Peer Instruction Workshop

University of Michigan
Ann Arbor, MI, 14 February 2014

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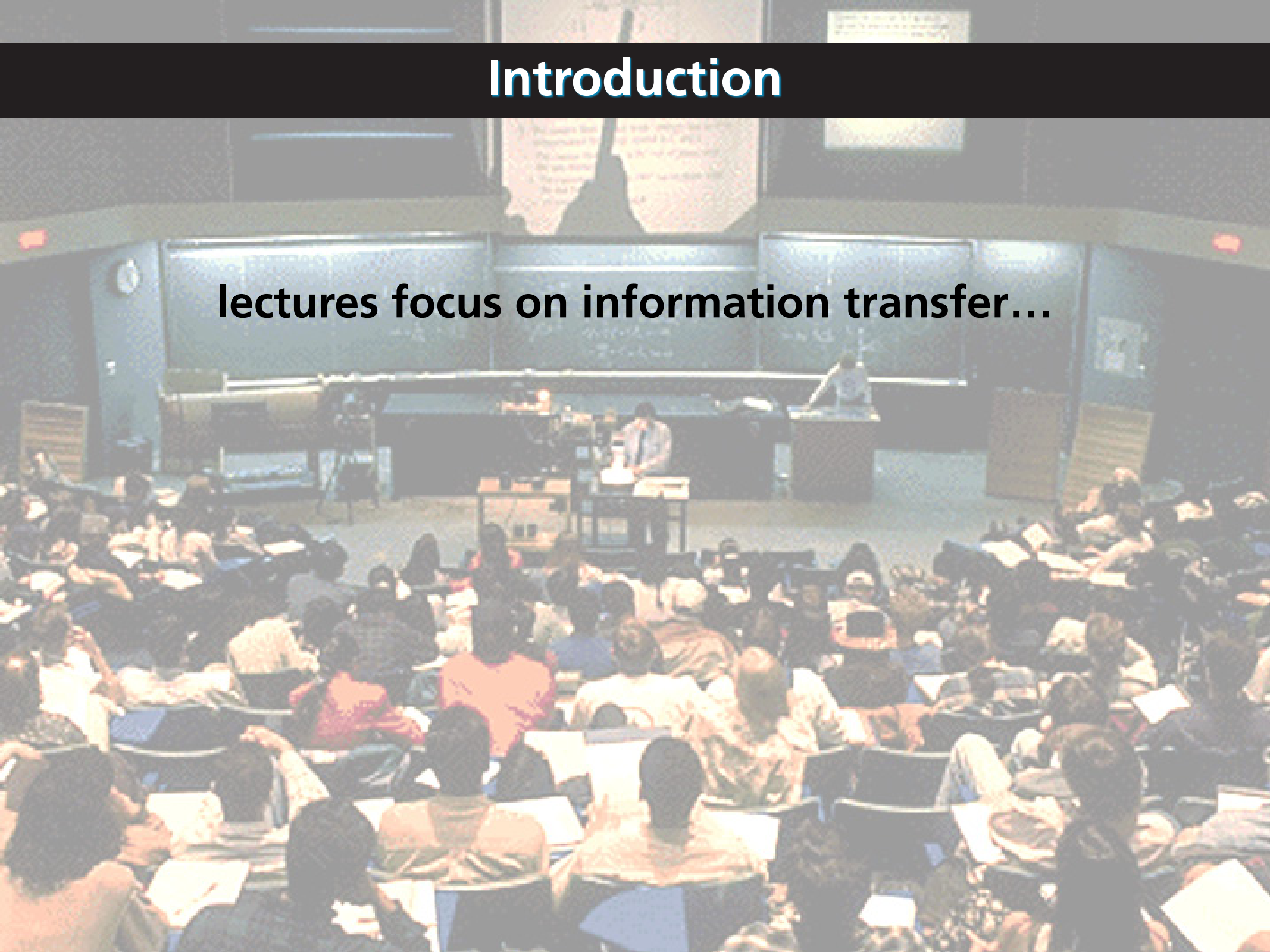
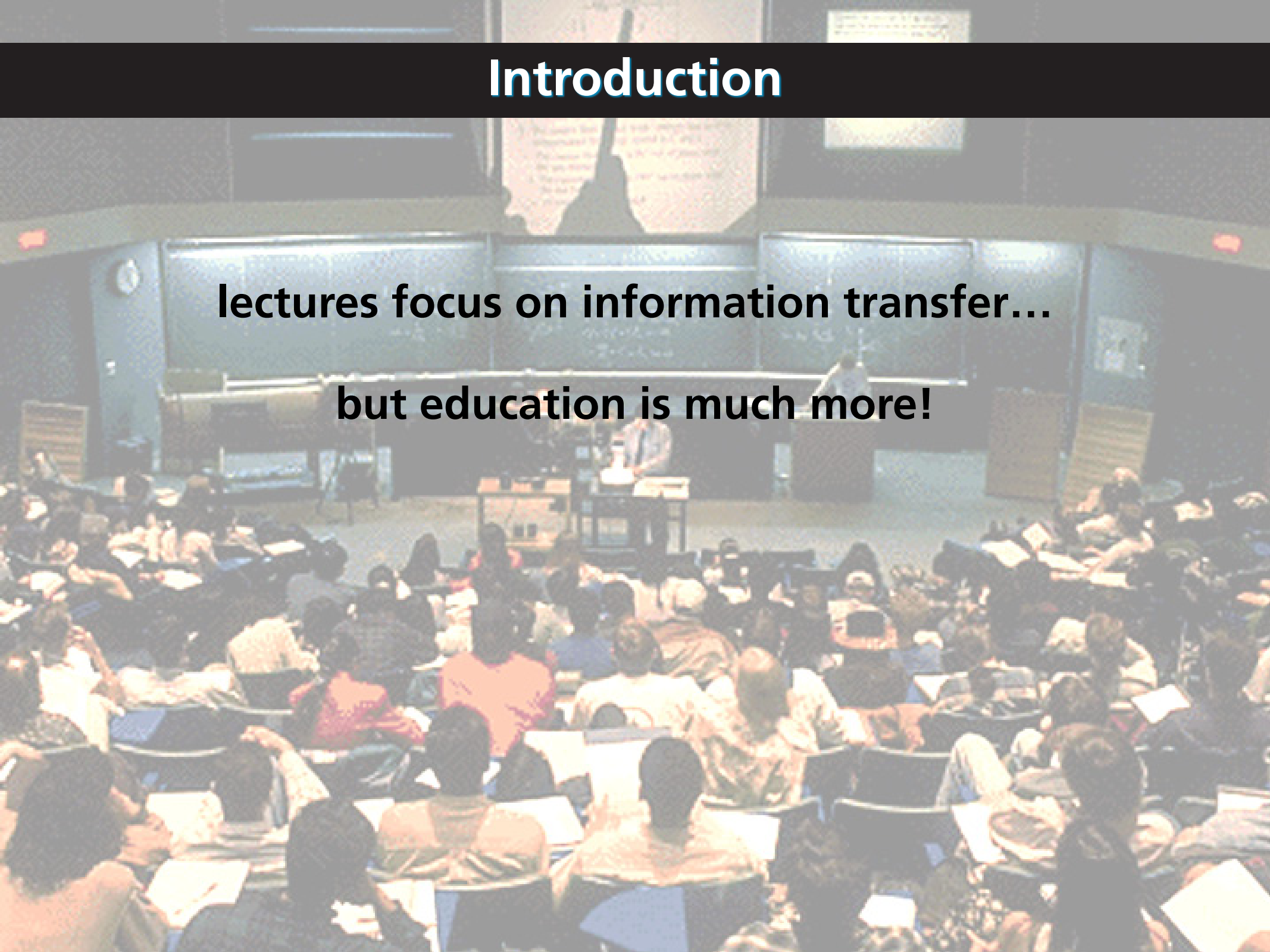
Introduction



lectures focus on information transfer…

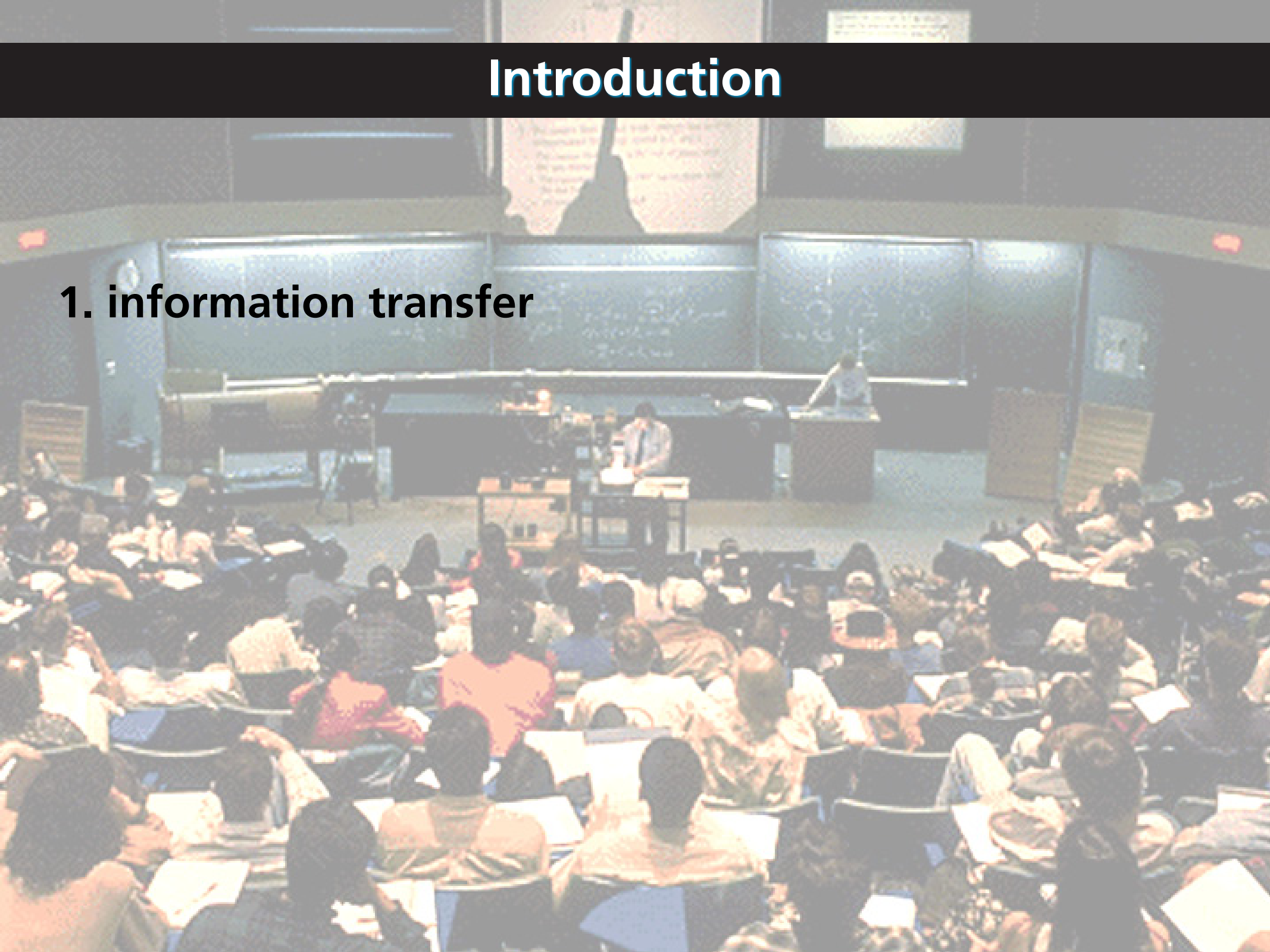
Introduction



lectures focus on information transfer…

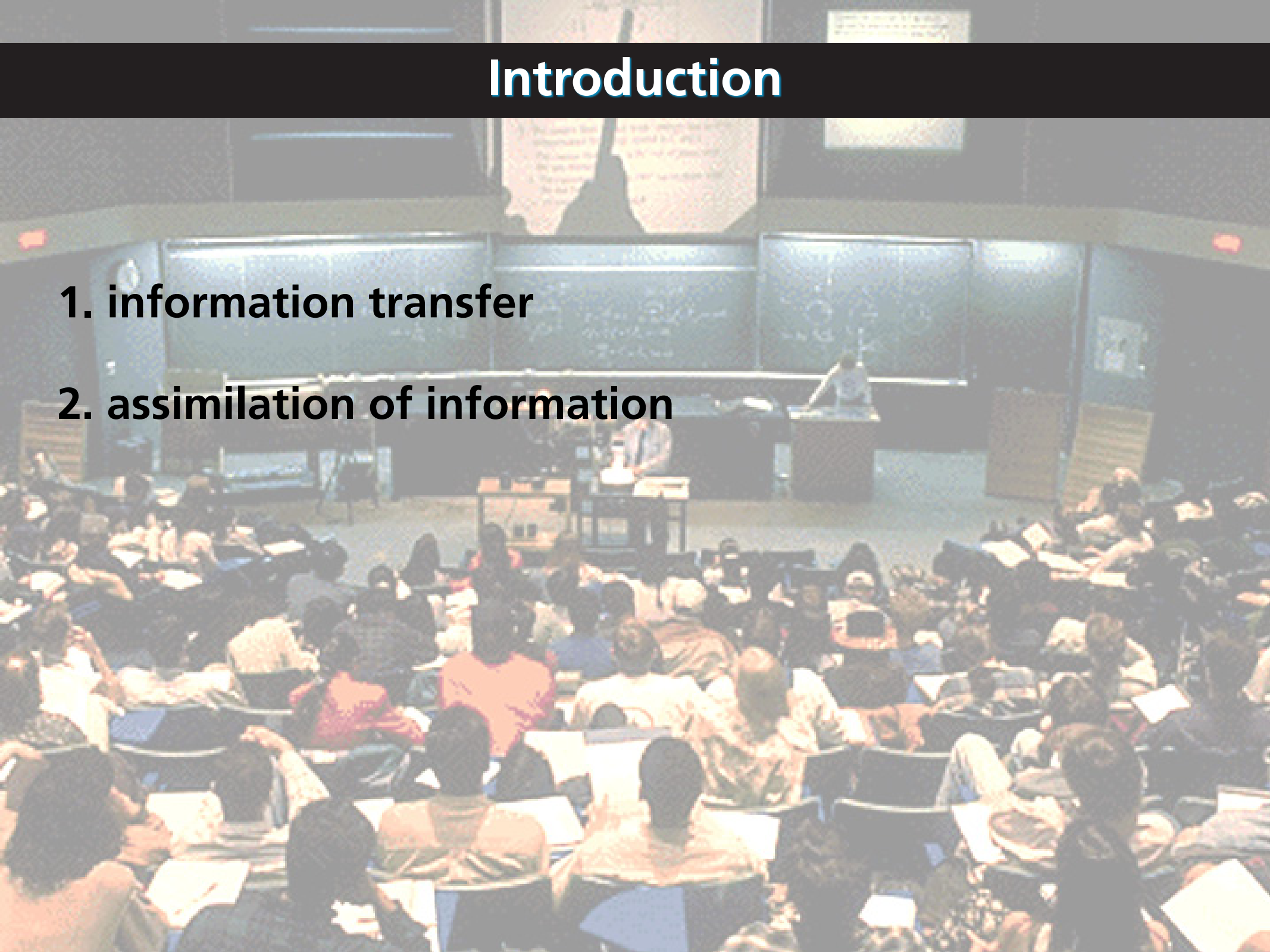
but education is much more!

Introduction



1. information transfer

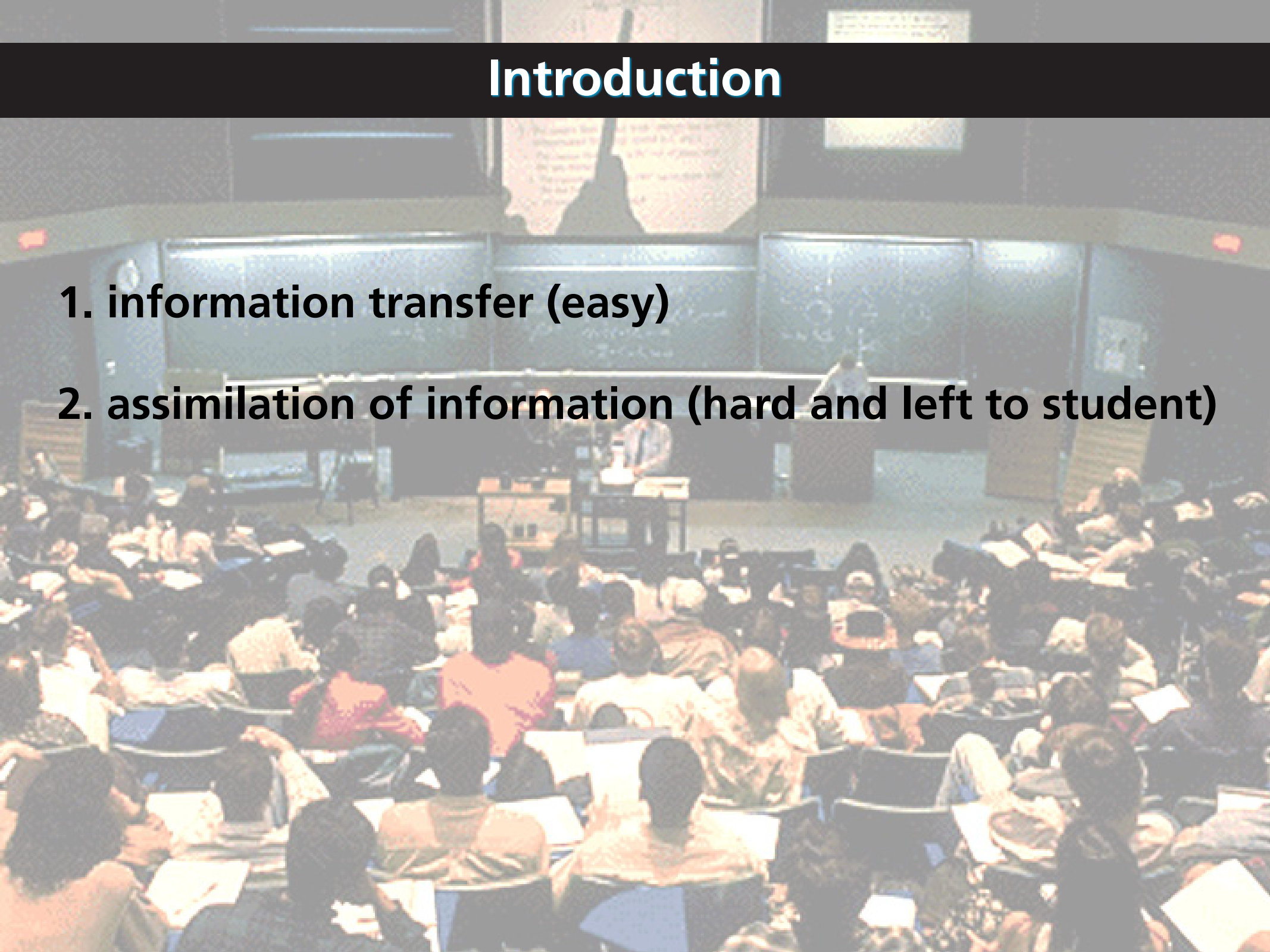
Introduction



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

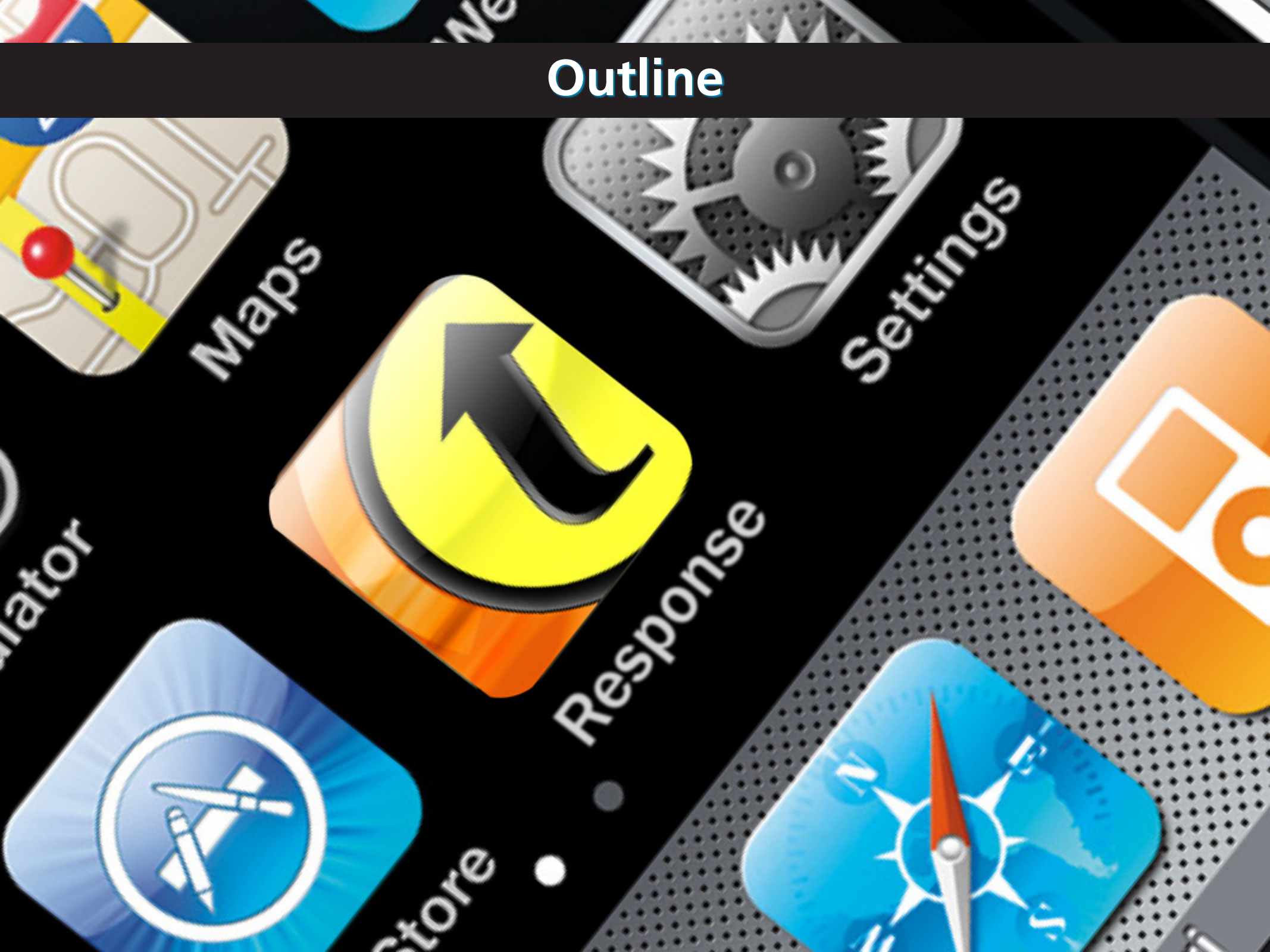
How to move information transfer out of classroom?

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

PI & JiTT Overview

Students do not come to class prepared, because...

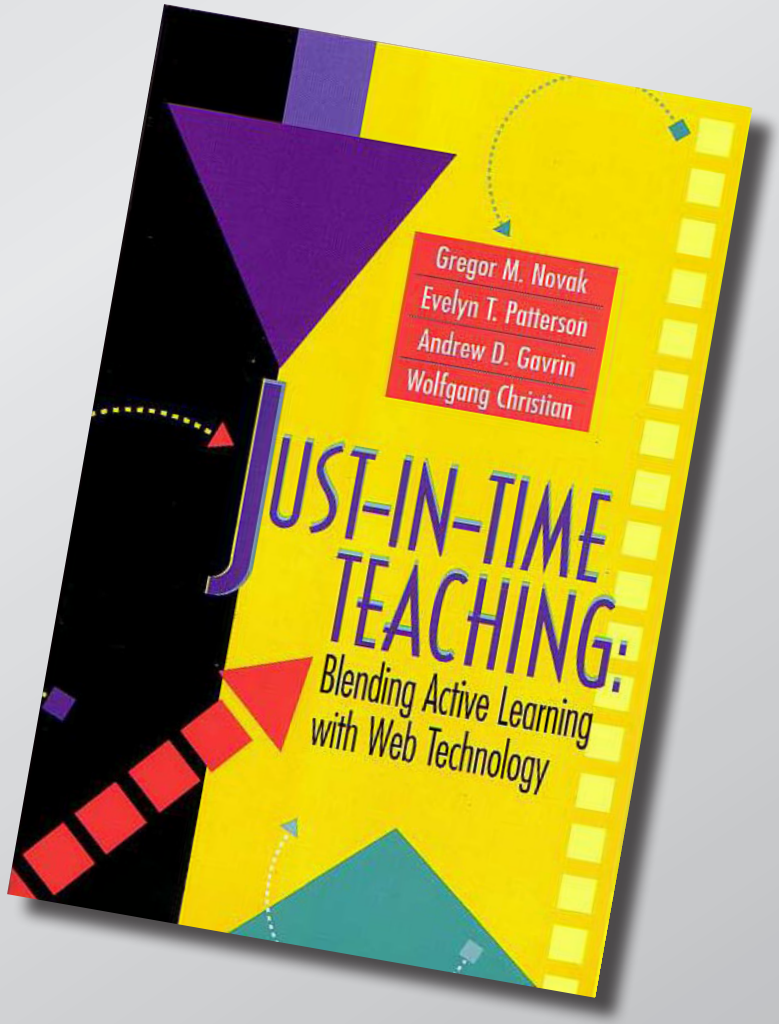
1. they don't have time.
2. they are not motivated to learn.
3. their instructors take away the incentive.
4. they do not have the requisite skills.
5. of some other reason.
6. They do come prepared in my class!

(select what you consider to be the main reason)

PI & JiTT Overview

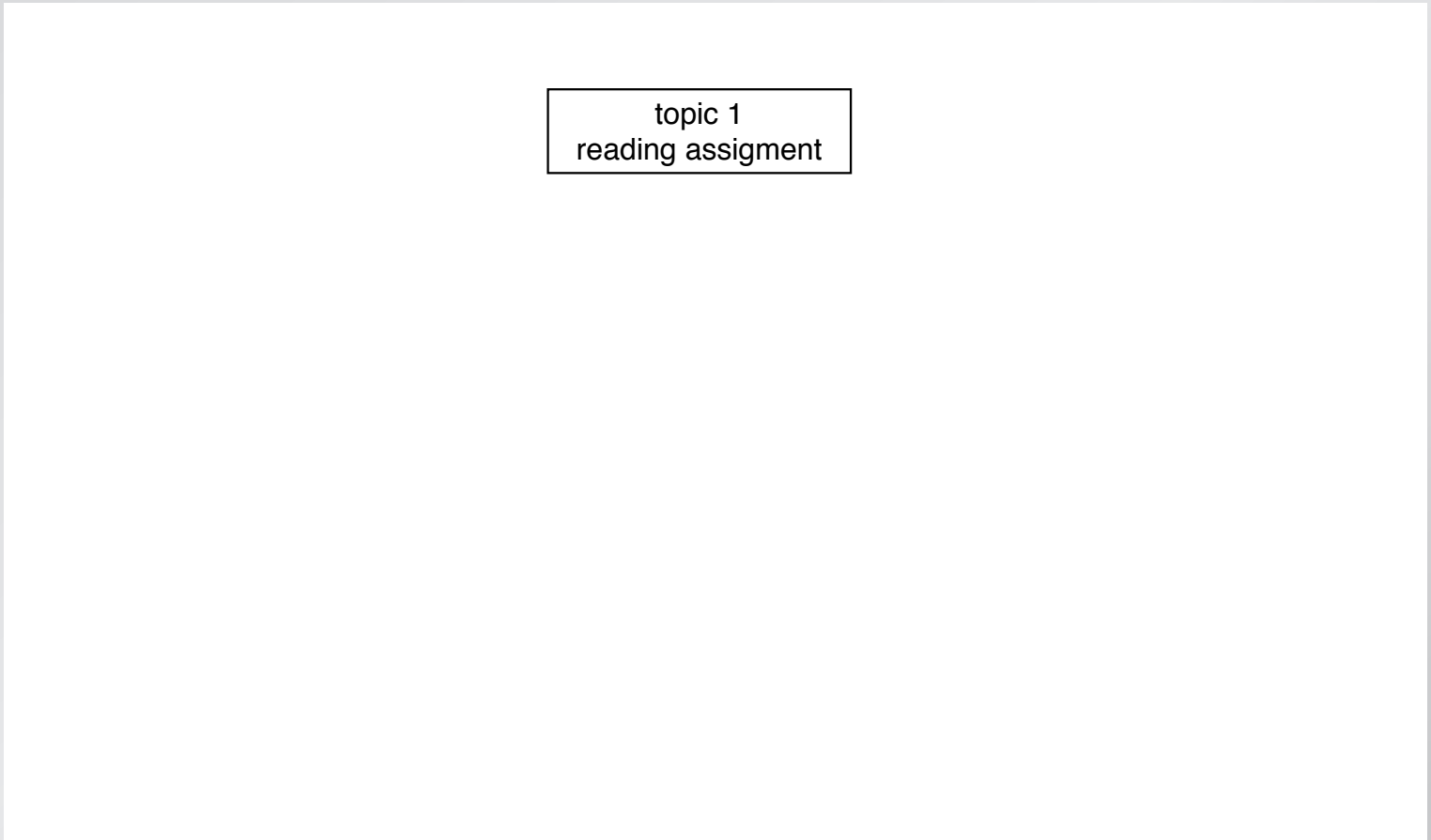
Just-in-time-Teaching (JiTT)

www.jitt.org



PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

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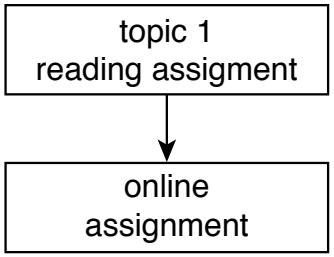
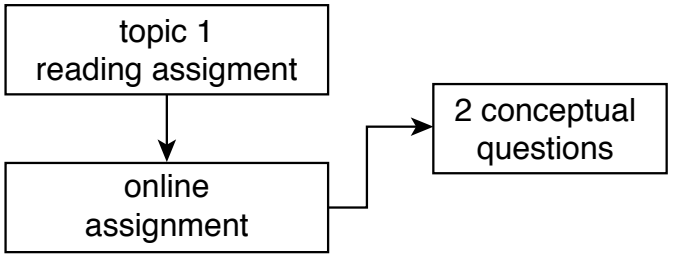


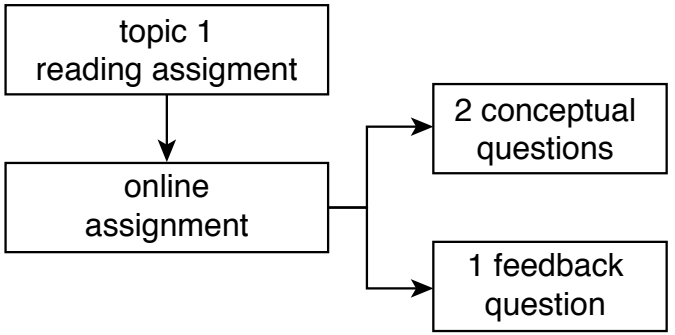
PI & JiTT Overview

JiTT workflow



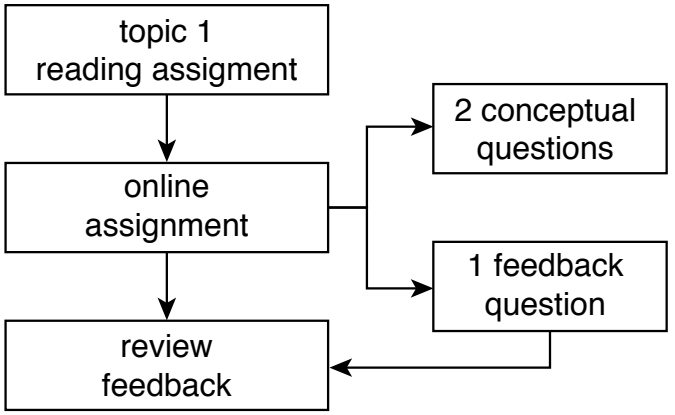
PI & JiTT Overview

JiTT workflow



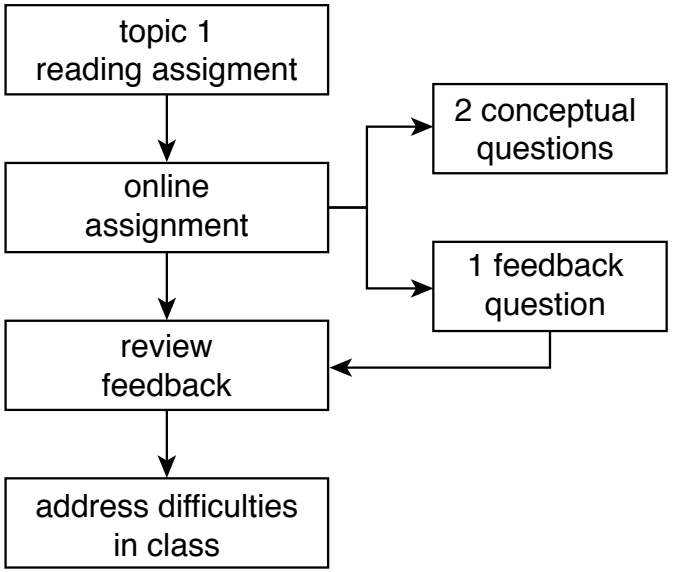
PI & JiTT Overview

JiTT workflow



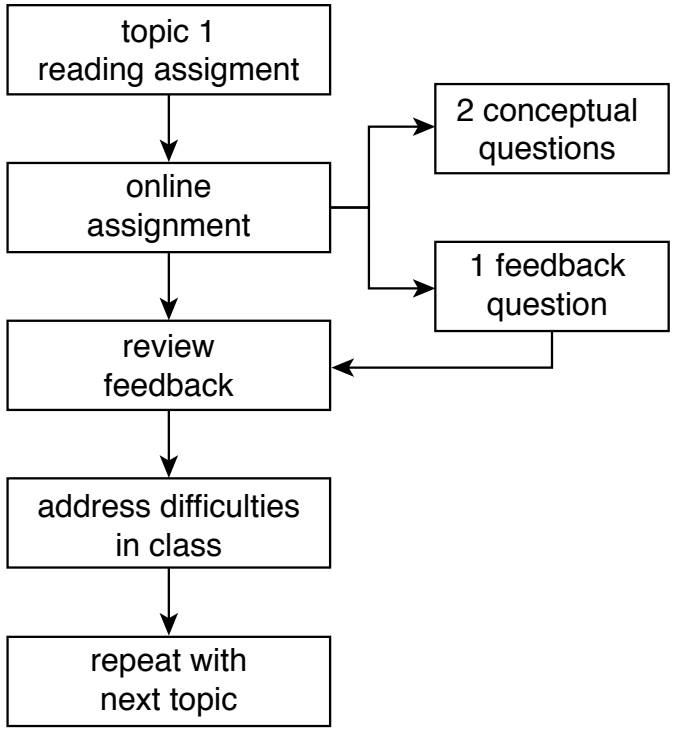
PI & JiTT Overview

JiTT workflow



PI & JiTT Overview

JiTT workflow



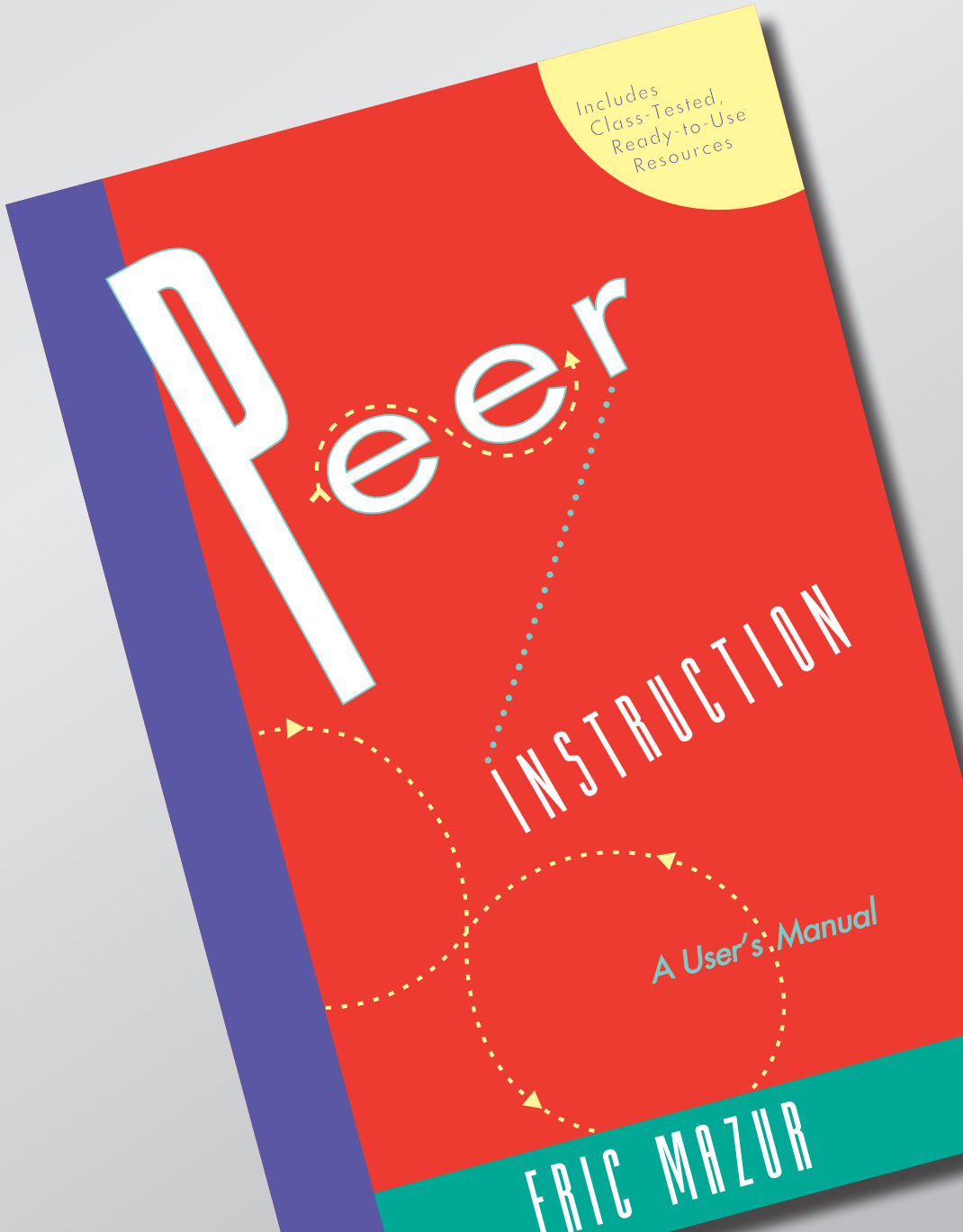
PI & JiTT Overview

JiTT:

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

PI & JiTT Overview

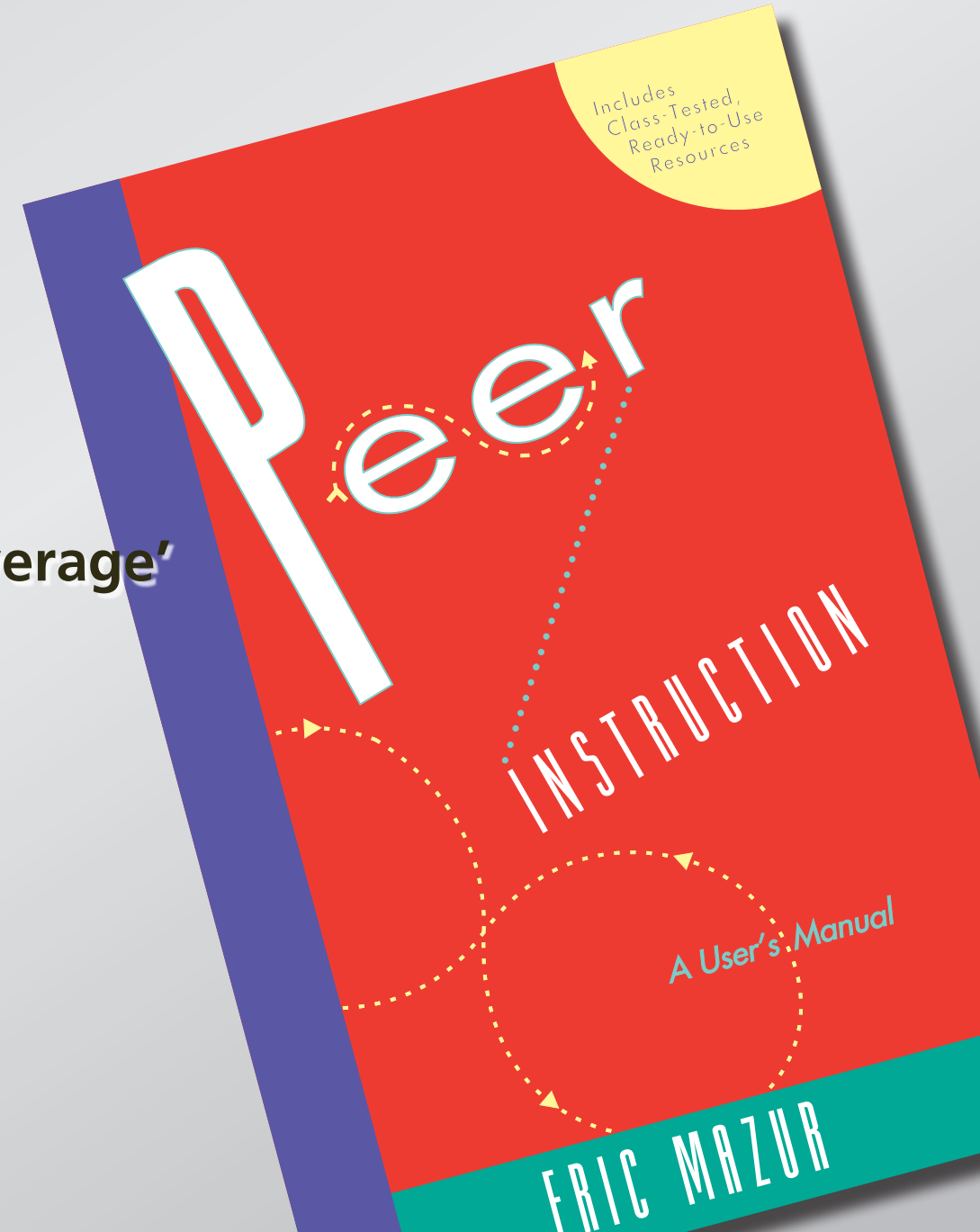
Peer Instruction (PI)



PI & JiTT Overview

Main features:

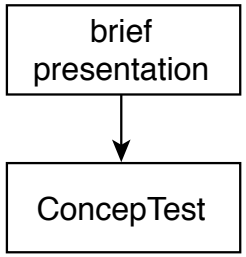
- **pre-class assignment**
- **in-class: depth, not 'coverage'**
- **ConcepTests**



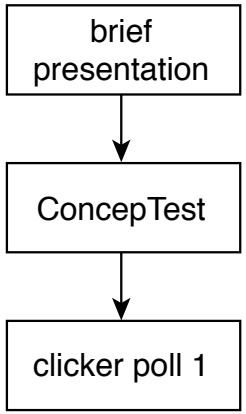
PI & JiTT Overview

brief
presentation

PI & JiTT Overview



PI & JiTT Overview



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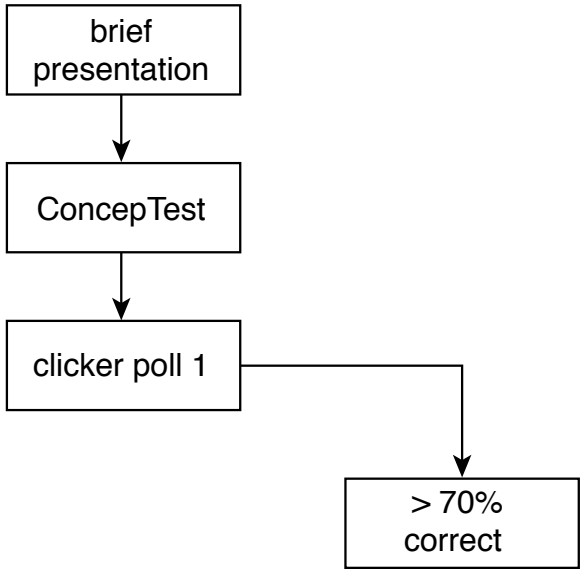

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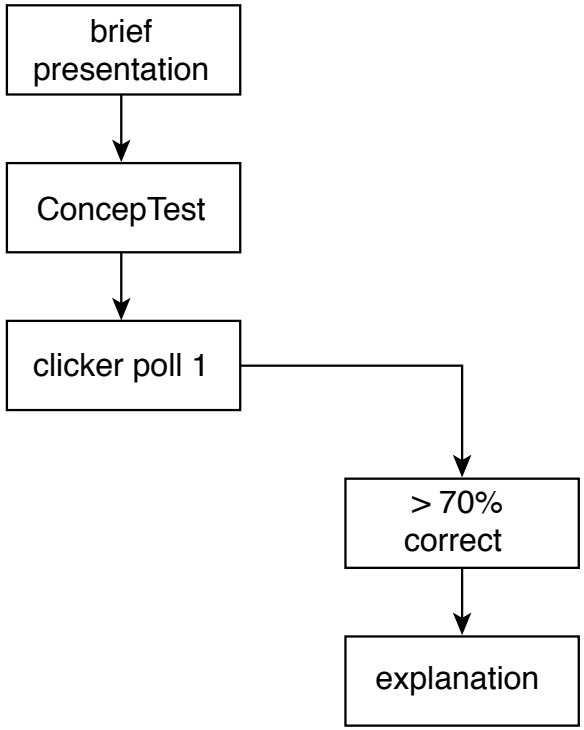

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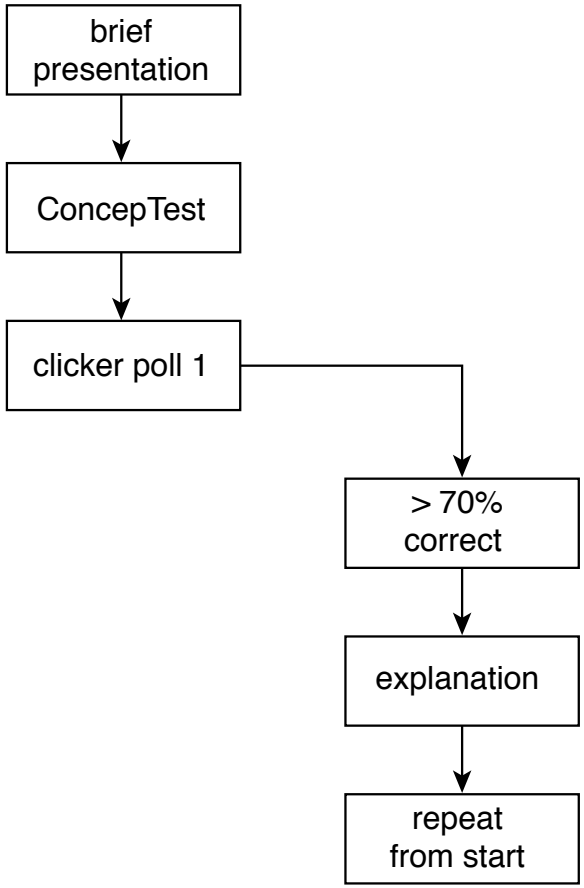

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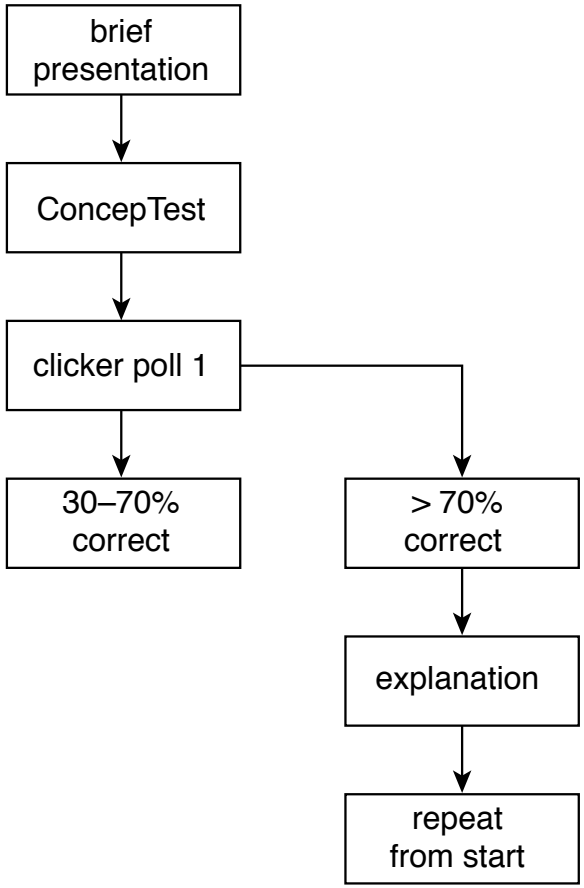

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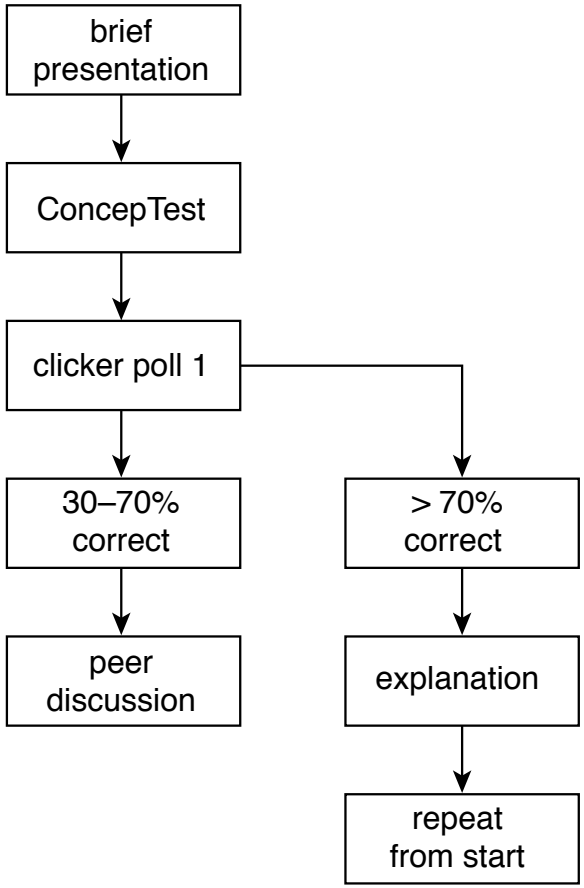

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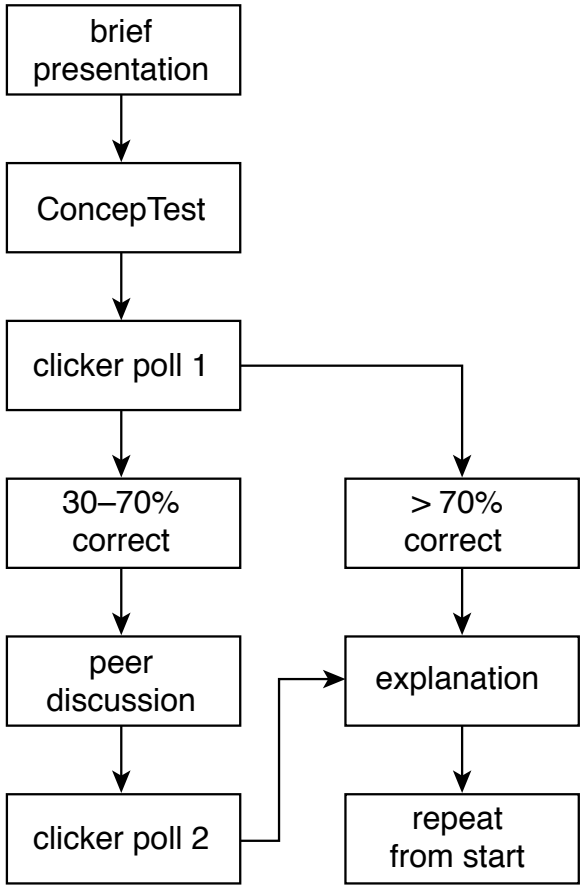

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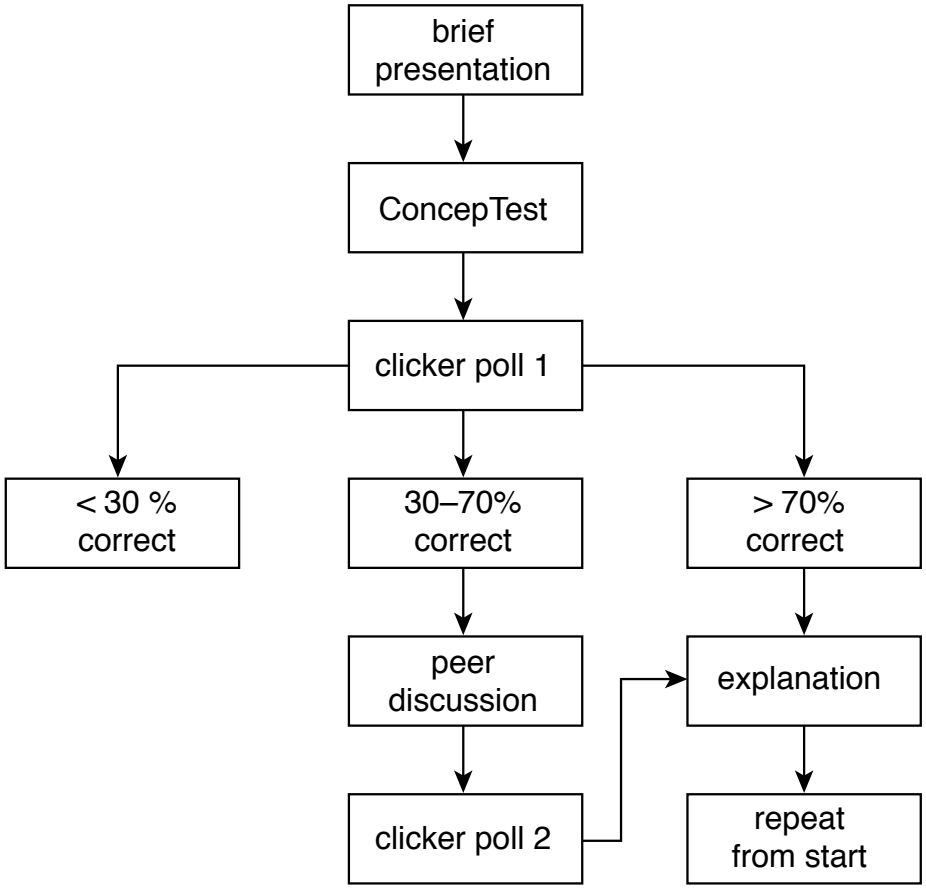

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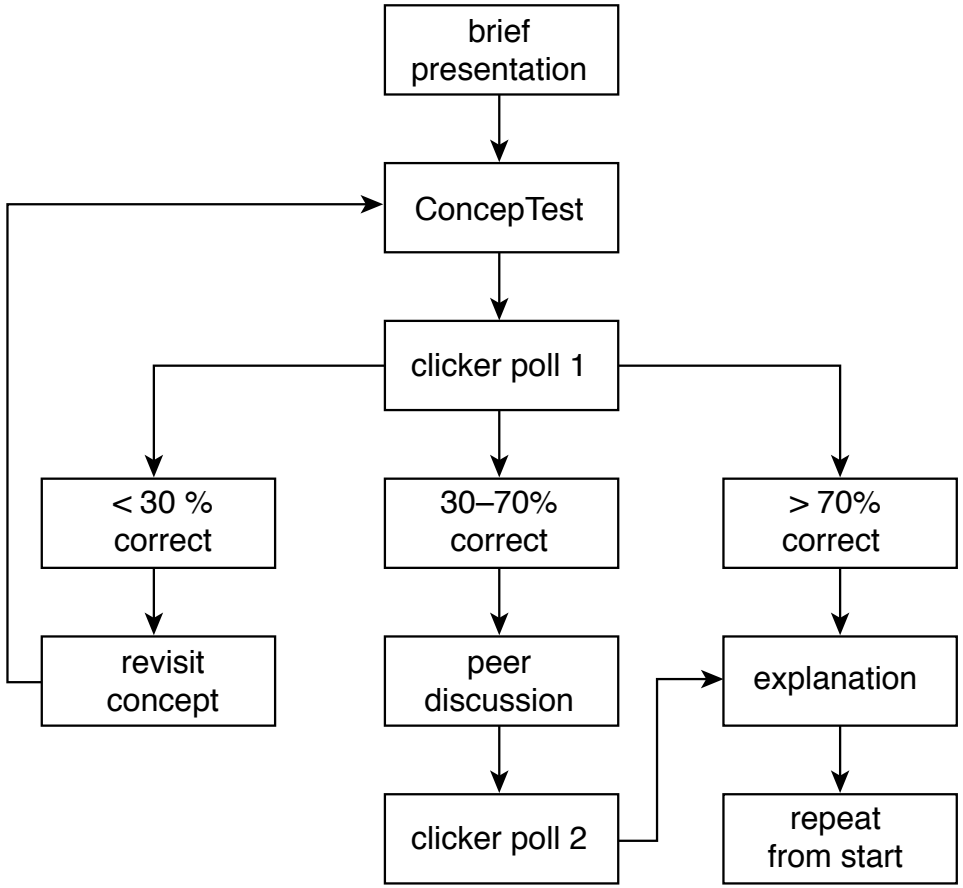

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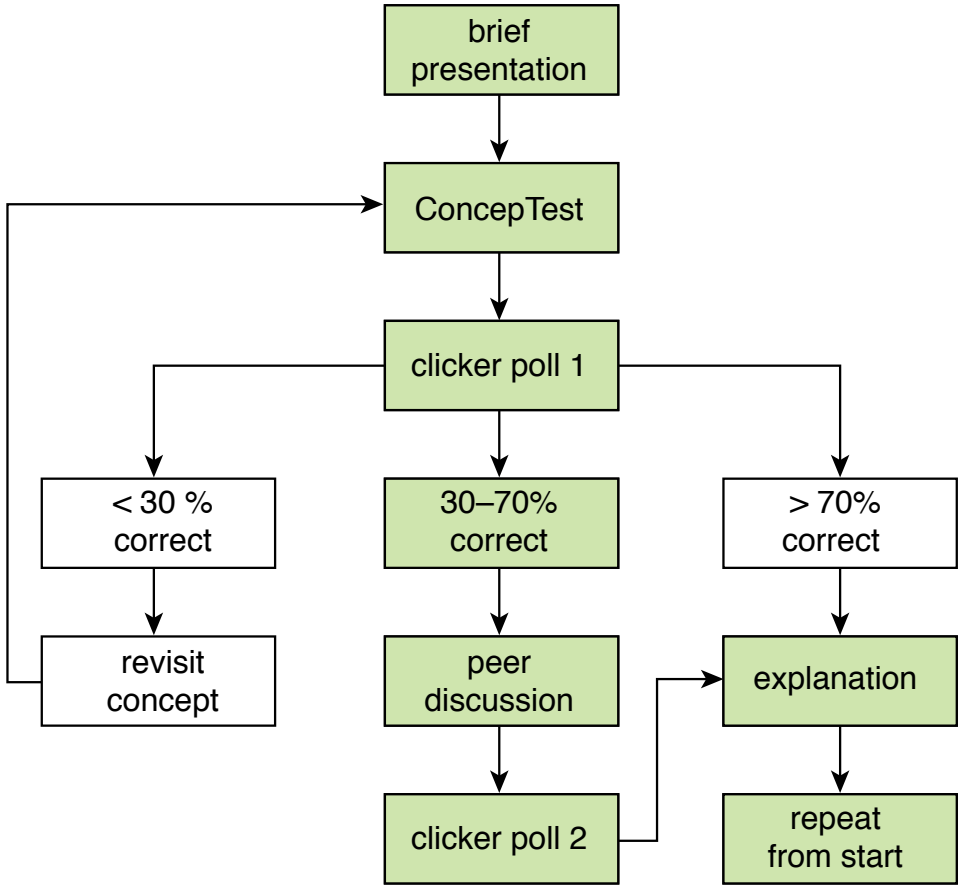


PI & JiTT Overview

PI:

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

PI & JiTT Overview

“How do I promote fruitful discussion?”

PI & JiTT Overview

Find someone with a *different* answer

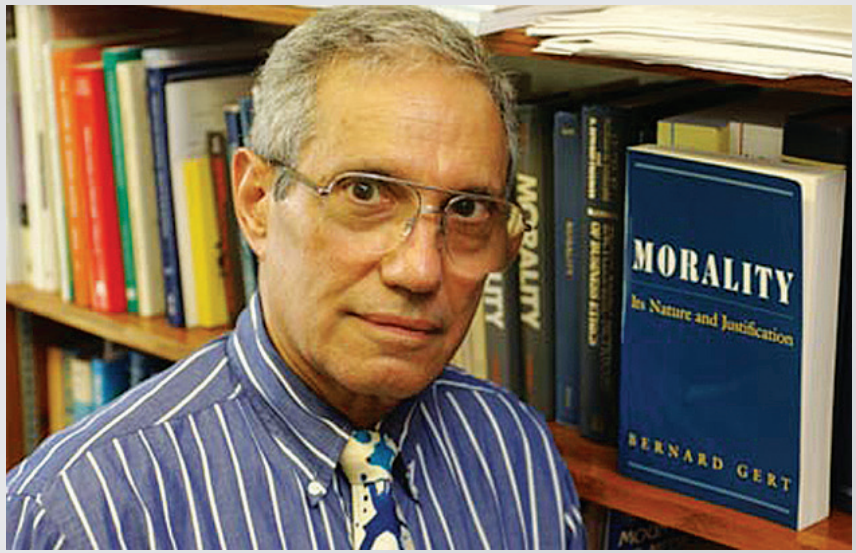
PI & JiTT Overview

“Can this method be used in my class,

where questions don’t necessarily have right answers?”

Let's try it!

Bernard Gert (1934 – 2011)

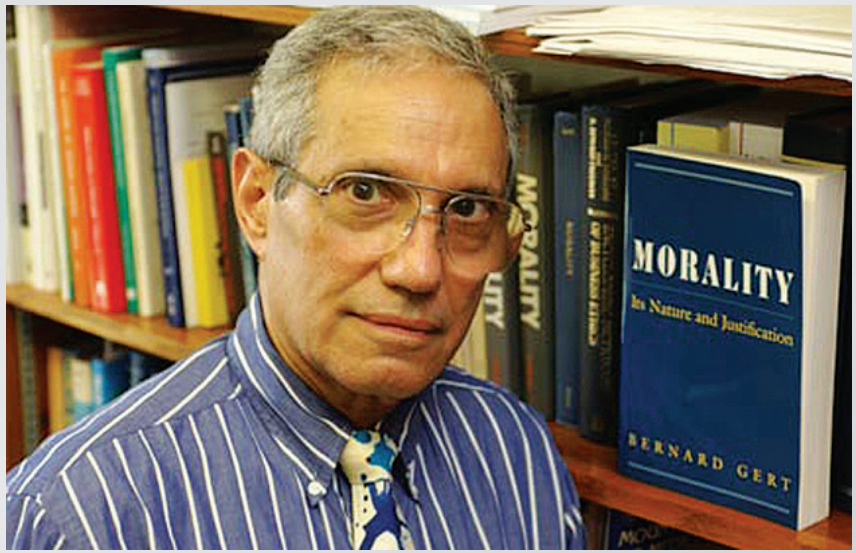


Moral philospher

Professor at Dartmouth

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'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!

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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!

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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!

Outline

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

Implementing PI & JiTT

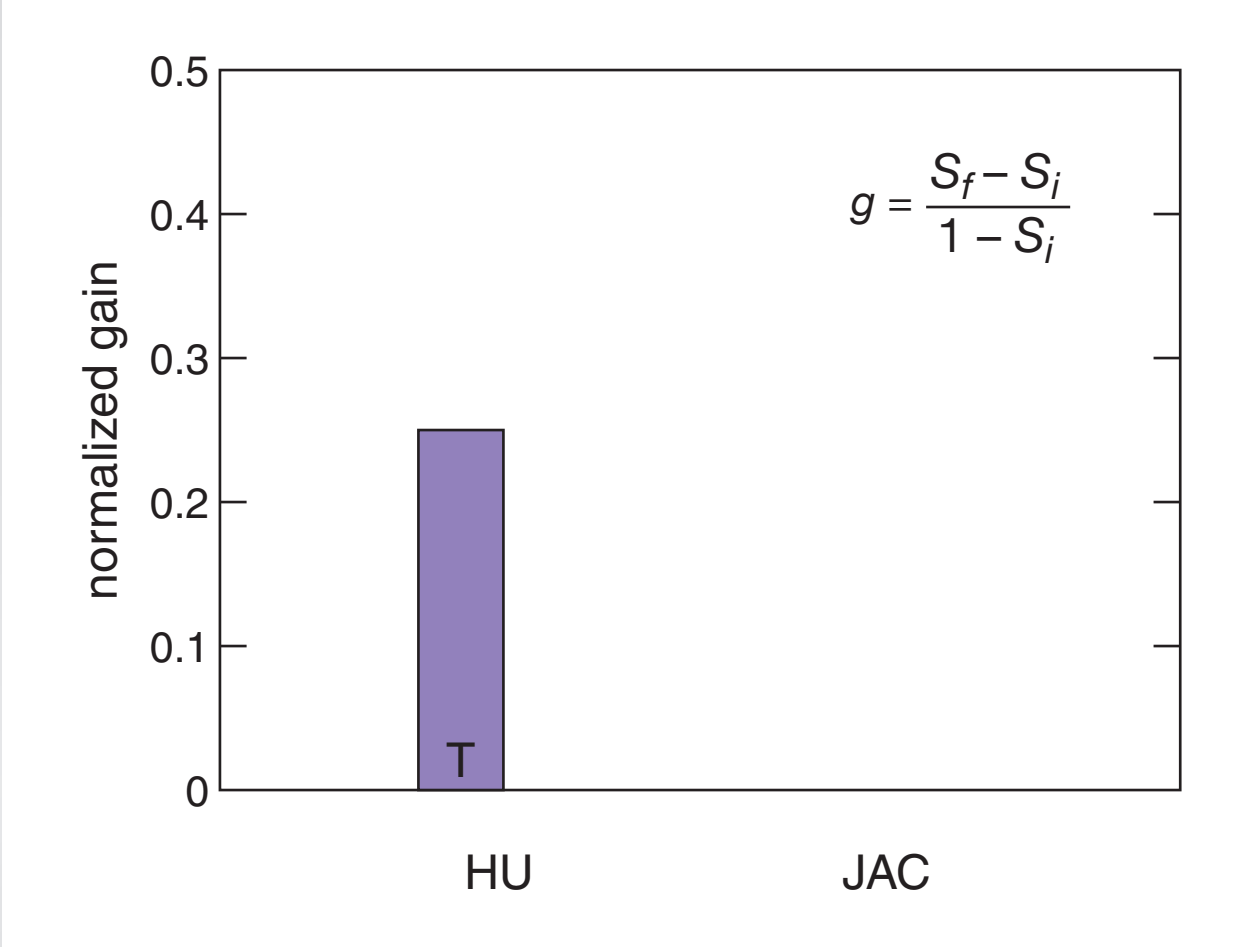
“Will it work at my institution?”

It works here…

…but will it work here?

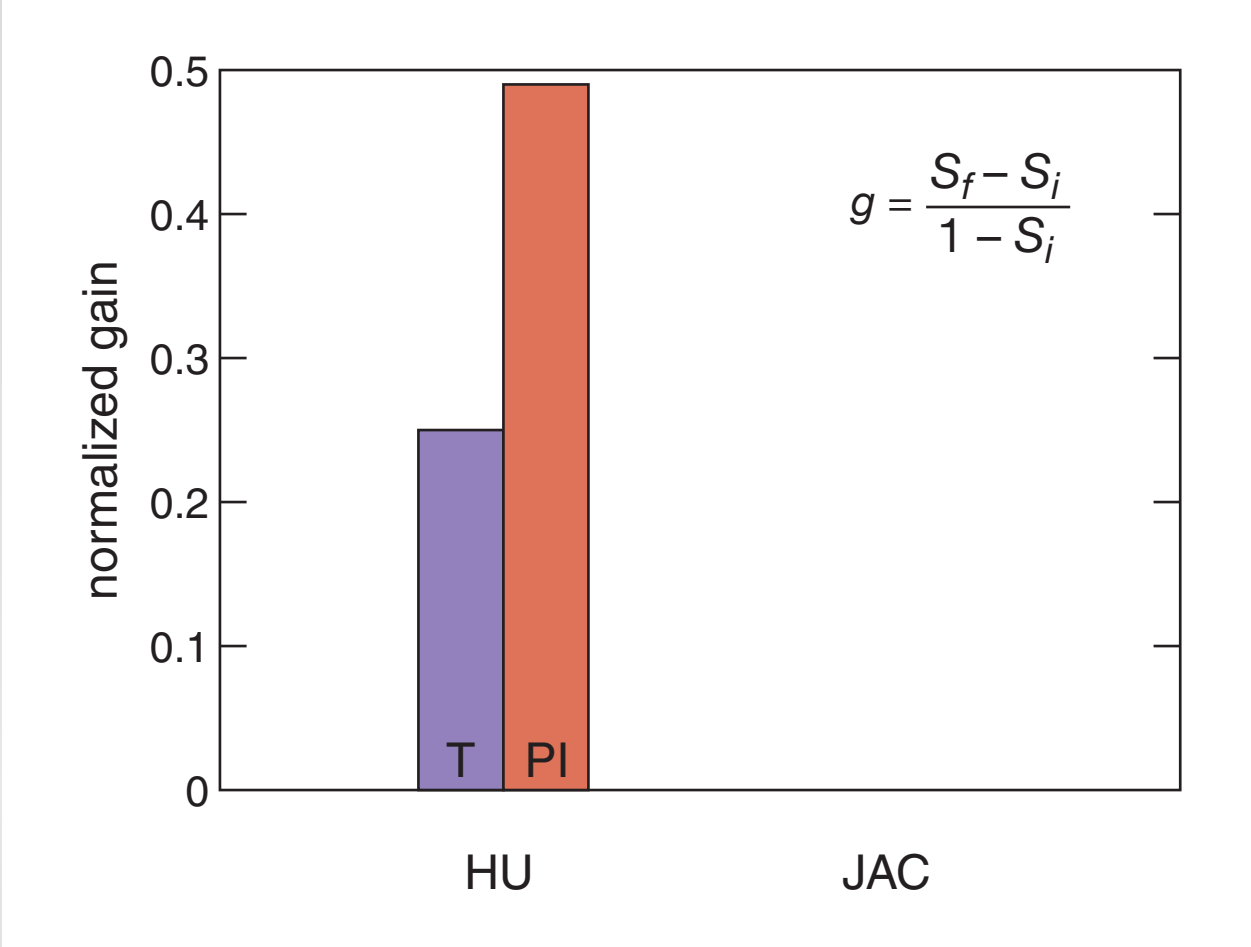
Implementing PI & JiTT

FCI normalized gain



Implementing PI & JiTT

FCI normalized gain



Implementing PI & JiTT

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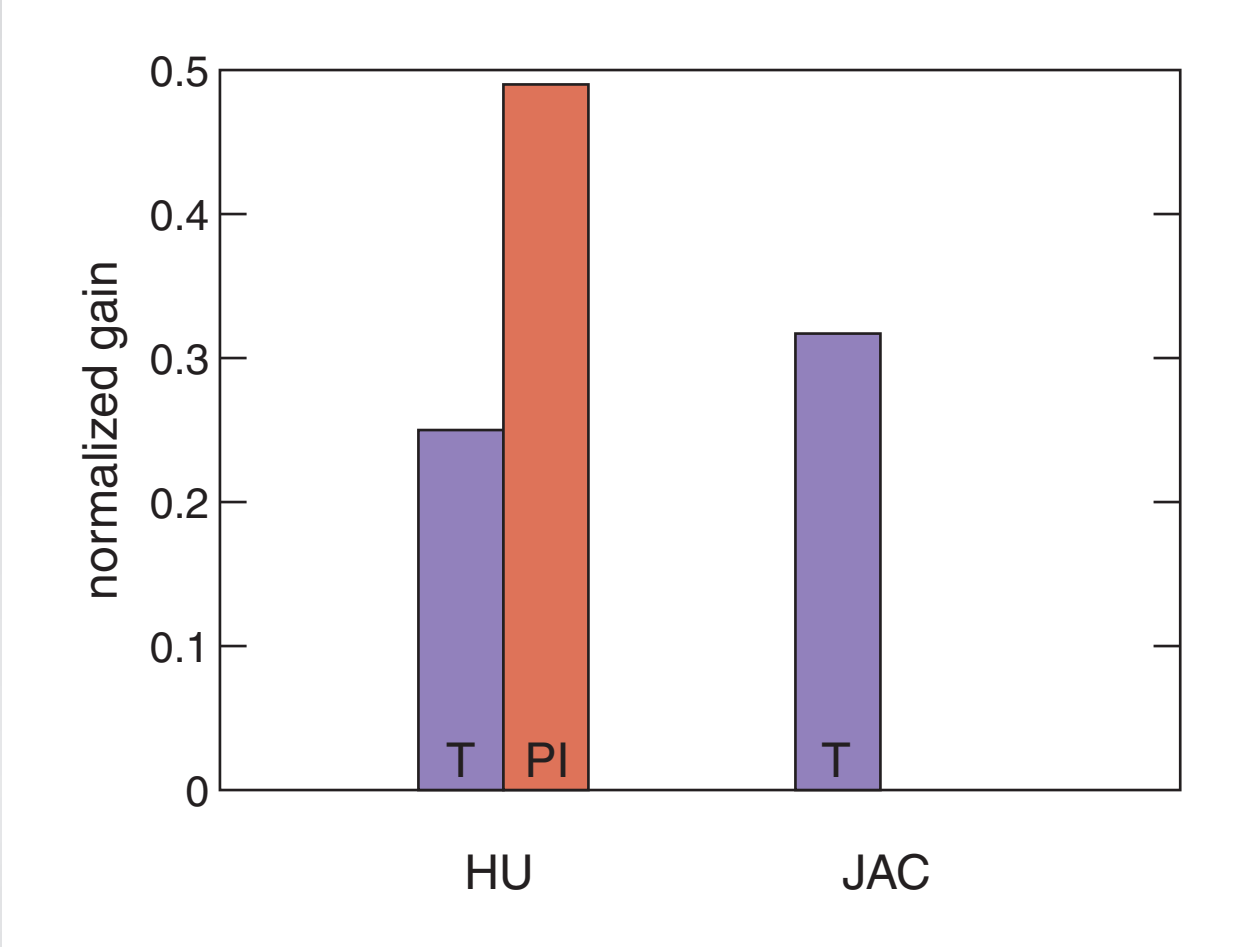

Implementing PI & JiTT

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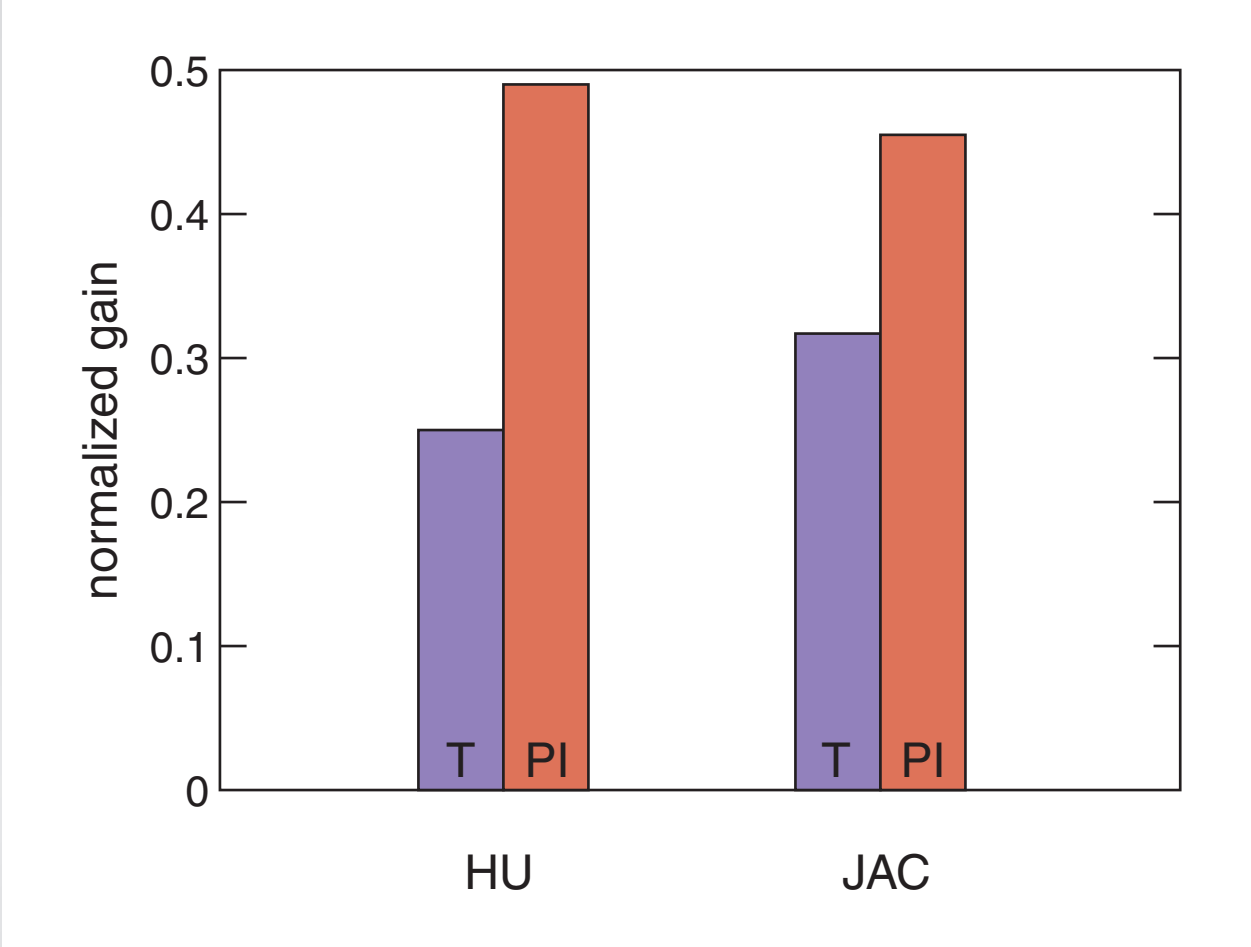
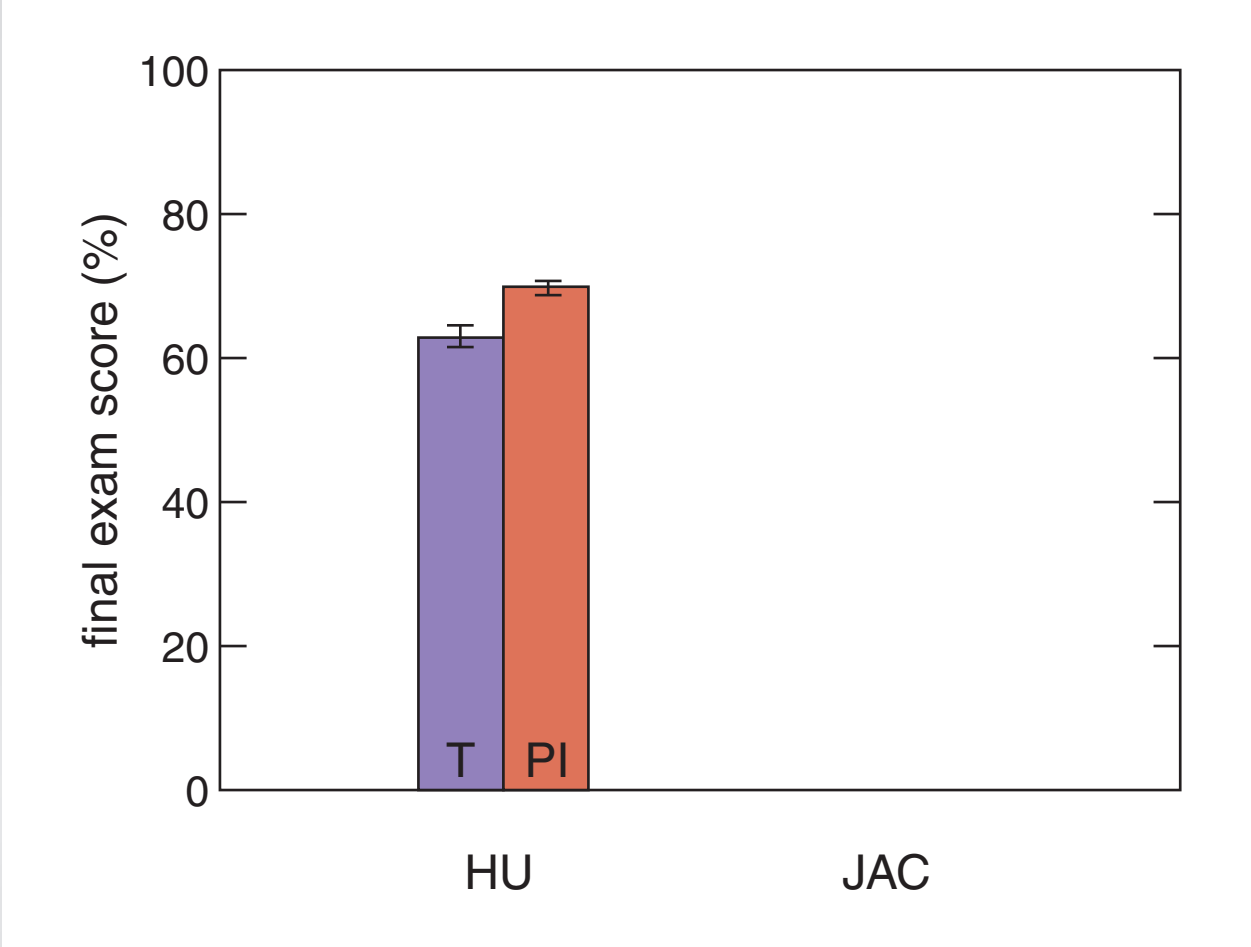


Implementing PI & JiTT

exam performance



Implementing PI & JiTT

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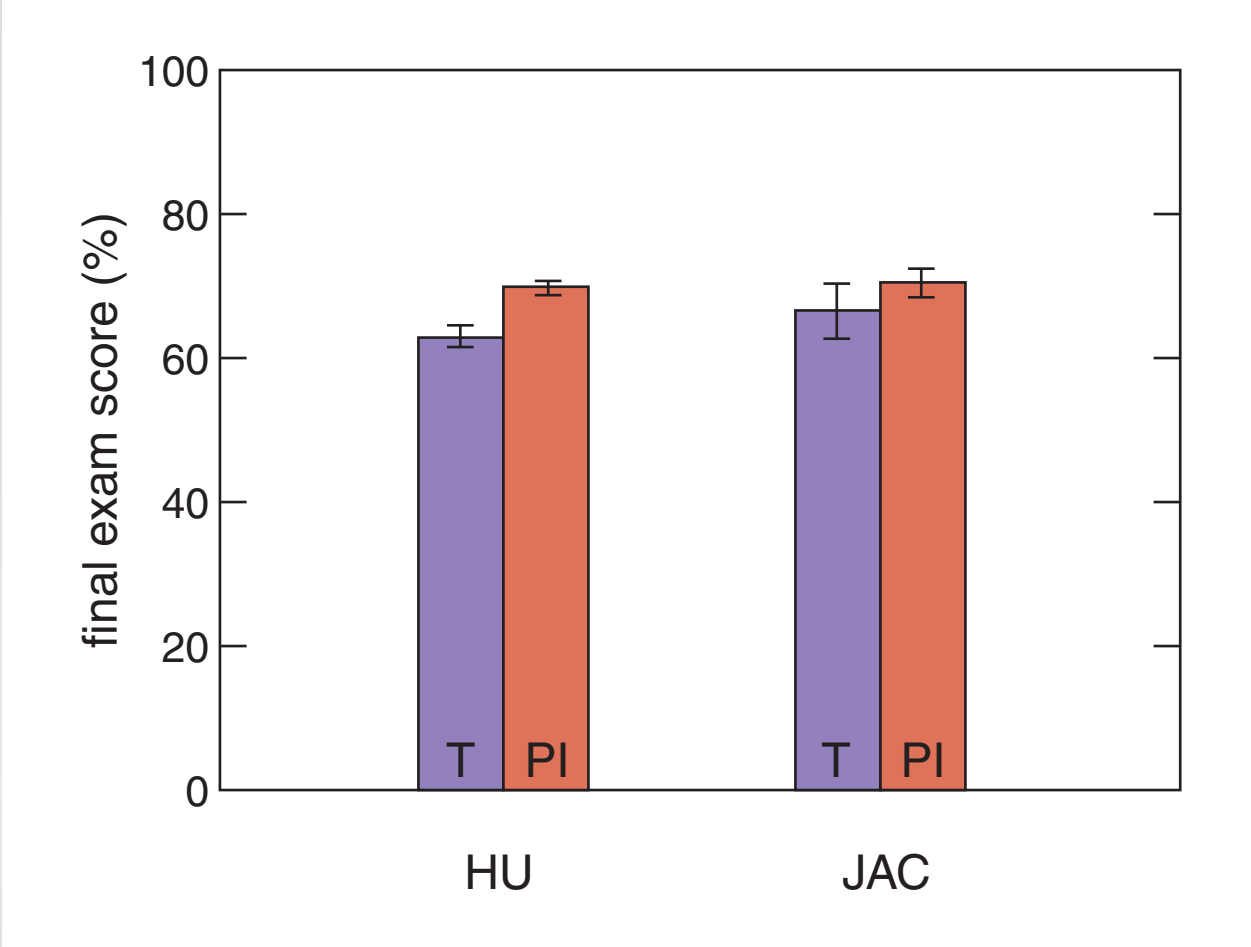
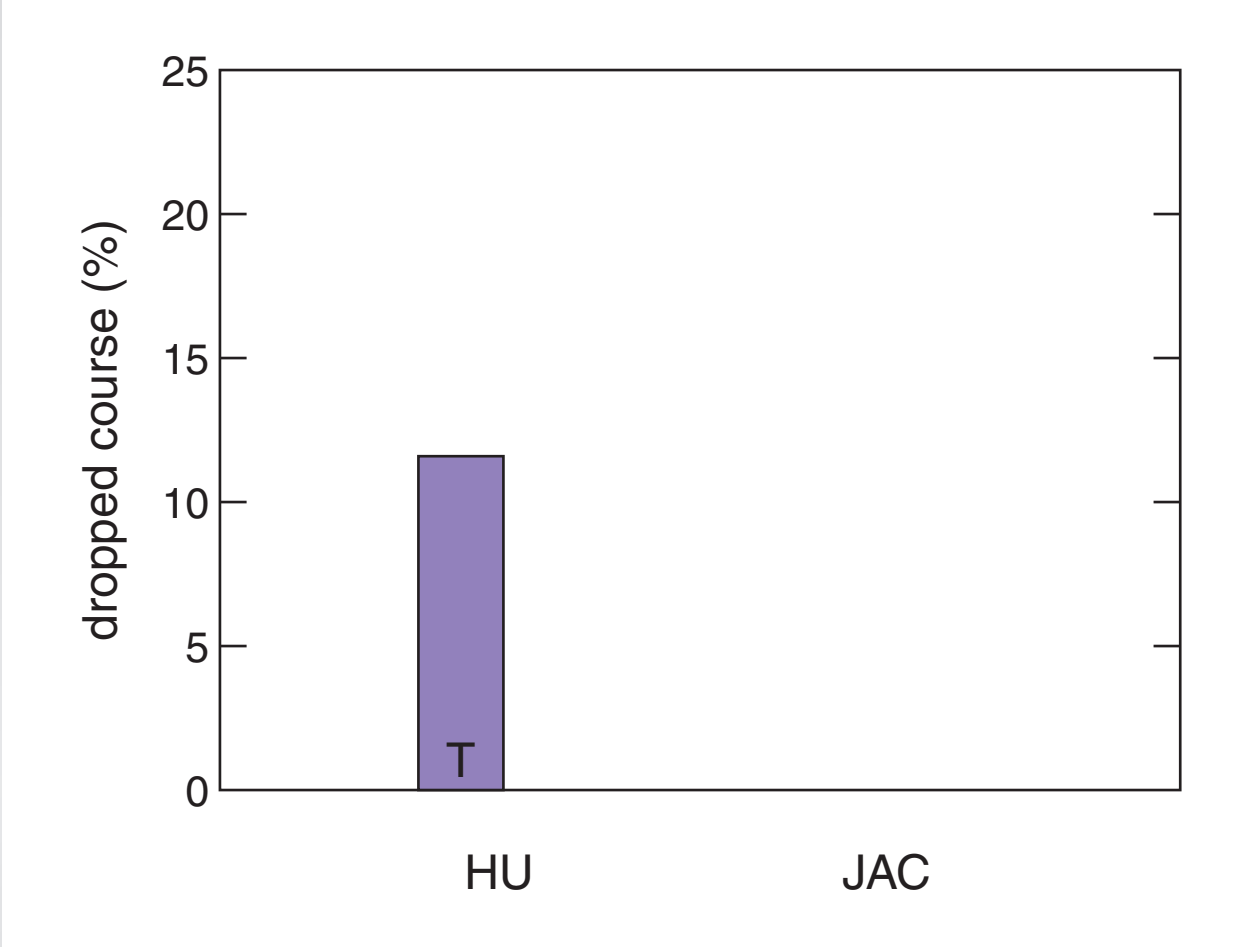


Implementing PI & JiTT

student retention



Implementing PI & JiTT

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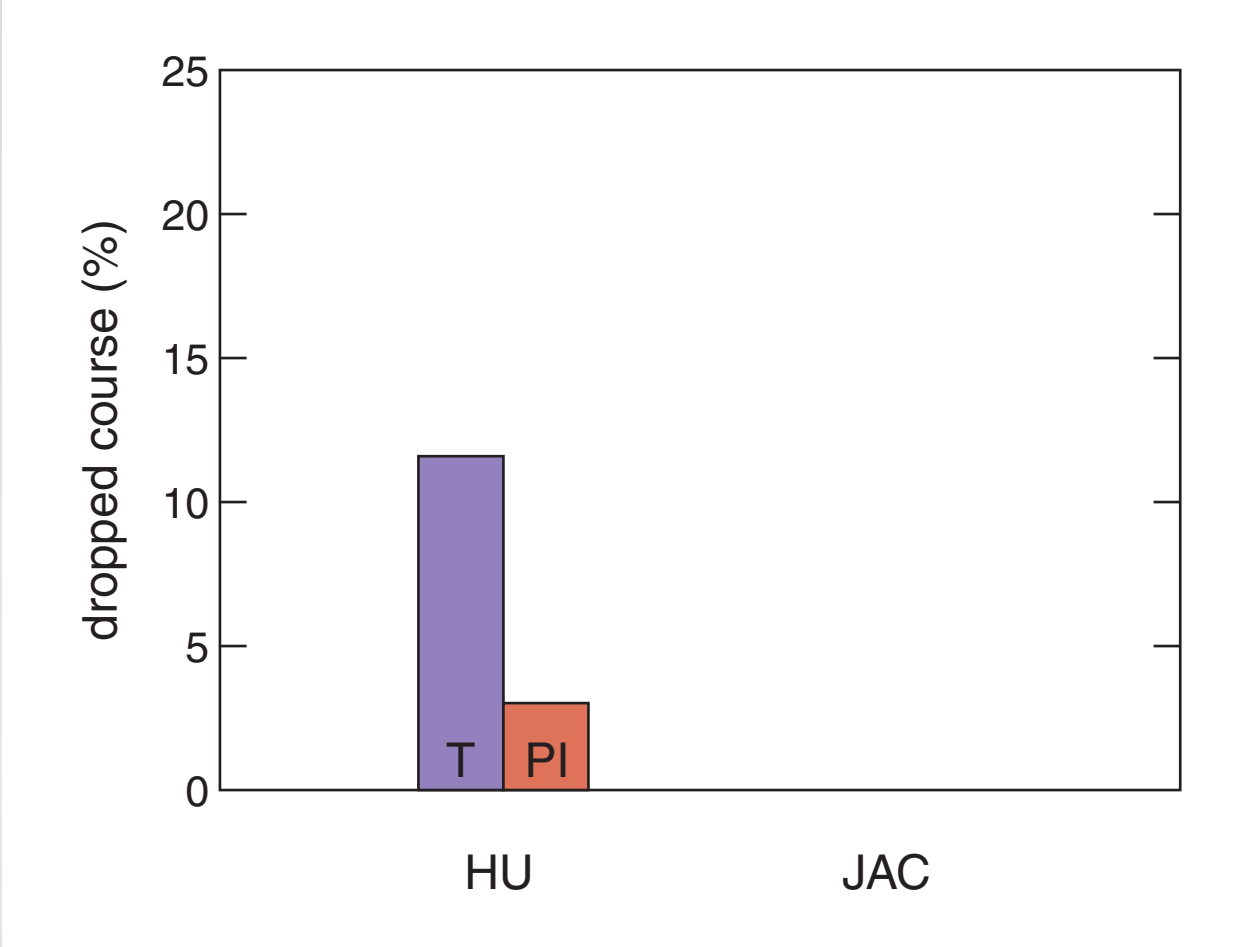

Implementing PI & JiTT

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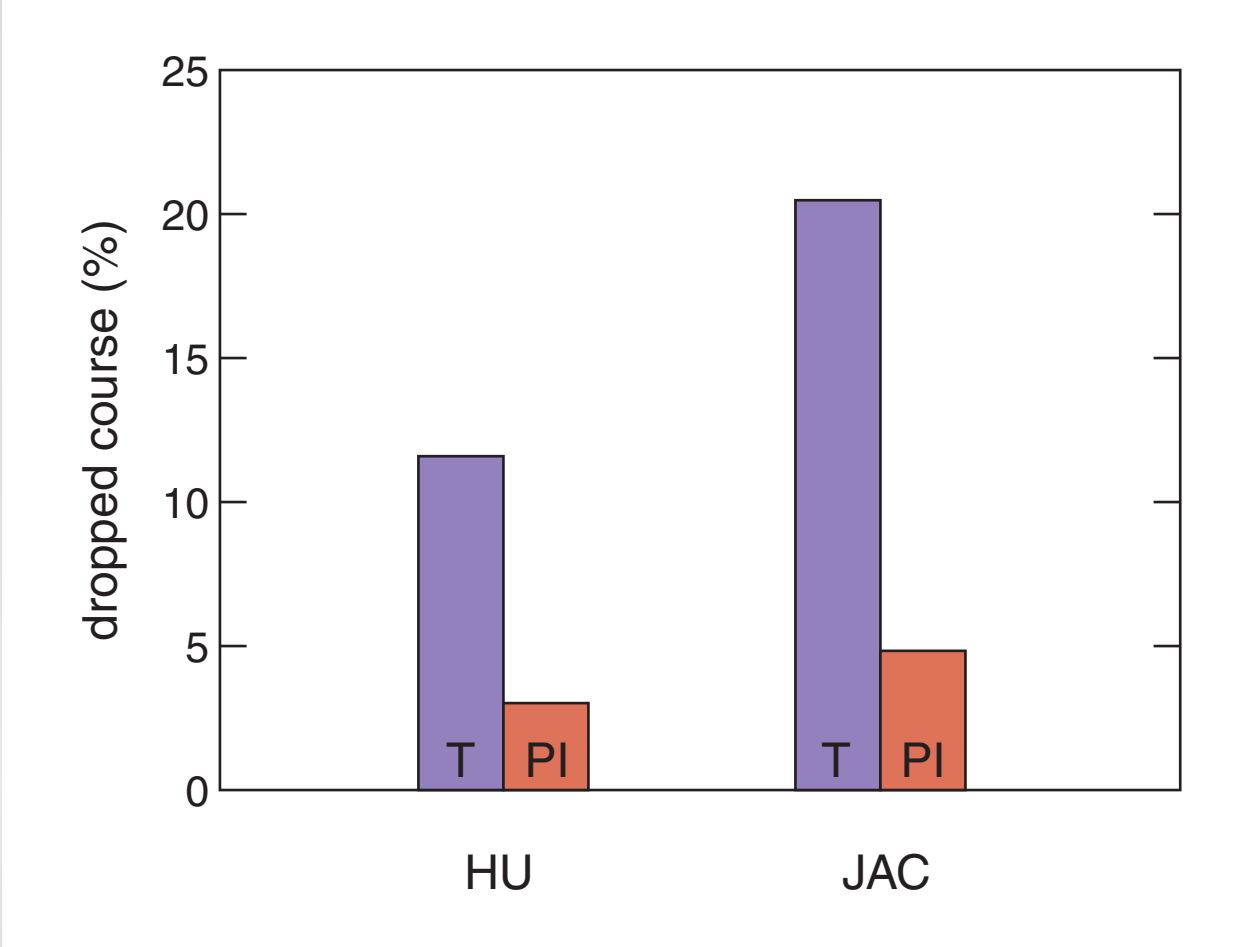


Implementing PI & JiTT

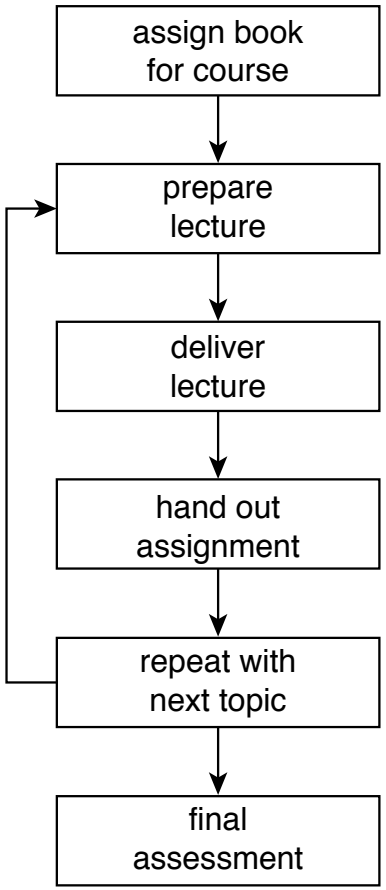
similar learning gains in different environments

Implementing PI & JiTT

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

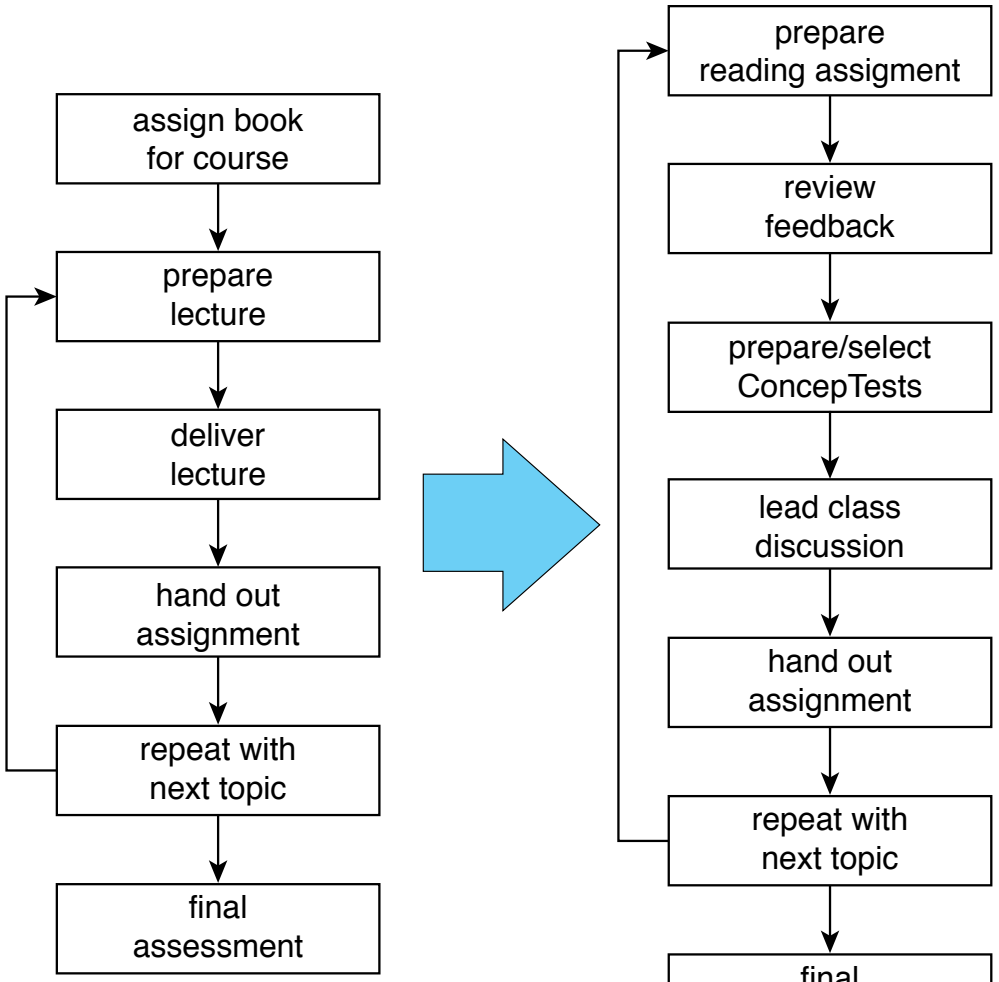
Implementing PI & JiTT

preparing for a lecture-based class



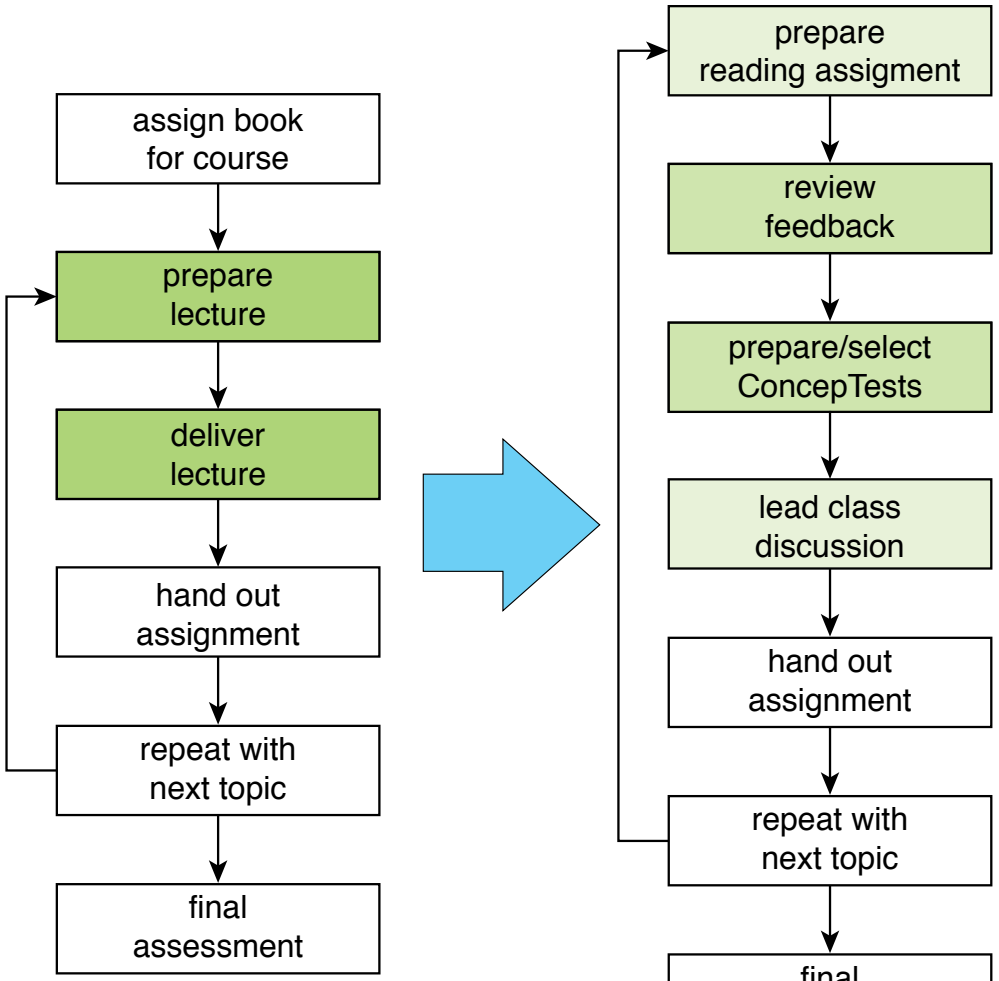
Implementing PI & JiTT

transitioning: where does the effort go?



Implementing PI & JiTT

transitioning: where does the effort go?



Implementing PI & JiTT

New activities:

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

Implementing PI & JiTT

“How do I cover everything using this method?”

Implementing PI & JiTT

	traditional	PI
in-class coverage	complete	partial

Implementing PI & JiTT

	traditional	PI
in-class coverage	complete	partial
out-of-class coverage	?	complete

Implementing PI & JiTT

	traditional	PI
in-class coverage	complete	partial
out-of-class coverage	?	complete
material learned	little	substantial

Implementing PI & JiTT

	traditional	PI
in-class coverage	complete	partial
out-of-class coverage	?	complete
material learned	little	substantial

what good is coverage if little is retained?

Outline

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

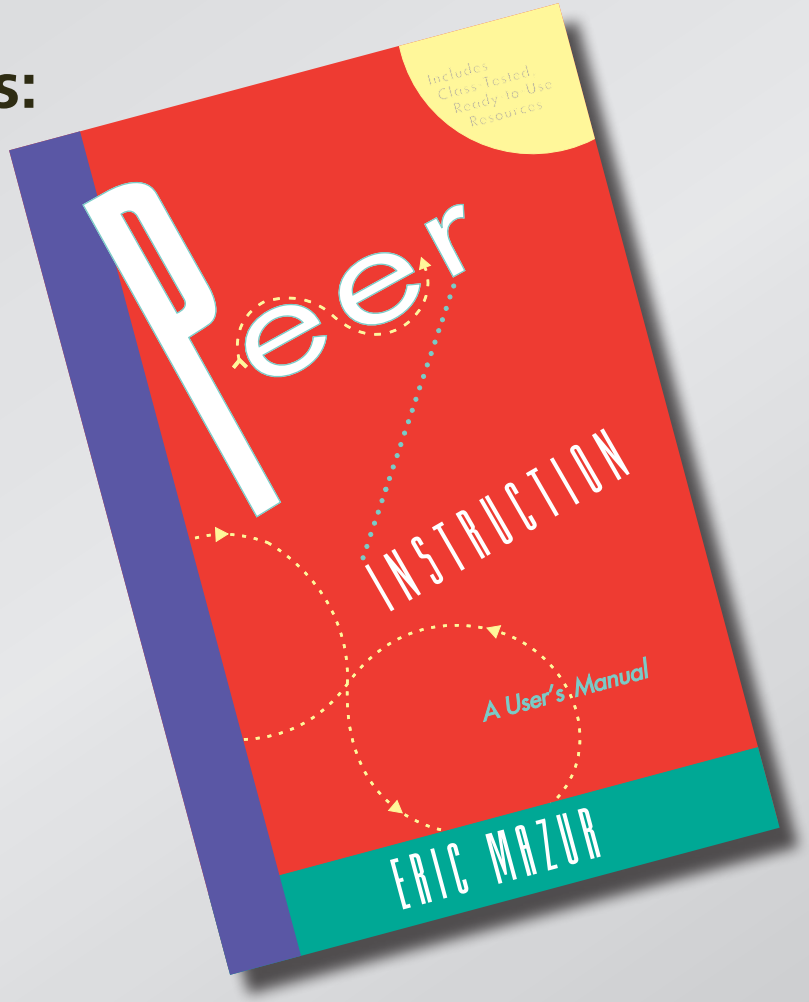
ConcepTests

“Where can I get examples of good questions?”

ConcepTests

Books with ConcepTests:

- **Physics (Prentice Hall)**



ConcepTests

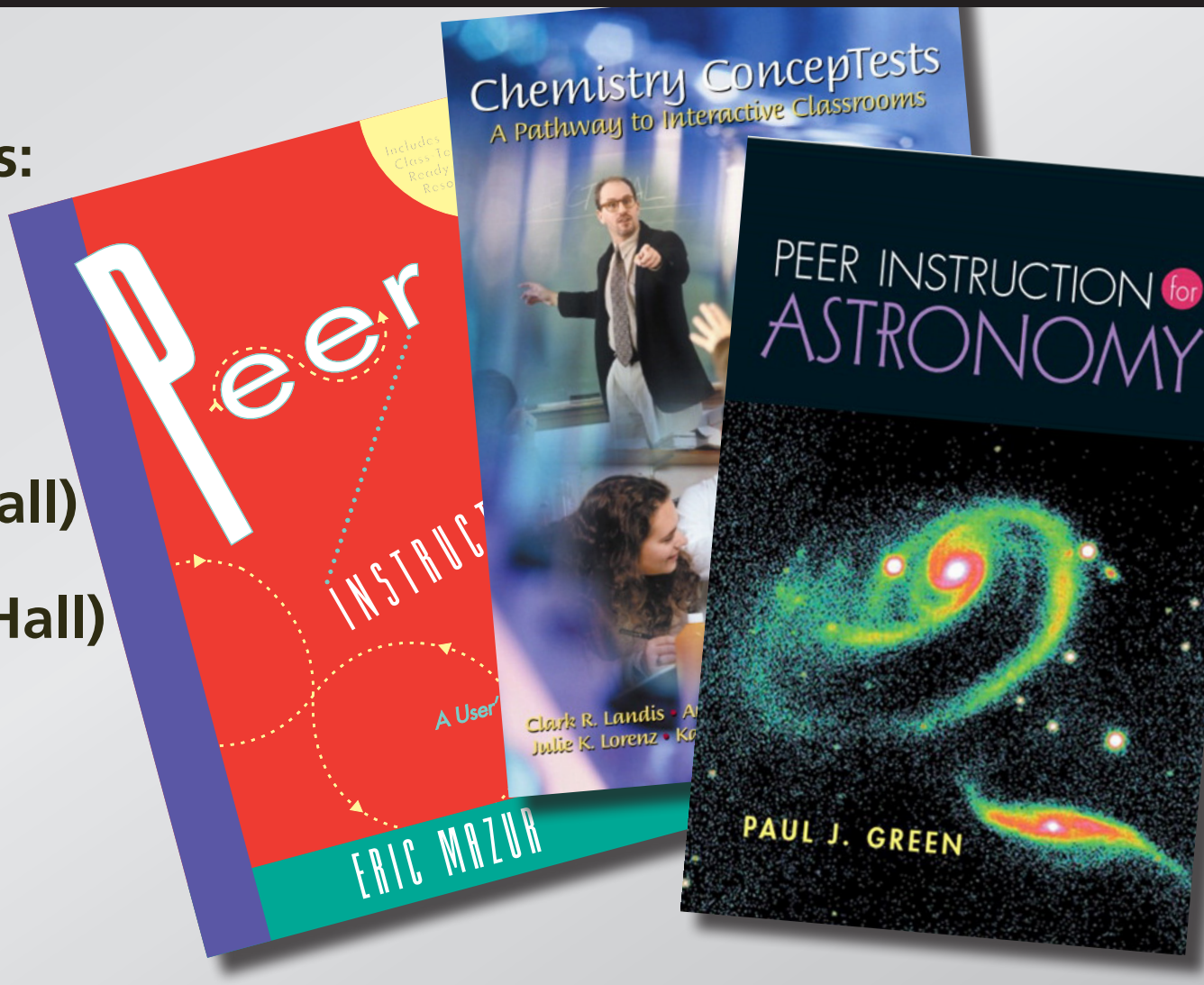
Books with ConcepTests:

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

ConcepTests

Books with ConcepTests:

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



ConcepTests

Books with ConcepTests:

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

Join now!
PeerInstruction.net

ConcepTests

… or try searching Google:

<subject> “Peer Instruction”

<subject> ConcepTest

<subject> “Concept Test”

<subject> clickers

ConcepTests

Good conceptual questions (ConcepTests):

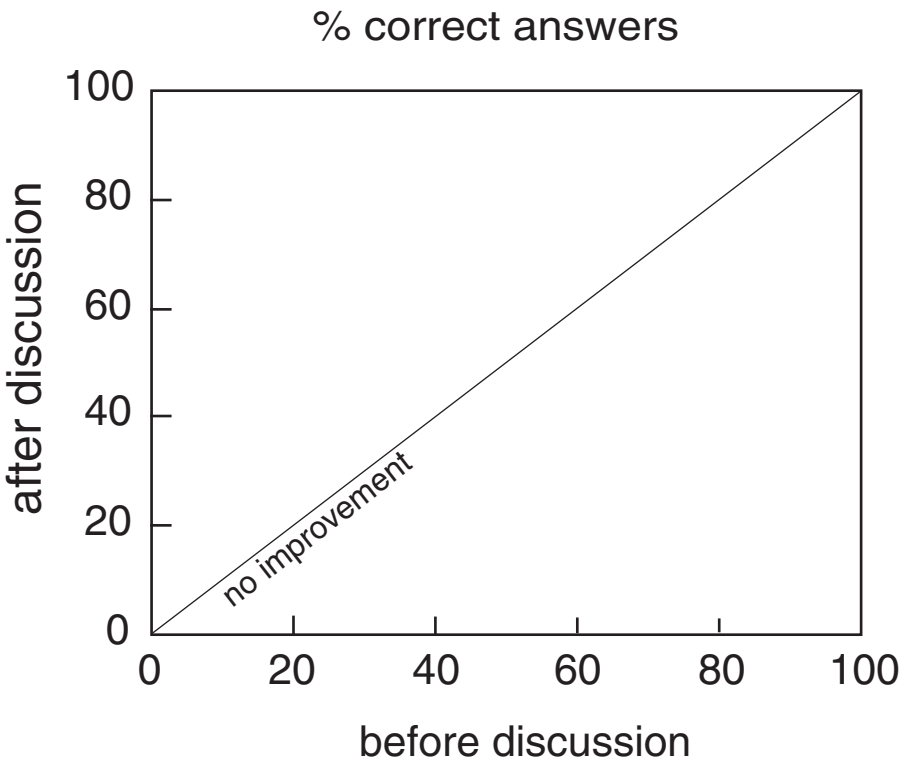
- are based on common student difficulties
- focus on single concept
- require more than “plug and chug” or recall
- are clear and concise
- are of manageable difficulty

ConcepTests

“How can I promote active/fruitful discussions?”

ConcepTests

ConcepTest data



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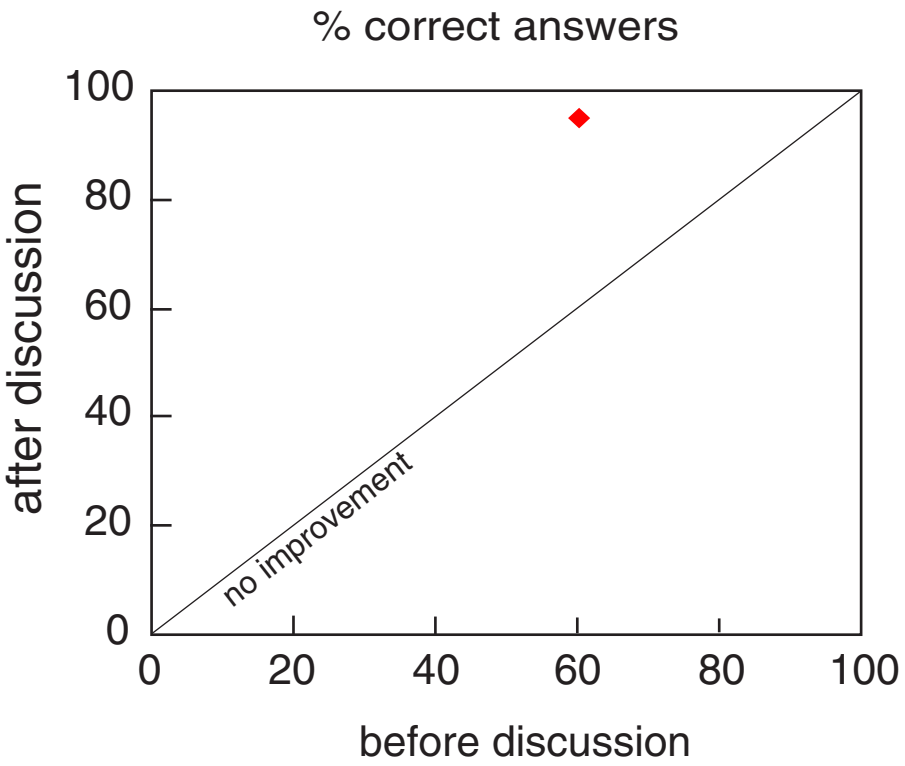

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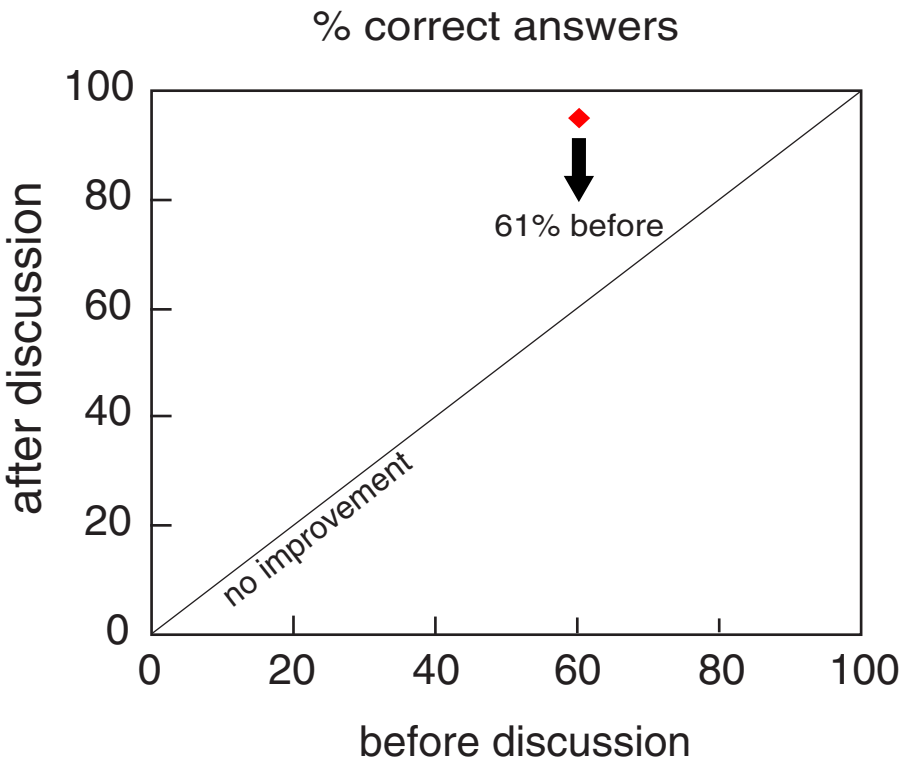

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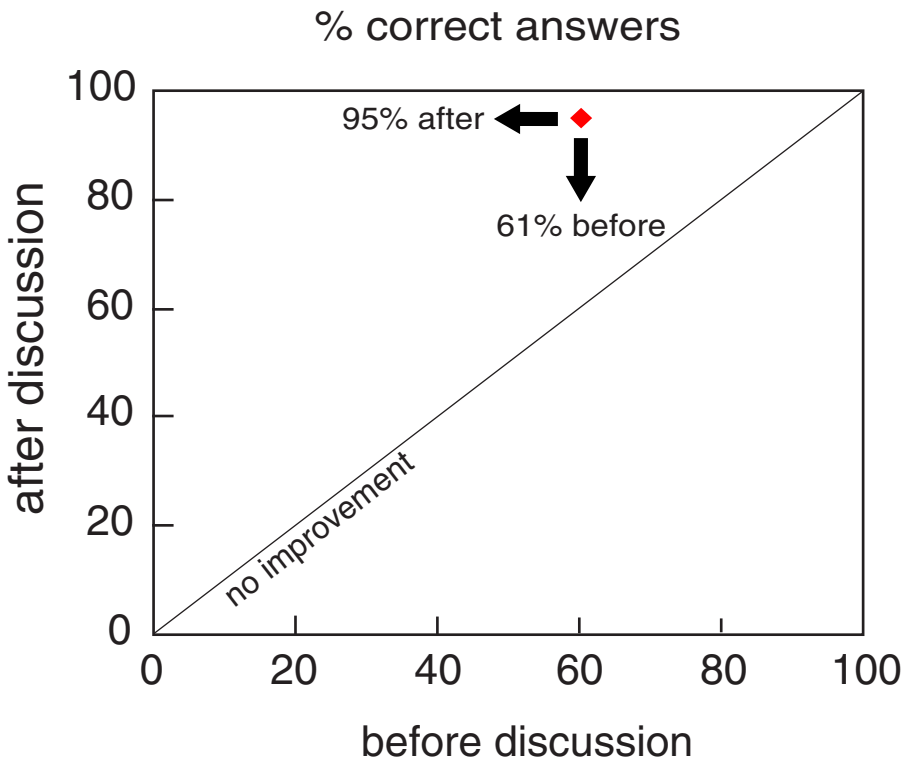

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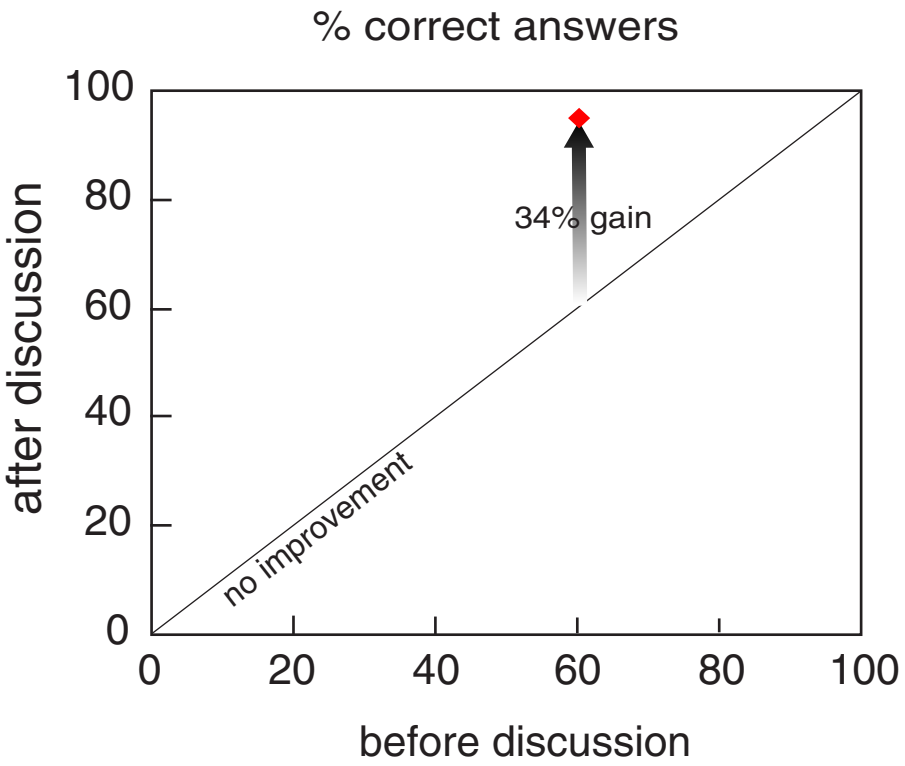

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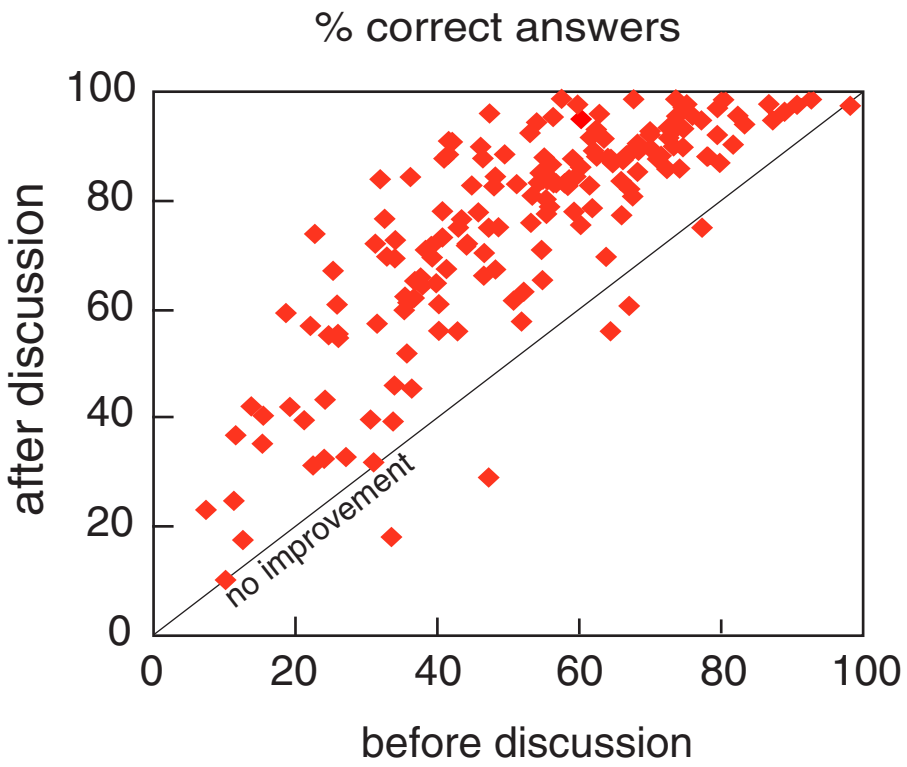

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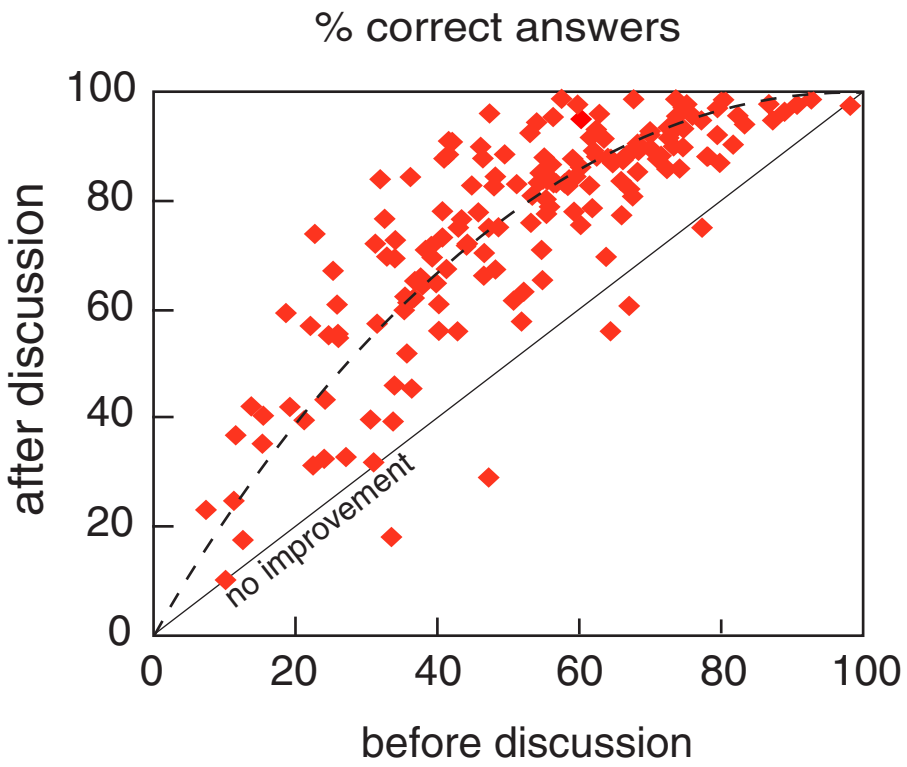

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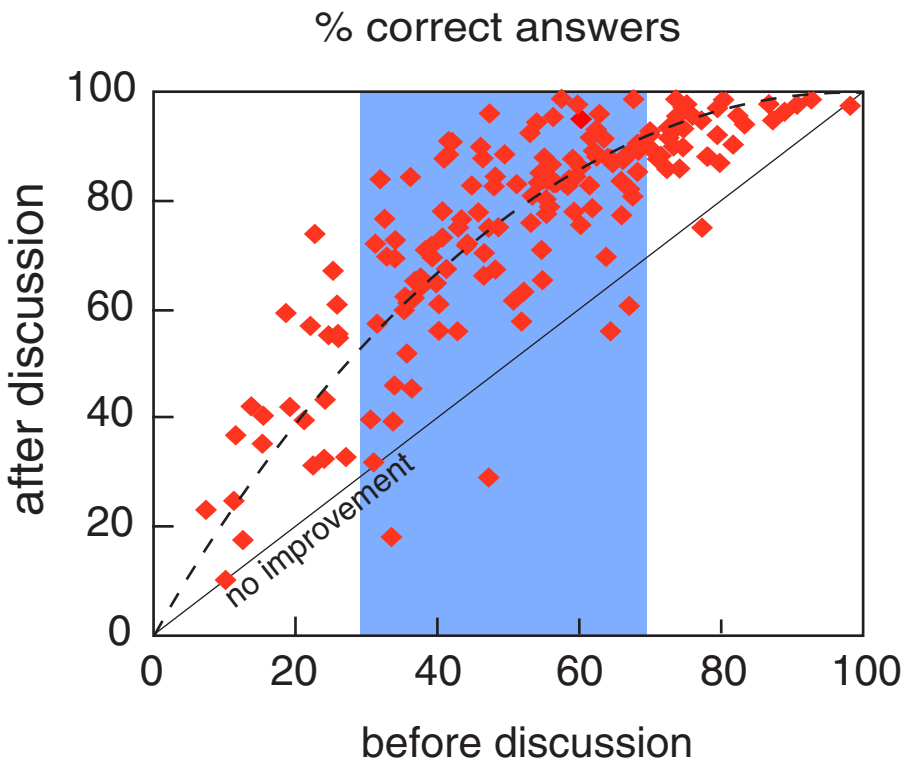

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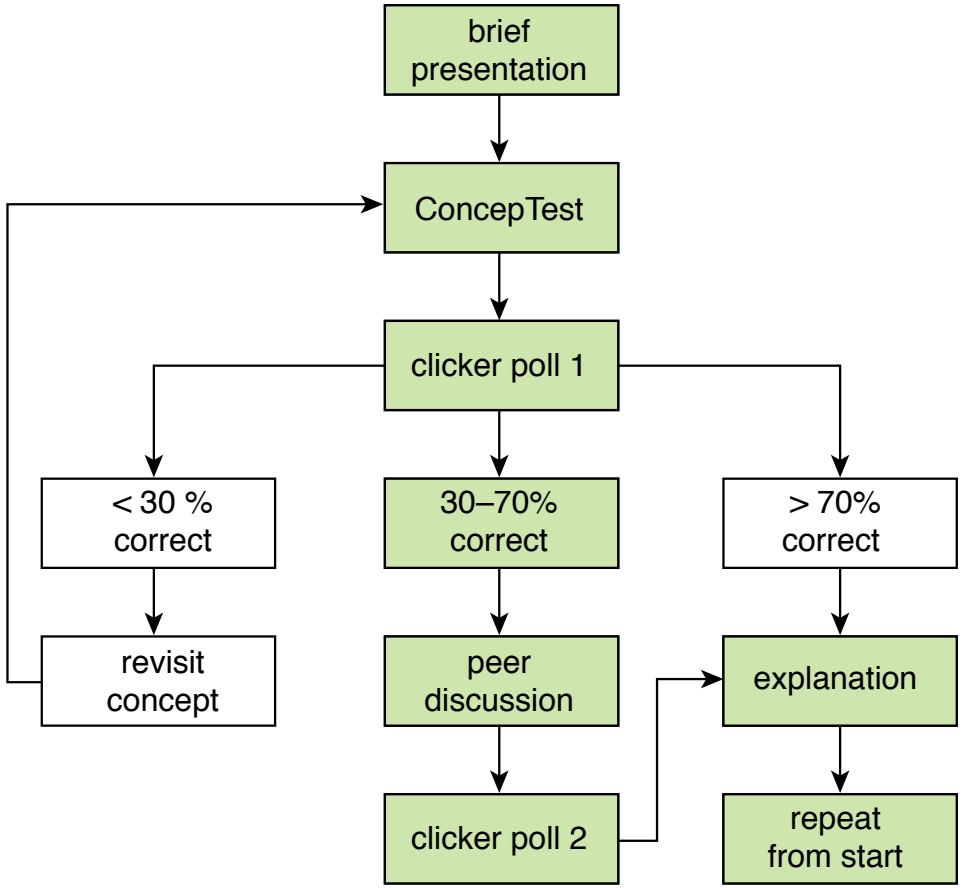

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Funding:

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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

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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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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

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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

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

Requires:

Using a calculator

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

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Need to test meaningful skills!

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Some additional ideas:

- Open book/computer exam
- Collaborative exam
- Multidimensional testing

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"How do I deal with students who resist this new approach to studying?"

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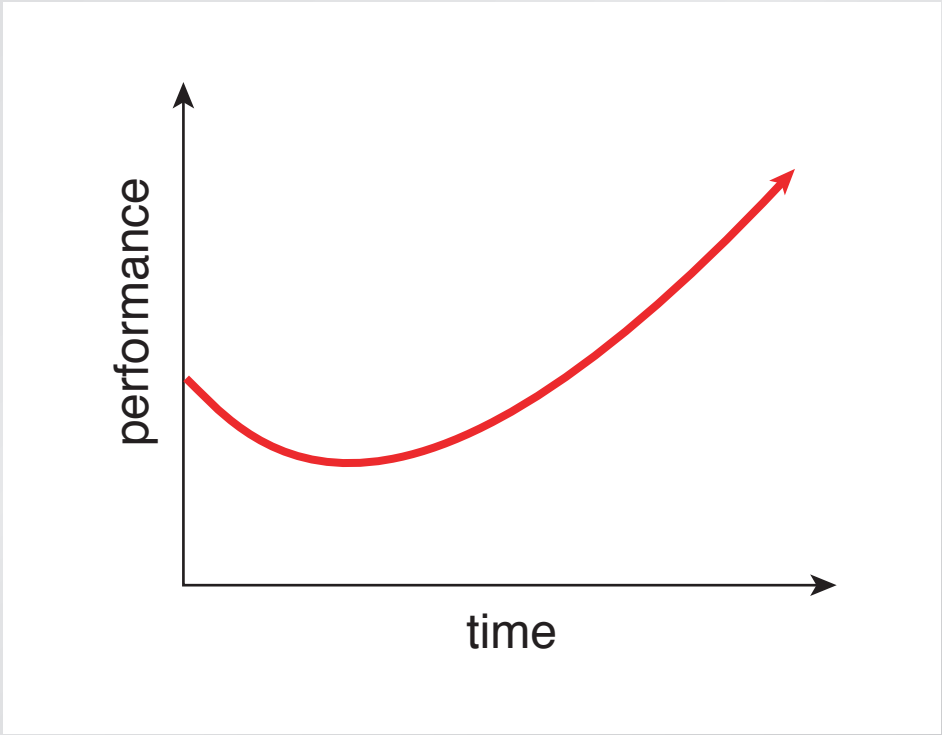
After changing, things might get *worse* before they get better!



Implementing PI & JiTT

Written on Wednesday Feb 16, two weeks into the course:

> Subject: concerns
>
> Professor Mazur,
>
> Here are a few concerns. I speak for many of my classmates.
>
> 1) You are giving us WAY to much work. After spending multiple hours on the problem set, and not being able to figure out many of the questions, I now see that we have an additional 6 or 7 pages or homework in the workbook. I just spent 4 hours on the lab, and I am not confident on almost half of the questions. This is more work than I have had all semester in all of my other classes combined.
>
> 2) If you are going to give us this much work, I would suggest re-structuring the lectures. I find the readings very difficult to understand. I am not a bad student (I got a solid A in physics 1a), but it is very difficult to internalize the readings. You should spend most of the lecture going over, point by point, the readings in their entirety. While the PRS clickers are fun, they do not help me understand the complex material.
>
> I am extremely flustered by the incredibly large amount of work, and my inability to understand it, and I am strongly considering dropping the course.

Implementing PI & JiTT

Written on Monday May 23, just after the final exam:

> Subject: Thanks!
>
> Professor Mazur,
>
> First of all I want to thank you for a great semester. You are an excellent professor, and it is clear that you truly care about each and every student.
>
> The exam went well today. I'm not sure to what extent you will curve the final grades (if at all), but it looks like I may be right around the cutoff point between an A and an A-. I studied as hard as I could and I'm keeping my fingers crossed about the A, but no matter what happens with my grade you should know that you are one of the best professors that I have ever had at Harvard.
>
> Thanks again!

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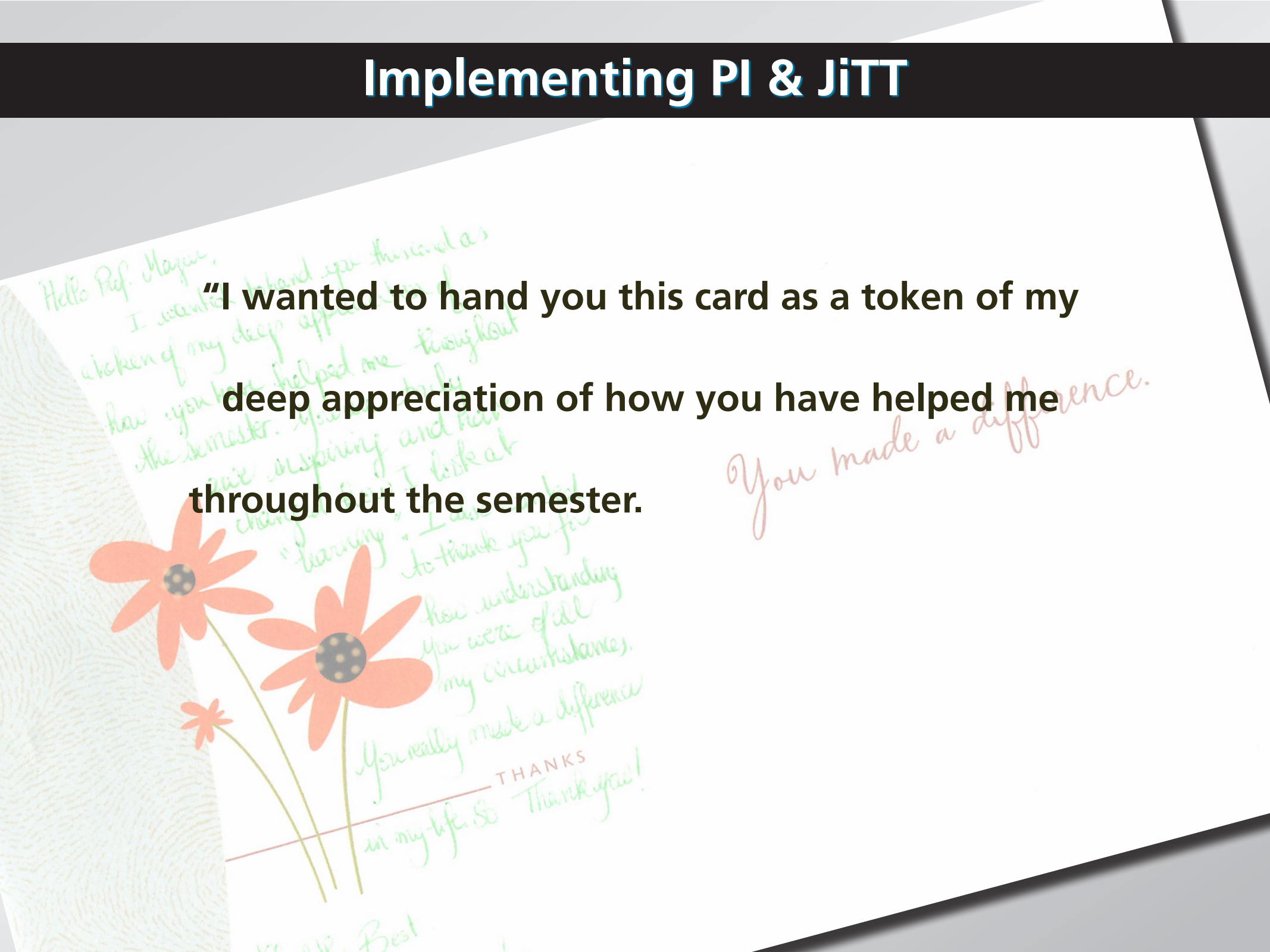

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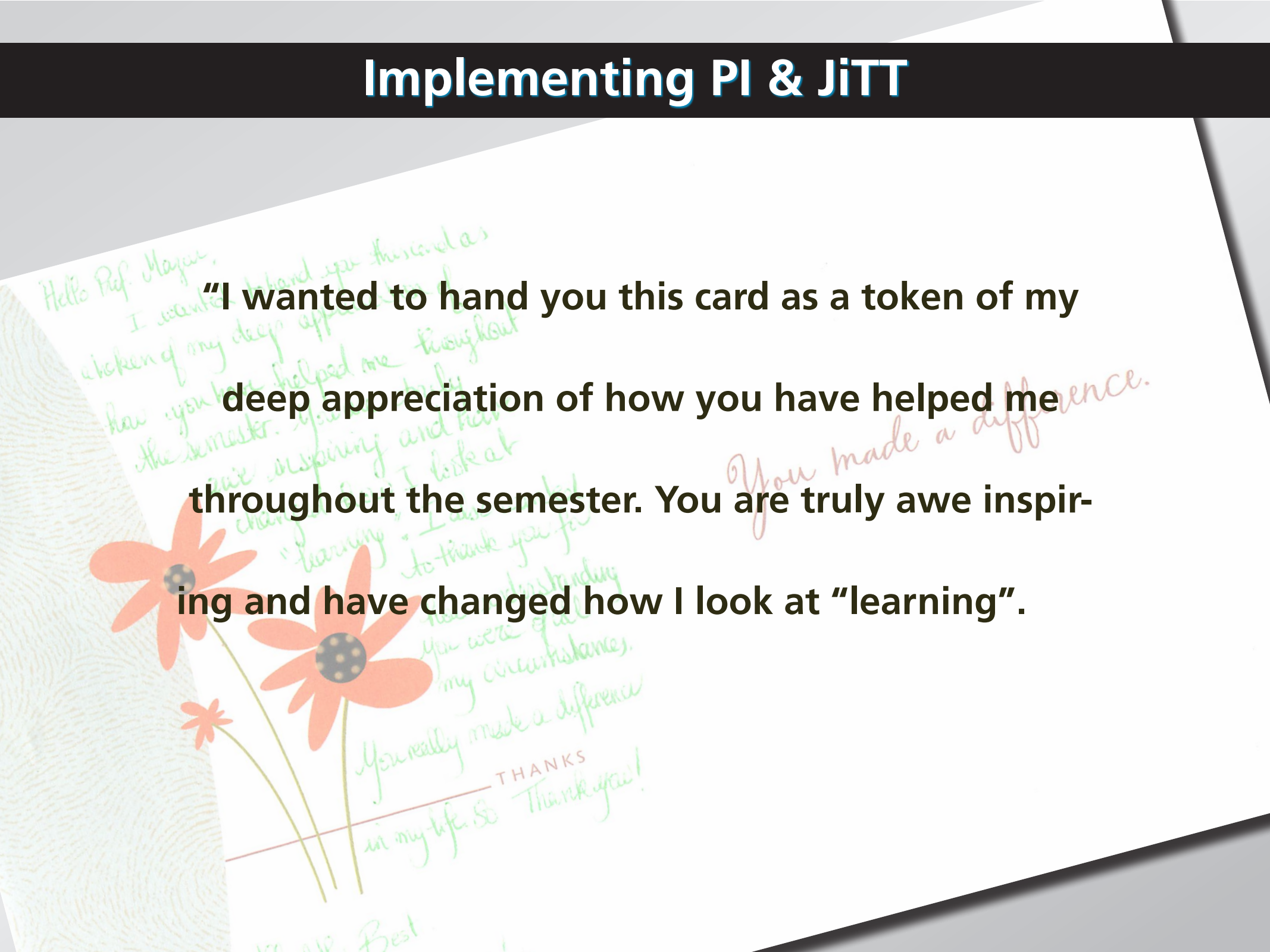

"I wanted to hand you this card as a token of my deep appreciation of how you have helped me throughout the semester. You are truly awe inspiring and have changed how I look at "learning".

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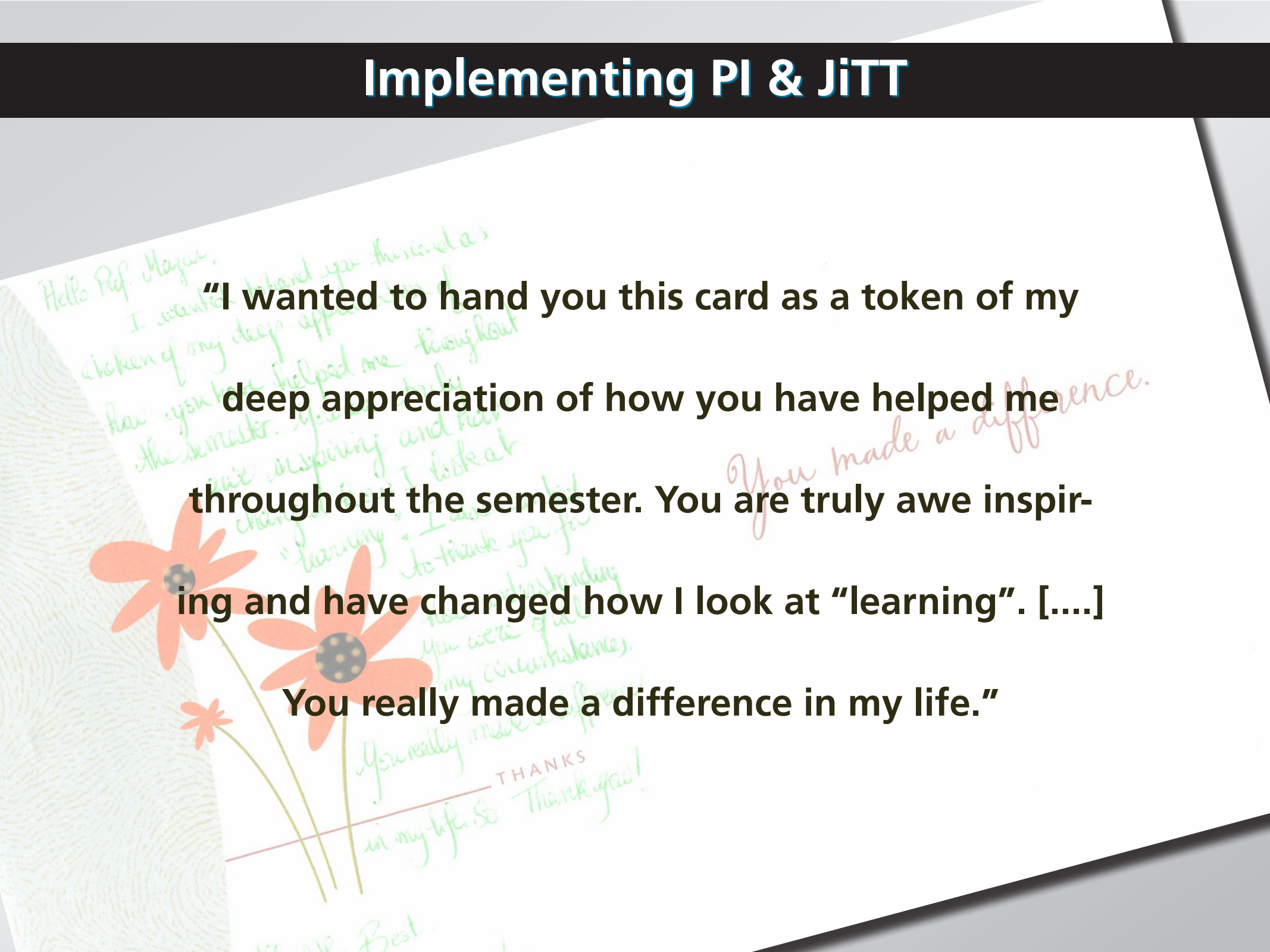

"I wanted to hand you this card as a token of my deep appreciation of how you have helped me throughout the semester. You are truly awe inspiring and have changed how I look at "learning". [....] You really made a difference in my life."

Implementing PI & JiTT

and don’t forget…

Implementing PI & JiTT

and don’t forget…

PI leads to better learning and retention!