Teaching faculty about effective use of clickers

Tips on effective professional development for faculty who are learning to use classroom response systems

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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
1. The **goals** of our faculty professional development

2. What is **peer instruction**?

3. How do we make an **effective PD** experience so instructors are more likely to use peer instruction and use it successfully?
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 & Consultant

http://sciencegeekgirl.com

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Simple, reliable classroom response systems

www.iclicker.com
1. The **goals** of our faculty PD
2. What *is* **peer instruction**?
3. How do we make an **effective PD** experience so instructors are more likely to use peer instruction and use it successfully?
The typical pattern...

- (we) Tell them how to do it
- (they) Try it
- (they) Fail or fade
- (we) Repeat (louder!)

In physics, half of faculty only use Peer Instruction for a single semester

Chat discussion: Why do you think this happens? What are your solutions?
What goes wrong?

We need to help faculty develop a pedagogical strategy, and face challenges that come up during implementation.
Goals of our faculty PD

We want to help faculty to....

- Recognize the benefit of using clickers and peer instruction to promote student engagement
- Begin to put together a pedagogical strategy for using clickers, including thoughtful question-writing
- Be prepared for some common challenges and strategies to overcome them
- Keep using Peer Instruction over time!

*Technical training is separate from pedagogical training*

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Effective PD is....

- Collaborative
- Active and hands-on
- Discipline-oriented
- Instructor-driven
- Respectful
- Research-based
- Sustained over time

$x^2 + 1$
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

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U. Colorado resources for giving workshops

- Go to STEMclickers.colorado.edu
- Look for “Workshop Materials”
  - Example questions and handouts
  - Links to past workshops
  - Will be updated soon!
- See also blog.sciencegeekgirl.com
- Look for “Presentations”
  - Will have latest workshop materials and handouts
- You can use any of our materials with attribution!
Agenda

1. The **goals** of our faculty PD
2. What *is* **peer instruction**?
3. How do we make an **effective PD** experience so instructors are more likely to use peer instruction and use it successfully?
What is Peer Instruction?

POLL:
Do you know what peer instruction is (in the context of clickers)?

A. Yes
B. No
C. Maybe, not sure

i.e., does this look familiar?

Mazur(1996), Peer Instruction

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Anatomy of a clicker question

...Lecture...

Ask Question

(May vote individually)

Peer Discussion

Debrief

Vote

* See also: Peer Instruction, A User’s Manual. E. Mazur.*
1. Asking Question

Why do it?
• Students can learn by considering a question
• Breaks up lecture
• Learning is in the application of knowledge

Best practices
• Ask several times during lecture
• Ask challenging, meaningful questions
• Questioning is integral to lecture
A small acorn over time can grow into a huge oak tree. The tree can weigh many tons. Where does most of the mass come from as the tree grows?

A) Minerals in the soil  
B) Organic matter in the soil  
C) Gases in the air  
D) Sunlight

Common misconception leads to answers (A) and (B). Correct answer: C
2. Peer Discussion

**Why do it?**
- Students learn more deeply by teaching each other
- Makes them articulate answer
- Lets you see inside their heads

**Best Practices:**
- 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
- Show students you value their ideas
3. Wrap-Up Discussion.

**Why do it?**
- Student ideas are important
- Instructor feedback is important
- So students know answer and reasoning by the end

**Best practices:**
- Establish culture of respect
- Don’t always show the histogram immediately
- Ask multiple students to defend their answers
- Emphasize reasoning: Why are wrong answers wrong and why right answer is right
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
Question break

...Lecture...

Debrief

Ask Question

Vote

(May vote individually)

Peer Discussion
Agenda

1. The goals of our faculty PD
2. What is peer instruction?
3. How do we make an effective PD experience so instructors are more likely to use peer instruction and use it successfully?

BP

This symbol indicates conscious attempt to use Best Practices in PD (Collaborative, Active, Respectful, Hands-on, Teacher-driven, Research-based)
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.

“Clickers” are really just a focal point

We aim to help instructors:

- Use student-centered, interactive teaching techniques
- By the use of a tool (clickers) which makes a transition to that pedagogy easier

Our talks are “how people learn” talks in disguise. 😊

Bransford, Brown, Cocking (1999), *How People Learn*
How we try to accomplish goals:

- Give a clear **introduction** to peer instruction. *What does it really look like?*
- Give **experience** in peer instruction. *How does it feel as a student? As an instructor?*
- **Why** does it work? *The research.***
- **Respect** their experience. *Answer their questions/challenges, rather than being gung-ho salesman.*
- Provide opportunity **for practice and feedback.** *Especially in writing questions and facilitation.*
- **Practice what we preach.** *Do all this in a student-centered, interactive environment. Don’t lecture about how not to lecture.*
Key aspects of our workshops

1. Focus discussion on questioning
2. Show some examples early
3. Give explanation of clickers and peer instruction (with a practice question and time for questions)
4. Pedagogical philosophies (optional)
5. Common challenges
6. Writing great questions
#1: Focus the discussion on questioning

- If you start with technology, they focus on technology.
- Frame it as a workshop about questioning.
- Don’t equate the technology and the pedagogy
Warm Up #1 to Focus on Questions

- Why do we ask questions? When might we use questions? What is the purpose of clicker questions?

Warm up activity #1
Discuss in small groups, making notes in handout. Then share-out. Discuss differences/similarities between clicker questions and other types of questions.
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.
Warm Up #2: Clicker question about questions

The toughest thing about asking questions in class is...

A. Writing good questions
B. Getting students to really think about them
C. Getting students to answer the questions / Nobody responds
D. The same students always respond / Not everybody responds
E. It takes too long / I have a lot of content to cover

This is an example question about questions. Have others? Share in the chat!
Warm Up #3: Question goals

- If sufficient time, can have them discuss goals of a question they draft

**Warm up activity #3**
Watch a short mini lecture and write up one or two questions you could ask students to assess learning (not multiple choice).

What is the goal of your question?
A. Setting up instruction
B. Developing knowledge
C. Assess Learning
D. Something else
#2. Early in workshop: Show some examples

- It seems important to show examples early though this can also be done when discussing features of good questions.
- This broadens their thinking from the start, and gives them some concrete examples before abstract pedagogy.
Gallery Walk Activity
Post questions around room. Often in “trios” of similar question types. Circulate with buddy. “What would an instructor be trying to accomplish with such questions?”
Possible example question activity #2

**Question Rating Sheet**
Give a sheet with various questions and ask them to rate them on a 4-point scale. Discuss.

*This is best done after discussing features of good questions.*
Possible example question activity #3

**Powerpoint**
Show a series of questions via Powerpoint and discuss.

*This has never worked very well for me. The audience tunes out after more than 3 questions, and it’s hard to get a wide range. Simultaneous contrast seems to work better.*
#3. Introduction to clickers and peer instruction

- Give explanation of Peer Instruction pedagogy
- Show them what it really looks like
- Allow time for questions afterwards

*Chat discussion:* Share any strategies or resources you have for giving an introduction to clickers and peer instruction
Introduction to clickers and peer instruction

- Give explanation of Peer Instruction pedagogy

Show video
“Teachers and students speak” for the skeptical audience

“Anatomy of a clicker question” for the savvy audience (early poll questions help you know your audience)

STEMvideos.colorado.edu
Introduction to clickers and peer instruction

- What about showing data and research?
- I at least mention it, to show this isn’t just cool gimmick
- But faculty typically not convinced by data – use it to justify practices that make sense to them intuitively
Introduction to clickers and peer instruction

- **Allow time for questions**
- Make sure this happens early in the workshop (or else these questions will be burning in their minds)
- Sit down to indicate that this is time for a “chat”
How do you choose an authentic question to practice peer instruction, that your audience can all understand, and thus see the value of discussion?

Got any good practice questions? Share them in the chat!
Practice question #1: Superpowers

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

No one right answer encourages discussion.

Question: Ian Beatty, UNC Greensboro
Image: Thibault fr on Wikimedia
Practice Question #2: Twins

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

Good question, but faculty typically don’t come to consensus, and K12 teachers have trouble reasoning through it.
Practice Question #3: Math

A tennis racket and can of balls together costs $110. The tennis racket alone costs $100 more than the can of balls. How much does the can of balls alone cost?

A. $5
B. $10
C. $11
D. $100
E. None of these

Most people at first glance say that the balls cost $10. Silent vote: 35% right. After discussion: 75%. (Right answer is A).

Courtesy Steven Pollock, CU-Boulder
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

Works well, but be prepared to have a long discussion about challenges. Leads well into challenges.
#4. Optional: Pedagogical Philosophy

- Didactic explanation of best-practices alone seems preachy and shallow
- One option is to have an explicit discussion of the underlying pedagogical principles and philosophies
Core Philosophies exercise

What are the underlying principles that make this work?

Discuss in groups, and then share-out.

Use these as guiding principles when discussing best practices
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
#5: Challenges and Best Practices

- Important to address common hurdles

Chat discussion: What do you think are the main Peer Instruction sticking points for faculty?
Discuss Peer Instruction Challenges

1. Small Groups
What are the challenges they foresee? What are some solutions? Share out.

2. Pre-seeded sheets
Have common challenges written down on sheets of paper, give one to each group. Each group discusses, brainstorms, and share-out.

3. Discuss challenges associated with each aspect of PI
• Writing questions / Peer discussion / Wrap-up discussion

4. Role Play
• Give groups a question to try teaching. Seed a “ringer” group to mess it up.
My current approach

Challenges Brainstorm

Brainstorm in your groups the challenges related to:
1. Writing/asking questions
2. Student peer discussion
3. Whole class wrap-up
4. Other

Write on the board

I then go through these three aspects of Peer Instruction, discussing challenges together and presenting some of my best-practices as answers to those challenges.
What are the challenges?

**POLL:** Which do you think is the most common challenge cited by teachers?

A. Writing good questions
B. Technical issues
C. Tough to get students to discuss questions
D. I have too much content to cover / takes too much time
E. Something else

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#6: Writing Great Clicker Questions

- This is instructors’ first common hurdle
- This can be an entire workshop
Didactic: 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

Also provided on handout
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.
Cognitive Depth: Bloom’s Taxonomy

Do the questions you use intellectually challenge your students or simply assess their factual knowledge?
Activity #1: Writing Clicker Questions

Write your own question and workshop to improve

Participants write a question aimed at a particular pedagogical goal (i.e., “setting up instruction”) or learning goal (e.g., “students should be able to...”). Then swap with a neighbor. Work to improve it.

This only works well in workshops focused on question writing. Otherwise, instructors don’t want to take the time.
Activity #2: Writing questions

Rate and Swap

Participants take their question and rate it on Bloom’s Taxonomy (right). Swap with neighbor. Work to “Bloomify up” the level of the question.

This only works well in workshops focused on question writing. Otherwise, instructors don’t want to take the time.
Activity #3: Writing questions

Rate existing question

With partner, take an existing question and work to improve it. Rate it on Bloom’s. “Bloomify up” the level.

Tough to find questions to match all disciplines, or that is understandable by all disciplines.
What do you think?

What additional ideas, questions, or concerns do you have about teaching effective clicker use?

Do you think this will work with your faculty?
To Learn More... (this webinar can’t do it all!)

Watch expert users

Read books

Bruff *Teaching with Classroom Response Systems*
Mazur *Peer Instruction*
Duncan *Clickers in the Classroom*
Asirvatham *Clickers in Chemistry*

Watch our videos; get resources

Contact me

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