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 and done in class)
2. assimilation of information (hard and left to student)
1. information transfer (out of class)

2. assimilation of information (in class)
use JiTT before class and PI in class!
“How much time to spend on each PI step?”
Peer Instruction: a primer
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

explanation
Peer Instruction: a primer

1. Brief presentation
2. ConceptTest
3. 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
peer discussion

clicker poll 2

> 70% correct
explanation

repeat from start
Peer Instruction: a primer

[Diagram]

- Brief presentation
  - ConcepTest
    - Clicker poll 1
      - < 30% correct
      - 30–70% correct
      - > 70% correct
        - Peer discussion
        - Explanation
          - Repeat from start
        - 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

clicker poll 2

> 70% correct

explanation

repeat from start
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.

After the boulder sinks to the bottom of the pond, the level of the water in the pond is

1. higher than
2. the same as
3. lower than

it was when the boulder was in the boat.
Let’s try it!

A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.

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After the boulder sinks to the bottom of the pond, the level of the water is

1. higher than
2. the same as
3. lower than it was when the boulder was in the boat.

Before I tell you the answer, let’s analyze what happened.
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond. After the boulder sinks to the bottom of the pond, the level of the water in the pond is

1. higher than
2. the same as
3. lower than it was when the boulder was in the boat.

Before I tell you the answer, let's analyze what happened. You...
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.

After the boulder sinks to the bottom of the pond, the level of the water in the pond is

1. higher than
2. the same as
3. lower than it was when the boulder was in the boat.

Before I tell you the answer, let’s analyze what happened. You...

1. made a commitment
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.

After the boulder sinks to the bottom of the pond, the level of the water in the pond is

1. higher than it was when the boulder was in the boat.
2. the same as it was when the boulder was in the boat.
3. lower than it was when the boulder was in the boat.

Before I tell you the answer, let’s analyze what happened. You...

1. made a commitment
2. externalized your answer
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.

After the boulder sinks to the bottom of the pond, the level of the water in the pond is

1. higher than
2. the same as
3. lower than it was when the boulder was in the boat.

Before I tell you the answer, let’s analyze what happened. You...

1. made a commitment
2. externalized your answer
3. moved from the answer/fact to reasoning
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond. After the boulder sinks to the bottom of the pond, the level of the water in the pond is 1. higher than, 2. the same as, 3. lower than it was when the boulder was in the boat.

Before I tell you the answer, let’s analyze what happened. You...

1. made a commitment
2. externalized your answer
3. moved from the answer/fact to reasoning
4. became emotionally invested in the learning process
A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.

After the boulder sinks to the bottom of the pond, the level of the water in the pond is

1. higher than
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A boat carrying a large boulder is floating on a small pond. The boulder is thrown overboard and sinks to the bottom of the pond.

After the boulder sinks to the bottom of the pond, the level of the water in the pond is

1. higher than
2. the same as
3. lower than ✓

it was when the boulder was in the boat.
Let's try it!

remember: amount of displaced water
Let’s try it!

remember: amount of displaced water
Let’s try it!

remember: amount of displaced water
Let’s try it!

remember: amount of displaced water

displaced water
Let’s try it!

remember: amount of displaced water

discharged water ∆ = weight of rock
Let’s try it!

remember: amount of displaced water

![Diagram of displaced water, weight, and volume of rock]

displaced water = weight of rock

= volume of rock
Let’s try it!

remember: amount of displaced water

\[
\text{displaced water} = \text{weight of rock} = \text{volume of rock}
\]

you won’t forget this
“How can I make sure all students participate?”
“When/which poll results do I show?”
“Will it work at my institution?”
It works here...
...but will it work here?
Will it work at my institution?

FCI normalized gain

\[ g = \frac{S_f - S_i}{1 - S_i} \]
FCI normalized gain

\[ g = \frac{S_f - S_i}{1 - S_i} \]

normalized gain

<table>
<thead>
<tr>
<th></th>
<th>HU</th>
<th>JAC</th>
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<tbody>
<tr>
<td>T</td>
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<td></td>
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<tr>
<td>PI</td>
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Will it work at my institution?
Will it work at my institution?

FCI normalized gain

![FCI normalized gain graph](image)
Will it work at my institution?

FCI normalized gain

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Will it work at my institution?

Exam performance

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<thead>
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<tr>
<td>Final exam score (%)</td>
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<td></td>
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<tr>
<td>0</td>
<td>60</td>
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Will it work at my institution?

exam performance

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<tr>
<td>T</td>
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<td>60</td>
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<tr>
<td>PI</td>
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Will it work at my institution?

student retention

<table>
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<tr>
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<tr>
<td>HU</td>
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</tr>
<tr>
<td>JAC</td>
<td>0</td>
</tr>
<tr>
<td>T</td>
<td>25</td>
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</tbody>
</table>
Will it work at my institution?

student retention

![Bar chart showing dropped course (%) for HU and JAC, with HU having significantly more dropped courses compared to JAC. The chart highlights that HU and JAC are distinct institutions.]
Will it work at my institution?

student retention

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Will it work at my institution?

similar learning gains in different environments
“Can PI be used in small or graduate level classes?”
“How is preparing a PI class different from preparing a lecture-based class?”
Implementing PI & JiTT

preparing for a lecture-based class

assign book for course

prepare lecture

deliver lecture

hand out assignment

repeat with next topic

final assessment
Implementing PI & JiTT

transitioning: where does the effort go?

assign book for course

prepare lecture

deliver lecture

hand out assignment

repeat with next topic

final assessment

prepare reading assignment

review feedback

prepare/select ConcepTests

lead class discussion

hand out assignment

repeat with next topic

final assessment
Implementing PI & JiTT

transitioning: where does the effort go?

assign book for course

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prepare/select ConcepTests

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final assessment
Implementing PI & JiTT

New activities:

1. Reading assignment
2. ConcepTests
Implementing PI & JiTT

“How do I cover everything using this method?”
## Implementing PI & JiTT

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<td>complete</td>
<td>partial</td>
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## Implementing PI & JiTT

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what good is coverage if little is retained?
“What will changing to PI do to my course evaluations?”
“How do I deal with students who resist this new approach to studying?”
After changing, things might get worse before they get better!
Student resistance

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.
From: Eric Mazur <mazur@deas.harvard.edu>
Subject: Written on Wednesday Feb 16, two weeks into the course:

Subject: concerns
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I speak for many of my classmates.
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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!

(Student is Matt Wallenstein from Physics 1b in 2005)
Hello Prof. Mayes,

I wanted to thank you for the excellent instruction you have provided throughout the semester. You are truly inspiring and have helped me throughout the process of learning. I also wanted to thank you for your understanding and support.

You really made a difference in my life. So, thank you!

Thanks,

[Name]
“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.

THANKS
“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”.
"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."
Student resistance

and don’t forget...
Student resistance

and don’t forget…

PI leads to better learning and retention!
“Where can I get examples of good questions?”
Books with ConcepTests:

- Physics (Prentice Hall)
- Chemistry (Prentice Hall)
- Astronomy (Prentice Hall)
- Calculus (Wiley)
... or try searching Google:

<subject> “Peer Instruction”
<subject> ConcepTest
<subject> “Concept Test”
<subject> clickers
Types of questions

- survey
- model testing
- discussion
- select from list
Let’s try it!

Which of the following airlines tries to save fuel by suggesting that its passengers use the bathroom before boarding?

1. Delta Airlines
2. Lufthansa
3. All Nippon Airways
4. British Midland Airways
5. Air France
6. JAL
7. Aboriginal Air Services
8. Aeroflot
9. Are you kidding me? None of the above.
Which of the following airlines tries to save fuel by suggesting that its passengers use the bathroom before boarding?

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Join now!

PeerInstruction.net
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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