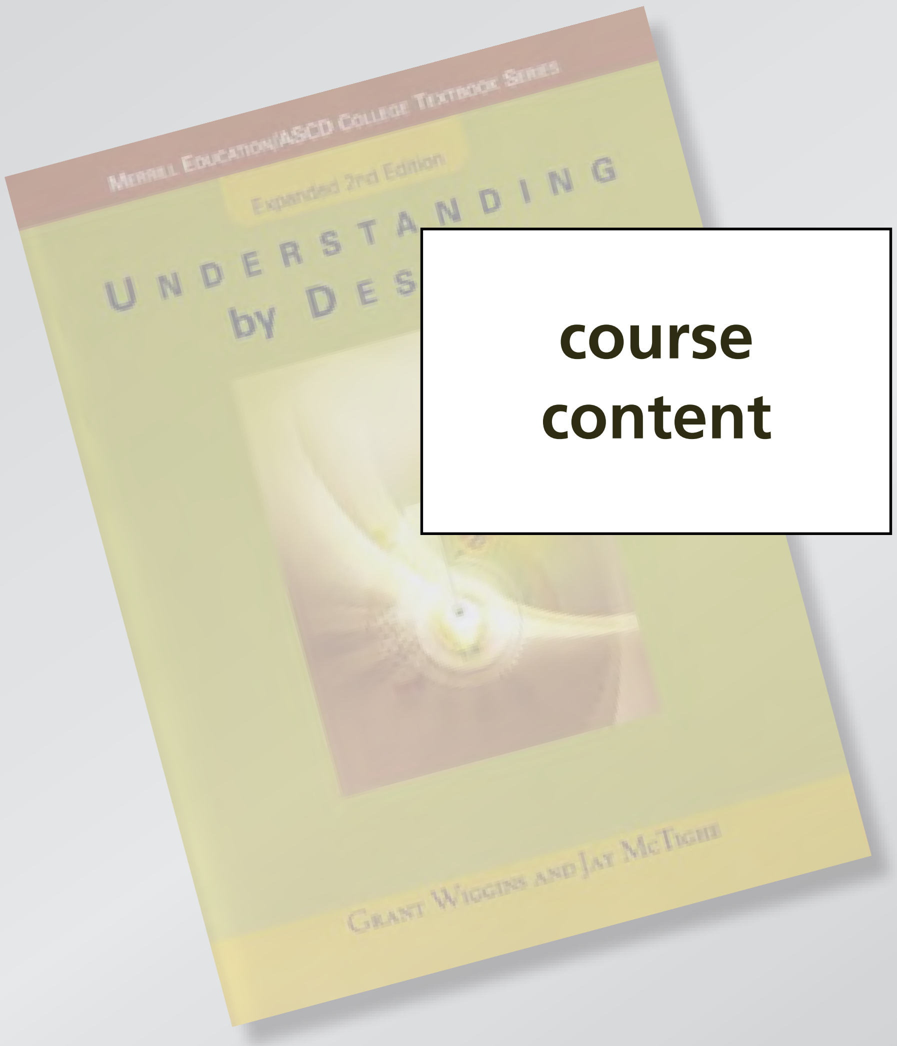
Traditional approach to course planning



course content

Course design

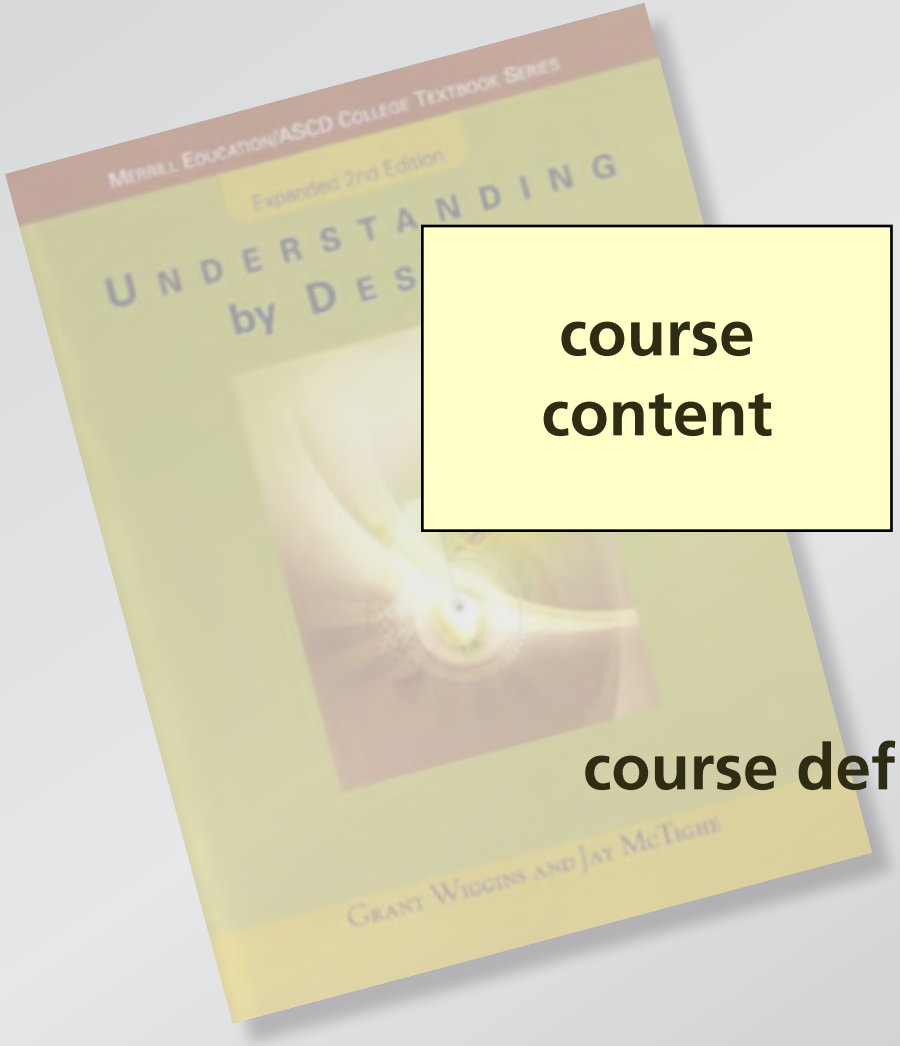
Traditional approach to course planning



course content → assessment

Course design

Traditional approach to course planning

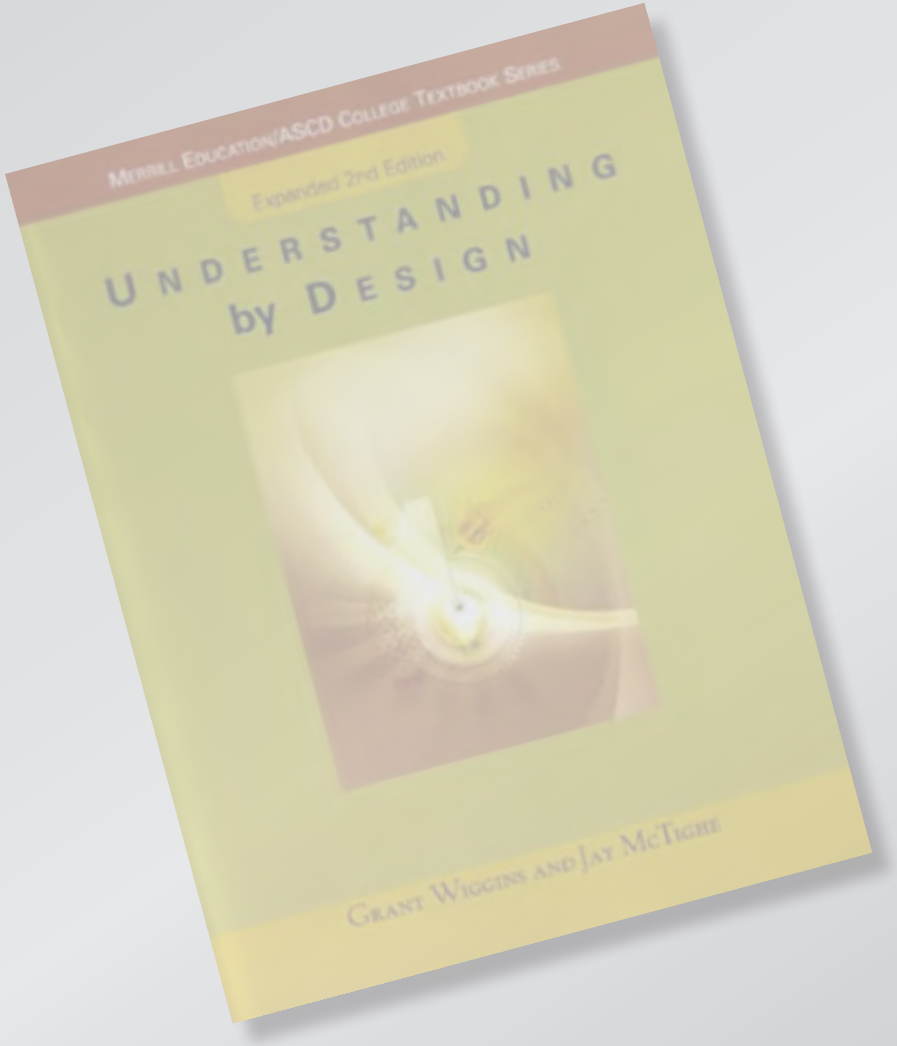


course content → assessment

course defined by content

Course design

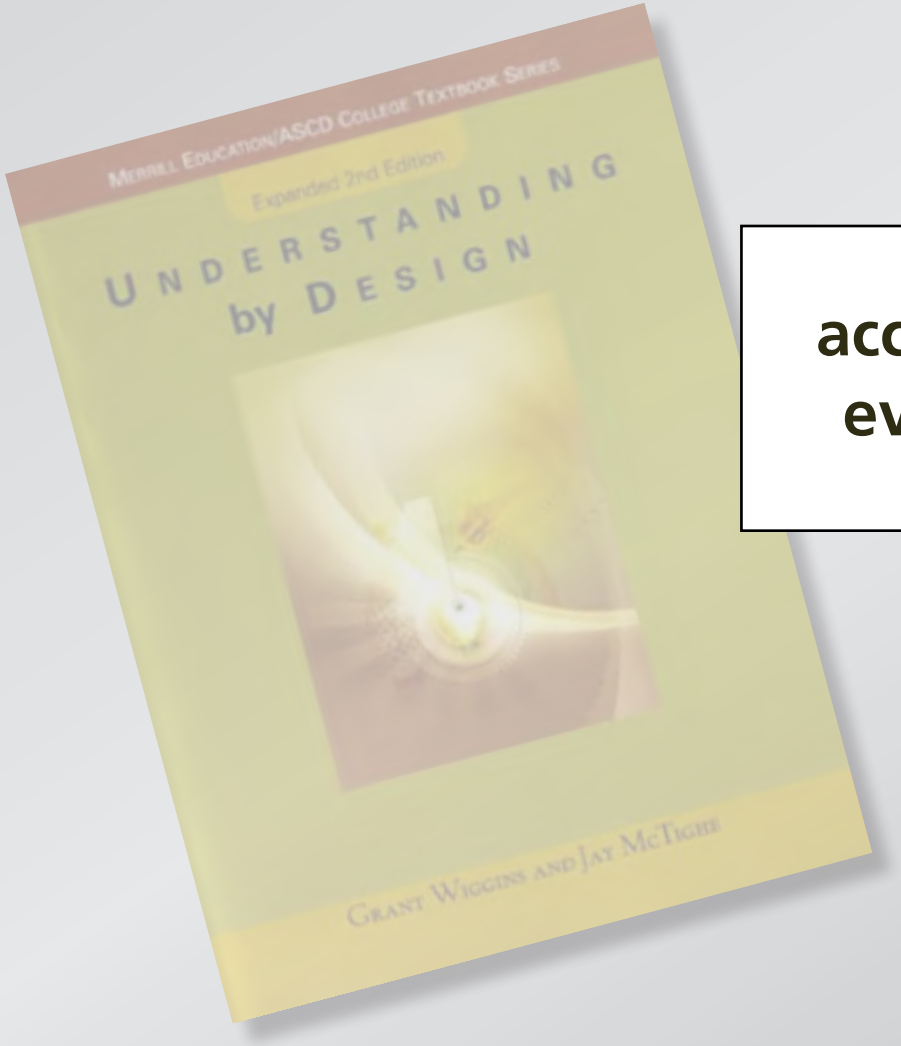
Backward design



desired outcomes

Course design

Backward design

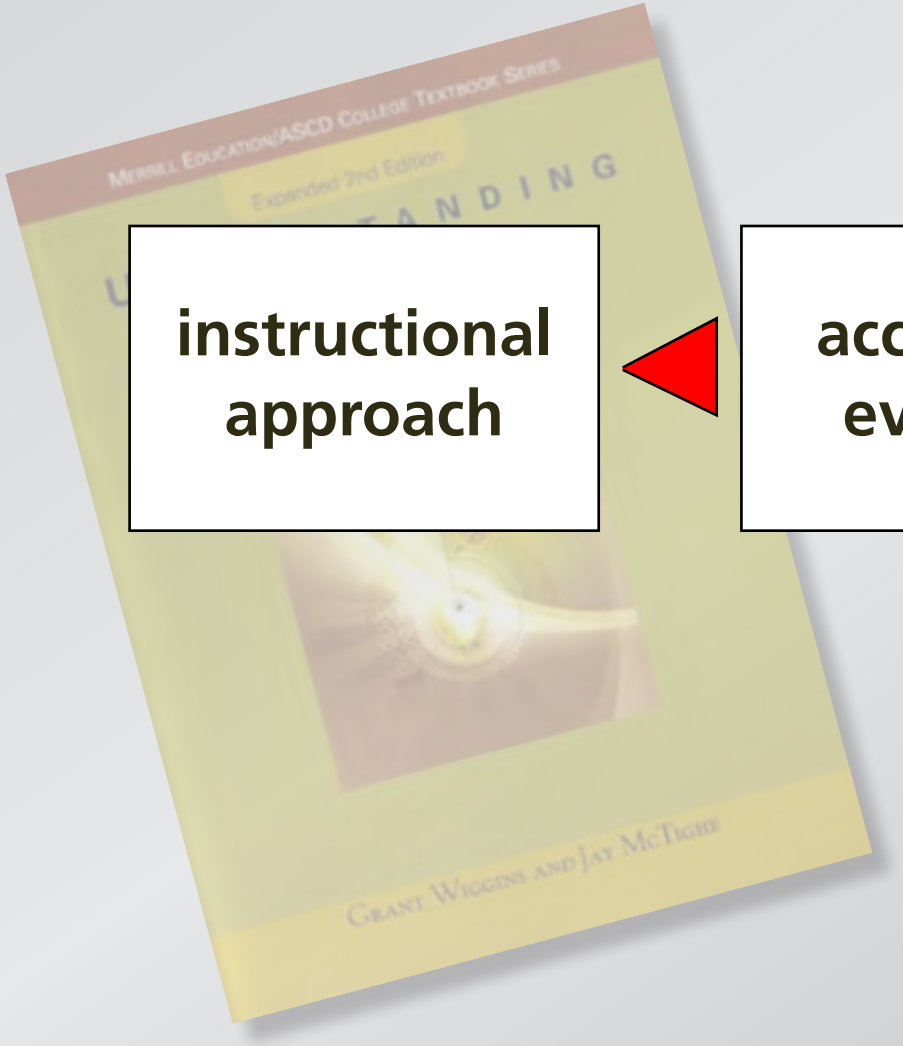


acceptable evidence

desired outcomes

Course design

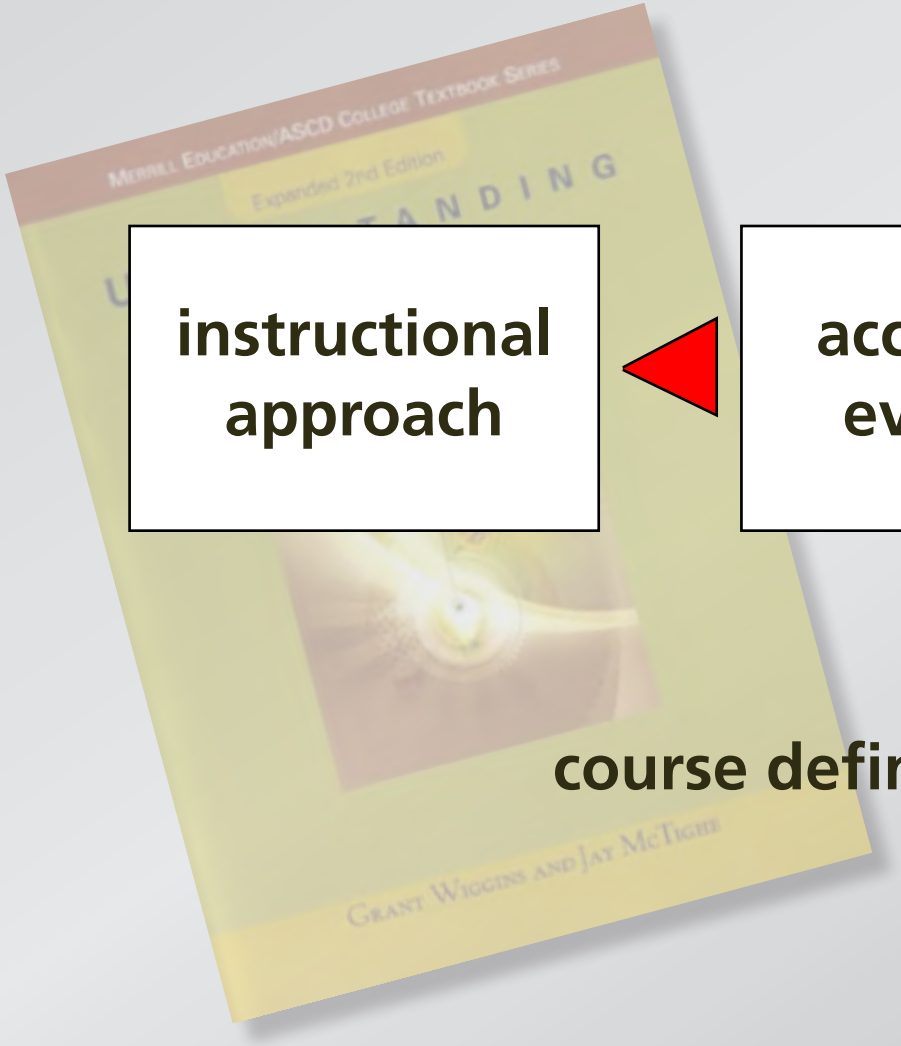
Backward design



desired outcomes ◀ **acceptable evidence** ◀ **instructional approach**

Course design

Backward design



instructional approach ◀ **acceptable evidence** ◀ **desired outcomes**

course defined by outcomes

Research Funding:

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for more information and a copy of this presentation:

http://mazur-www.harvard.edu

Follow me!  **eric_mazur**

Consider this

Professor	A	B
pedagogy	traditional	PI with clickers
student evaluation	1.5/5.0	3.7/5.0
FCI <g>	0.42	0.57

What might account for the large difference in evaluation?

I. professor personality
II. technology
III. pedagogy

1. I only
2. II only
3. III only
4. II and III
5. I, II, and III
6. other combination

Consider this

a couple of points worth noting:

Consider this

a couple of points worth noting:

1. you got engaged

Consider this

a couple of points worth noting:

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

Consider this

a couple of points worth noting:

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

Consider this

a couple of points worth noting:

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

Setting the stage

To set stage for successful implementation, I need to…

Setting the stage

To set stage for successful implementation, I need to…

(actions to take *before* course begins)

Setting the stage

- convince yourself (and your colleagues)
- set learning goals
- select approaches
- identify resources

Setting the stage

Pre/post-testing important for:

- **justifying approach**
- **improving implementation**

Setting the stage

Evaluate assessment by comparing

student performance on various kinds of problems

Setting the stage

How to move information transfer out of classroom?

Setting the stage

Imagine a rope that fits snugly along the equator.

Setting the stage

Imagine a rope that fits snugly along the equator.

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

1. the width of a few atoms
2. the width of a few hairs
3. the height of a curb
4. exactly 1 m
5. more than 1 m

Setting the stage

circumference at equator:

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

Setting the stage

circumference at equator:

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

new circumference:

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

Setting the stage

circumference at equator:

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

new circumference:

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

radius of circle with new circumference:

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