Make clickers work for you...

Dr. Stephanie Chasteen & Trish Loeblein
University of Colorado at Boulder
And Evergreen High School

Have you used clickers before?
A) Yes, lots
B) Yes, a little
C) No
D) No & my school doesn’t have clickers
E) N/A: I don’t teach

Take a clicker & turn it on
If the green light flashes, your vote has been counted
The Science Education Initiative

Applying scientific principles to better understand how people learn

- Within University of Colorado - Boulder
- Physics, biology, chemistry, geoscience, molecular biology

U. of Colorado  
Science Ed. Initiative  
NSF
Physics Education Research @CU

Faculty Collaborators:
- Michael Dubson
- Noah Finkelstein
- Susan Jurow
- Ben Kirshner
- Valerie Otero
- Kathy Perkins
- Steven Pollock
- Patricia Rankin
- Paul Beale
- Carl Wieman

Post Docs & Scientists:
- Wendy Adams
- Steve Goldhaber
- Laurel Mayhew
- Archie Paulson
- Noah Podolefsky

Ph.D. Students:
- Chandra Turpen
- Charles Baily
- Lauren Kost
- Ben Spike
- Kara Gray
- Heidi Iverson
- May Lee
- Mike Ross
- Robert Talbot

* = Science Education Initiative

This material is based upon work supported by the Science Education Initiative and National Science Foundation Grant # 0737118.
Workshop goals

You will be able to:

- Make informed choices about how to implement clickers
- Explain how research on learning supports clicker use
- Write a clicker question for different goals
- Create an experience for yourself where using clickers is fun and personally rewarding
I am a...

A) Teacher
B) Administrator
C) Technology coordinator
D) Other
I teach...

A) Elementary School
B) Middle School
C) High school
D) College or University
E) Other/I don’t teach
Discussion

Clicker technology

- What aspects of clicker technology makes it helpful for classroom use?
- Questions about how this works?
- Challenges?
Clickers in large lectures at University of Colorado

% large lecture sections
What are the benefits of using clickers?
Clicker question cycle

1. Learning goals
2. Ask question
3. Peer discussion
4. Vote
5. Whole class discussion
6. Interpret & use results
Compare it to…

- Youtube video here
Let’s try it

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

A) Twin boys
B) Twin girls
C) One girl and one boy
D) All are equally likely
The Message:
The answer is NOT important. The strategy for getting the answer is the goal.

Strategy:
• What is the probability that one egg will be a boy or a girl? (Think coin flips - heads or tails)
• What is the probability that both of those things happen at once? (Two eggs = two coins to flip)

The student must be convinced that:
• understanding strategies = high exam score.
• remembering answers to specific questions = low exam score.
Think-pair-share

The clicker question cycle

- What are some of the *challenges* in this cycle (asking question / peer discussion / voting / class discussion)?
Novice vs Expert

\[ f(x) = e^{-x^2} \]
Two way conversations with students are vital...

...because students can misunderstand what we say

Traditional model of education...

Content → Student

transmissionist
It’s built into our (university) classes
We can do better!

A different model of learning

Content transmitted Student

Content actively constructed

actively engaging students is important
One study (Hake, 1998) showed that using traditional lecture methods, students only learned about 25% of what they didn’t already know.

But by actively engaging students... based on what they know....

Learning gains ranged from 25% to 75%.
If interactive engagement works...

*How does it play out in the classroom?*

<table>
<thead>
<tr>
<th>Goal</th>
<th>Interactive engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedagogy</td>
<td>Question-driven instruction</td>
</tr>
<tr>
<td>Tool</td>
<td>Clickers</td>
</tr>
</tbody>
</table>
• Clickers aren’t a magic bullet.
• How well they work depends on how they’re used.
The feature of clickers that is most important to me is...

A. “Anonymous” responses
B. Instant feedback to teacher and students
C. Focuses class on a question and forces them to commit to answer
D. Makes your student’s thinking visible
E. Models reasoning and oral presentation
Basic use of clickers...

• Only for quizzes or testing
• Only occasionally or at set times
• To check for basic comprehension

Better use of clickers...

• Frequent and integrated into class
• Require or encourage peer discussion
• Mix of difficulty
• Use results to direct instruction
Modes of clicker use

1) quiz on the reading
2) require recall of lecture point
3) elicit/reveal prior ideas
4) require prediction of demo, expt, sim.
5) test conceptual understanding
6) transfer/implication
7) relate different representations
8) do a calculation
9) survey students
The clicker question cycle

1. Learning goals
2. Ask question
   • Peer discussion
   • Vote
   • Whole class discussion
   • Interpret & use results
Asking the question

- **Focuses** students’ attention on important ideas
- Allows students to try **applying** ideas they just heard
- Allows students to make **connections** between ideas
- Gets students thinking about **asking questions** themselves

**Design questions to achieve your objectives.**

What is its role in the student’s learning process?
Example questions

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
You’re on a cart, initially at rest, throwing balls at a partition that is rigidly mounted on the front of the cart. If the balls bounce straight back, as in the figure, then is the cart put in motion?

A. Yes, left  
B. Yes, right  
C. No  
D. Don’t know
What is the function of the flared bell on the end of a recorder?

a) It aids in projecting the music
b) It slows the speed of the sound being produced
c) It lowers pitch of the note
d) It is mostly for visual effect
e) Some other important function
Question-writing challenges

- Be patient, it gets easier
- How do you find good “wrong answers”? 
- Making it “hard enough”
- Clear wording
The clicker question cycle

1. Learning goals
2. Ask question
3. Peer discussion
4. Vote
5. Whole class discussion
• Interpret & use results
Peer Discussion

• **Actively engages** students in thinking about and discussing the concept/skill/idea

• Gives students an opportunity to **explain and defend** their reasoning, and evaluate others reasoning (to engage in scientific argument)

• Gives the **teacher a chance to hear** what students are thinking (ask students or listen to group discussion).

• Gives **students a chance to voice** their and hear others’ questions (students are not alone in their confusion).

• Builds a **collaborative** learning community

• Others????
The role of talk

- Eric Mazur
- Harvard U.
Whole-class Discussion

• **Hide the histogram** until after discussion (unless there is a mixed vote)

• Teacher hears **students reasoning** for various answers. Hear from more than one student.

• **Students hear and respond** to each others ideas

• Opportunity to **emphasize and support reasoning** as important
  
  “Why might someone pick B? Why is that answer tempting?”

• **Students know correct answer and reasoning** by the end. (Important … correct reasoning for answer is NOT typically obvious to students.)
Whole class discussion:
Giving the answer stops student thinking

- Do not reveal answer immediately
- Do not reveal histogram immediately.
- Get students to share reasoning
- Understanding why wrong answers are wrong is as important as why the right answers are right
- Value reasoning above the right answer. (The right answer for the wrong reason is useless).
Grading

We recommend:
• Mostly participation credit (eg., 2 points)
• Small amount of credit for right answer. (eg., 1 point)

• Keeps students trying
• Focuses on process not the right answer -- low stress
• This is formative assessment
Tips for success

- Be clear (to students and yourself) why you’re using clickers
- Use them frequently
- Ask questions at a variety of levels of difficulty
- Encourage discussion and listen to students
- Use a variety of techniques
- Start small
It’s not about our teaching, it’s about student learning.
PLEASE RETURN YOUR CLICKER!

For more information...

- **STEMclickers.colorado.edu** has videos and resources, including clicker guide

*Stephanie.Chasteen@Colorado.EDU*