

# Peer Instruction Workshop



Includes  
Class-Tested,  
Ready-to-Use  
Resources

# Peer

## INSTRUCTION

A User's Manual

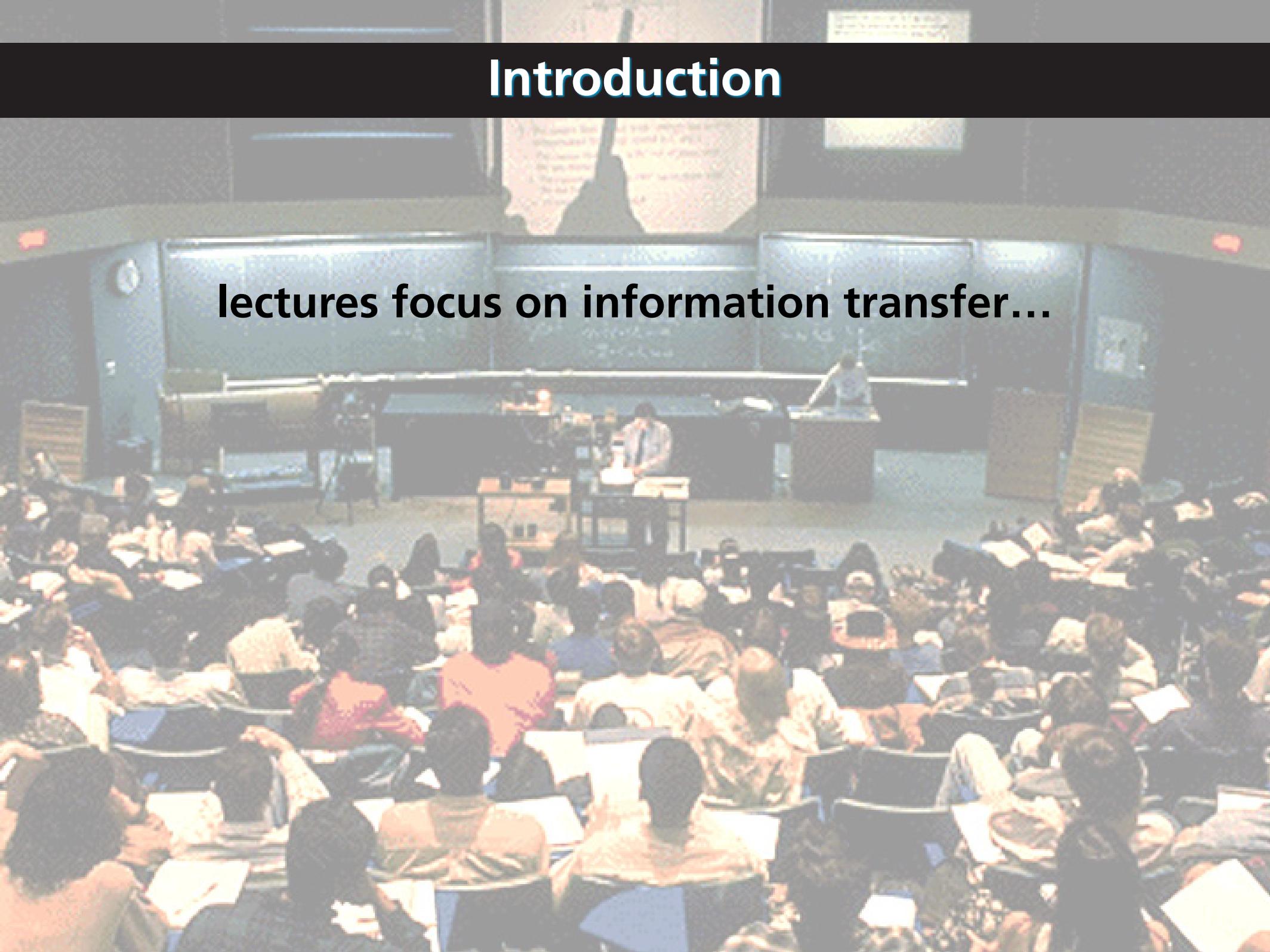
### ERIC MAZUR



2012 Teaching & Learning Symposium  
Carleton University  
Ottawa, Canada, 13 June 2012

# Introduction

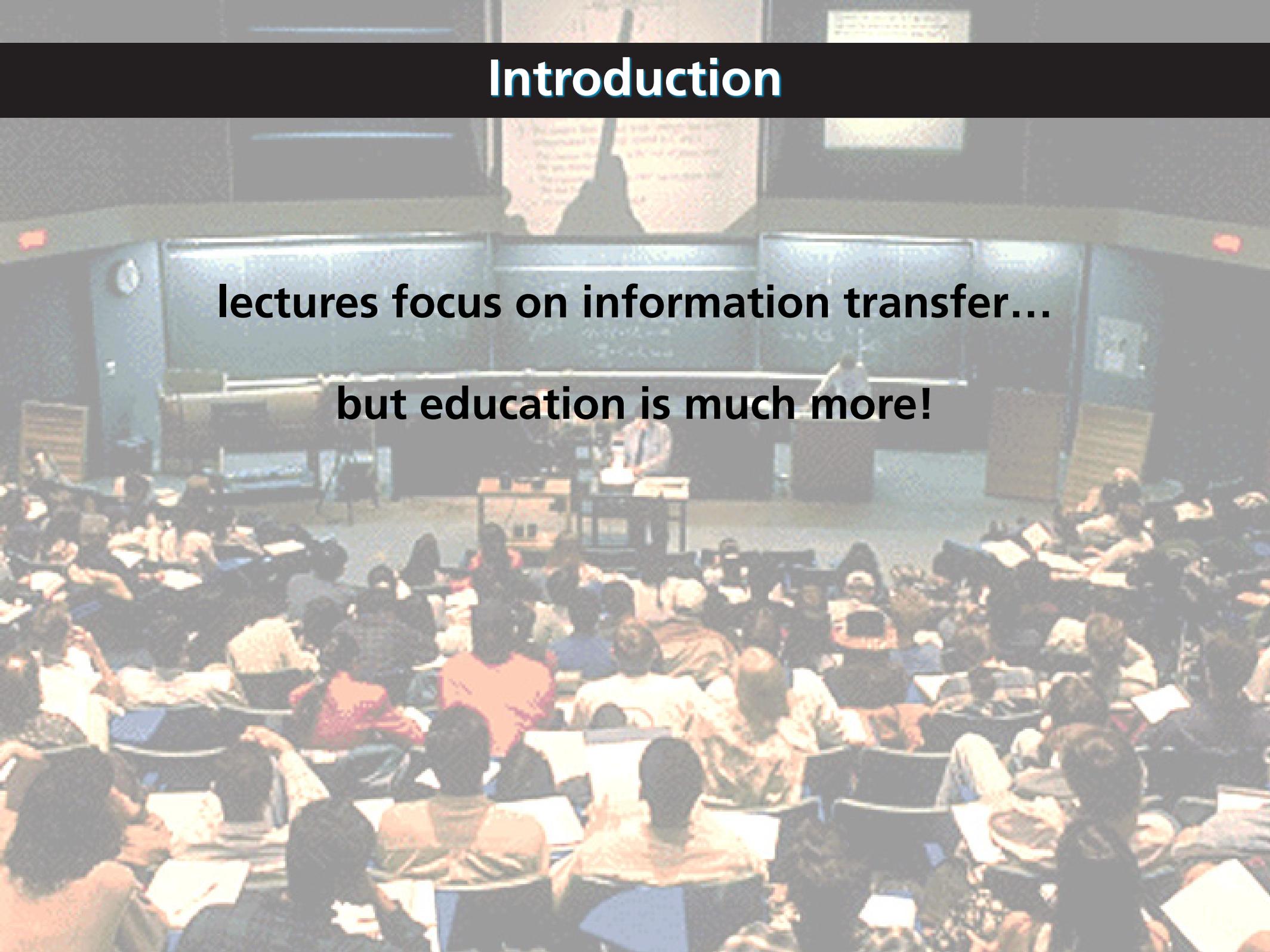
lectures focus on information transfer...



# Introduction

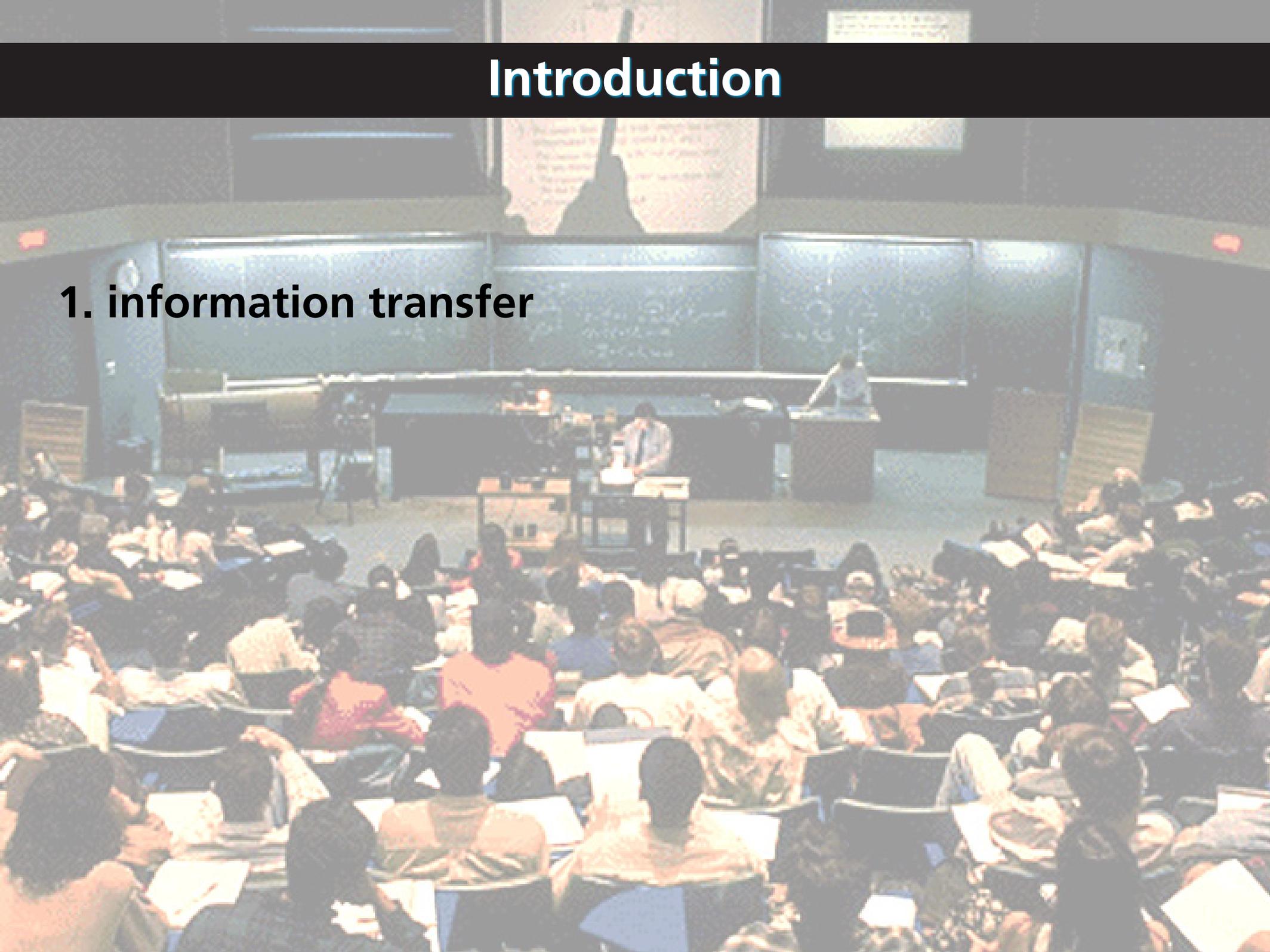
lectures focus on information transfer...

but education is much more!



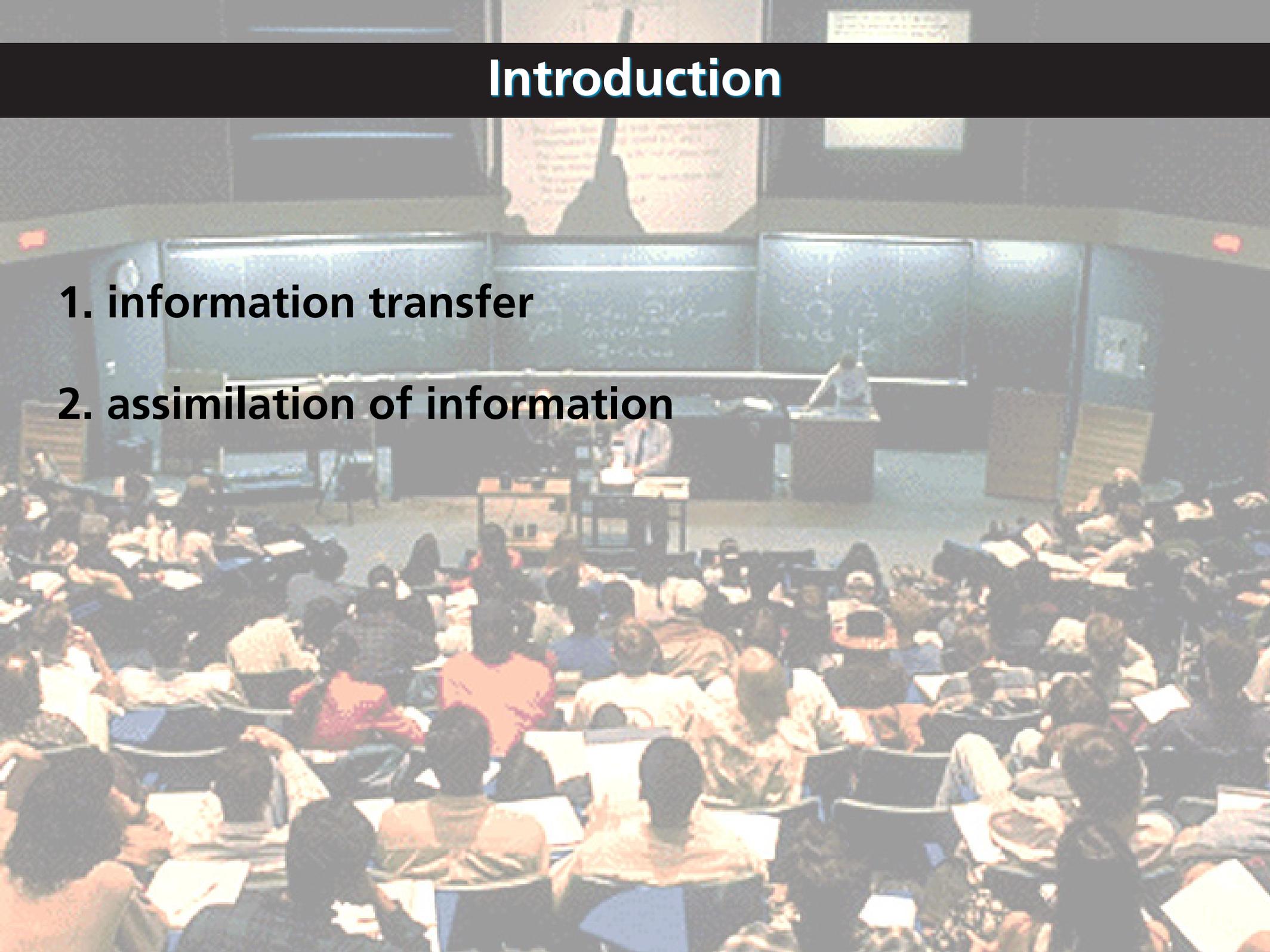
# Introduction

## 1. information transfer



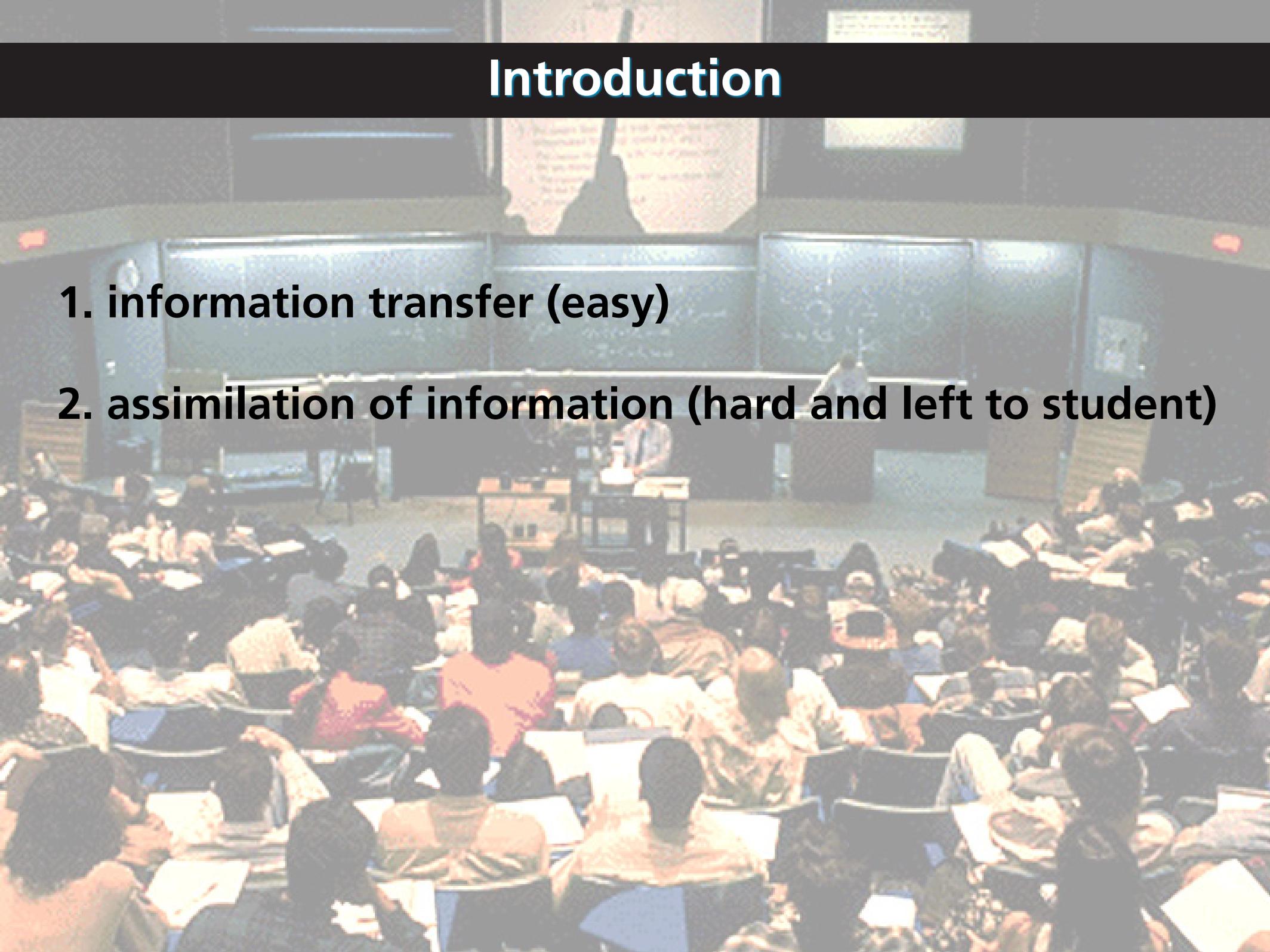
# Introduction

1. information transfer
2. assimilation of information



# Introduction

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



# Introduction

**Solution: move information transfer out of classroom!**

# Introduction

**How to move information transfer out of classroom?**

# Introduction

**How to move information transfer out of classroom?**

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

# Outline



# Outline

- **PI & JiTT Overview**
- **Implementing PI & JiTT**
- **ConceptTests**

# 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!**

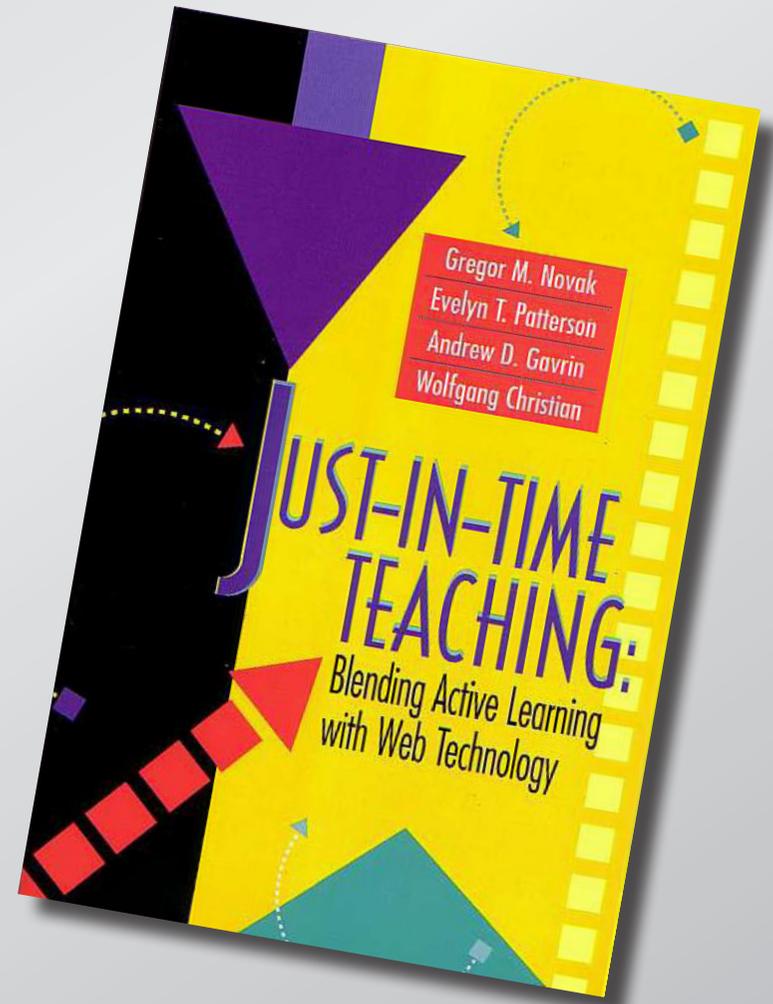
**(select what you consider to be the main reason)**



# PI & JiTT Overview

Just-in-time-Teaching (JiTT)

[www.jitt.org](http://www.jitt.org)



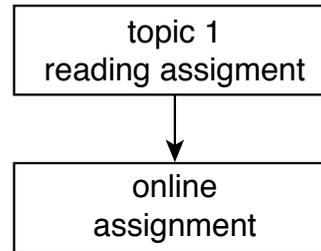
# PI & JiTT Overview

## JiTT workflow

topic 1  
reading assignment

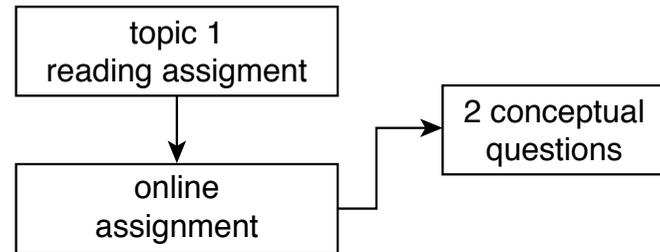
# PI & JiTT Overview

## JiTT workflow



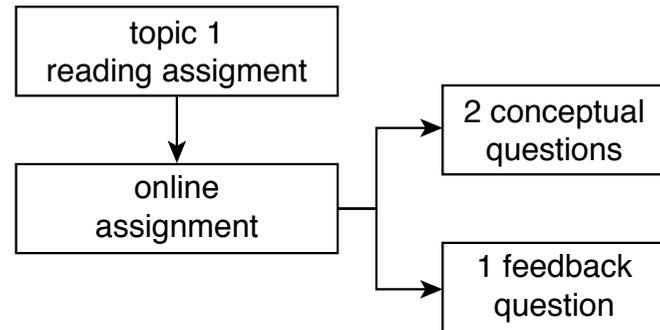
# PI & JiTT Overview

## JiTT workflow



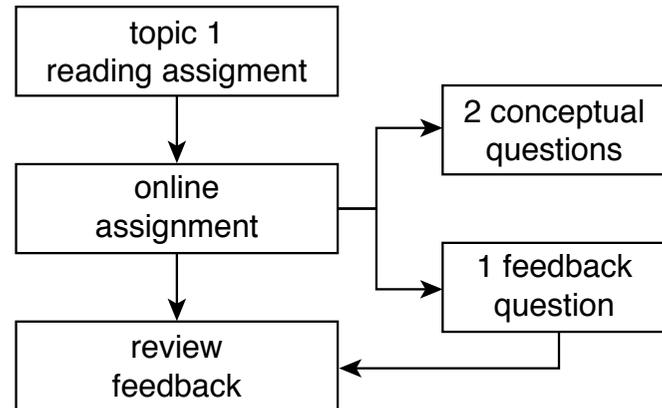
# PI & JiTT Overview

## JiTT workflow



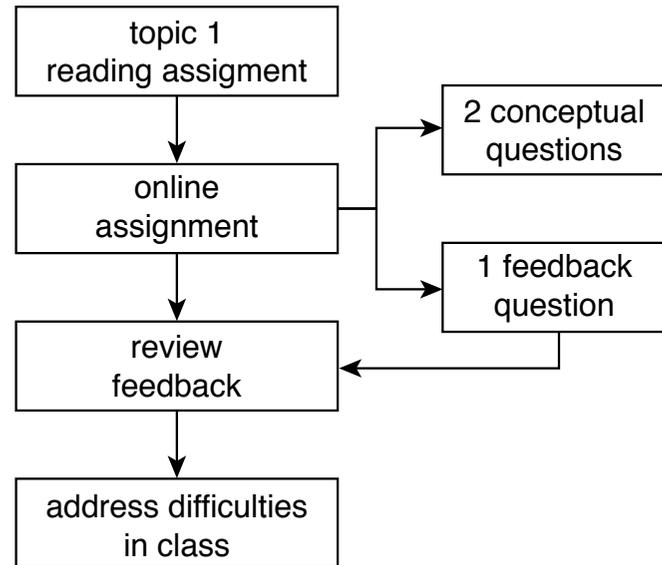
# PI & JiTT Overview

## JiTT workflow



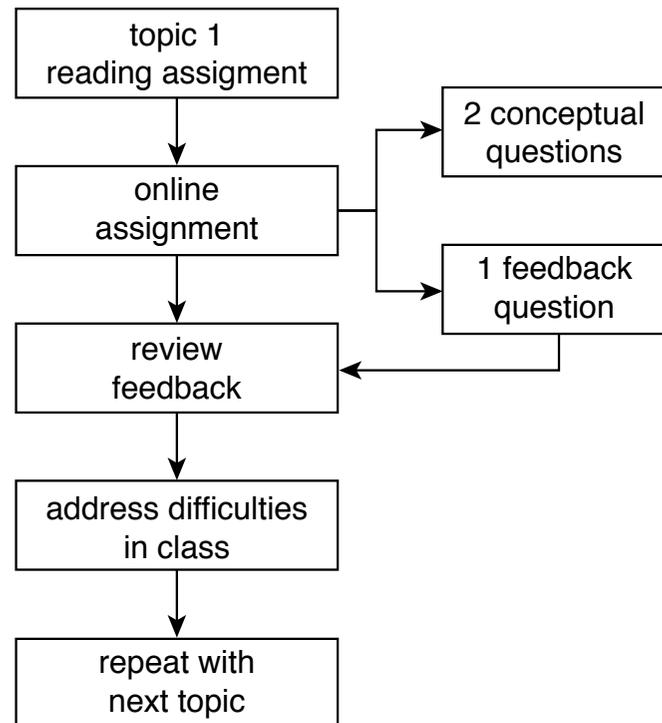
# PI & JiTT Overview

## JiTT workflow



# PI & JiTT Overview

## JiTT workflow



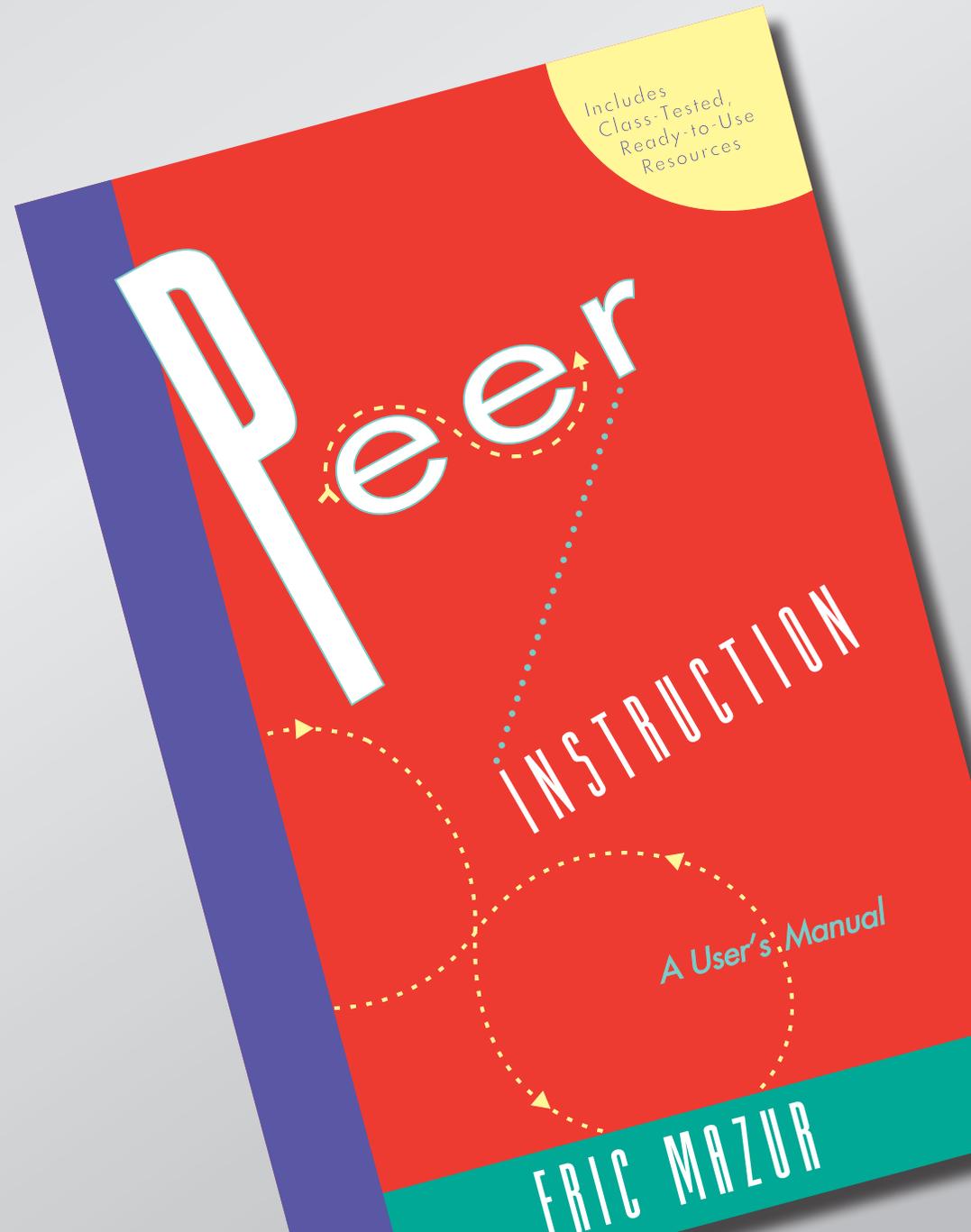
# PI & JiTT Overview

## JiTT:

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

# PI & JiTT Overview

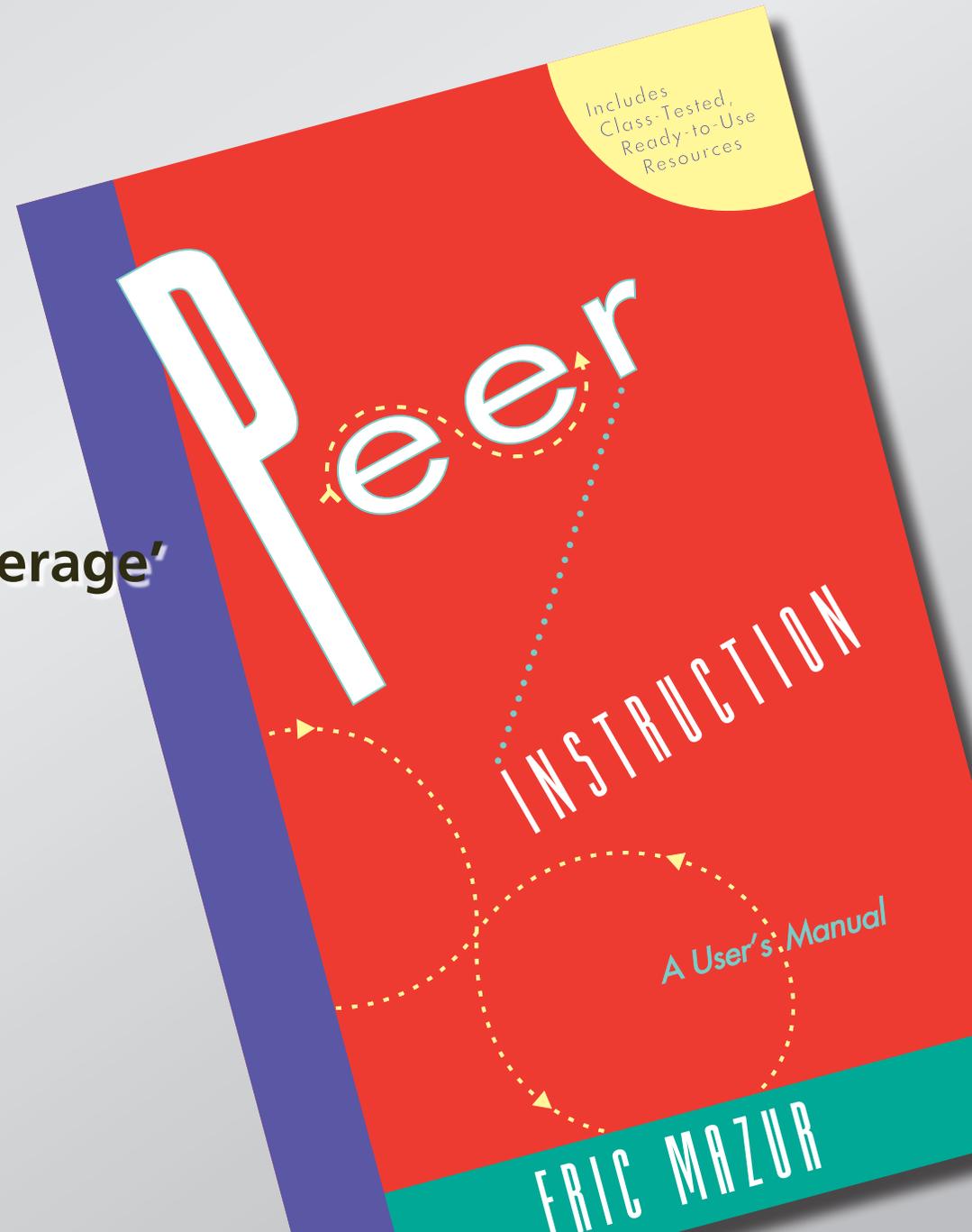
## Peer Instruction (PI)



# PI & JiTT Overview

## Main features:

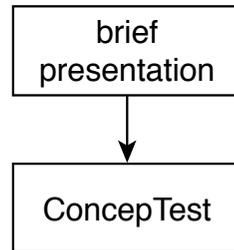
- pre-class assignment
- in-class: depth, not 'coverage'
- ConcepTests



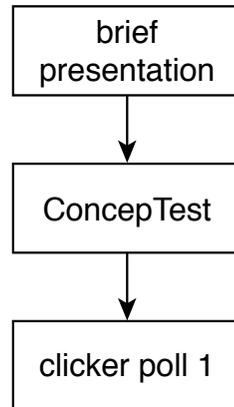
# PI & JiTT Overview

brief  
presentation

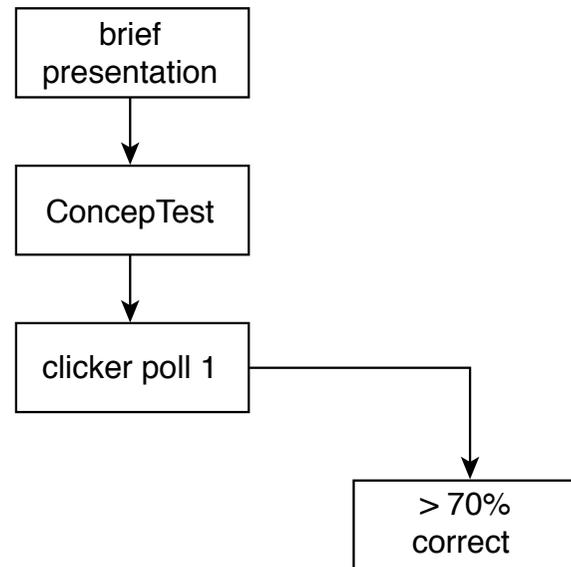
# PI & JiTT Overview



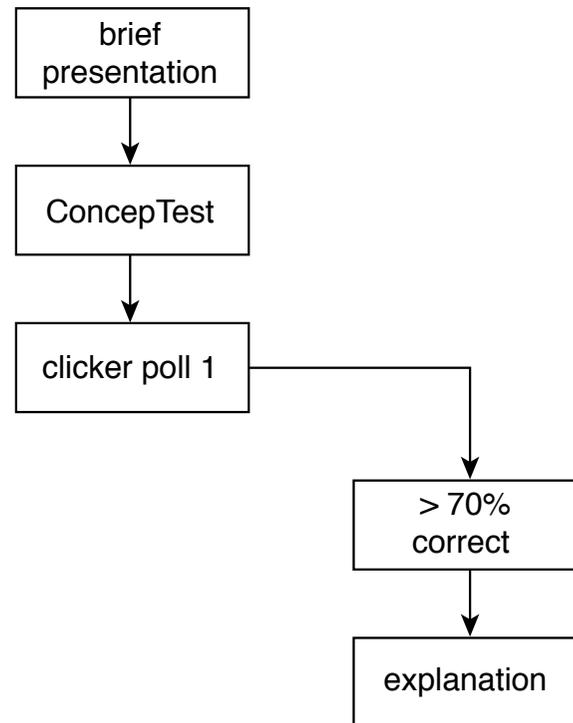
# PI & JiTT Overview



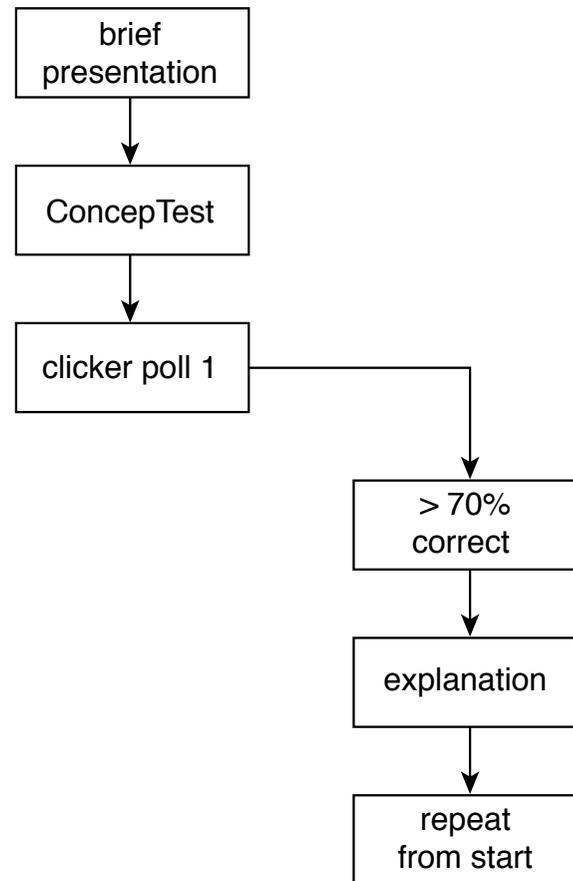
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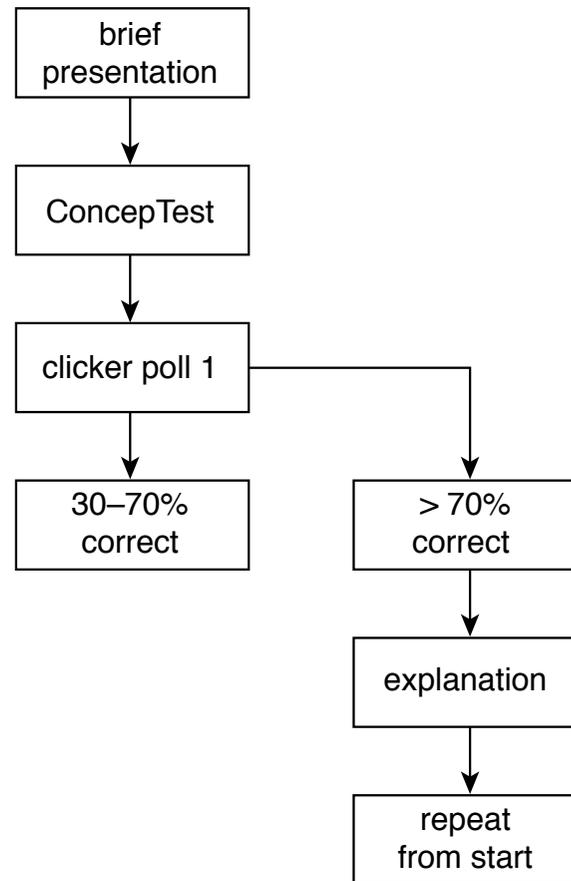
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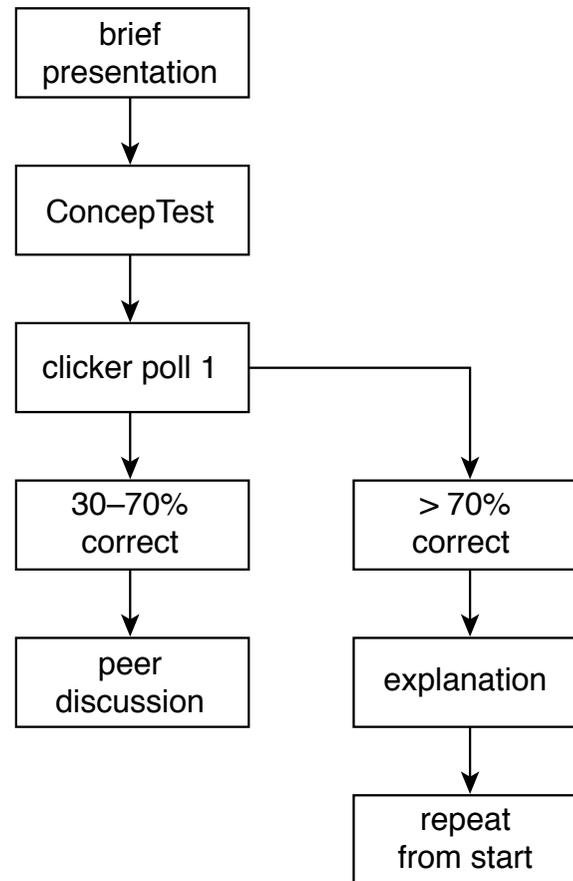
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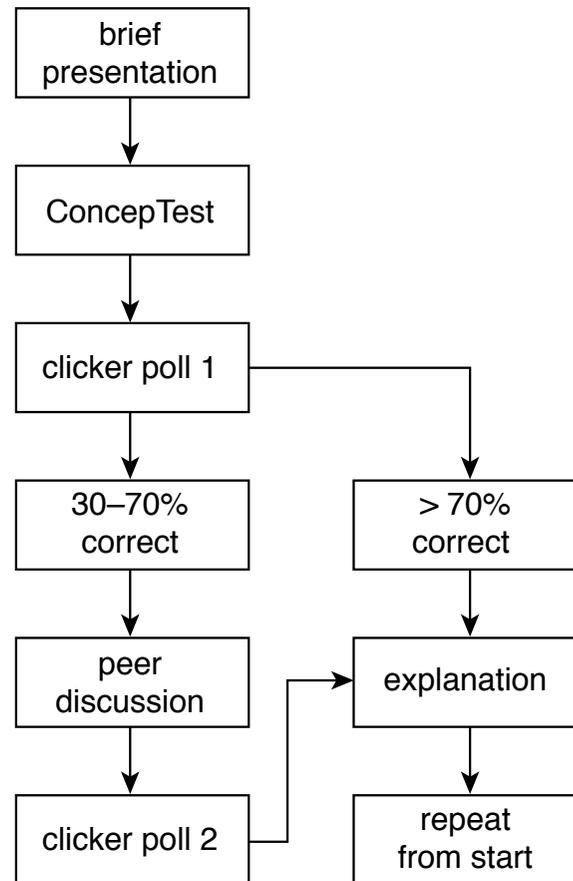
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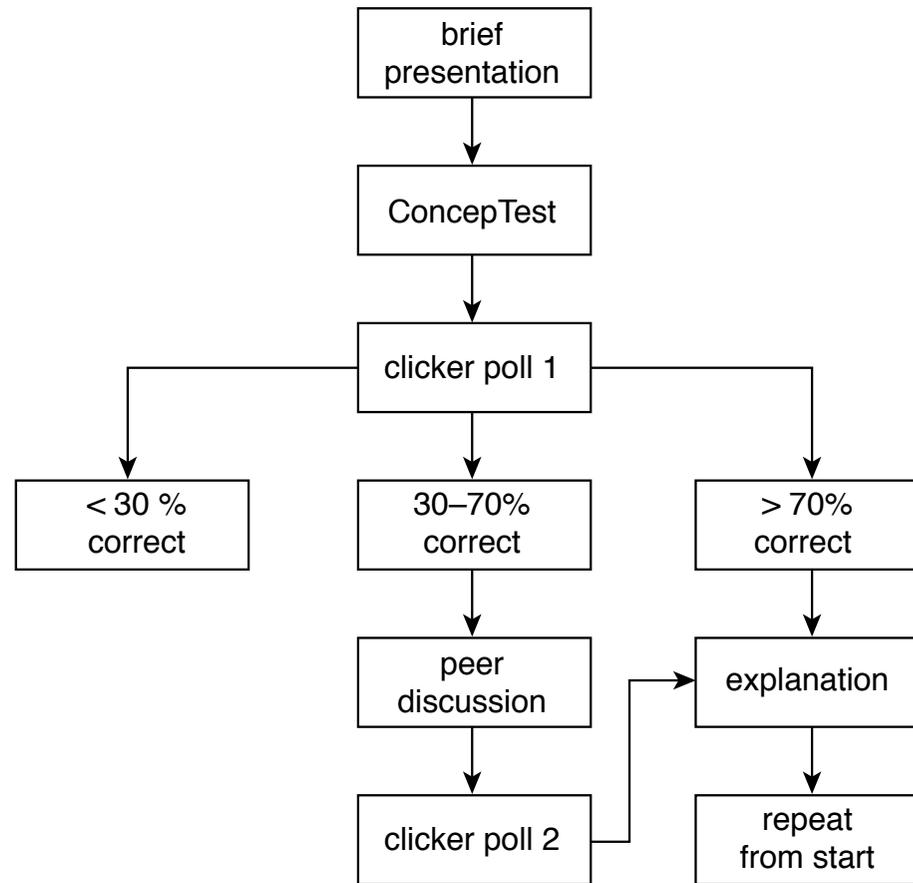
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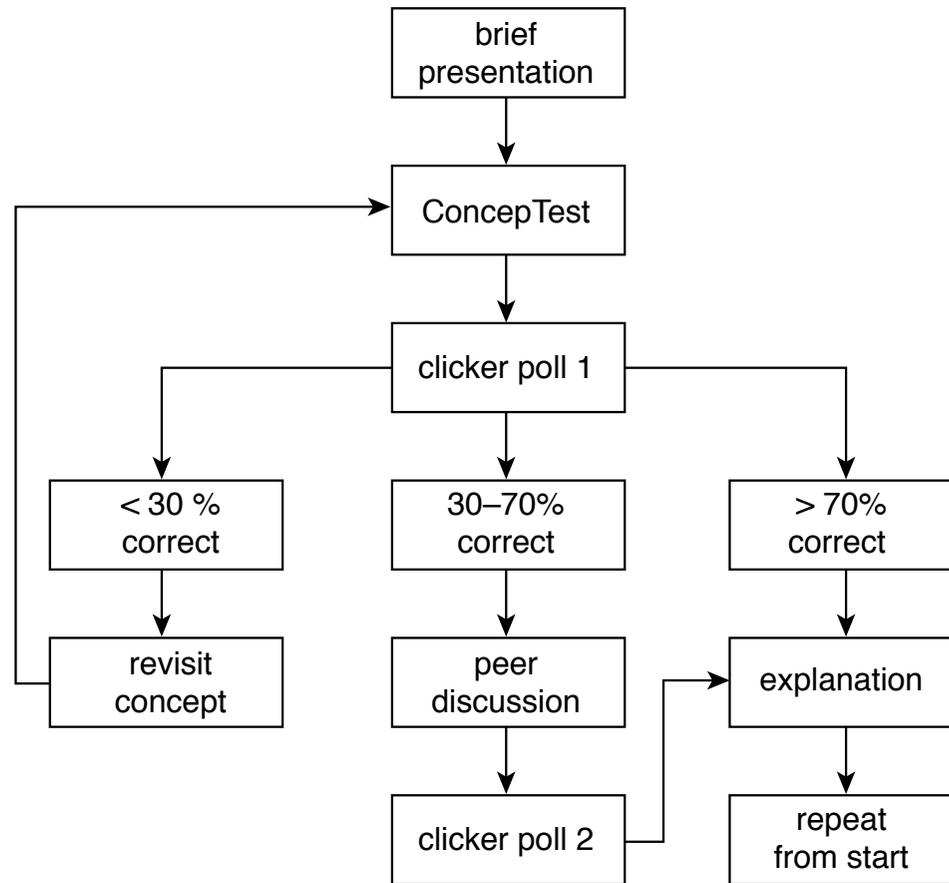
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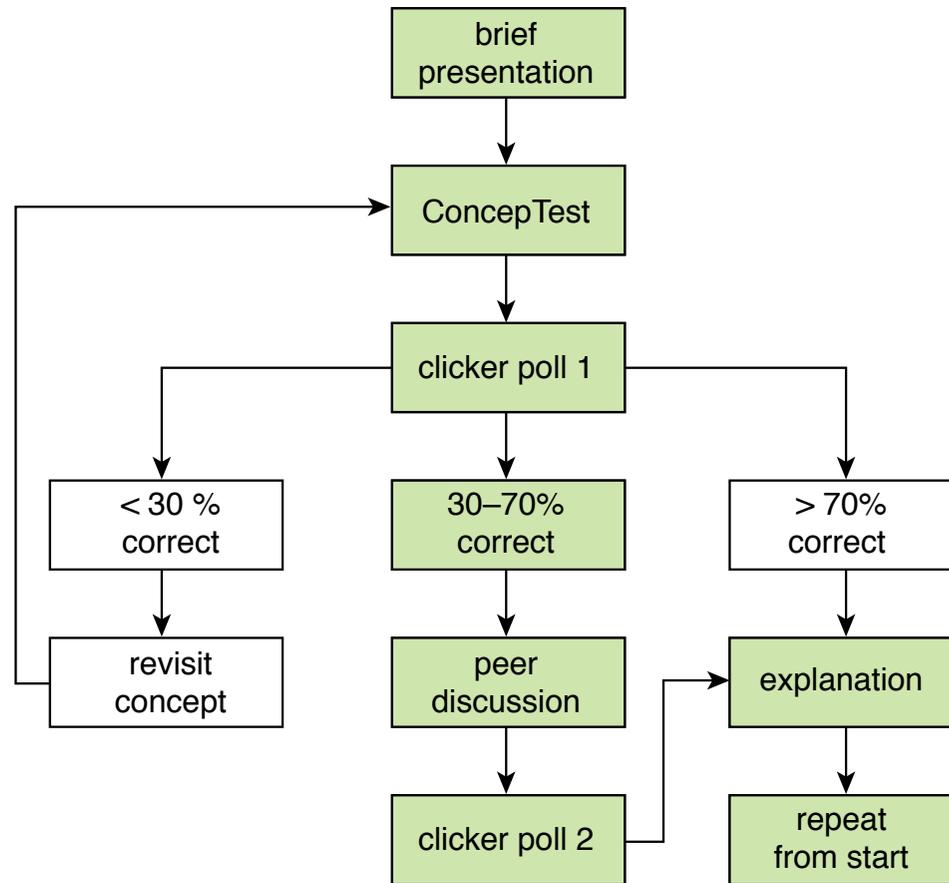
# PI & JiTT Overview



# PI & JiTT Overview



# PI & JiTT Overview



# PI & JiTT Overview

**PI:**

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

# PI & JiTT Overview

*“How do I promote fruitful discussion?”*

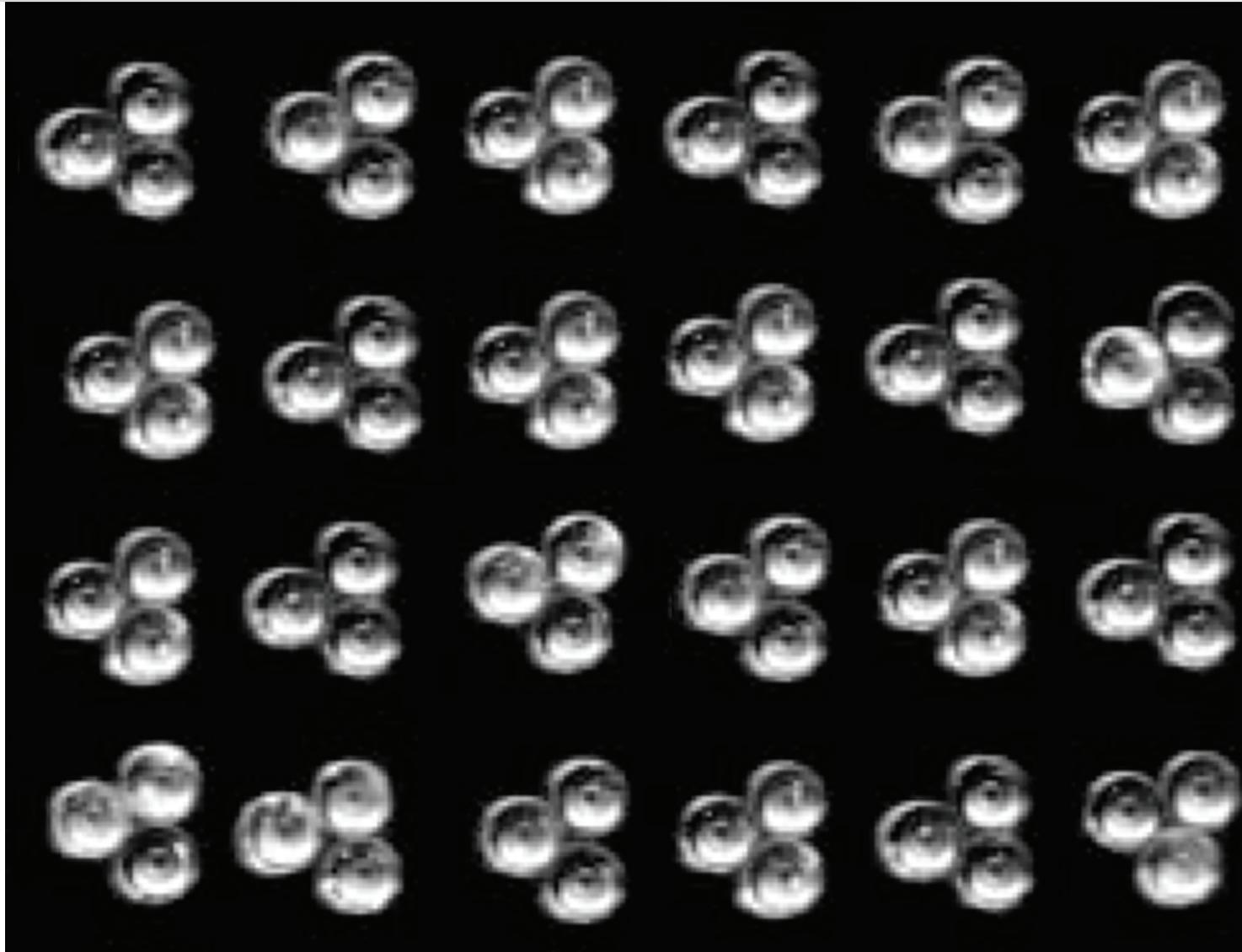
# PI & JiTT Overview

Find someone with a *different* answer

# PI & JiTT Overview

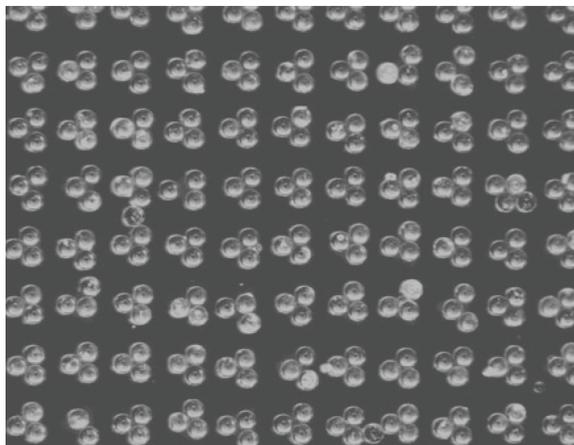
*“Can this method be used in my class,  
where questions don’t necessarily have right answers?”*

Let's try it!

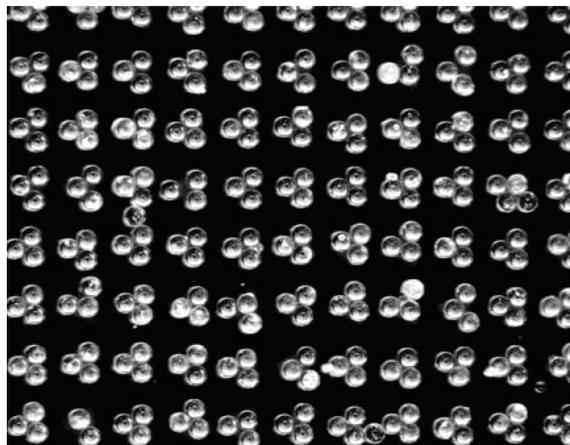


# Let's try it!

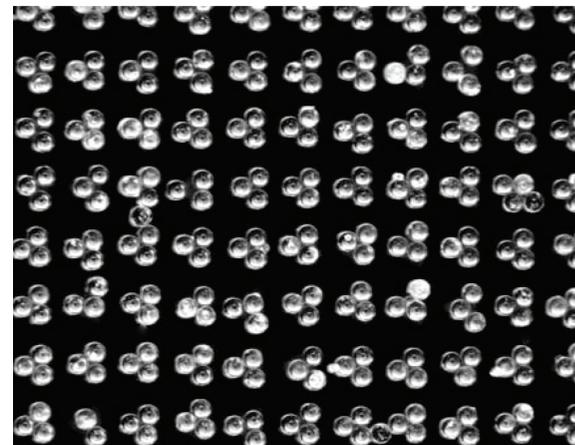
original



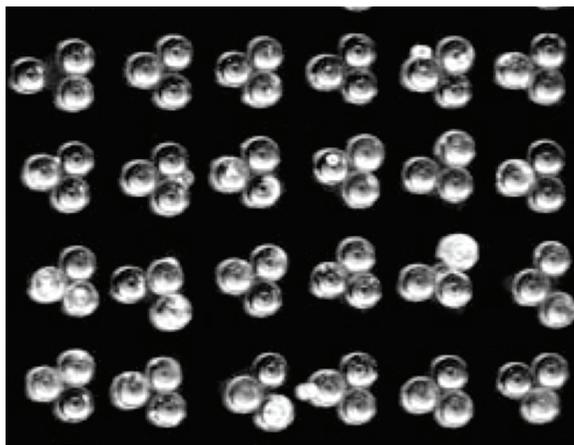
1. adjust contrast



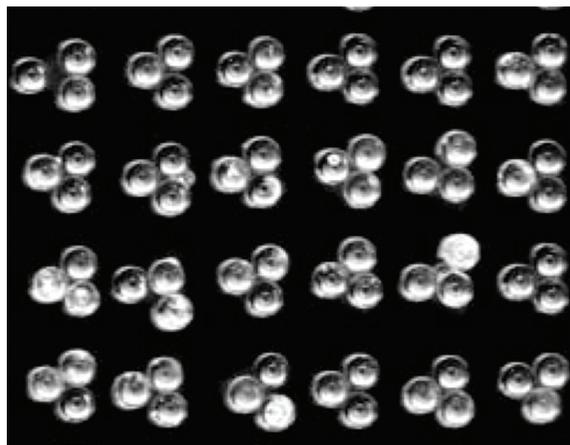
2. remove blemishes



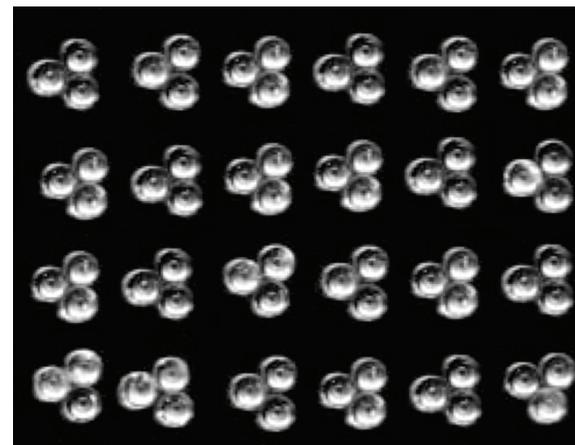
3. crop



4. remove outliers

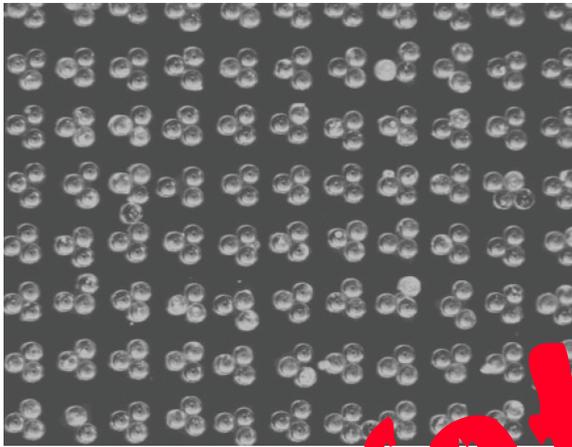


5. reconstruct



# Let's try it!

original



1. adjust contrast



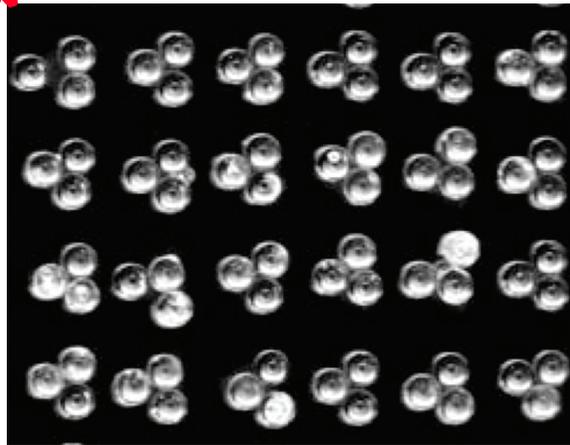
2. remove blemishes



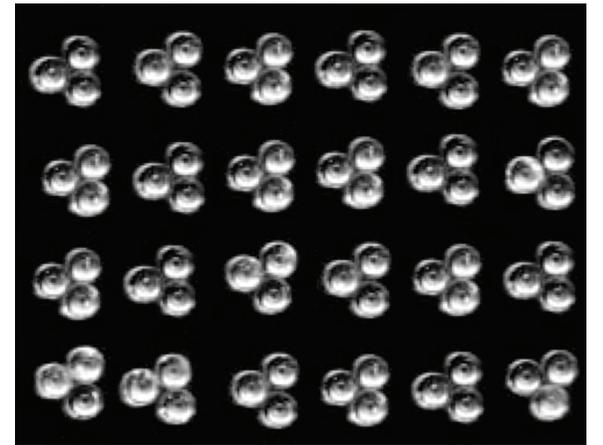
3. crop



4. remove outliers



5. reconstruct



**you got all engaged!**

# PI & JiTT Overview

**Don't need a correct answer!**

# Outline

- **PI & JiTT Overview**
- **Implementing PI & JiTT**
- **ConceptTests**

# Implementing PI & JiTT

*“Will it work at my institution?”*

It works here...

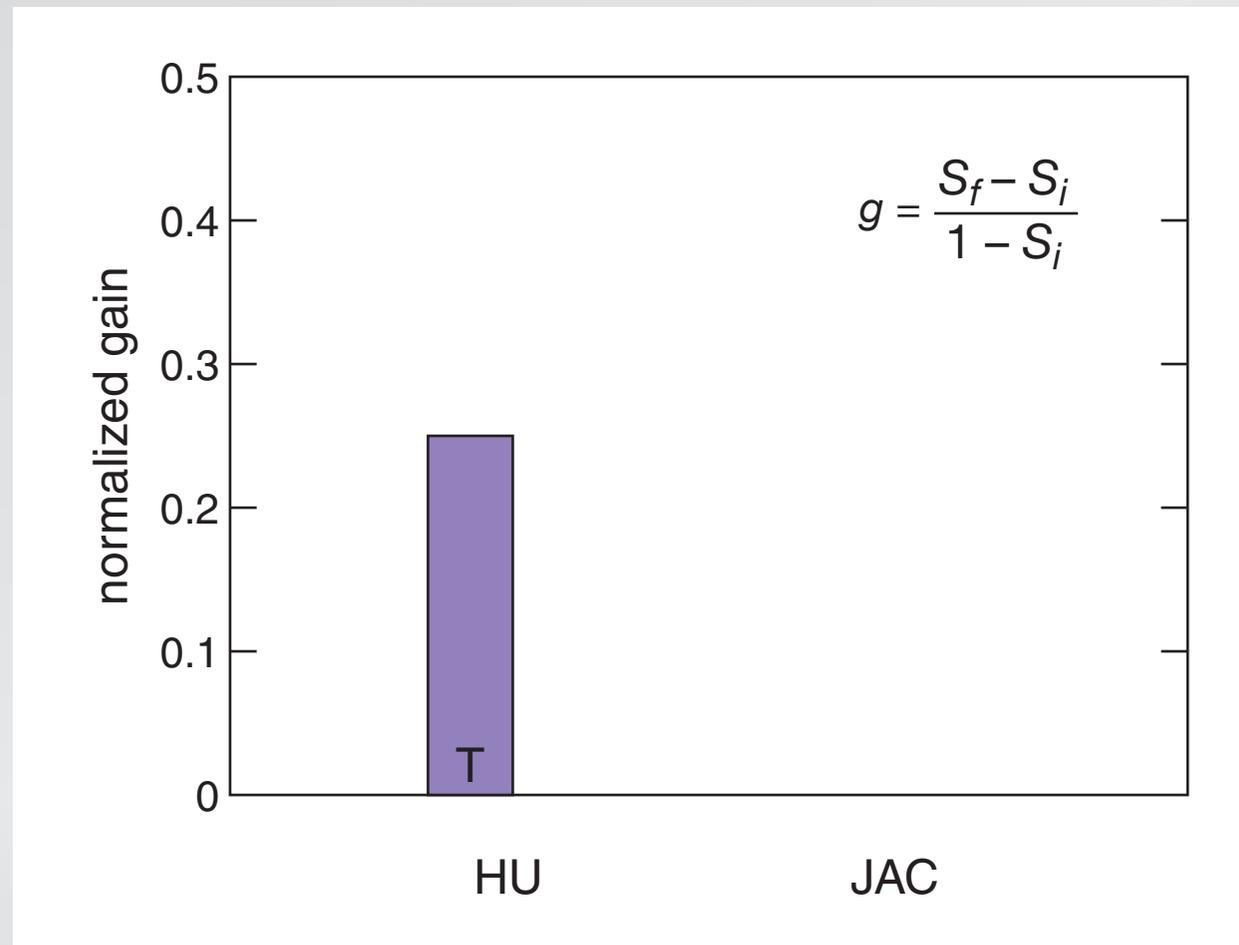


...but will it work here?



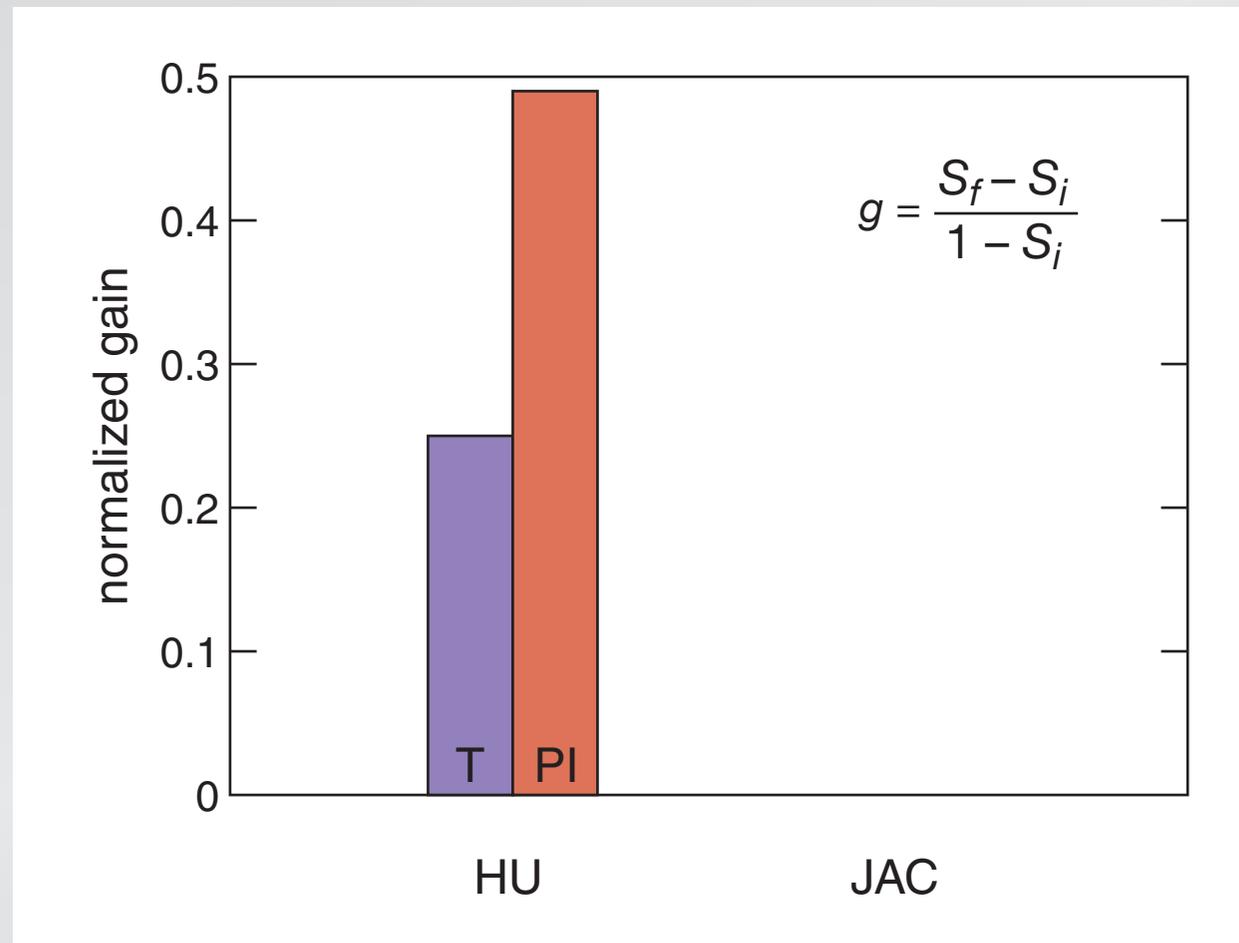
# Implementing PI & JiTT

## FCI normalized gain



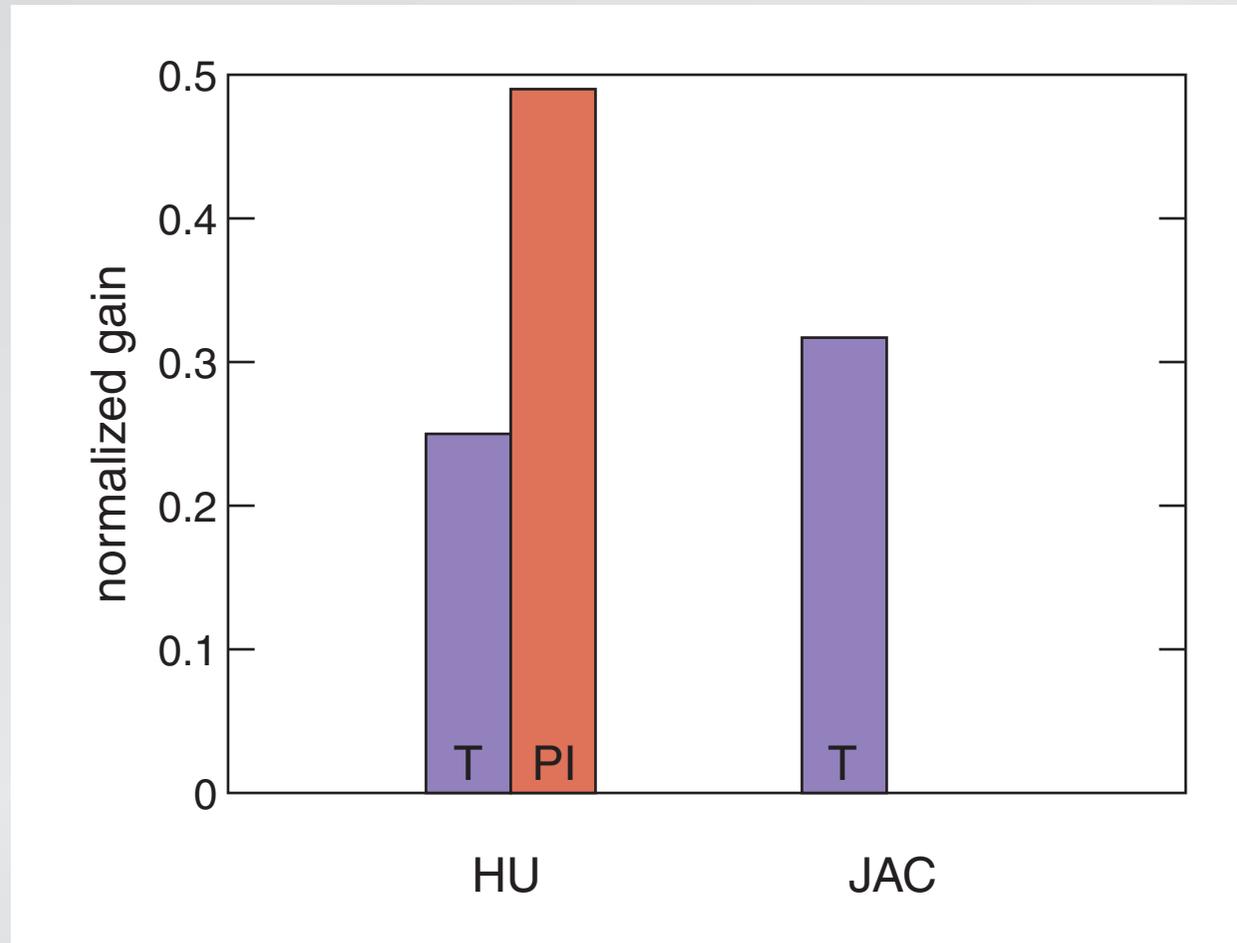
# Implementing PI & JiTT

## FCI normalized gain



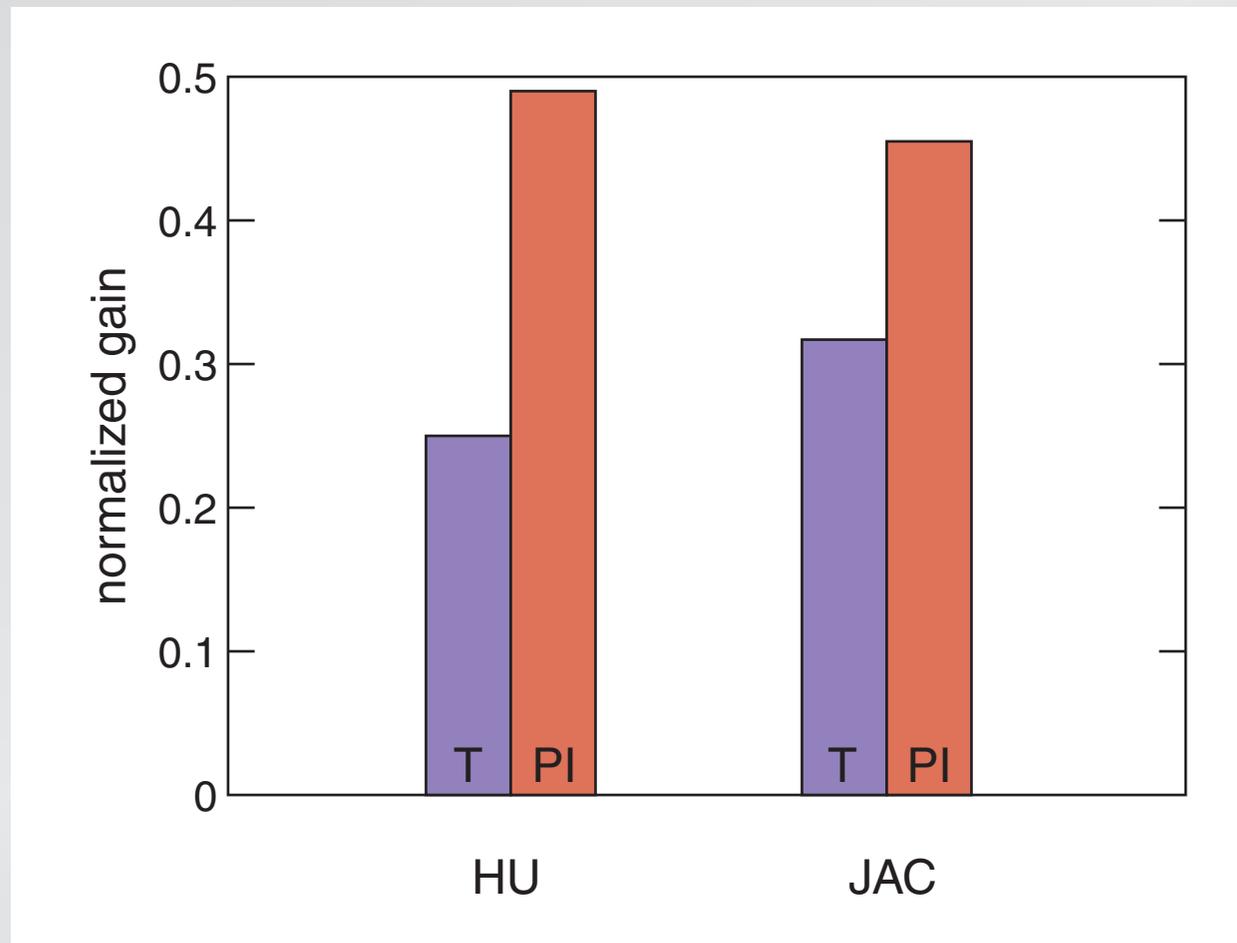
# Implementing PI & JiTT

## FCI normalized gain



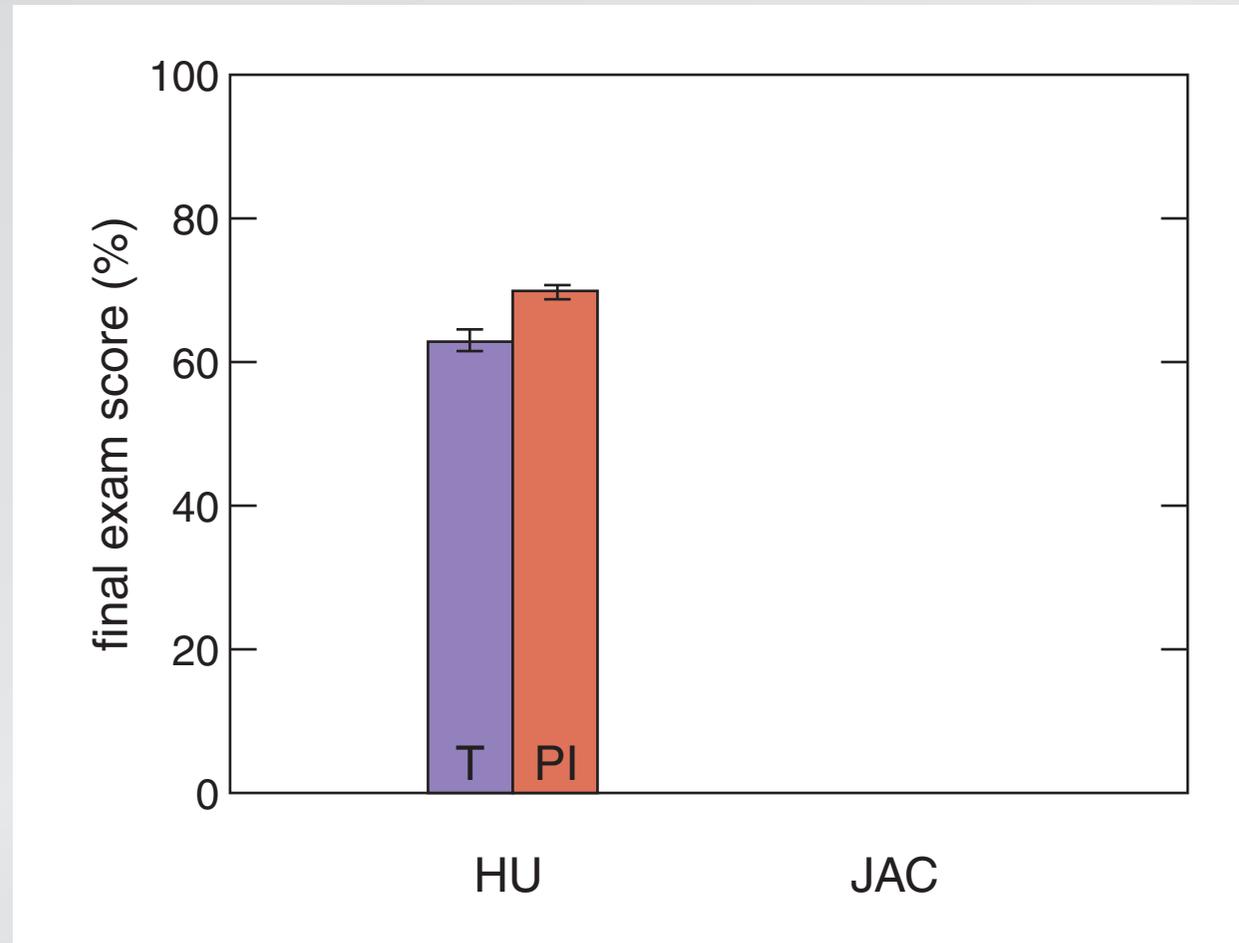
# Implementing PI & JiTT

## FCI normalized gain



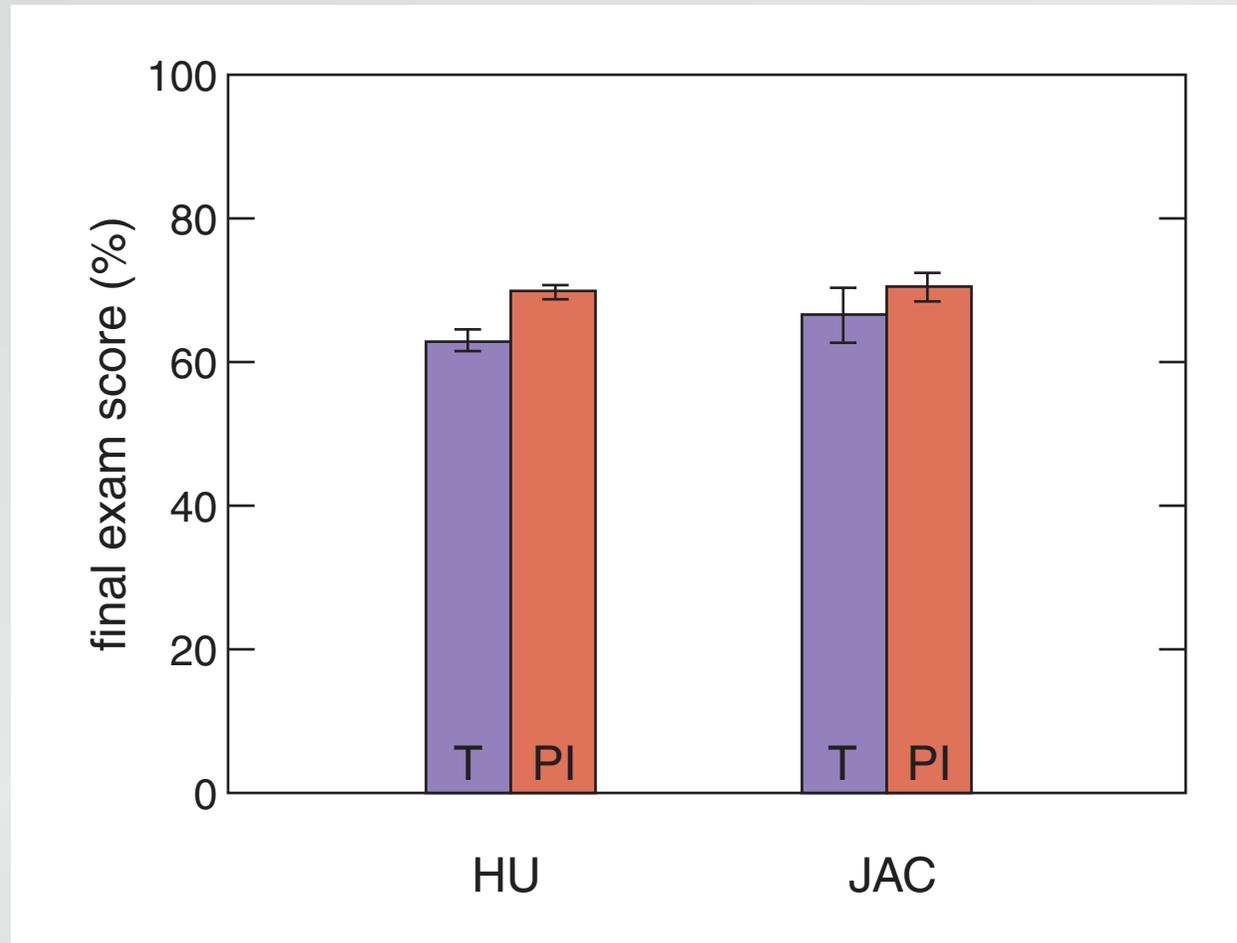
# Implementing PI & JiTT

exam performance



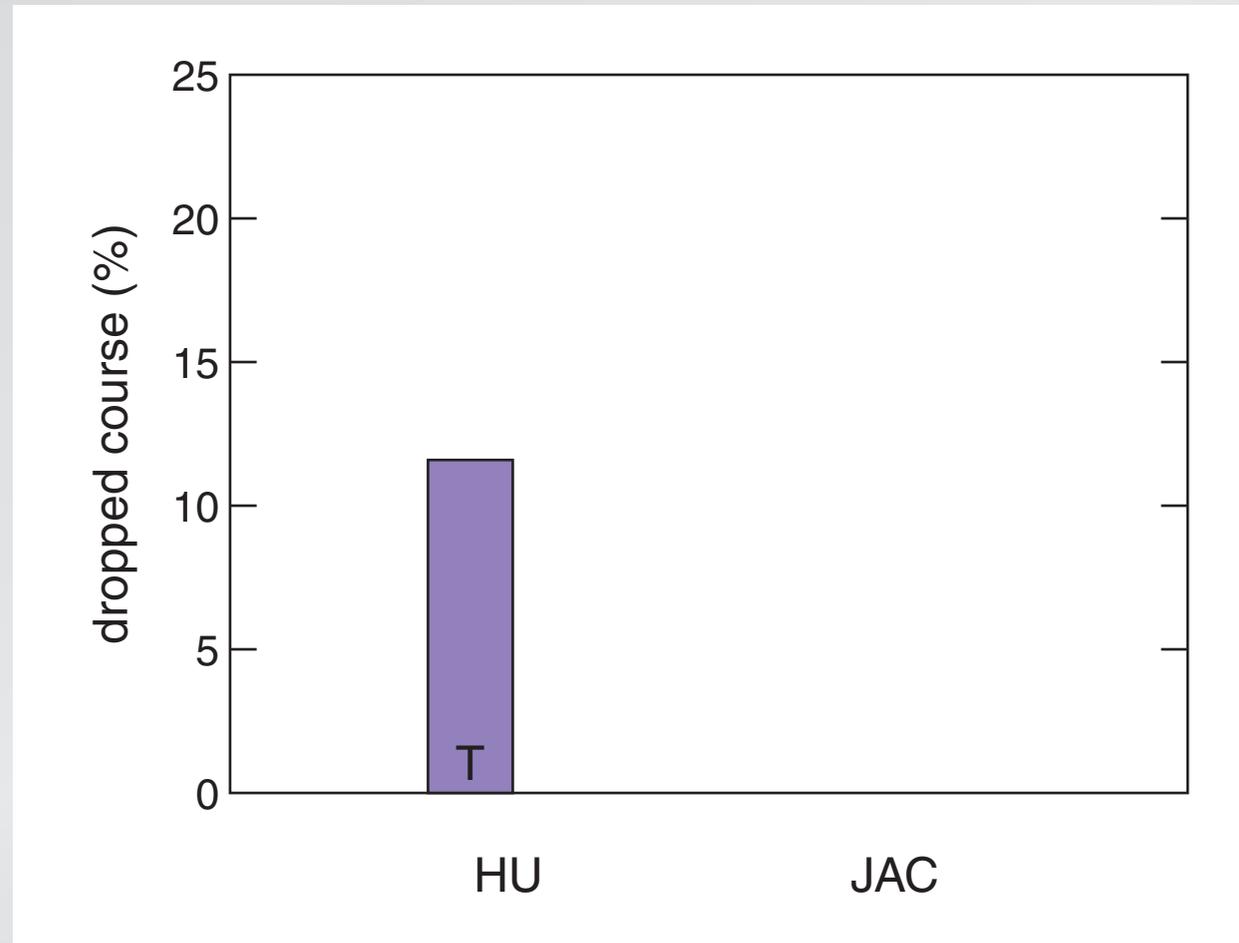
# Implementing PI & JiTT

exam performance



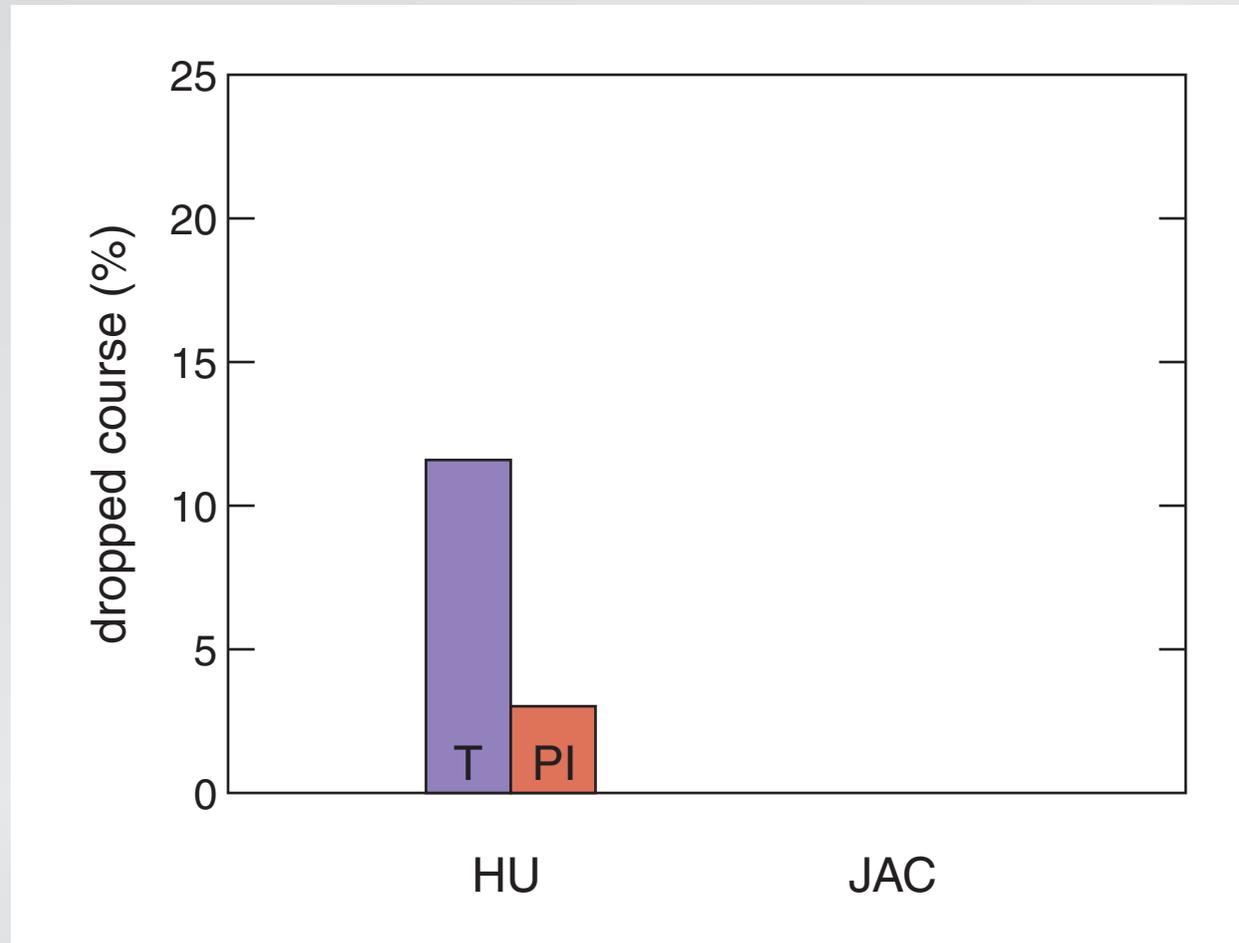
# Implementing PI & JiTT

student retention



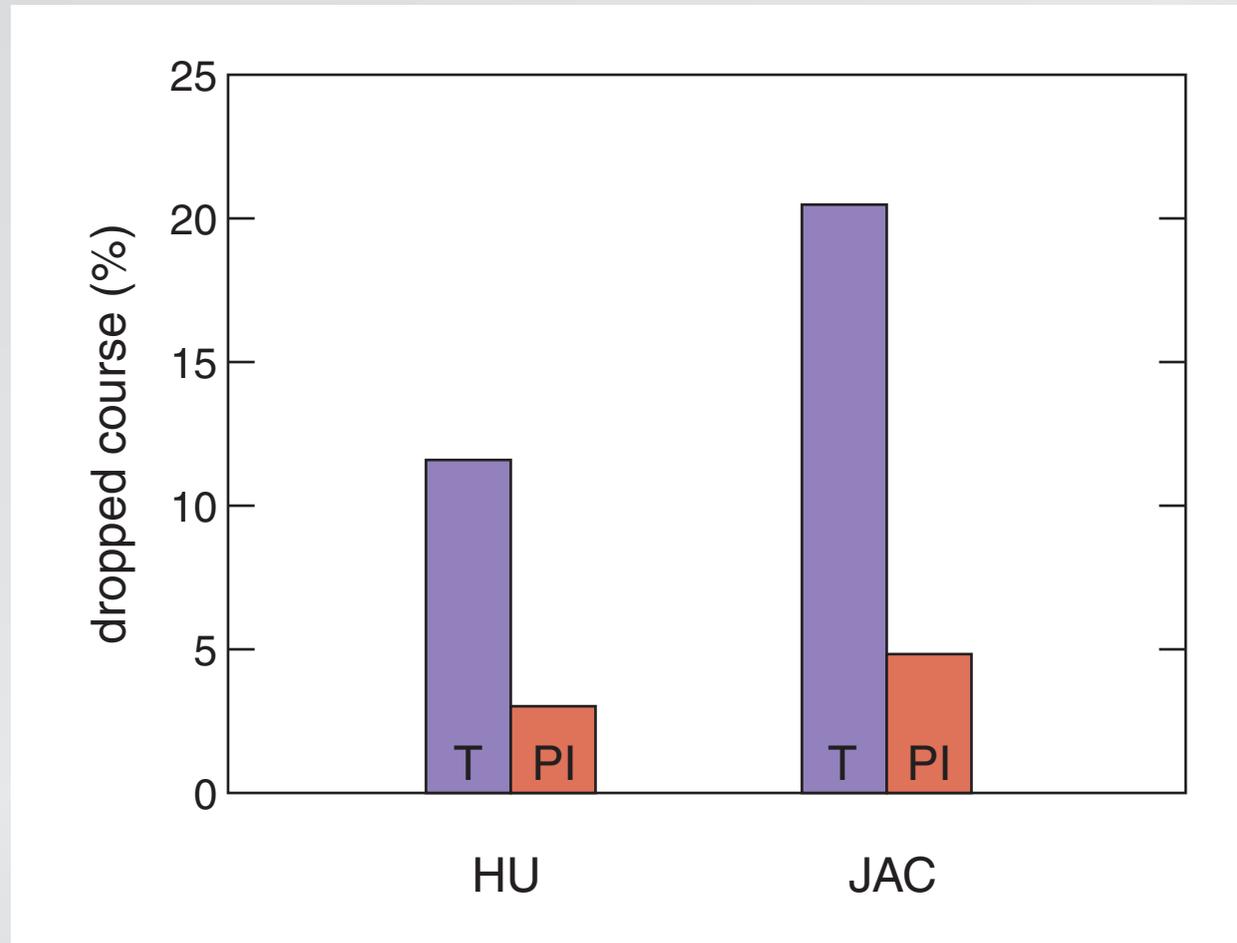
# Implementing PI & JiTT

student retention



# Implementing PI & JiTT

student retention



# Implementing PI & JiTT

**similar learning gains in different environments**

# Implementing PI & JiTT

*“How do I cover everything using this method?”*

# Implementing PI & JiTT

---

	<b>traditional</b>	<b>PI</b>
<b>in-class coverage</b>	<b>complete</b>	<b>partial</b>

---

# Implementing PI & JiTT

---

	<b>traditional</b>	<b>PI</b>
<b>in-class coverage</b>	<b>complete</b>	<b>partial</b>
<b>out-of-class coverage</b>	<b>?</b>	<b>complete</b>

---

# Implementing PI & JiTT

---

	<b>traditional</b>	<b>PI</b>
<b>in-class coverage</b>	<b>complete</b>	<b>partial</b>
<b>out-of-class coverage</b>	<b>?</b>	<b>complete</b>
<b>material learned</b>	<b>little</b>	<b>substantial</b>

---

# Implementing PI & JiTT

---

	<b>traditional</b>	<b>PI</b>
<b>in-class coverage</b>	<b>complete</b>	<b>partial</b>
<b>out-of-class coverage</b>	<b>?</b>	<b>complete</b>
<b>material learned</b>	<b>little</b>	<b>substantial</b>

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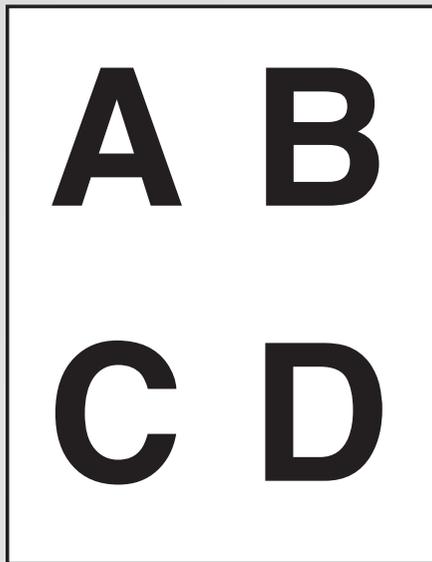
**what good is coverage if little is retained?**

# Implementing PI & JiTT

*“Do I need clickers?”*

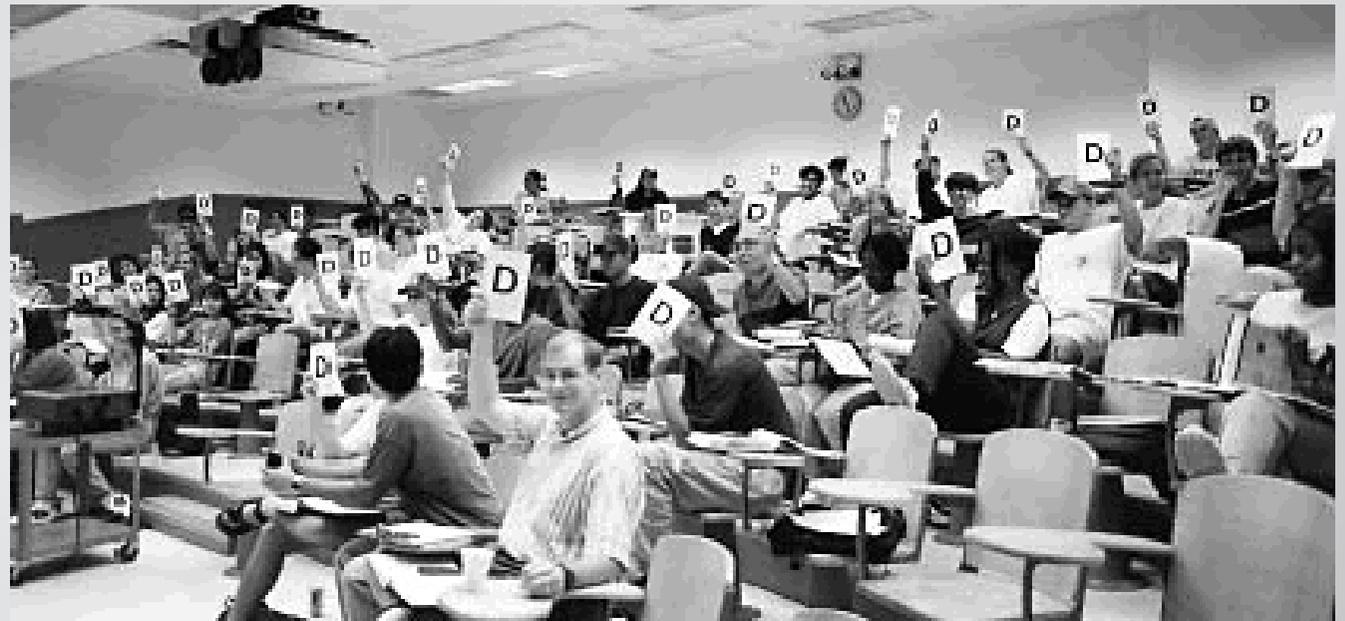
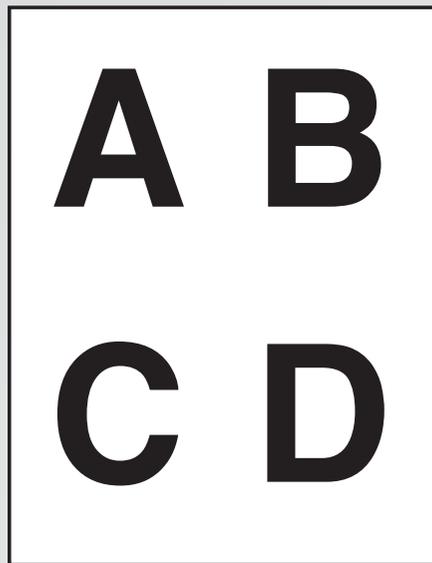
# Implementing PI & JiTT

Flashcards: simple and effective



# Implementing PI & JiTT

Flashcards: simple and effective



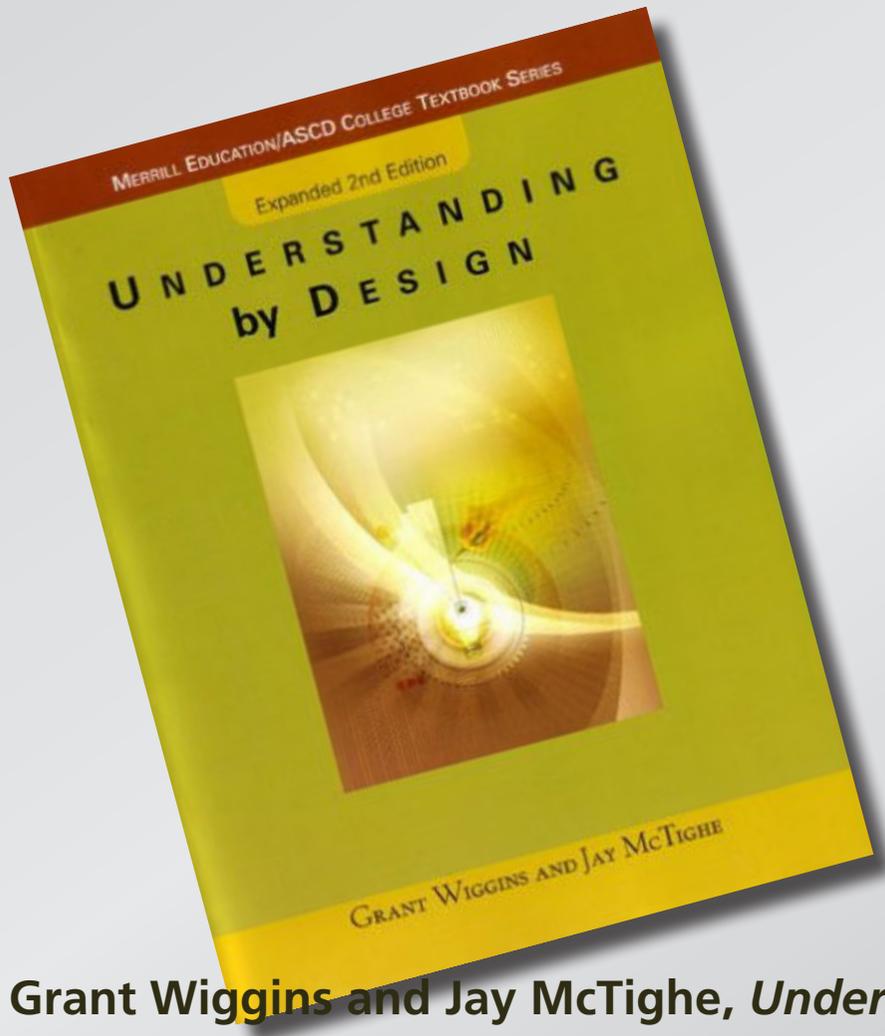
Meltzer and Mannivanan, South Eastern Louisiana University

# Implementing PI & JiTT

*“How should I assess my students  
when using this approach?”*

# Implementing PI & JiTT

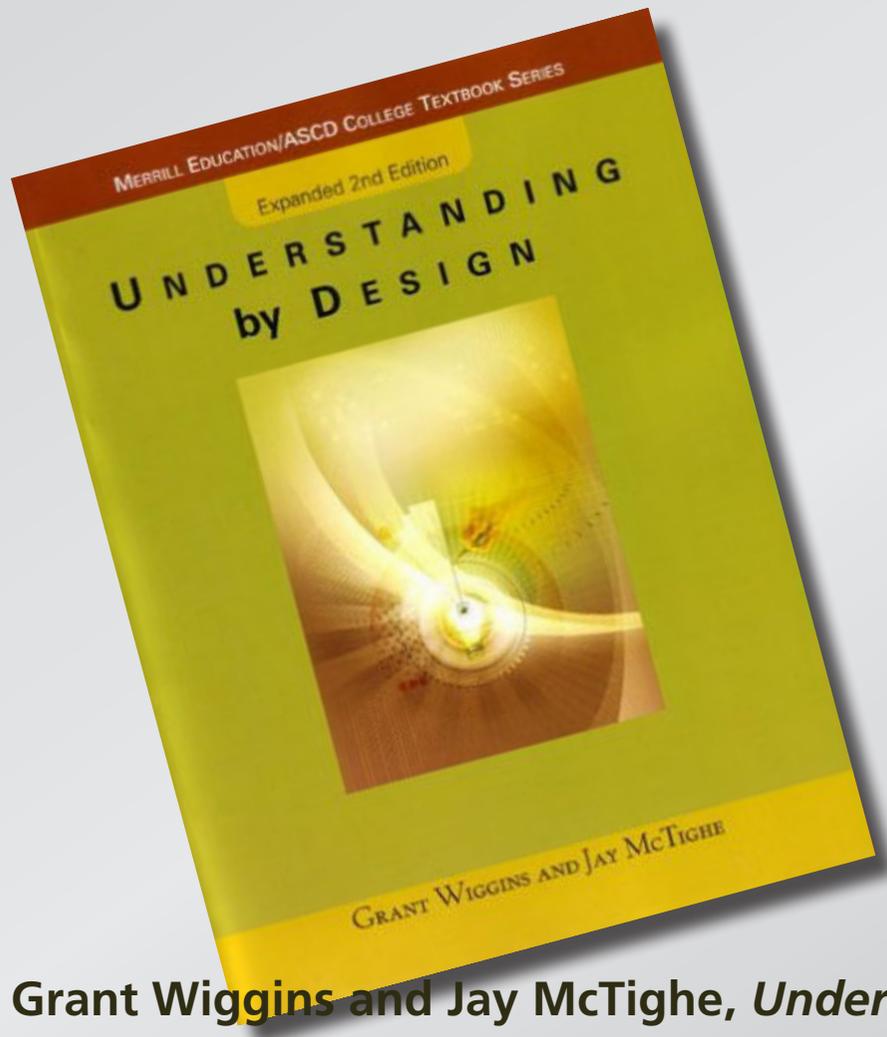
Begin by setting learning goals



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

# Implementing PI & JiTT

Begin by setting learning goals

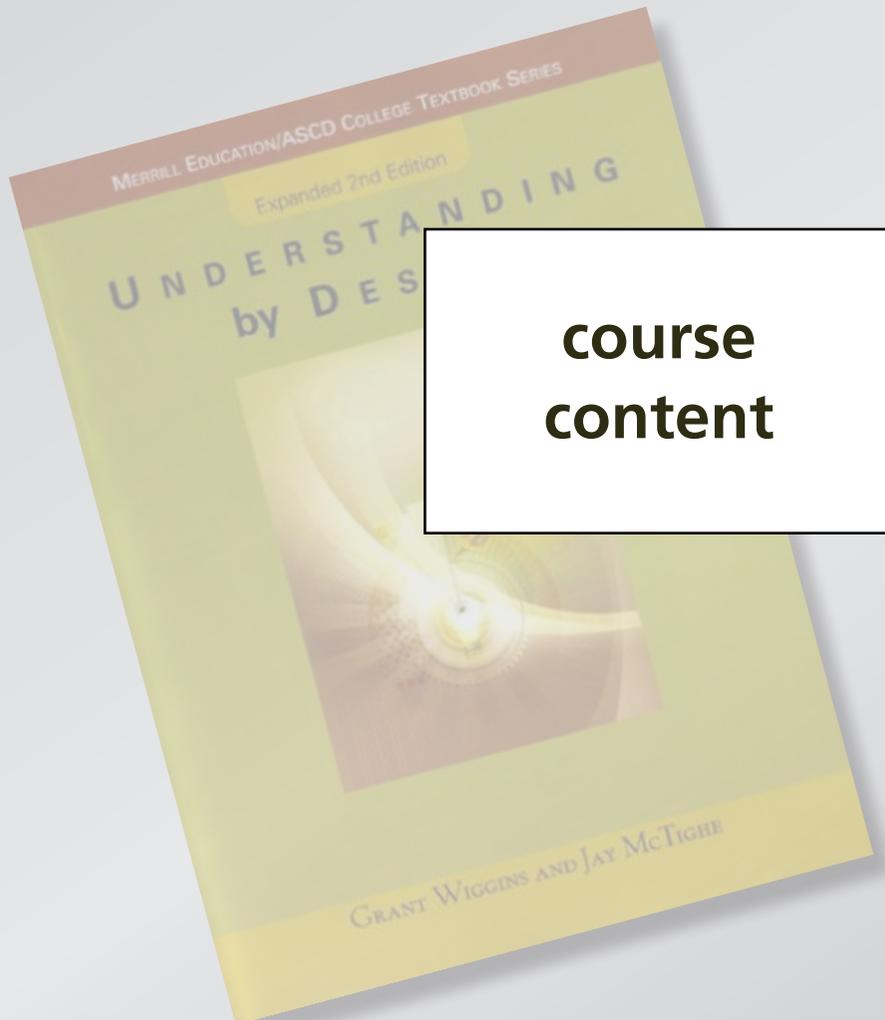


- approach, not content
- focus on understanding
- backward design

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

# Implementing PI & JiTT

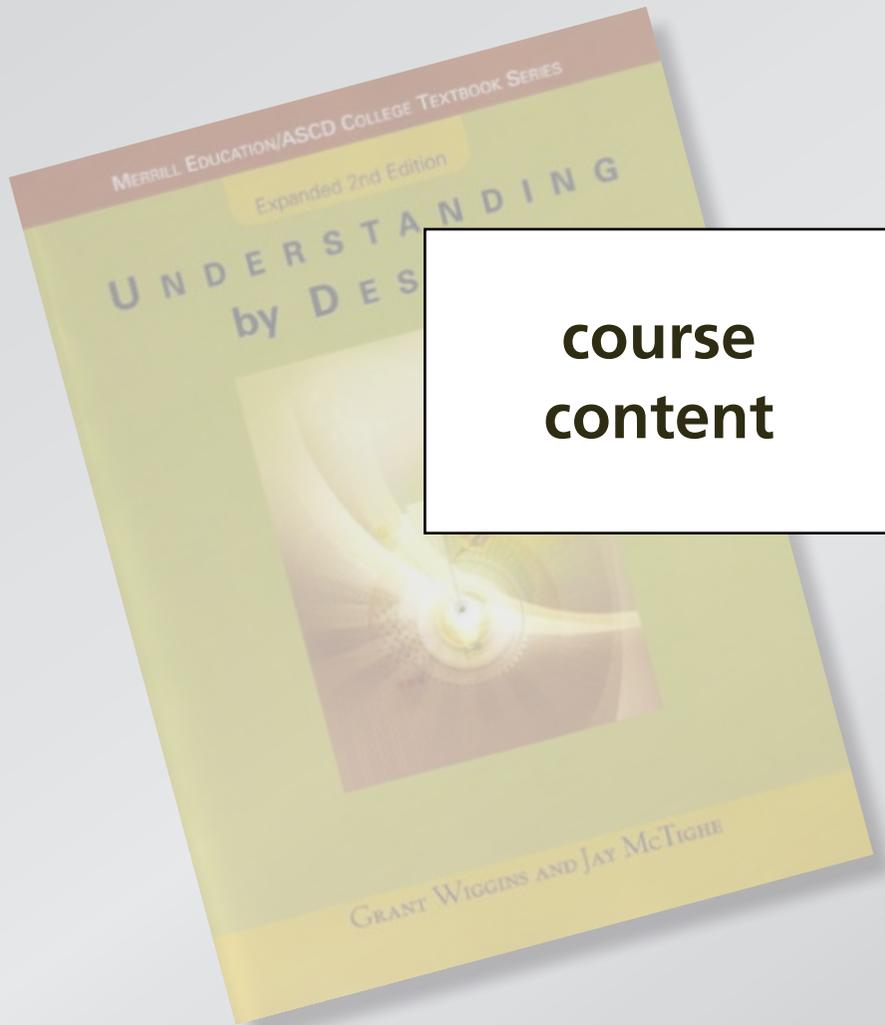
Traditional approach to course planning



**course  
content**

# Implementing PI & JiTT

## Traditional approach to course planning



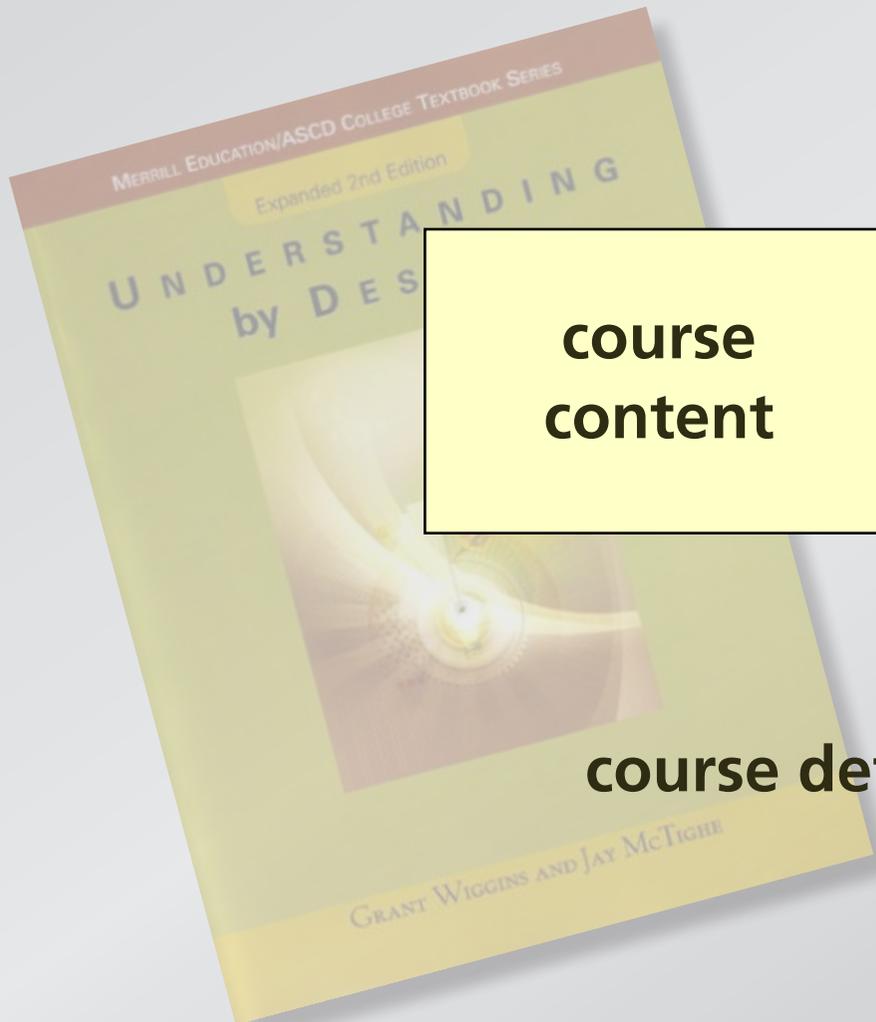
**course  
content**



**assessment**

# Implementing PI & JiTT

## Traditional approach to course planning



**course  
content**

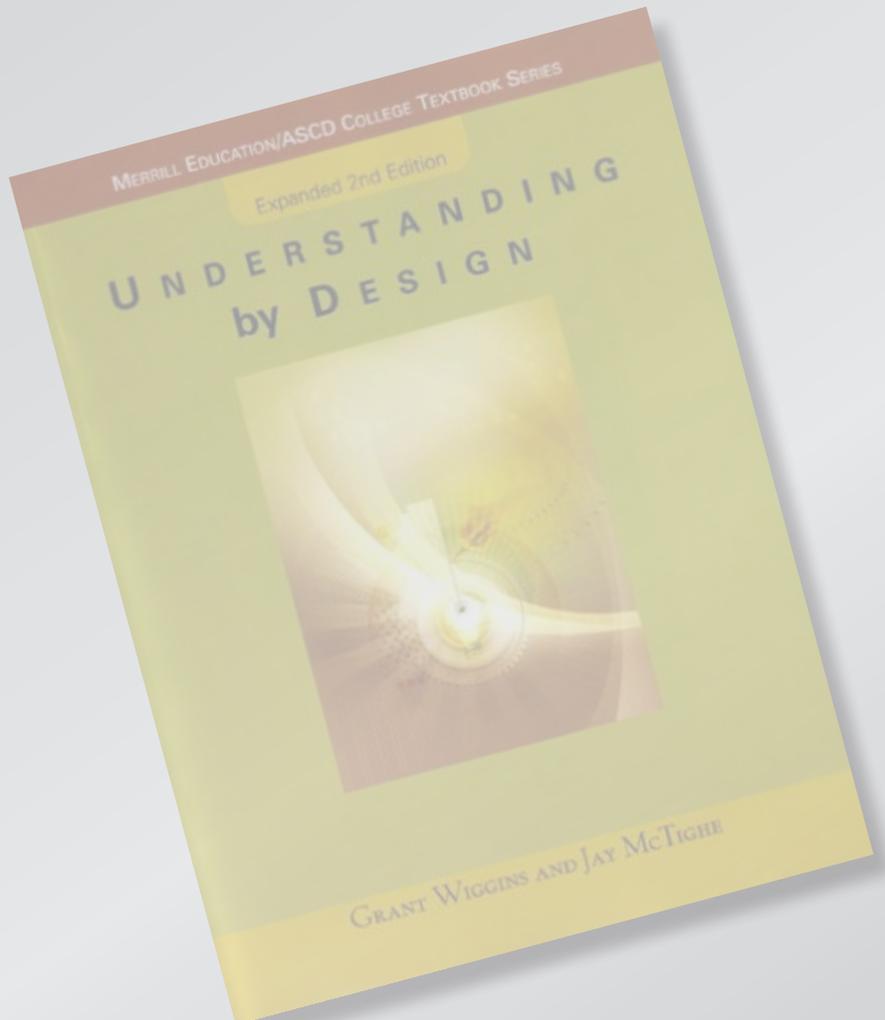


**assessment**

**course defined by content**

# Implementing PI & JiTT

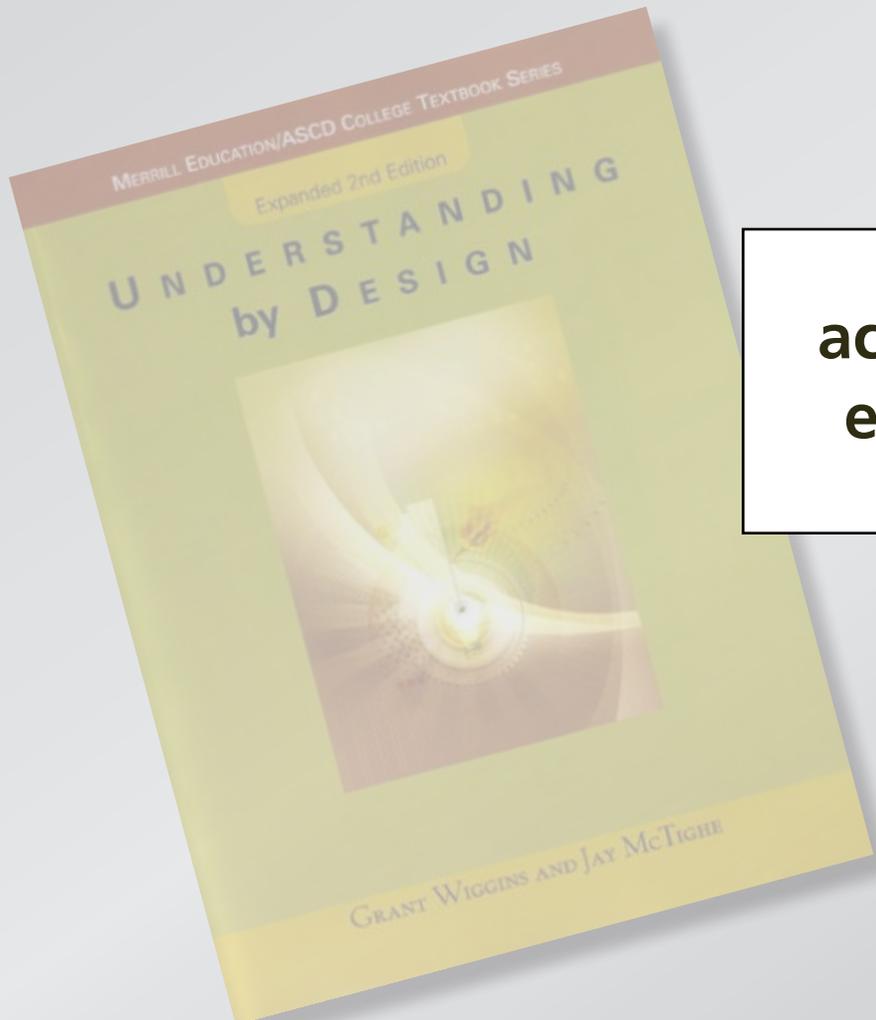
## Backward design



**desired  
outcomes**

# Implementing PI & JiTT

## Backward design



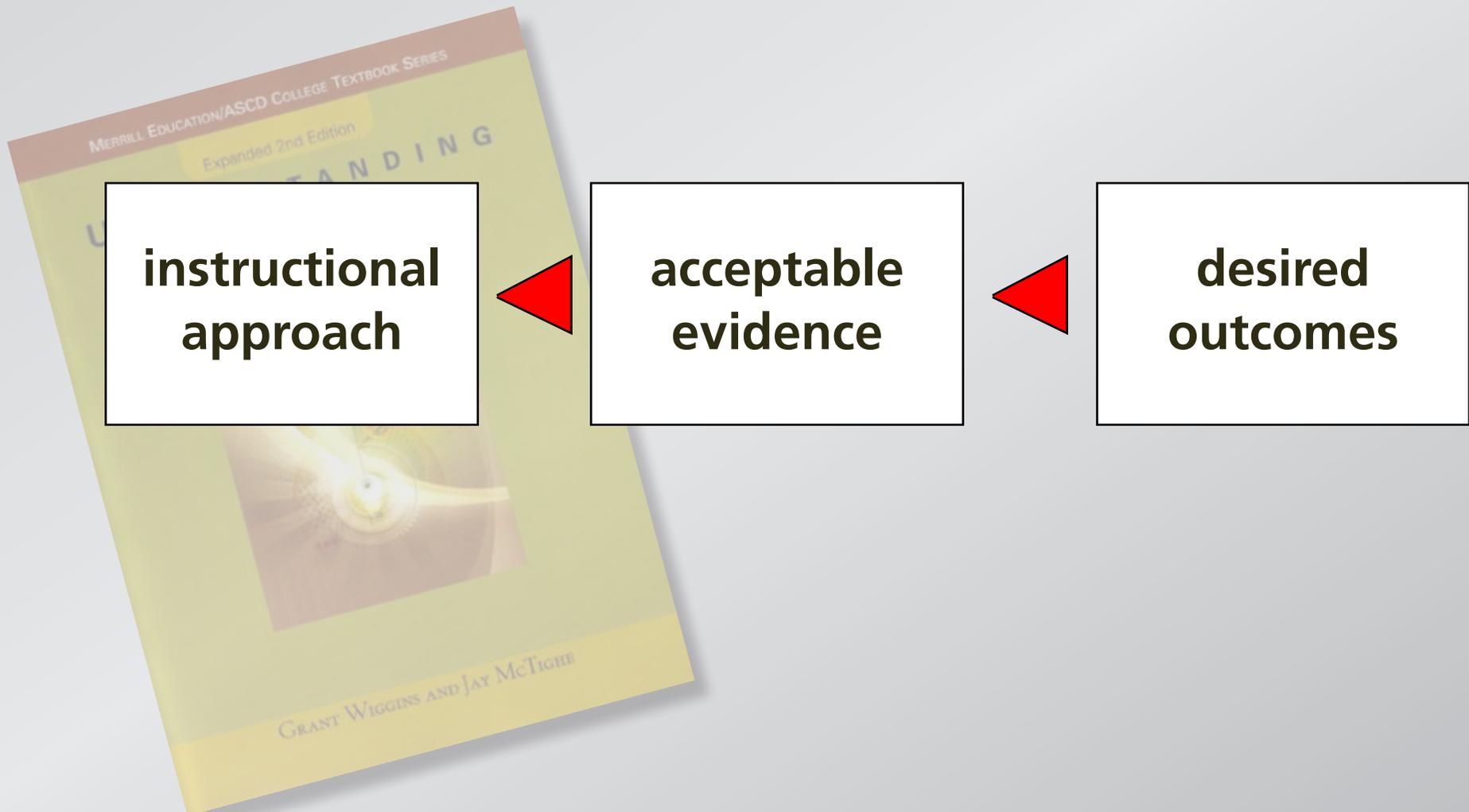
**acceptable  
evidence**



**desired  
outcomes**

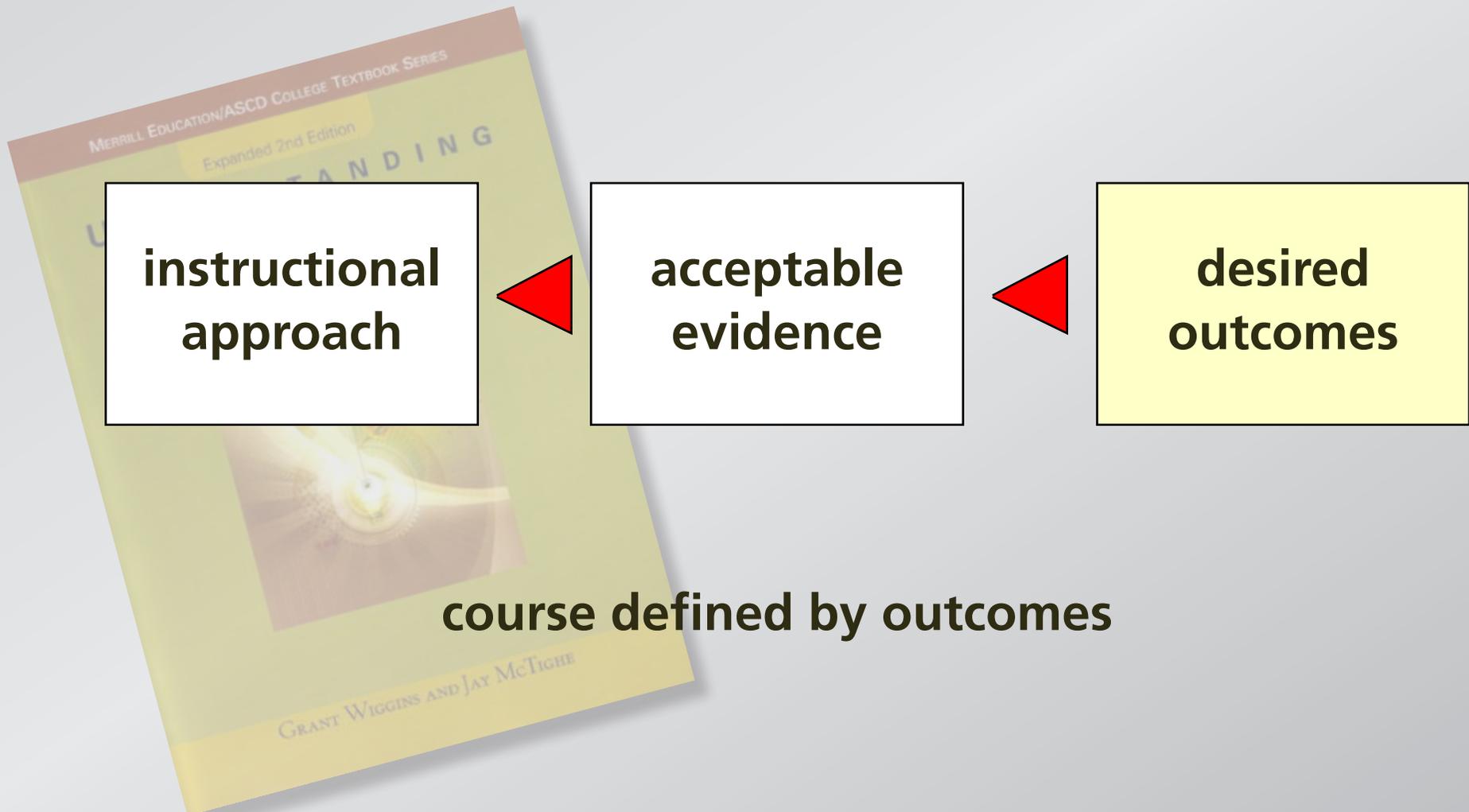
# Implementing PI & JiTT

## Backward design



# Implementing PI & JiTT

## Backward design



# Outline

- **PI & JiTT Overview**
- **Implementing PI & JiTT**
- **ConceptTests**

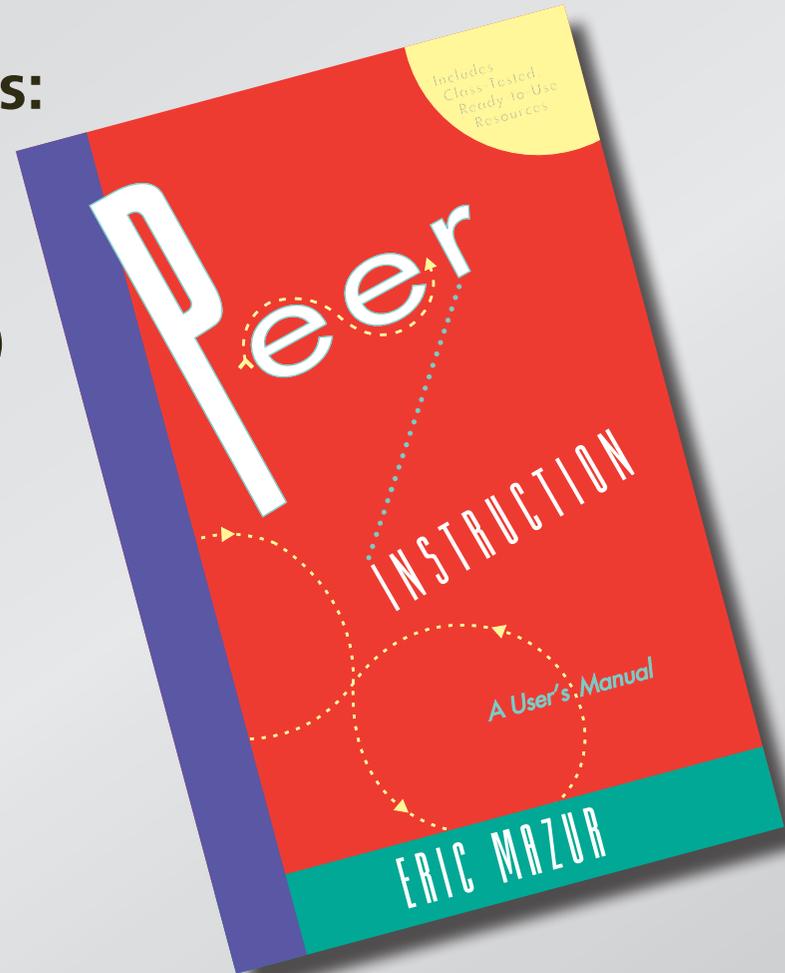
# ConceptTests

*“Where can I get examples of good questions?”*

# ConceptTests

## Books with ConceptTests:

- Physics (Prentice Hall)



# ConceptTests

## Books with ConceptTests:

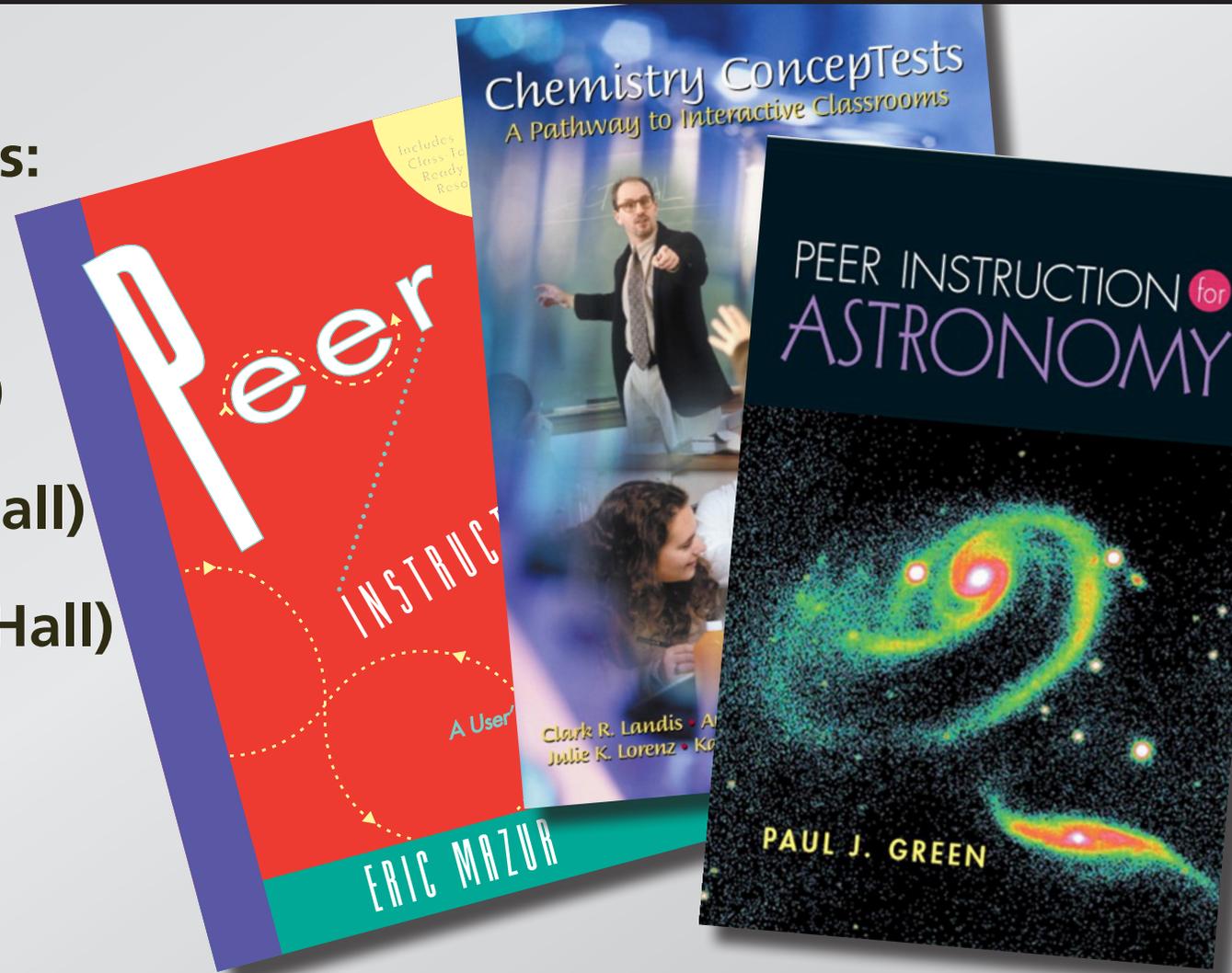
- Physics (Prentice Hall)
- Chemistry (Prentice Hall)



# ConceptTests

## Books with ConceptTests:

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



# ConcepTests

## Books with ConcepTests:

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



# ConceptTests

... or try searching Google:

<subject> "Peer Instruction"

<subject> ConceptTest

<subject> "Concept Test"

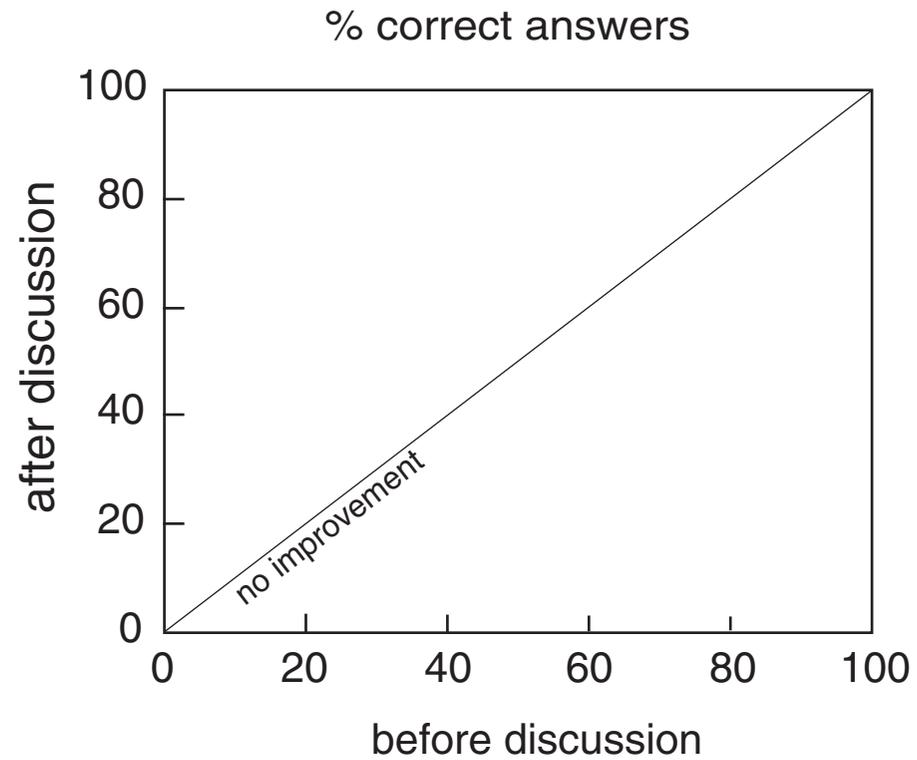
<subject> clickers

# ConceptTests

*“How can I promote active/fruitful discussions?”*

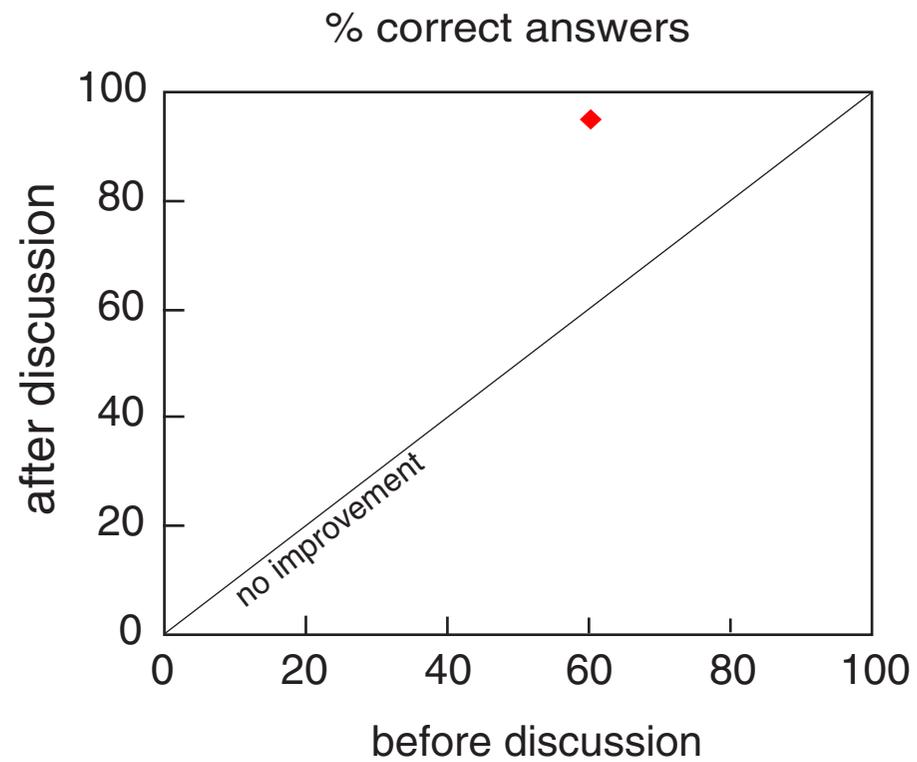
# ConceptTests

## ConceptTest data



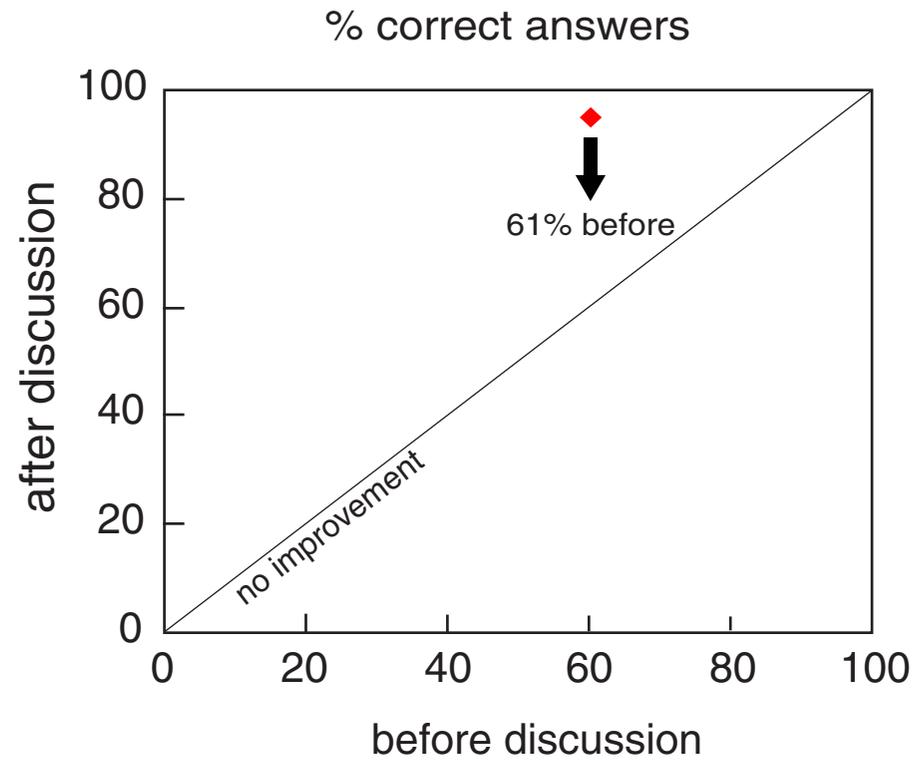
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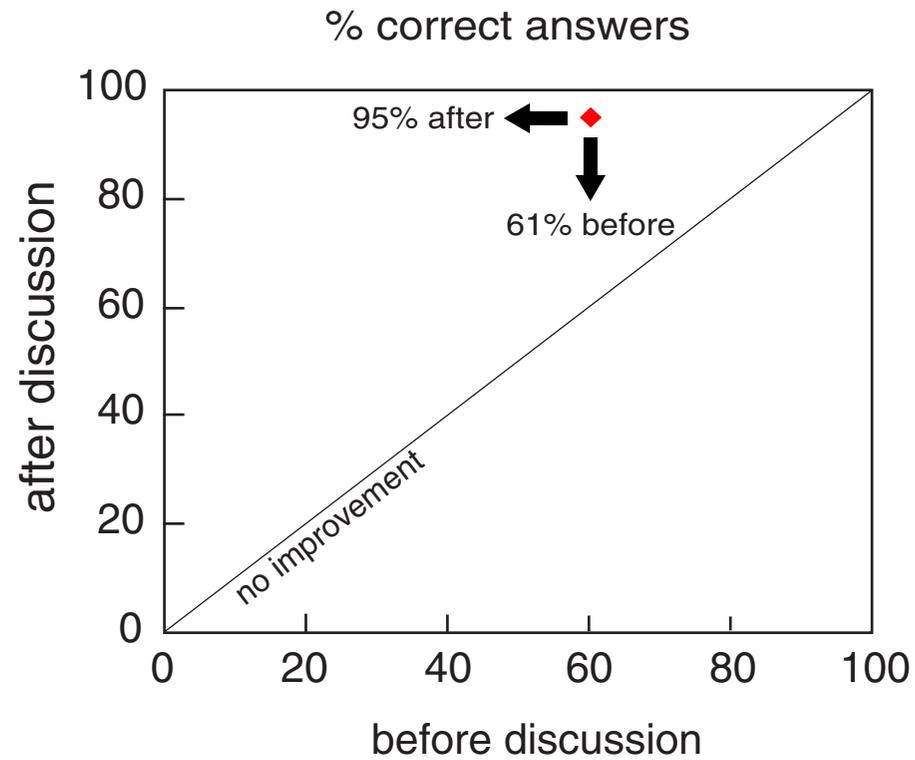
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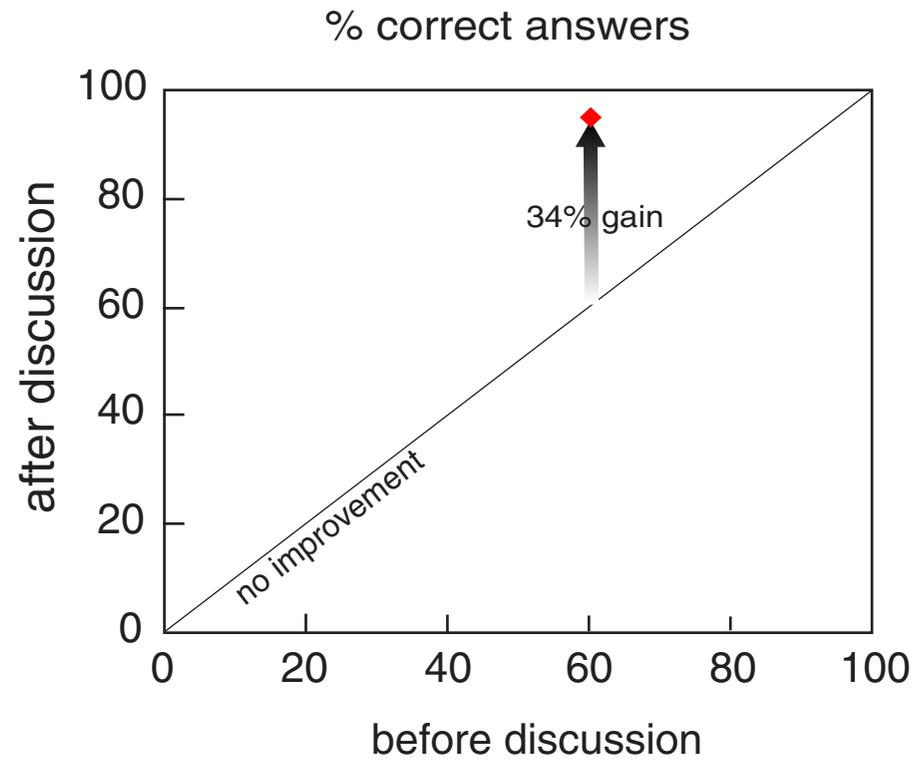
# ConceptTests

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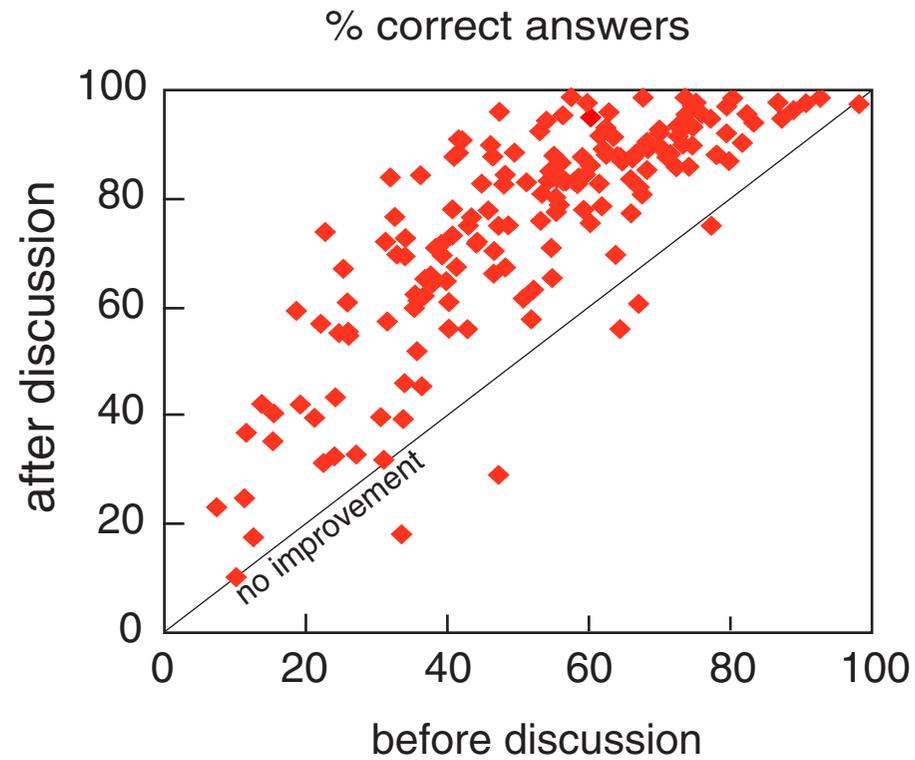
# ConceptTests

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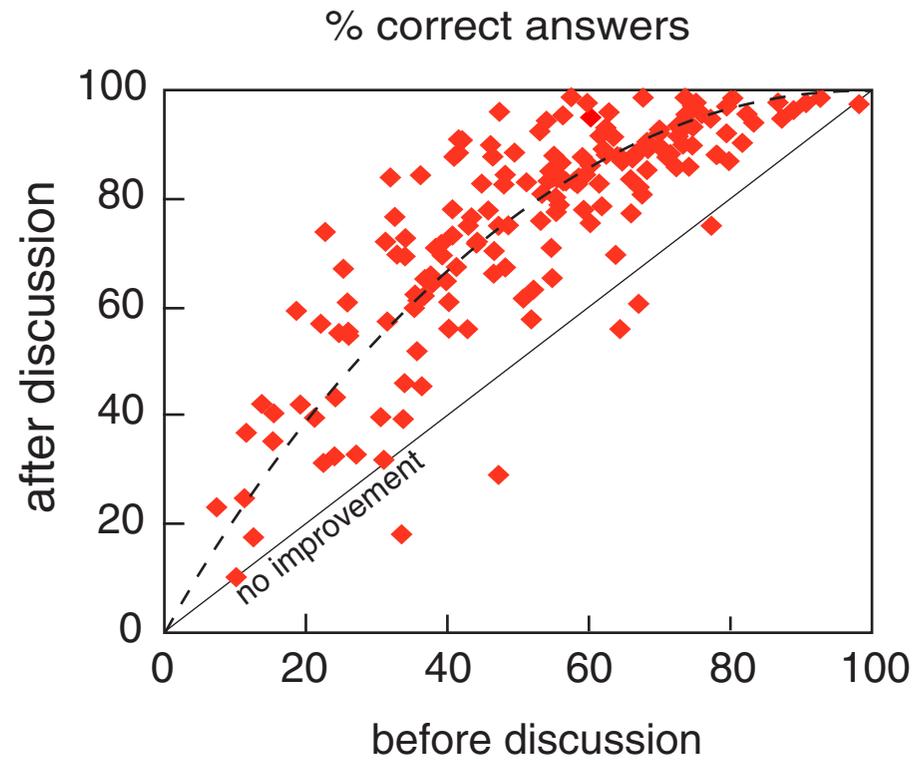
# ConceptTests

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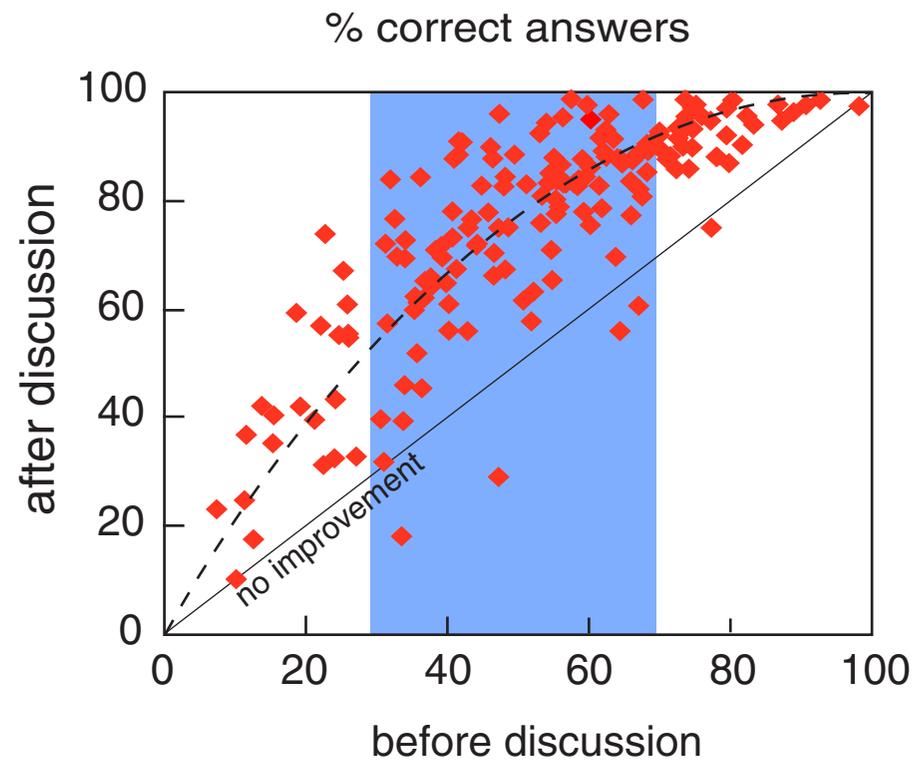
# ConceptTests

## ConceptTest data

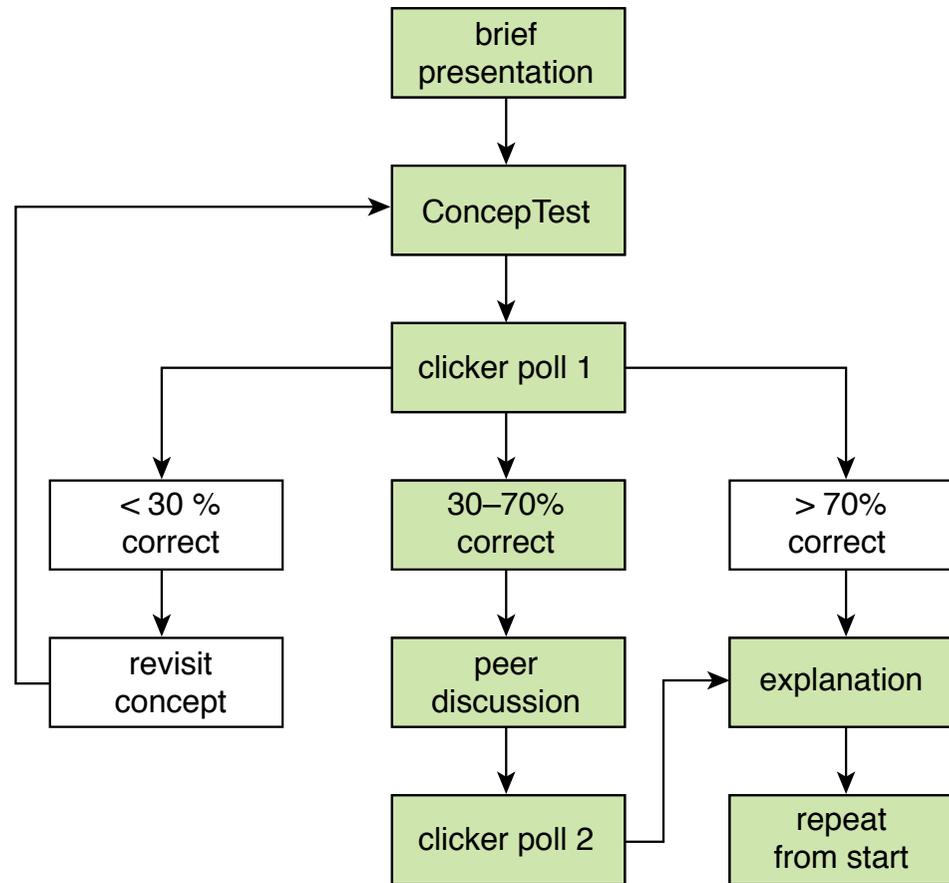


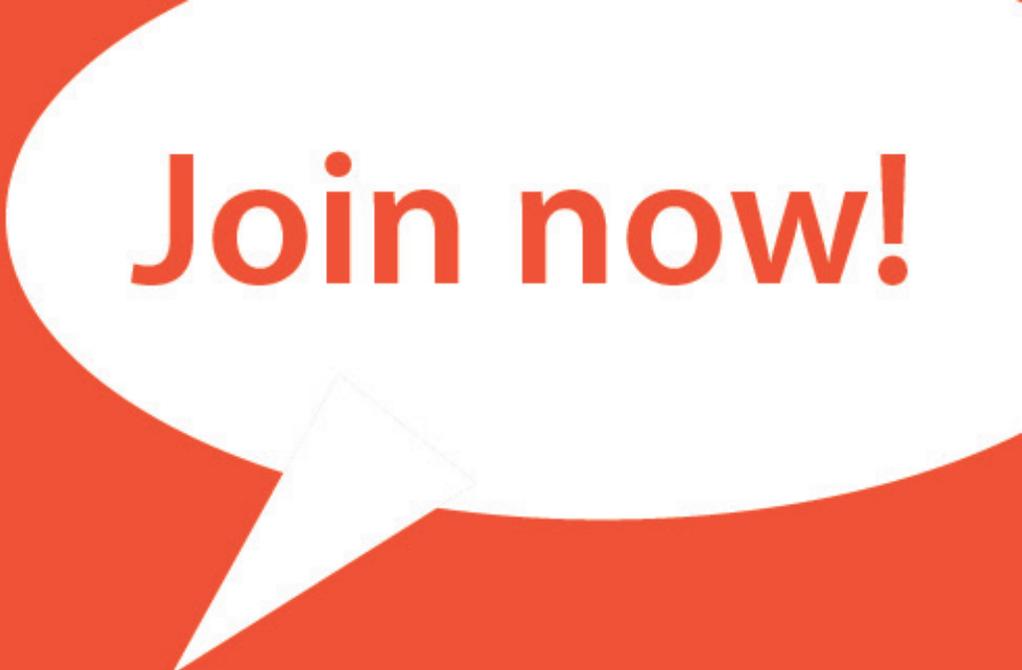
# ConcepTests

## ConcepTest data



# ConceptTests





**Join now!**

**PeerInstruction.net**

# Implementing PI & JiTT

**Evaluate assessment by comparing  
student performance on various kinds of problems**

# Implementing PI & JiTT

*“What constitutes a good problem?”*

# Implementing PI & JiTT

On a Saturday afternoon, you pull into a parking lot with unmeasured 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 unmeasured 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 unmeasured 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 unmeasured 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.**

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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?

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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 unmeasured 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.

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

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

Requires:

Using a calculator

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

# Implementing PI & JiTT

**Need to test meaningful skills!**

# Implementing PI & JiTT

**Some additional ideas:**

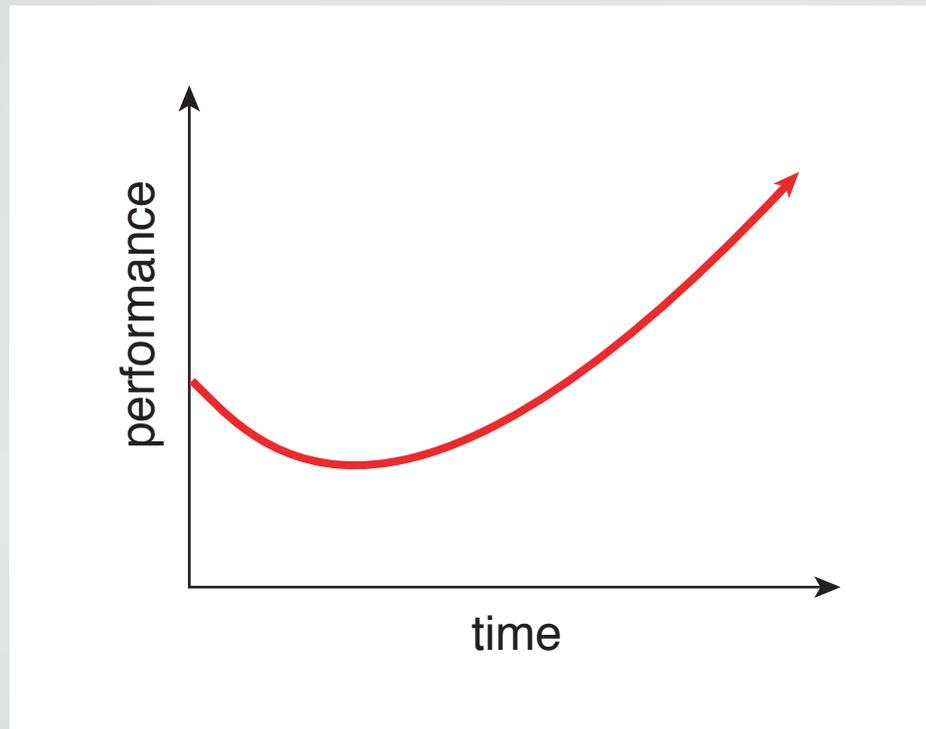
- **Open book/computer exam**
- **Collaborative exam**
- **Multidimensional testing**

# Implementing PI & JiTT

*“How do I deal with students who resist  
this new approach to studying?”*

# Implementing PI & JiTT

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!

# Implementing PI & JiTT

Hello Prof. Mayer,  
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  
an inspiring and have  
changed how I look at  
"learning". I also wanted  
to thank you for  
how understanding  
you were of all  
my circumstances.  
You really made a difference  
in my life. So THANKS  
Thank you!



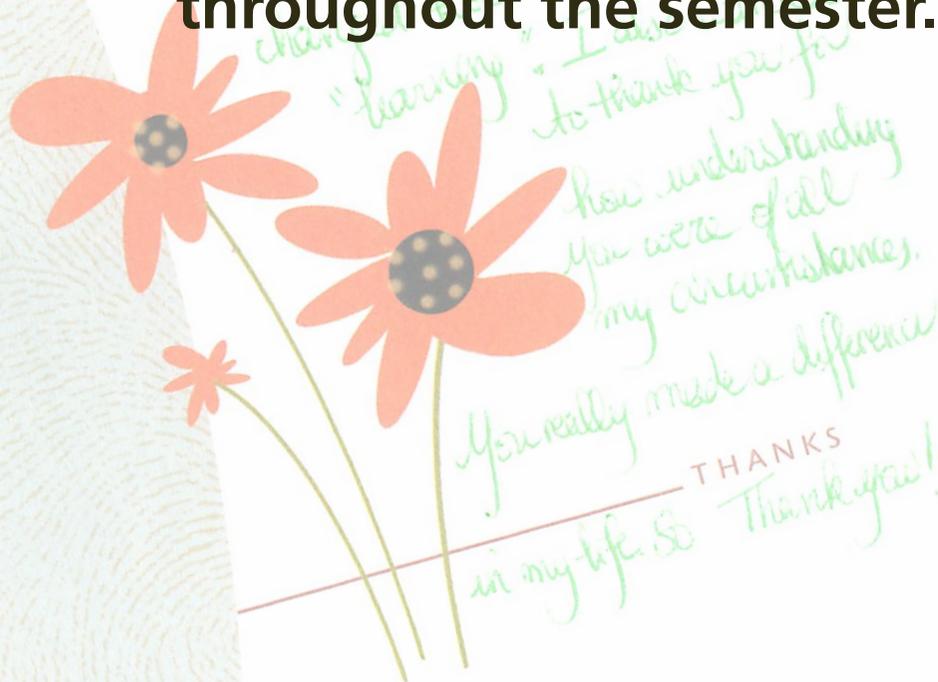
You made a difference.

Love, Best

# Implementing PI & JiTT

**"I wanted to hand you this card as a token of my deep appreciation of how you have helped me throughout the semester.**

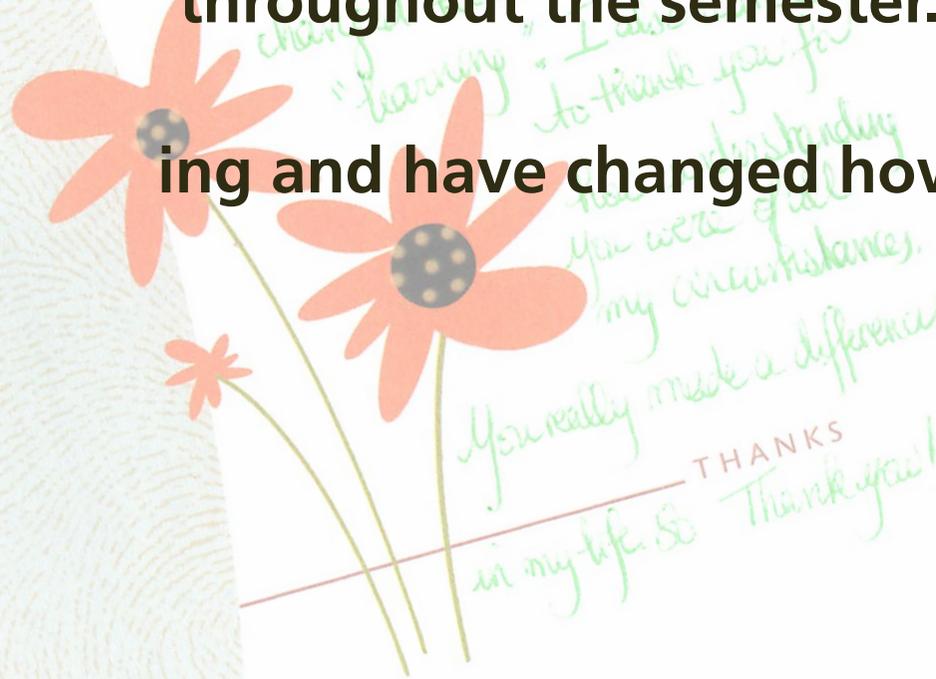
*You made a difference.*



# Implementing PI & JiTT

**"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 made a difference.*



THANKS  
in my life. So Thank you!

Best

# Implementing PI & JiTT

**"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."**

*You made a difference.*

*THANKS  
in my life. So Thank you!*

*Best*

# Implementing PI & JiTT

**and don't forget...**

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**and don't forget...**

**PI leads to better learning and retention!**