## Peer Instruction: <br> Engaging Students in the Classroom



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MECESUPRrogramoon innovative Teaciing and Learning Harvard University
Cambridge, MA, 3 October 2012
we

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Think of something you are good at

Think of something you are good at

How did you become good at this?

## Became good at it by:

1. trial and error
2. lectures
3. practicing
4. apprenticeship
5. other


(1) education

(1) education
(2) PI


## (1) education

(2) PI
(3) test

(1) education
(2) PI
(3) test

## What happens in a lesture?

(1) education

(1) education

## some people talk in their sleep

1) education

## some people talk in their sleep

lecturers talk while other people are sleeping

## (Albert Camus)

(1) education

(1) education

(1) education

(1) education
education is not just information transfer


## 1) education

## education is not just information transfer



## (1) education

## education is not just information transfer



## 1) education



## (1) education



## (1) education


(1) education

R.R. Hake, Am. J. Phys. 66, 64 (1998)

## (1) education

## only one quarter of maximum gain realized


R.R. Hake, Am. J. Phys. 66, 64 (1998)
(1) education

# not transfer but assimilation of information is key 

## conventional problems misleading


(1) education

## conventional problems misleading

Calculate:
(a) current in $2-\Omega$ resistor
(b) potential difference between $P$ and $Q$

(1) education
are the basic principles understood?
(1) education

## are the basic principles understood?

When $S$ is closed, what happens to:
(a) intensities of $A$ and $B$ ?
(b) intensity of C?
(c) current through battery?
(d) potential difference across
$A, B$, and C?
(e) the total power dissipated?

## conventional


conceptual


## (1) education

## conventional


conceptual


## (1) education



## (1) education



## (1) education



## (1) education <br> (2) PI

1. transfer of information
(1) education
(2) PI

# 1. transfer of information 

2. assimilation of that information
3. transfer of information (in class)

## 2. assimilation of that information

## 1. transfer of information (in class)

2. assimilation of that information (out of class)

## Should focius nan THIS!

## 1. transfer of information $>$

2. assimilation of that information (out of class)
3. transfer of information (in class)
4. assimilation of that information (out of class)
5. transfer of information (out of class)
6. assimilation of that information (in class)

## 1. transfer of information (out of class)

2. assimilation of that information (in class)

## question

think
(1) education
(2) PI

(1) education
(2) PI

(1) education
(2) PI

(1) education
(2) PI




1) education

(1) education
(2) PI
thermal expansion
(1) education
(2) PI

(1) education
(2) PI

(1) education
(2) PI

(1) education
(2) PI

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


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

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

1. increases.
2. stays the same.
3. decreases.

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

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

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3. decreases.

## Before I tell you the answer...

(1) education
(2) PI
(3) test

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

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

You...

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

You...

1. made a commitment

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

You...

1. made a commitment
2. externalized your answer

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

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

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

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

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2. stays the same.
3. decreases.

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

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

1. increases.
2. stays the same.
3. decreases.
consider atoms at rim of hole

consider atoms at rim of hole
consider atoms at rim of hole
consider atoms at rim of hole

is it any good?
(1) education
(2) PI
(3) test

## first year of implementing PI



## first year of implementing PI



## first year of implementing PI





R.R. Hake, Am. J. Phys. 66, 64 (1998)

R.R. Hake, Am. J. Phys. 66, 64 (1998)
what about problem solving?
(1) education
(2) PI
(3) test




So better understanding leads to better problem solving!

So better understanding leads to better problem solving!
(but "good" problem solving doesn't always indicate understanding!)

## in a lecture, students...

## in a lecture, students...

1. don't pay utmost attention




in a lecture, students...
2. don't pay utmost attention
3. think they know it
in a lecture, students...
4. don't pay utmost attention
5. think they know it
6. are not confronted with misconceptions
in a lectu"e, sturnts...
7. don't pay utinost attention
8. think they knoy it 3 velop fonted with misconceptions


## an illusion. . .

(1) education
(2) PI
(3) test

## Education is not just about:

- transferring information
- getting students to do what we do


## Education is not just about:

- transferring information
- getting students to do what we do
active participation a must!
not technology, but pedagogy matters
(1) education
(2) PI
(3) test


## First International Asia-Pacific Conference

## on Peer Instruction

## mazur@harvard.edu

Beijing, China
14-16 December 2012

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## National Science Foundation

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