Hands-on with Peer Instruction

@eric__mazur

10th Annual Academic Success Lecture
Texas Woman’s University
Denton, TX, 29 April 2016
Peer Instruction: a primer

lectures focus on information transfer...
Peer Instruction: a primer

lectures focus on information transfer...

but education is much more!
Peer Instruction: a primer

1. information transfer
Peer Instruction: a primer

1. information transfer
2. assimilation of information
1. information transfer (easy)

2. assimilation of information (hard and left to student)
Solution: move information transfer out of classroom!
Peer Instruction: a primer

Main features:

• pre-class reading

• in-class: depth, not ‘coverage’

• ConcepTests
Peer Instruction: a primer

brief presentation

ConcepTest
Peer Instruction: a primer

brief presentation

ConcepTest

clicker poll 1
Peer Instruction: a primer

- brief presentation
- ConcepTest
- clicker poll 1
- > 70% correct
Peer Instruction: a primer

brief presentation

ConcepTest

clicker poll 1

> 70% correct

explanation
Peer Instruction: a primer

brief presentation

ConcepTest

clicker poll 1

> 70% correct

explanation

repeat from start
Peer Instruction: a primer

brief presentation

ConcepTest

clicker poll 1

30–70% correct

> 70% correct

explanation

repeat from start
Peer Instruction: a primer

brief presentation

ConcepTest

clicker poll 1

30–70% correct

peer discussion

> 70% correct

explanation

repeat from start
Peer Instruction: a primer

- brief presentation
- ConcepTest
- clicker poll 1
  - 30–70% correct
  - > 70% correct
    - peer discussion
    - explanation
    - repeat from start

- clicker poll 2
Peer Instruction: a primer

- brief presentation
- ConceptTest
- clicker poll 1
  - < 30% correct
  - 30–70% correct
  - > 70% correct
    - explanation
    - repeat from start
    - peer discussion
- clicker poll 2
Peer Instruction: a primer

brief presentation

ConcepTest

clicker poll 1

< 30% correct

revisit concept

30–70% correct

peer discussion

clicker poll 2

> 70% correct

explanation

repeat from start
Peer Instruction: a primer

- **brief presentation**

- **ConcepTest**

- **clicker poll 1**

  - **< 30 % correct** → **revisit concept**
  - **30–70% correct** → **peer discussion**
  - **> 70% correct** → **explanation**

- **clicker poll 2**

  - **repeat from start**
“Can this method be used in my class, where questions don’t necessarily have right answers?”
Bernard Gert (1934 – 2011)

Moral philosopher
Professor at Dartmouth
Let’s try it!

Bernard Gert (1934 – 2011)

Moral philosopher
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).
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.
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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
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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!
“How do I move information transfer out of classroom?”
“How can I be sure that my students will prepare for class?”
Getting students to read

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)
Getting students to read

Just-in-time-Teaching (JiTT)

www.jitt.org
Getting students to read

JiTT workflow

<table>
<thead>
<tr>
<th>topic 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>reading assignment</td>
</tr>
</tbody>
</table>
Getting students to read

JiTT workflow

- topic 1 reading assignment
- online assignment
Getting students to read

JiTT workflow

- topic 1 reading assignment
- online assignment
- 2 conceptual questions
Getting students to read

JiTT workflow

- topic 1 reading assignment
- online assignment
- 2 conceptual questions
- 1 feedback question
Getting students to read

JiTT workflow

- topic 1 reading assignment
- online assignment
- review feedback
- 2 conceptual questions
- 1 feedback question
Getting students to read

JiTT workflow

1. Topic 1 reading assignment
2. Online assignment
3. Review feedback
4. Address difficulties in class
5. 2 conceptual questions
6. 1 feedback question
Getting students to read

JiTT workflow

- topic 1 reading assignment
- online assignment
- review feedback
- address difficulties in class
- repeat with next topic
- 2 conceptual questions
- 1 feedback question
“Do I need clickers?”
Clickers necessary?

Flashcards: simple and effective

A
B
C
D
Clickers necessary?

Flashcards: simple and effective

Meltzer and Mannivanan, South Eastern Louisiana University
Clickers necessary?
circumference
circumference

of a circle of radius $R$ is $2\pi R$
Imagine a rope that fits snugly along the equator.
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. about 0.15 m
4. exactly 1 m
5. more than 1 m
Clickers necessary?

You all got fired up!
Clickers necessary?

You all got fired up!

(WITHOUT CLICKERS!)
Imagine a rope that fits snugly along the equator.

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Clickers necessary?

circumference at the equator:

\[ 2\pi R_E \]
circumference at the equator:

\[ 2\pi R_E \]

new circumference:

\[ 2\pi R_E + 1 \text{ m} \]
circumference at the equator:

$$2\pi R_E$$

new circumference:

$$2\pi R_E + 1 \text{ m}$$

radius of circle with new circumference:

$$2\pi R = 2\pi R_E + 1 \text{ m}, \quad \text{and so} \quad R = R_E + \frac{1 \text{ m}}{2\pi}.$$
Clickers necessary?

It’s not the technology, but the pedagogy!
Clickers necessary?

It’s not the technology, but the pedagogy!

(but clickers do offer advantages)
“How do I deal with students who resist this new approach to studying?”
After changing, things might get worse before they get better!
Subject: concerns

Professor Mazur,

Here are a few concerns. I speak for many of my classmates.

1) You are giving us WAY too 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 of 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.
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!
Hello Prof Mayor,

I wanted to thank you for your role as a catalyst for my deep appreciation of how you have helped me throughout the semester. You are truly inspiring and have changed how I look at "learning." I also wanted to thank you for your understanding and how you were able to navigate my circumstances. You really made a difference in my life, so thank you!

THANKS

Best,

You made a difference.
“I wanted to hand you this card as a token of my deep appreciation of how you have helped me throughout the semester.
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Student resistance

and don’t forget...
Student resistance

and don’t forget...

PI leads to better learning and retention!
“I still need help getting started...”
Summary
Summary

PI easy to implement (and improves learning gains)
Summary

Pl easy to implement (and improves learning gains)

technology facilitates active engagement (but not required)
Funding:

National Science Foundation

for a copy of this presentation:

http://mazur.harvard.edu

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