Creating Effective Clicker Questions in Life Sciences

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Adapted from workshops developed by: Stephanie Chasteen (CU-SEI), Peter Newbury (UC San Diego) and Cynthia Heiner (Freie Universität Berlin)
Have you used clickers in your teaching?

a. Not at all, and I haven’t seen them used.
b. Not at all, but I have seen them used.
c. I’ve used them a few times in my class.
d. I’ve used them many times in my class.
e. I could be (should be?) giving this workshop.
## Agenda

<table>
<thead>
<tr>
<th>Time (mins)</th>
<th>Activity Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Introduction</td>
</tr>
<tr>
<td>5–10</td>
<td>Peer instruction review and components of an effective clicker question</td>
</tr>
<tr>
<td>15</td>
<td>Different types of clicker questions &amp; when to ask them</td>
</tr>
<tr>
<td>15–20</td>
<td>Create a clicker question</td>
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<tr>
<td>15–20</td>
<td>Gallery walk, give feedback, share comments</td>
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<tr>
<td>10</td>
<td>Wrap-up: reflection and feedback</td>
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<td>Total: 70–85</td>
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Workshop Goals:

1) identify what makes an effective clicker question

2) become familiar with different types of clicker questions and when to use them

3) practice creating your own clicker question, sharing with the group in order to receive constructive feedback
Typical Peer Instruction Episode

1. Instructor poses multiple-choice question.

2. Students think about question on their own.

3. Students vote for an answer using clickers, coloured cards, ABCD voting cards, etc.

4. The instructor reacts, based on the distribution of votes.
In effective peer instruction...

- students teach each other immediately, while they may still hold or remember their novice misconceptions
- students discuss the concepts in their own language
- the instructor finds out what the students know (and don’t know) and reacts

\[\text{students learn and practice how to think, communicate like scientists}\]
Effective peer instruction requires...

1. identifying key concepts, misconceptions
2. creating multiple-choice questions that require deeper thinking and learning
3. facilitating peer instruction episodes that spark student discussion
4. resolving the misconceptions (unless leaving the question temporarily unresolved is part of the lesson plan)
What makes an effective clicker question?

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<th>connection to learning goals</th>
<th>Does the question make students do the right thing to demonstrate they grasp the concept?</th>
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<tbody>
<tr>
<td>context</td>
<td>Is this topic currently being covered in class?</td>
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<tr>
<td>clarity</td>
<td>Students should waste no effort trying to figure out what’s being asked.</td>
</tr>
<tr>
<td>distracters</td>
<td>What do the “wrong” answers tell you about students’ thinking?</td>
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<td>difficulty</td>
<td>Is the question too trivial? too hard?</td>
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<td>Will the question engage the students and spark thoughtful discussions?</td>
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<td>Is there potential for you to be “agile”?</td>
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Credit: P. Newbury, C. Heiner,
The molecules making up the dry mass of wood that forms during the growth of a tree largely come from where?

a) Sunlight  
b) The air  
c) The seed  
d) The soil
Exercise 1: Brainstorm goals for clicker questions

• What goals might clickers be used to achieve? Or, put another way, what might you use clicker questions to accomplish in your class?

• *Brainstorm in your handout, then we will discuss as a group.*
**BEFORE learning**

*Setting up instruction*

- Motivate
- Discover
- Predict outcome
- Provoke thinking
- Assess prior knowledge

**DURING learning**

*Developing knowledge*

- Check knowledge
- Application
- Analysis
- Evaluation
- Synthesis
- Probe misconception
- Exercise skill

**AFTER learning**

*Assessing learning*

- Relate to big picture
- Demonstrate success
- Review or recap
- Exit poll

Credit: Rosie Piller and Ian Beatty.
The molecules making up the dry mass of wood that forms during the growth of a tree largely come from which source?

a) Sunlight  
b) The air  
c) The seed  
d) The soil

What is the goal of this question? When might you use it?
Which point on the phylogenetic tree represents the closest relative of the frog?

What is the goal of this question? When might you use it?
Exercise 2: Writing a question

• Choose one of the question goals
• Write a draft question that aims to achieve this goal.
• Question goals and space for writing in your handout
• Don’t worry about writing answers yet

5 minutes
Remember components of an effective clicker question*

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*Particularly when using peer instruction
An Example Clicker Question

Which is necessary for the evolution of a trait by natural selection?

a) The trait is present in all individuals in the population.

b) The trait increases fitness.

c) The trait is complex.

d) The trait is unique to that species.
An Example Clicker Question

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a) The trait is present in all individuals in the population.

b) The trait increases *fitness*.

c) The trait is complex.

d) The trait is unique to that species.

*Can we make a better question on the SAME topic? Yes!*
An Example Clicker Question

What would happen if predators that hunted by sight were removed from this environment?

a) Non-cryptic mice would survive and reproduce better than cryptic mice.
b) Cryptic mice would survive and reproduce better than non-cryptic mice.
c) Cryptic and non-cryptic mice would survive and reproduce equally well.
d) Survival and reproduction for mice with either trait would not change.
Creating believable “distracters”

1) Talk with other instructors that have taught the course in the past.

2) Talk with your students one-on-one before class, after class, during office hours.

3) Use student responses to open-ended questions that you include in HW and exams.

4) Ask your students to come up with answers that will be used as the choices.

5) Use researched and documented student misconceptions.

Credit: D. Duncan, Univ. of Colorado
Exercise 3: Revisit your question

• Continue writing your question using what we’ve just talked about and the “tips” in your handouts

• If you wish, swap with your neighbor and discuss.
Share-out

• What did you learn from writing and revising your own question?

• What worked well, what was challenging about writing a question?

• How might you go about writing questions in the future?
Final point to consider:
Use questions at a variety of cognitive depth

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

• Circulate and look at the questions around the room.

• Try to identify a suitable goal for each question. Jot any ideas down on the sheet.

• Note any question types you’d like to try. When to use? For what purpose?
I think the toughest part about using clickers and peer instruction in class will be...

a) Writing good questions
b) Getting students to really think about them
c) Getting students to discuss the questions
d) Getting students to share their ideas in class discussion
e) I have a lot of content to cover, clickers take too long
Action Plan

• Take a few minutes to write down your action plan to implement ideas you heard about in the workshop
Resources: will follow-up with email

Clicker resource guide
(CU-SEI, CWSEI)

• Will email with additional resources and today’s slides

Eric Mazur (1996)
Derek Bruff (2009)
Doug Duncan (2004, 2005)
Wrap-up

• Any additional questions or comments to discuss with the group?

• Evaluation: Please take a moment to give us your feedback!
  — tell us the resources you’d like us to send you
Thank you!