Clicker Choreography

Courtesy of Cynthia Heiner and Peter Newbury

To be effective, the instructor needs to run the peer instruction in a way that gives students sufficient time to think about, discuss, and resolve the concepts. We want students to participate without ever having to stop and think, "What am I supposed to do now?"

---

1. Present the question. You may not want to read it out loud.

Reasons for not reading the question out loud:
- your voice may give away key features or even the answer
- you might read the question you hoped to ask, not the words that are actually there
- the students are not listening anyway – they're trying to read it themselves and your voice may, in fact, distract them

---

2. "Please answer this on your own"

Goals of the first, solo vote:
- get the students to commit to a choice in their own minds
- get the students to commit to a choice so they'll be curious about the answer
- get the students prepared to have a discussion with their peers, if necessary

If they discuss the question right away:
- students are making choices based on someone else's reasoning
- those students cannot contribute to the peer instruction as they have no ideas of their own

Students may be reluctant to quietly think on their own. After all, they have a better chance of picking the right choice after talking to their friends.

If you're going to impose a certain behaviour on the students, getting their "buy-in" is critical. Explain to them why the solo vote is so important. Explain it to them early in the term and remind them when they start drifting to immediate discussions.

http://STEMvideos.colorado.edu

---

3. Don't start the i>clicker poll. Instead give the students sufficient time to make a choice. What is *sufficient*?

- Turn to the screen, read and answer the question as if you are one of your students.
- Another possibility: keep facing the class, helping those with confused stares.
- Another possibility: model how to think about the question by "acting it out."
- When you notice students picking up their clickers and getting restless, they are prepared to vote.

---

4. When *you* have made a choice or when you see the class getting restless, ask the students, "Do you need more time?"

If many students are not ready to vote, they will not have committed to a choice and will be unprepared to discuss the question. Some students may be uncomfortable asking for more time. Make it clear, from the first class, that you'll honour the request with no repercussions to the student who asked.

5. **"Yes!"** Give them a few more seconds.
"[silence]" Ask them to prepare to vote.

6. **"Please vote."**

If you've given them sufficient time to commit to a choice, the voting should take very little time.
Another option: watch the number of votes and when most of the votes are in say, "Can I have your final answers, please?"
Don't wait for every last student to vote. Some may be choosing not to vote.

7. **Check distribution of votes on the i>clicker receiver.**

Don't show the histogram to the class (yet):
   • if there is a popular choice, students are apt to choose it in a 2nd vote, without reasoning why.
   • a student who picked an unpopular choice is unlikely to participate in peer or class discussion
You can motivate students **without** showing the histogram, e.g., by saying "there seem to be two popular answers"
The students' behaviours will change when they see the histogram, probably not for the right reasons.

8. **Depending on the distribution of votes, proceed.**

You don't know what's going to happen but you can **anticipate** and **prepare yourself** for the likely outcomes.

When you know the first-vote distribution (but they don't) there are many options. You can
   • confirm and move on
   • ask the students to discuss with their peers
   • ask students to advocate for the choices they made
   • check that the question made sense
   • eliminate one or more choices before re-voting
   • and more...

This is where you show your "agility."

   • What do you do if 90% of the class has the *right* answer on the first vote?
   • What do you do if the class is split between two answers on the first vote?
   • What do you do if the class is split between all answer choices on the first vote?
   • What do you do if 90% of the class chooses the *wrong* answer on the first vote?
   • What do you do if the class is split between two answers on the *second* vote?

9. **At the end, confirm the answer(s) and continue with the class.**

Even if more than 80–90% of the students have picked the correct choice, some students are still not sure why that choice is correct.
Briefly confirm the correct choice:
   • explain why the correct choice is correct
   • explain why popular distractors are incorrect
   • allows those who chose the correct answer to make sure they had the correct reasoning

Facilitating Peer Discussion

Challenges:

- Students will be reluctant to talk to each other
- Students won't know how to reason through the questions
- There are always students in the back who won't participate
- Getting students back together after a clicker question

Solutions / Best Practices:

- Make it clear why you're using Peer Instruction (student buy-in). For example, explain the benefits of Peer Instruction and what you expect from students several times at beginning of semester.
- Circulate class, asking questions and modeling good reasoning and Socratic technique.
- Use questions they *want* to discuss (challenging, interesting questions)
- Allow enough time for the solo vote, and for the peer discussion (2-5 mins)
- Focus on reasoning in wrap-up (this indicates that their job during discussion is to focus on reasoning so they can share it later)
- Use an initial solo vote, so that students are committed to an answer and thus more curious about the answer and more prepared to discuss with one another
- Use the results of the class votes to guide your instruction (so that students see that the results of the activity are being used)
- Do not give points for correctness of response, or give minimal points for correctness. Research has shown that if clicker questions are high-stakes that student discussion becomes focused on correctness rather than reasoning.
- Use a routine to get students back together, such as ringing a bell when time is up.

Facilitating Whole-Class Wrap-Up

Challenges:

- Students don't speak up in discussion
- How do you deal in a positive way with a student response that is wrong?

Solutions / Best Practices:

- Circulate class during peer discussion, so that you can gain insight into student thinking and share what you heard if students are reluctant to share (or have a Teaching Assistant do the same)

- Establish a culture of respect, where you identify the merit in an idea or under what circumstances it would be right. Make sure students don't feel foolish for having erroneous thinking.
- Consider whether to show the histogram immediately (it is often strategic to withhold the histogram results until after discussion so that student discussion isn't shut-down. If the vote is a split-vote, however, showing the results can motivate discussion).
- Ask multiple students to defend their answers
- Avoid the "rapid reward," where you nod assent as soon as you hear the answer you are looking for. Instead, withhold judgment on student reasoning until most common ideas are out on the floor.
- Discuss why the wrong answers are wrong *and* why the right answer is right
- Reward students who speak up – either verbally or, if you wish, with some sort of treat. (We have used candy, NASA stickers, or physics formula books)
- Use non-threatening wording to ask students to share their answers, e.g., "Even if you didn't answer 'C', why might someone have answered 'C'? What makes 'C' a tempting choice?"

Use flexible, agile teaching based on your sneak-preview of the student responses:
- If 80-90% get the right answer, briefly explain why the right answer is right and why the wrong answers are wrong, so that all know the correct reasoning. *Note:* If 80-90% have the correct answer after the solo vote, peer discussion is not necessary.
- If 70% or fewer get the correct response, then solicit reasoning as described above.

But.. it takes too much time!

Solutions:
- Limit the use of Peer Instruction to questions that align with your learning goals for the class and focus on key concepts.
- Don't spend too much time on a question (but not too little either); about 5 minutes.
- Reduce your content coverage so the class focuses on key, important ideas. Better for students to walk out with a firm grasp of the important ideas rather than a vague understanding of a long list of topics
- Move some content coverage outside of class – e.g., students can do pre-reading, watch video lectures, or do derivations or other long calculations at home instead of watching in lecture time
- Don't recreate the wheel; use questions that others have written

While we would like to teach for understanding, many teachers feel pressured to teach for exposure – the classic "mile wide but an inch deep" problem. It's worth noting that in research studies, some teachers found that they could teach the material more efficiently using question-driven instruction. They found that they had a deeper understanding of students' difficulties, allowing them to tune their instruction more efficiently. Plus, in later units, students' grasp of the underlying material helps them progress through the units more quickly.

Tips for Writing Clicker Questions

See also the Instructor's Guide to the Effective Use of Clickers, at
http://STEMclickers.colorado.edu

- **Start with existing questions** where possible: See lists of question banks at
  http://STEMclickers.colorado.edu

- **Don't agonize too much**; after all, the perfect question doesn't solve all problems:
  It's hard to tell in advance which questions will be great, and a great question
  poorly facilitated can fall flat. Show questions to a colleague for feedback.

- **Don't make them too easy**. This is a common mistake, and misleads students as
  to your expectations. Challenge student thinking (students prefer this!) rather than
  testing memorized facts. You *can* write multiple choice questions that test higher
  levels of thinking (e.g, Analyzing, Evaluating; see Bloom's Taxonomy)!

- **Use questions that emphasize reasoning** or process rather than the correct answer;
  this is knowledge that is more generalizeable.

- **Use questions that will prompt discussion**. Interesting questions that students
  can't answer on their own are more likely to spur productive discussion.

- **Use clear wording** so that students understand what they are being asked. Keep
  revising over time.

- **Write tempting distractors** using your knowledge of student difficulties. For
  example, look at student answers on exams or quizzes, or first give the question as
  an open-ended question to generate common wrong answers. Talk to other
  instructors who have taught the course in the past, and talk to students one-on-one
  in office hours.

- **Use a wide variety of creative question types**. You can survey your students on
  their experiences or beliefs, assess what students already know about a topic, ask
  them to reflect on their own understanding, ask students to predict an outcome, use
  a series of questions to break problems into parts, stimulate discussion, or use
  pictures or graphs in the answer choices.

- Good sources of questions:

  - Questions your students ask you or that you overhear
  - Common analogies you use as a teacher
  - A series of connected questions to lead students through reasoning
  - Interpret graphs, data, pictures, etc.
  - Discussion questions where there is no one right answer