Peer Instruction: discussion and ‘brains-on’ demo

New Faculty Workshop
College Park, MD, 5–6 November 2004
Consider a rectangular metal plate with a circular hole in it.
Let’s try 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.
It’s easy to fire up the audience!
Let’s try it!

The distance between the atoms increases uniformly
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!

We all make mistakes!
Let’s try it!

When we hold a page of printed text in front of a mirror, the text on the image in the mirror runs from right to left:

The New York Times
When we hold a page of printed text in front of a mirror, the text on the image in the mirror runs from right to left:

The New York Times

Why is it that right and left are interchanged and not top and bottom? Because:

1. the mirror is oriented vertically.
2. we have two eyes in the horizontal plane.
3. the Earth’s gravitation is directed downward.
4. a habit we have when looking at images in a mirror.
5. It only appears to run from left to right.
Let’s try it!

It’s “simple” only if you know the answer
Feedback methods

Flashcards: simple and effective
Feedback methods

Flashcards: simple and effective

ABC

Meltzer and Mannivanan, South Eastern Louisiana University
Feedback methods

Infrared transmitters (PRS): easy collection of data
Feedback methods

Infrared transmitters (PRS): easy collection of data

Kristy Beauvais, Concord Carlisle High School
Feedback methods

near future: wireless classroom
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 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?
On a Saturday afternoon, you pull into a parking lot with unme-tered 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
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.

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

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

Requires:

Developing a model
Applying that model
On a Saturday afternoon, you pull into a parking lot with unme-tered 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.

**Assuming people leave at regularly-spaced intervals, how long do you have to wait before someone frees up a space?**
On a Saturday afternoon, you pull into a parking lot with unme-tered 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.

**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**
On a Saturday afternoon, you pull into a parking lot with unme-tered spaces near a shopping area, where people are know 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?
On a Saturday afternoon, you pull into a parking lot with unme-metered 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?

\[ t_{\text{wait}} = \frac{T_{\text{shop}}}{N_{\text{spaces}}} \]
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.

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

Requires:

Using a calculator

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

ConcepTest:

1. Question
2. Thinking
3. Individual answer
4. Peer discussion
5. Revised/Group answer
6. Explanation
Peer Instruction

Individual answers

before discussion

just guessing
not quite sure
pretty sure

count

answer

A
B
C
Peer Instruction

group answers

after discussion

<table>
<thead>
<tr>
<th>Answer</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12</td>
</tr>
<tr>
<td>B</td>
<td>80</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
</tr>
</tbody>
</table>

- **Just guessing**: 0
- **Not quite sure**: 4
- **Pretty sure**: 160

After discussion, the distribution of responses is as follows:

- **Answer A**: 12
- **Answer B**: 80
- **Answer C**: 16
Peer Instruction

ConcepTest data

% correct answers

after discussion

before discussion

no improvement
Peer Instruction

ConcepTest data

% correct answers

after discussion

before discussion

no improvement

0 20 40 60 80 100
0 20 40 60 80 100
Peer Instruction

ConcepTest data

% correct answers

after discussion

before discussion

61% before

no improvement
Peer Instruction

ConcepTest data

% correct answers

95% after

61% before

after discussion

before discussion

no improvement
Peer Instruction

ConcepTest data

The diagram shows the percentage of correct answers before and after discussion. It indicates a 34% gain.
Peer Instruction

ConcepTest data

![Graph showing the relationship between before and after discussion percentage of correct answers.](image-url)
ConcepTest data
optimum range: 30–70%
Research: providing the basis for change

who benefits from the ConcepTests?

![Scatter plot showing the relationship between individual CT score and final grade.](scatter_plot.png)
Research: providing the basis for change

who benefits from the ConcepTests?
Research: providing the basis for change

even the best students are challenged

![Graph showing a scatter plot with a trend line. The x-axis represents the final grade (%) ranging from 50 to 100, and the y-axis represents the individual CT score (%) ranging from 0 to 100. The data points are scattered across the graph, indicating a positive correlation between final grades and individual CT scores.]
Research: providing the basis for change

even the best students are challenged
Why does it work?

Students:

- promotes thinking
- helps uncover and address misunderstanding
- boosts confidence
Why does it work?

Students:

• promotes thinking
• helps uncover and address misunderstanding
• boosts confidence

Faculty:

• change of format, not content
• with existing questions, little effort
• adaptable
Funding:

National Science Foundation

for a copy of this presentation:

http://mazur-www.harvard.edu