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

Time (mins)	Activity Description:
10	Introduction
5–10	Peer instruction review and components of an effective clicker question
15	Different types of clicker questions & when to ask them
15–20	Create a clicker question
15–20	Gallery walk, give feedback, share comments
10	Wrap-up: reflection and feedback
Total: 70–85	

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

} students learn and practice how to think, communicate like scientists

- the instructor finds out what the students know (and don't know) and reacts

Effective peer instruction requires...

1. identifying key concepts, misconceptions
2. creating multiple-choice questions that require deeper thinking and learning

} before class

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)

} during class

What makes an effective clicker question?

connection to learning goals	Does the question make students do the right thing to demonstrate they grasp the concept?
context	Is this topic currently being covered in class?
clarity	Students should waste no effort trying to figure out what's being asked.
distracters	What do the "wrong" answers tell you about students' thinking?
difficulty	Is the question too trivial? too hard?
stimulates thoughtful discussion	Will the question engage the students and spark thoughtful discussions? Is there potential for you to be "agile"?

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

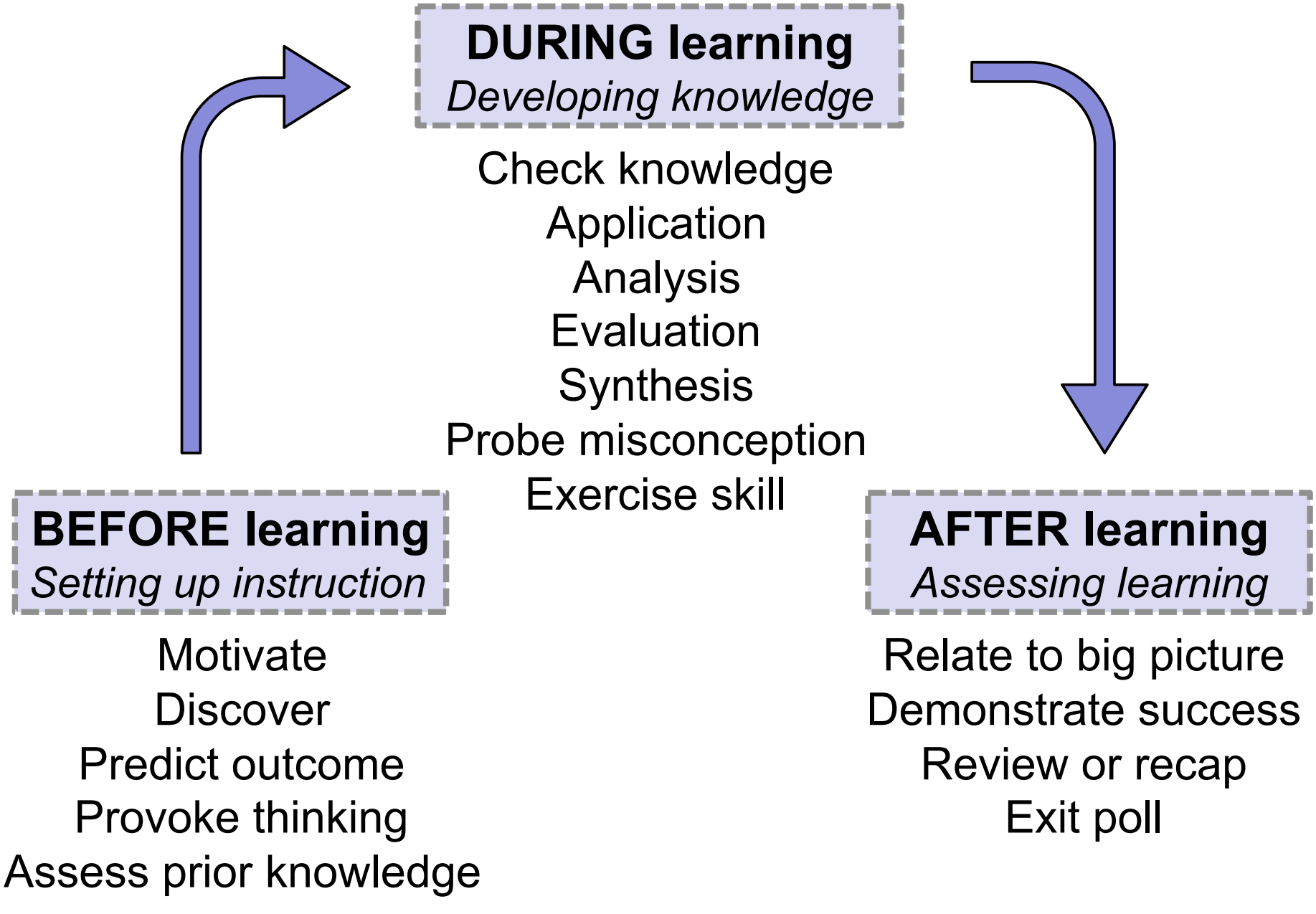
d) The soil

learning goals clarity context distracters difficulty discussion

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.*

3 minutes



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

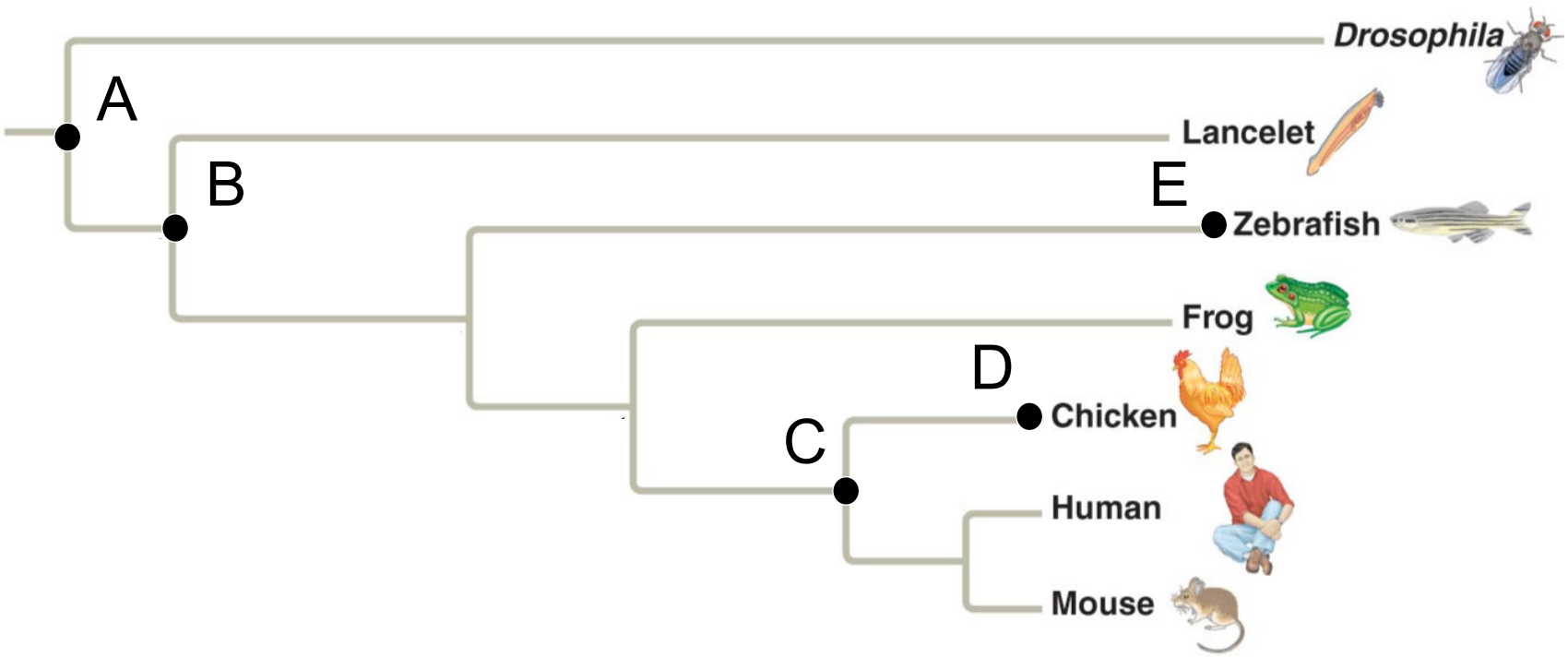
b) The air

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?

Question credit: Pearson Education, Inc.

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*

connection to learning goals	Does the question make students do the right thing to demonstrate they grasp the concept?
context	Is this topic currently being covered in class?
clarity	Students should waste no effort trying to figure out what's being asked.
distracters	What do the "wrong" answers tell you about students' thinking?
difficulty	Is the question too trivial? too hard?
stimulates thoughtful discussion	Will the question engage the students and spark thoughtful discussions? Is there potential for you to be "agile"?

*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

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.

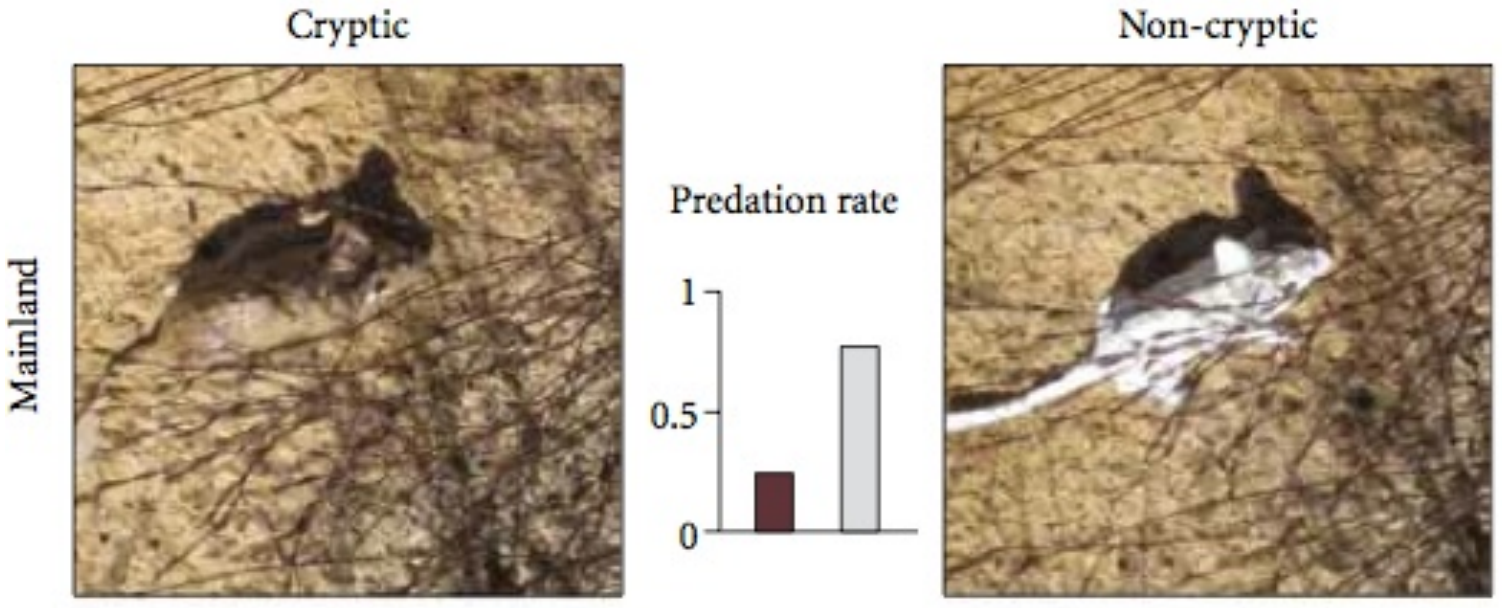
d) The trait is unique to that species.

Bad question. Can be answered by memorizing the word "fitness"

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.

5 minutes

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?

Higher order

Lower order

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?

15 minutes

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

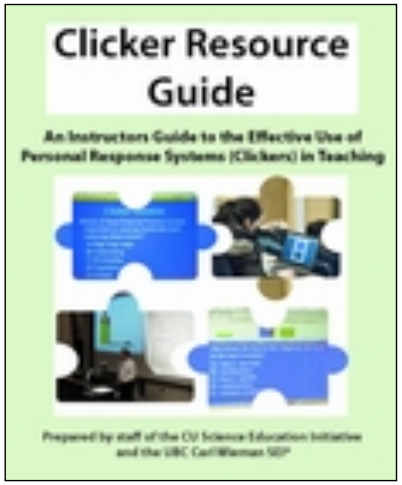
e) I have a lot of content to cover, clickers take too long

Action Plan

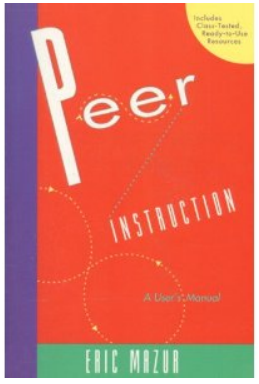
- Take a few minutes to write down your action plan to implement ideas you heard about in the workshop

Resources: will follow-up with email

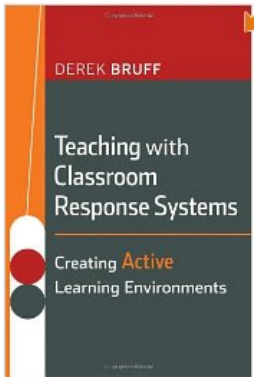
Clicker resource guide
(CU-SEI, CWSEI)



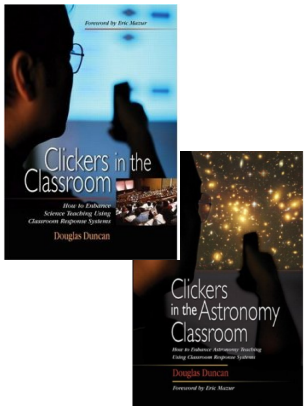
- Will email with additional resources and today's slides



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!