Make Clickers Work for You

FACILITATION TIPS AND TECHNIQUES

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Credit should be given to: Stephanie Chasteen and the Science Education Initiative at the University of Colorado, http://colorado.edu/sei
What do you teach?

A. Science  
B. Engineering or Math  
C. Social sciences  
D. Humanities  
E. Other  

Show of hands
Have you used response systems (clickers) in your teaching?

A. Not at all, and I haven’t seen them used
B. Not at all, but I’ve observed their use somewhat
C. I’ve used them a little
D. I’ve used them a lot
E. I could be (should be?) giving this workshop

Start by taking a clicker and turning it on. If the green light flashes, your vote has been counted.
How familiar are you with “Peer Instruction”

A. Fairly familiar, and I like it
B. Fairly familiar, but I’m not sure that I like it
C. I’ve heard of it but only have a vague idea what it is
D. Not familiar at all
E. Not sure
Quick poll

A. I *need* the workshop to end on time
B. I *prefer* the workshop to end on time
C. I don’t mind staying ~10 mins late if we run over
Introducing Us

Science Education Initiative

http://colorado.edu/SEI

Applying scientific principles to improve science education – What are students learning, and which instructional approaches improve learning?

Physics Education Research Group

http://PER.colorado.edu

One of largest PER groups in nation, studying technology, attitudes, classroom practice, & institutional change.

Blogger

http://blog.sciencegeekgirl.com
Why question?

- How many times have you given a lecture and found that students hadn’t followed you?
- Can you rely on students to ask questions if they don’t understand something?
- Can you rely on students to know if they don’t understand something?
- What are the benefits of questioning?
The image contains a cartoon illustration of a classroom scene. A professor is pointing to a board where the function $f(x) = e^{-x^2}$ is written. The professor says, "So clear..." with a thought bubble showing a bell curve. The students are engaged with the lesson, and one student is thinking, "$p - x^2$?" Another student, "EEE... Enn?"

In the background, a student is thinking, "$2 = 2$ cd floor $x = 1st$ floor $e = basement$." Another student is thinking, "2 more minutes..." and a third student, "Zzzz..."
What is special about clicker questions?

- Similar goals as other types of questioning techniques
- Multiple choice
- Anonymous (to peers)
- Every student has a voice – the loud ones and the shy ones
- Forced wait time
- You can withhold the answer until everyone has had time to think (choose when to show the histogram)

What does this tool help us to do?
Clickers are a tool for questioning

But not a magic bullet!

Don’t equate the pedagogy with the technology.
So what IS the pedagogy?
Why use peer instruction?
An outline of Peer Instruction.
Anatomy of Peer Instruction

* See also: Peer Instruction, A User’s Manual. E. Mazur.
Burning questions?

* See also: Peer Instruction, A User’s Manual. E. Mazur.
WHAT DO WE WANT?
EVIDENCE-BASED CHANGE
WHEN DO WE WANT IT?
AFTER PEER REVIEW
Peer instruction helps students learn

Research shows that:

- Students can better answer a similar question after talking to their peers
- Peer discussion + instructor explanation works better than either one alone
- Students like peer instruction
- Peer instruction outperforms traditional lectures on a common test

See http://STEMclickers.colorado.edu for various references
U. Colorado clicker resources...

**Videos of effective use of clickers**

http://STEMvideos.colorado.edu

2-5 mins long

**Clicker resource page**

http://STEMclickers.colorado.edu

- Instructor’s Guide
- Question banks
- Workshops
- Literature / Articles
Example question: Physics

Which superpower would you rather have? The ability to...

A. Change the mass of things
B. Change the charge of things
C. Change the magnetization of things
D. Change the boiling point of things

Question: Ian Beatty, UNC Greensboro
Image: Thibault fr on Wikimedia
Example question: Literature

If Homer wrote the *Iliad* today, Stanley Fish and Harold Bloom would argue, respectively, whether the work should be categorized as:

A. Existential vs. Romantic  
B. Postmodern vs Classical  
C. Modern vs Romantic  
D. Postcolonial vs Modern  
E. Preliterate vs Postliterate

Origin unknown
Example question: Math

Your sister in law calls to say that she’s having twins. Which of the following is the most likely? (Assume she’s having fraternal, not identical, twins)

A. Twin boys  
B. Twin girls  
C. One girl and one boy  
D. All are equally likely
Example question: History or Ethics

If you were a judge, how would you assess the “responsibility” of the U.S. Government, for what happened in the world between 1933 and 1945?

A. Not responsible
B. Minimally responsible
C. Responsible
D. Very responsible
I think the toughest thing about using clickers and peer instruction in class is / will be:

A. Writing good questions
B. Getting students to really think about the questions
C. Getting students to share their reasoning with the whole class
D. The same students always respond in whole class discussion
E. It takes too long / I have a lot of content to cover
Honestly, I think that I’m most likely to modify this technique of peer instruction to suit me and my students. I know that there are at least ____ parts of the technique that I’ll be changing:

A. None  
B. One  
C. Two-three  
D. Four or more
Is there a problem with modifications?

I won’t tell you how to teach. You’re smart & you care about instruction.

Be strategic about modifications. Know the research.
Some research on modifications

- 63.5% of faculty (in physics) say they are familiar with Mazur’s Peer Instruction
- 30% report that they use Peer Instruction
- 50% of those use Peer Instruction in the way described by developers
- Often dropped are:
  - Student discussion
  - Use of conceptual questions
  - Whole-class voting

Is this a problem? Probably.

Exercise #1: Core Philosophies

What are the underlying principles that make this work?

* See also: Peer Instruction, A User’s Manual. E. Mazur.
Some core philosophies of mine

Clicker questions are an integral part of my lecture

Students learn by
- ... teaching each other
- ... articulating their ideas

It’s important for me to
- .... hear student ideas
- ... know what my students understand

I value and respect student ideas

I want students to
- ... know that I value student ideas
- ... feel safe sharing their ideas
Exercise #2  Challenges in the Classroom

- You ask students a question, and ask them to discuss.
- You then ask them to share their answers and reasoning in a whole-class discussion.
- What could possibly go wrong? 😊

In groups of 3-5 brainstorm some of the challenges you imagine in using this.

**Brainstorm some solutions that are in line with your core philosophies**

Write on your handout and then scribe on board.

5 mins
1. Ask Question

What are some challenges/philosophies/solutions related to asking the question?

**Philosophies**
- Questions are integral to lecture
- Students can learn by considering a question

**Best practices**
- Ask several times during lecture
- Ask challenging, meaningful questions
- Don’t post until ready & give time to read
When can we ask questions?

BEFORE
Setting up instruction
E.g.: Motivate
Assess prior knowledge
... (handout!)

DURING
Developing knowledge
Application
Elicit misconception
...

AFTER
Assessing learning
Relate to big picture
Demonstrate success
...

Credit: Rosie Piller and Ian Beatty.
2. Peer Discussion

Philosophies:
• Students learn through discussion
• Students need to know that you value their ideas & that it’s safe to share

What are core philosophies in peer discussion?

What are challenges / how can you help make it work?

Solutions:
• Make it clear why you’re doing this
• Circulate and ask questions / model
• Use questions they want to discuss
• Allow enough time (2-5 mins)
• Focus on reasoning in wrap-up
Talking brings convergence

Eric Mazur - Harvard U.

Before discussion

Why do you think this happens?
(A) Students are getting answers from
(B) They’re learning from their discussions
(C) They just needed more time to think about it

Mazur, 1997
The hypothesis: If students learn from peer discussion, they should show better performance on a similar question. Ask a second, similar question without any instructor input: Q2

Undergrad introductory genetics course. 16 Q1/Q2 pairs.

Research by Michelle Smith, Bill Wood, Wendy Adams, Carl Wieman, Jenny Knight, Nancy Guild, Tin Tin Su, MCDB.

Are they learning from peers?

1) Students answer Q1 individually.

2) Students talk to neighbors and answer Q1 again (Q_{1_{AD}} = Q_1^{"After Discussion"}).

3) Students answer Q2 individually. Q2 tests same concept as Q1.

Then explain answers to Q1 and Q2

n = 350 students

Can students answer difficult questions correctly after discussion?

Very few students knew correct answer to Q1, but after discussion, many more answer correctly: students are constructing their own knowledge.

Student buy-in is key!
3. Wrap-Up Discussion

Philosophies? Challenges? What might you do to facilitate an effective wrap-up discussion?

**Philosophies:**
- Student ideas are important
- Students need to feel safe

**Solutions:**
- Establish culture of respect
- Consider whether to show the histogram immediately
- Ask multiple students to defend their answers
- Emphasize reasoning: Why are wrong answers wrong and why right answer is right
Giving the answer stops student thinking!
Effects of increased wait time

- **Changes in student behavior:**
  - More students respond
  - More students respond without being asked (unsolicited)
  - Student responses are longer
  - More alternative explanations are offered
  - Student confidence increases
  - There are more speculative responses
  - Students ask more questions

- **Other changes (on teacher!):**
  - Quantity of questions decreased
  - Quality of questions increased
  - Expectations of slower students were revised
  - Teacher reactions to answers were more appropriate

Rowe, Mary Budd (1974)
Other things we haven’t talked about?

- Other challenges / solutions / philosophies?
Action Plan

- Take a few minutes to write down your action plan to implement ideas you heard about in the workshop
U. Colorado clicker resources...

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- Instructor’s Guide
- Question banks
- Literature / Articles

PLUS past workshops
And all workshop materials

I can help you with your institution’s workshops too