Make Clickers Work for You

FACILITATION TIPS AND TECHNIQUES

Dr. Stephanie V. Chasteen
Dr. Steven Pollock
Physics Department
&
Science Education Initiative
Univ. of Colorado at Boulder

http://colorado.edu/sei

Web and blog: http://sciencegeekgirl.com
Email: stephanie.chasteen@colorado.edu
This presentation is copyrighted under the Creative Commons License Attribution Non-Commercial Share-Alike

That means: Please watch it, share it, and use it in your presentations. Just give us credit, don’t make money from it, and use the same kind of license on the works that you create from it.

More information about Creative Commons licenses here: http://creativecommons.org/licenses/

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

A. Natural sciences
B. Social sciences
C. Humanities
D. Arts
E. Languages
F. 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

Take a clicker & turn 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
Introducing Me

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
Agenda

1. Thinking about questioning
2. About clickers and peer instruction
3. Challenge #1: Writing/assembling question
4. Challenge #2: Getting students talking
5. Challenge #3: Effective whole-class wrapup
6. Other challenges/ action plan
1. Thinking about questioning
2. About clickers and peer instruction
3. Challenge #1: Writing/asking question
4. Challenge #2: Getting students talking
5. Challenge #3: Effective whole-class wrapup
6. Other challenges/ action plan
Exercise #1: Why question?

1. **Why** do we question our students?
2. **When** might you use questioning in your classes?
3. **For what purposes** might clickers be an appropriate questioning tool?

Discuss in groups of 2-3 for 5 minutes.

(May make notes in your handout)
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.
Agenda

1. Thinking about questioning
2. About clickers and peer instruction
3. Challenge #1: Writing/asking question
4. Challenge #2: Getting students talking
5. Challenge #3: Effective whole-class wrapup
6. Other challenges/ action plan
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)
Gallery Walk

- With a partner, look at the “example questions” trios on the wall.
- What do you think an instructor would be trying to accomplish with such questions?
- Jot down any ideas on the sheet
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.
Let’s try it

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
Burning questions?

* See also: Peer Instruction, A User’s Manual. E. Mazur.
U. Colorado clicker resources...

Videos of effective use of clickers
http://STEMvideos.colorado.edu

Clicker resource page
http://STEMclickers.colorado.edu

- Instructor’s Guide
- Question banks
- Workshops
- Literature / Articles
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 of question works better than either one alone
- Students like peer instruction
- Peer instruction classes outperform traditional lectures on a common test

See http://STEMclickers.colorado.edu for various references
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
Let’s try it

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
I won’t tell you how to teach. You’re smart & you care about instruction. But realize that modifications may change the effectiveness of the technique.

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

- 63.5% of faculty (in physics) say they are familiar with 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 #2: Core Philosophies

In groups: 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
Challenges?

I think the toughest thing about using clickers and peer instruction in class is / will be:

Brainstorm in your groups, and write down challenges related to:
1. Asking/writing questions
2. Student peer discussion
3. Whole class wrap-up discussion
4. Other

Write them on each relevant “challenge” sheet and post up on board when done. 5 minutes.
Agenda

1. Thinking about questioning
2. About clickers and peer instruction
3. **Challenge #1: Writing/asking question**
4. Challenge #2: Getting students talking
5. Challenge #3: Effective whole-class wrapup
6. Other challenges/ action plan
1. Asking Question. Philosophies? Challenges?

**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

Handout/worksheet / whiteboard
Question-writing tips

- Move away from simple quizzes
- Use questions that prompt discussion
- Use questions that emphasize reasoning or process
- Use clear wording
- Use tempting distracters
- Use questions for a variety of instructional goals
- Use questions at a mixture of cognitive depth
- Ask challenging questions – don’t just test memorized facts

See handout
Effective multiple-choice questions have believable “distracters.”

1) Talking with other instructors that have taught the course in the past.
2) Talking with your students one-on-one before class, after class, during office hours.
3) Using student responses to open-ended questions that you include in HW and exams.
4) Asking your students to come up with answers that will be used as the choices.
5) Use researched and documented student misconceptions.

D. Duncan, Univ. of Colorado
Remember the instructional goals for clickers when writing 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.
What causes the seasons?

A. The change in the earth’s distance from the sun during the year
B. The tilt of the earth’s axis
C. Changes in the sun’s brightness
D. Changes in clouds
E. None of the above
What causes the seasons?

A. The change in the earth’s distance from the sun during the year
B. The tilt of the earth’s axis
C. Changes in the sun’s brightness
D. Changes in clouds
E. None of the above

Can we make a better question on the SAME topic? Yes...
Use questions at a variety of cognitive depth

Do the questions you use intellectually challenge your students or simply assess their factual knowledge?

[Diagram showing levels of cognitive depth: Remembering, Understanding, Applying, Analyzing, Evaluating, Creating]

Higher order

Lower order
Exercise #4: Rate and Bloom it up

- Use the Bloom’s Taxonomy worksheet to rate the Bloom’s level of this question
- Use the verbs on the detailed Bloom’s handout to “Bloomify up” the level of this question

What causes the seasons?

A. The change in the earth’s distance from the sun during the year
B. The tilt of the earth’s axis
C. Changes in the sun’s brightness
D. Changes in clouds
E. None of the above

5 minutes
What would happen to the seasons if the earth’s orbit around the sun was made a perfect circle (but nothing else changed) ?

A. There would be no seasons
B. The seasons would remain pretty much as they are today
C. Winter to spring would differ much less than now
D. Winter to spring would differ much more than now

Much better question. Requires reasoning!
Share out

- What did you learn in this process?
- What worked well, what was challenging?
- How might you go about writing questions in your class?
1. Thinking about questioning
2. About clickers and peer instruction
3. Challenge #1: Writing/asking question
4. **Challenge #2: Getting students talking**
5. Challenge #3: Effective whole-class wrapup
6. Other challenges/ action plan
2. Peer Discussion. Philosophies? Challenges?

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

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 the 'smart' kids.
(B) They're learning from their discussions.
(C) They just needed more time to think about it.
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_{1AD} = Q1“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!
Agenda

1. Thinking about questioning
2. About clickers and peer instruction
3. Challenge #1: Writing/asking question
4. Challenge #2: Getting students talking
5. Challenge #3: Effective whole-class wrapup
6. Other challenges/ action plan
3. Wrap-Up Discussion. Challenges?

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!
Agenda

1. Thinking about questioning
2. About clickers and peer instruction
3. Challenge #1: Writing/asking question
4. Challenge #2: Getting students talking
5. Challenge #3: Effective whole-class wrapup
6. Other challenges/ action plan
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
Thanks!

Clicker resource page  http://STEMclickers.colorado.edu

• Instructor’s Guide
• Question banks
• Literature / Articles
  PLUS past workshops
  And all workshop materials

I can help you with your institution’s workshops too

Handouts will be at http://blog.sciencegeekgirl.com

Email me at stephanie.chasteen@colorado.edu