

Impactful clicker use in your class

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Biological Sciences



where discovery comes to life
↔ UC San Diego

Thank you to former fellows Peter Newbury, Cynthia Heiner,
and Bridgette Clarkston.



LS CWSEI

Workshop slides will be available at <http://ls-cwsei.biology.ubc.ca>

Goals

1. Identify reasons for using clickers in the class.
2. Identify how we as instructors can be the most effective before, during, and after clicker questions to maximize the benefits to students.
3. Practice introducing clicker questions in a way that promotes effective peer discussion.
4. Practice responding to clicker distributions on the fly.

Agenda

Time (mins)	Activity Description:
10	Clicker overview
15	Example clickers and types of questions
10	Setting up the question for peer instruction
25	Reacting to student responses, and eliciting meaningful discussion
25	Providing feedback
5	Wrap-up

Clicker Question + Peer Instruction Critique with three example questions

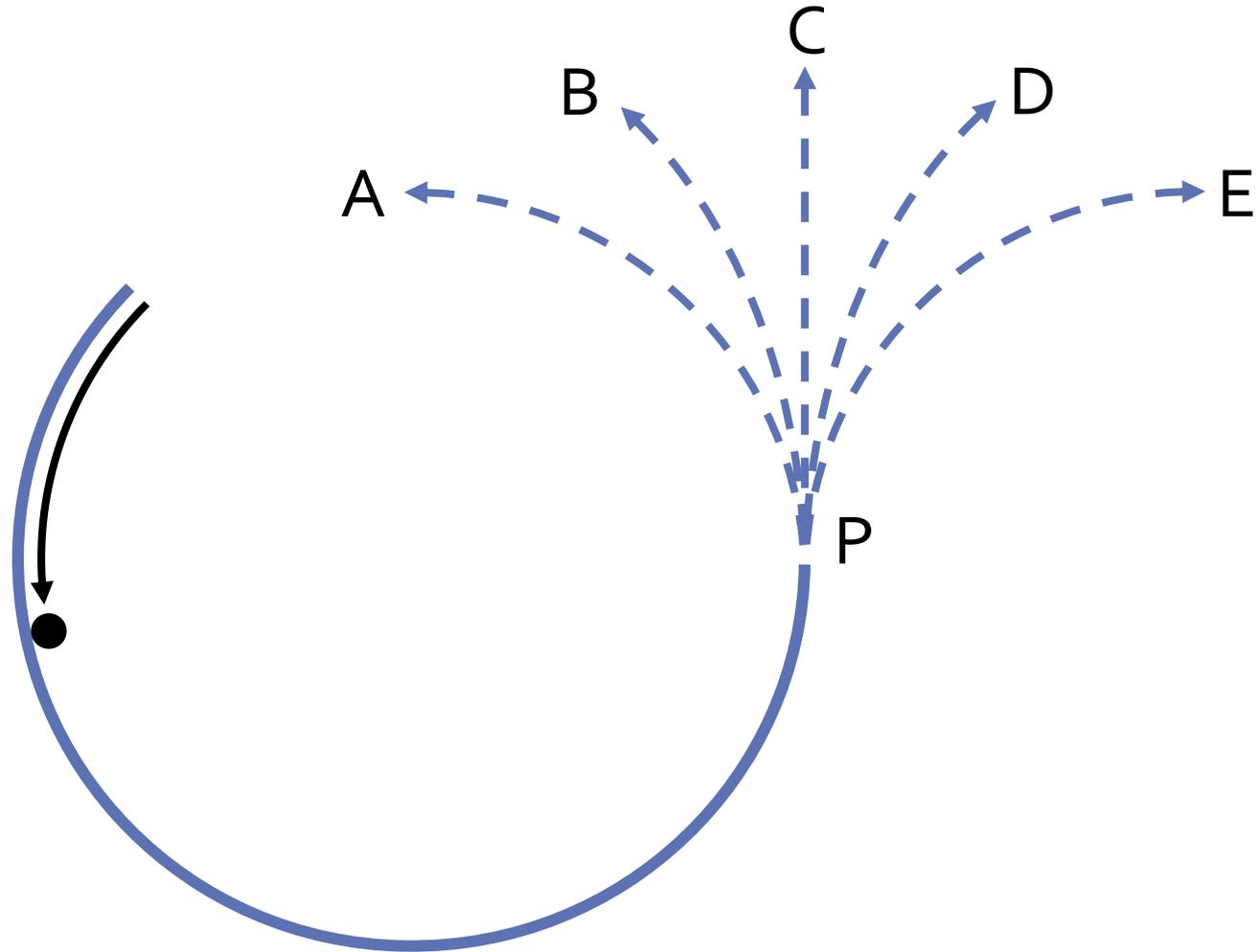
During these questions, jot down some notes of things you see that you like and/or don't like.

Answer each question to the best of your own ability, but for your notes, focus on the how the clicker question and peer instruction segment were choreographed.
How/why was it effective or not?

Clicker question

A ball is rolling around the inside of a circular track. The ball leaves the track at point P.

Which path does the ball follow?

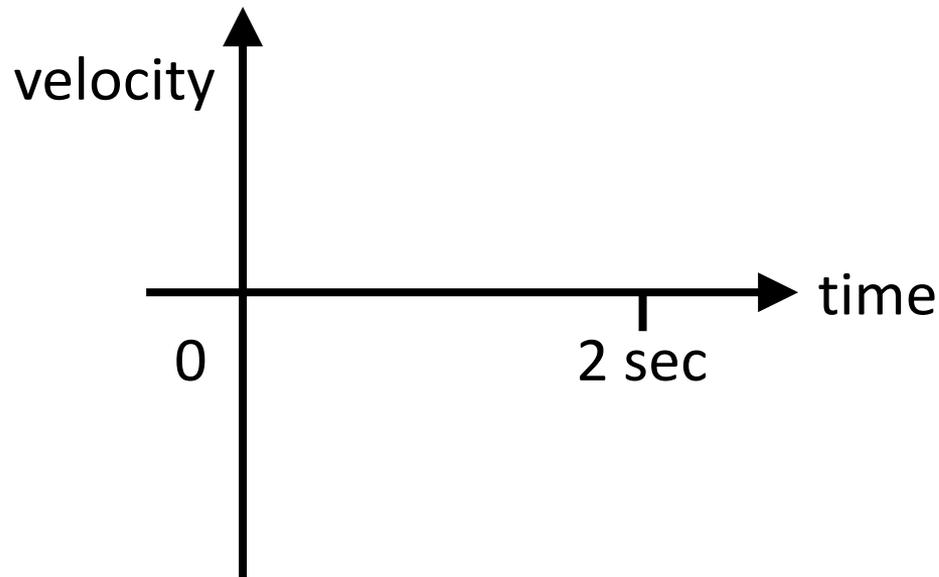


(Mazur)

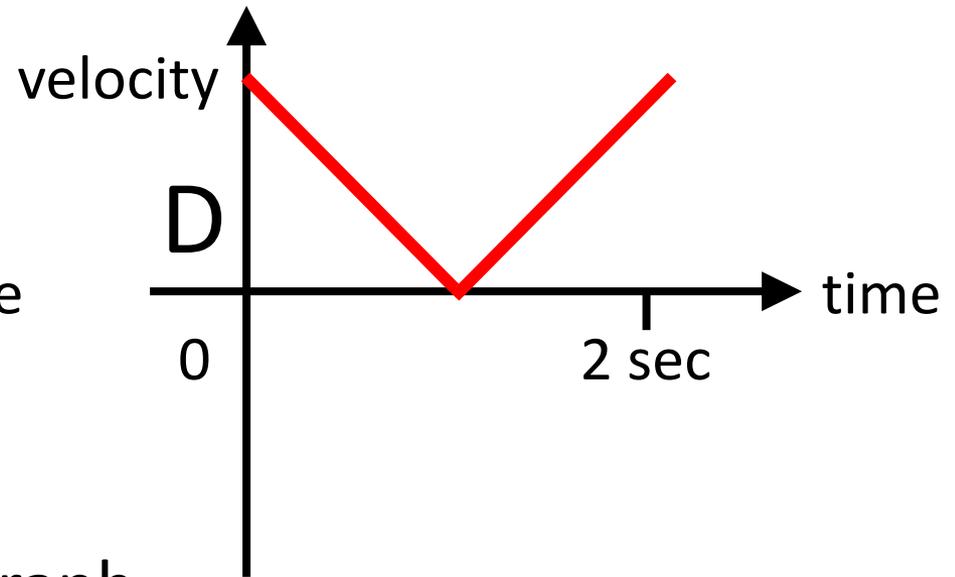
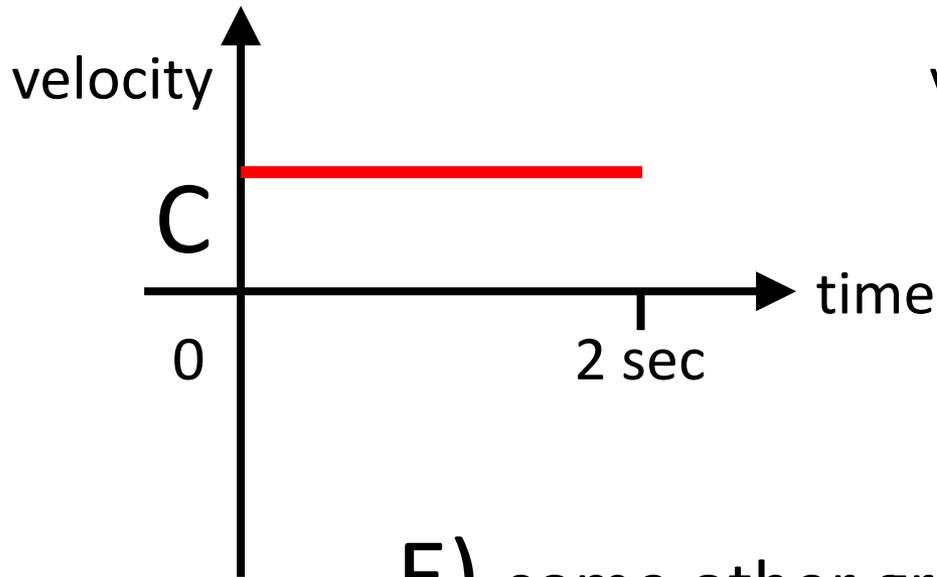
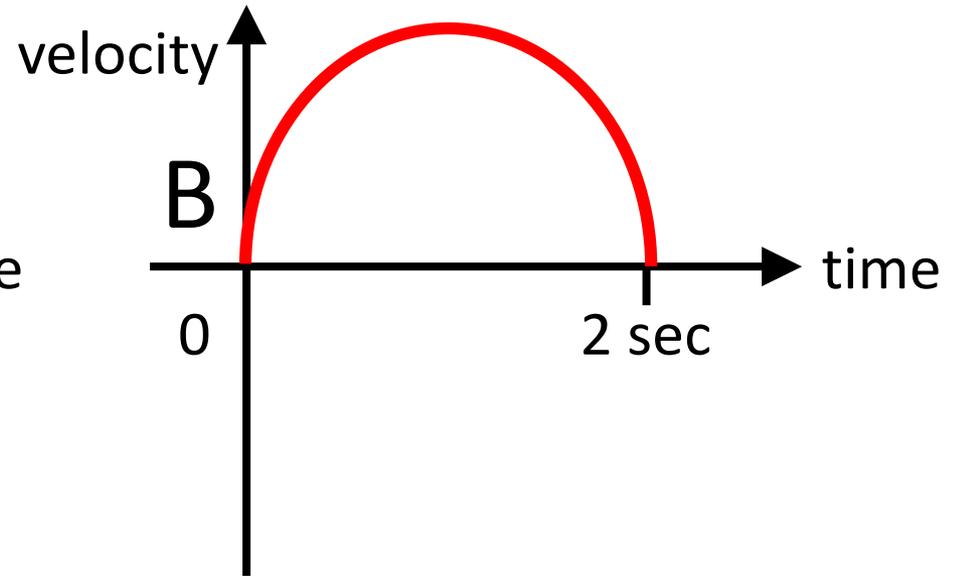
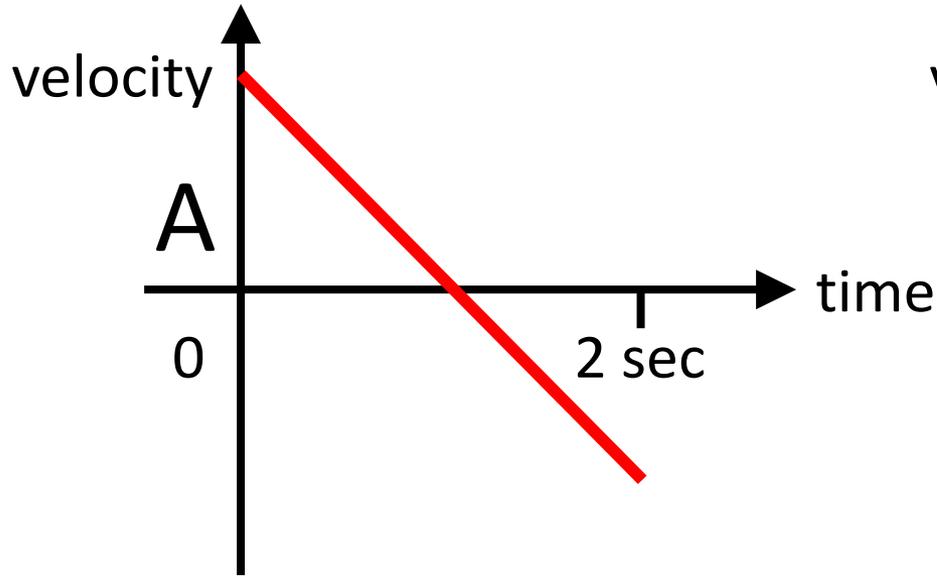
Clicker question

Susan throws a ball straight up into the air. It goes up and then falls back into her hand 2 seconds later.

Draw a graph showing the velocity of the ball from the moment it leaves her hand until she catches it again.



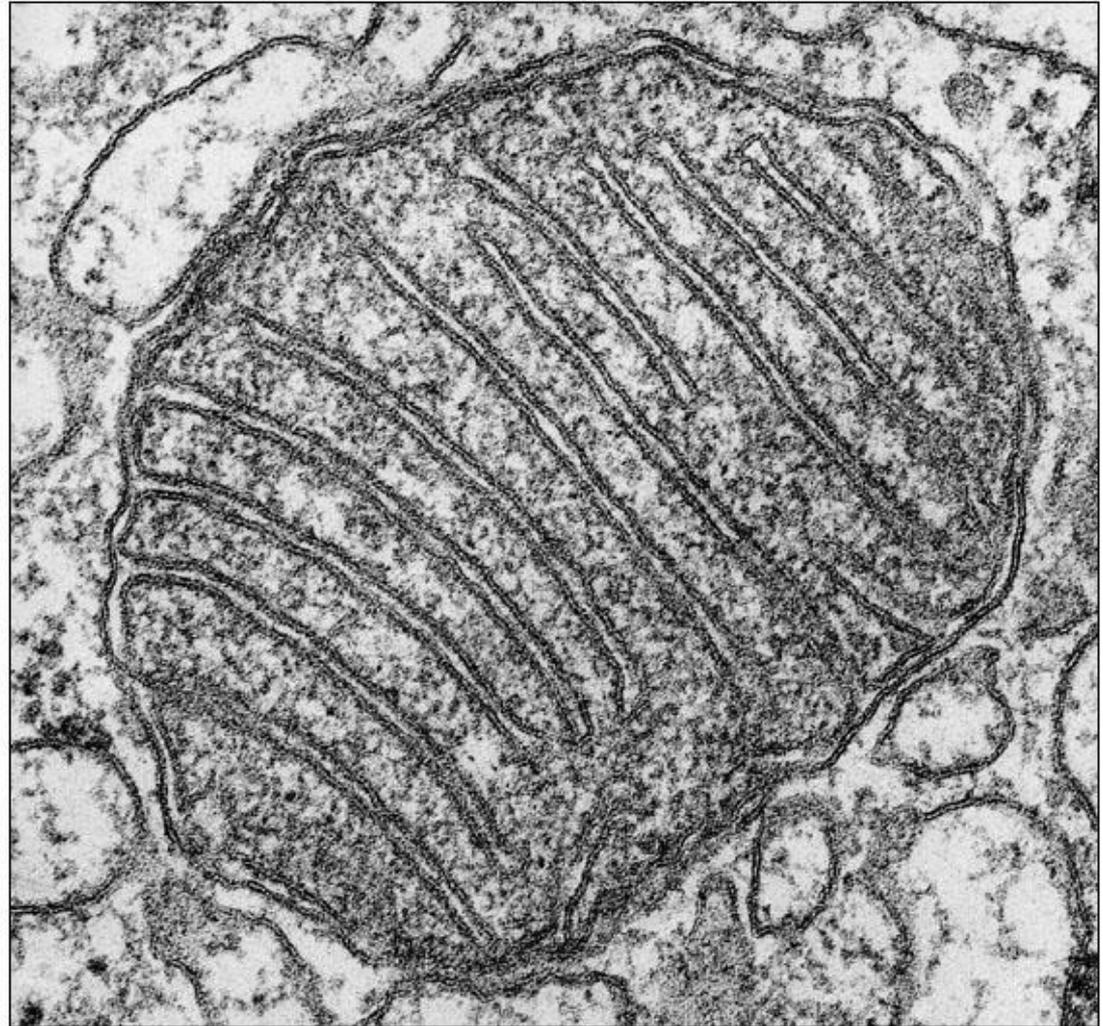
Which one is the closest match to your graph?



E) some other graph

Clicker question:
Are Mitochondria Cells?

- A. Yes
- B. No



100 nm

Summarize your notes: the things you liked/didn't like.

Peer Instruction

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 to take advantage of this opportunity

Clickers are a tool to engage the majority of students in thinking, discussing, and receiving feedback

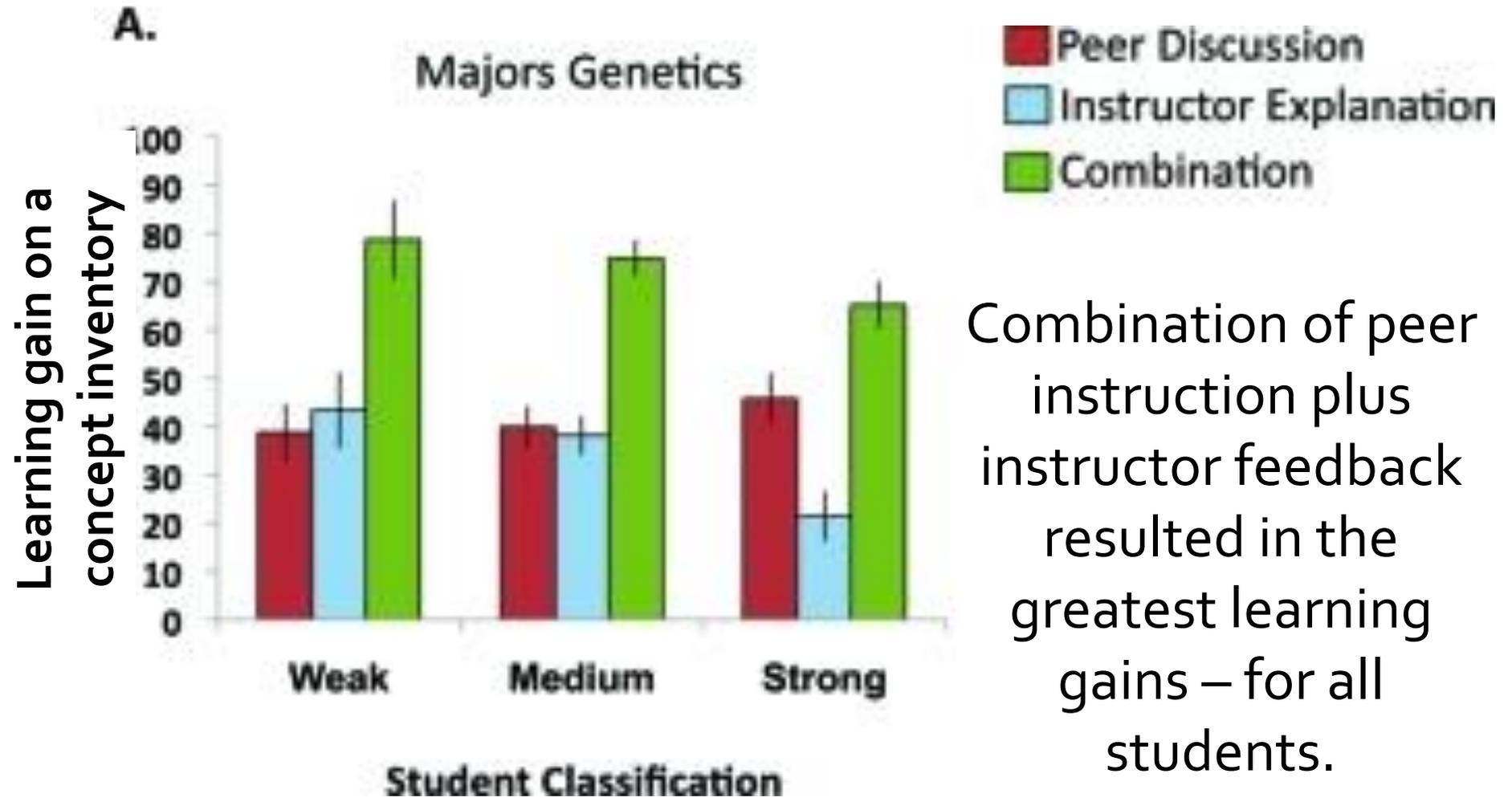


Clicker setup: Best practices

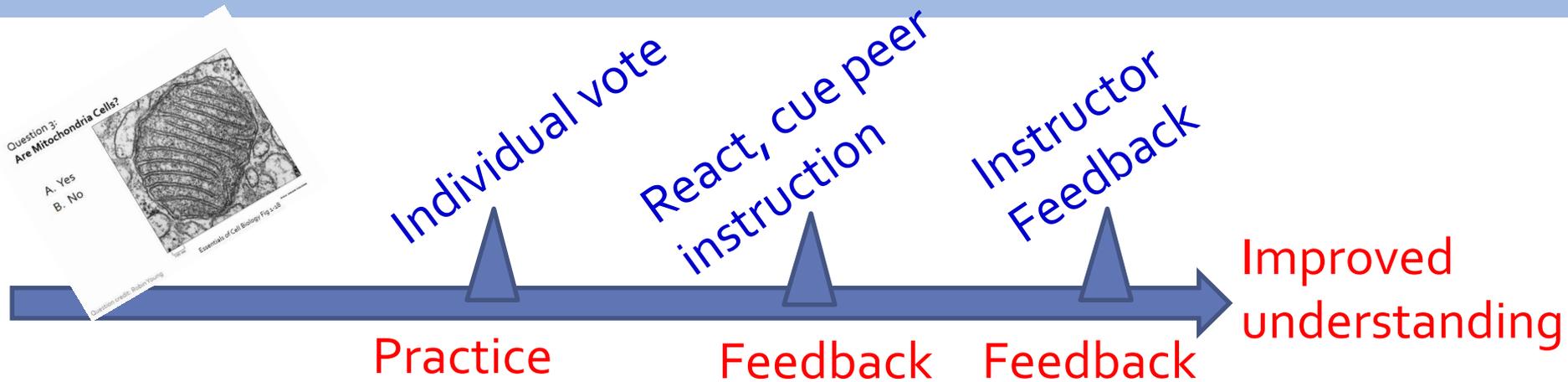
1. Instructor displays multiple-choice question, without reading it aloud or making many comments.
2. Instructor directs students to read and think about the question individually, and gives them time to do so.
3. Students vote for an answer using clickers (or coloured cards, ABCD voting cards, etc.)
4. The instructor reacts, based on the distribution of votes.



Peer discussion + instructor feedback most impactful



Clicker choreography to support peer instruction



We can prepare for the **three pieces** of this process:

1. **setting up** the clicker question,
2. **reacting** to the responses to elicit meaningful discussion, and
3. **facilitating the feedback** after the question.

Reacting to student votes

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

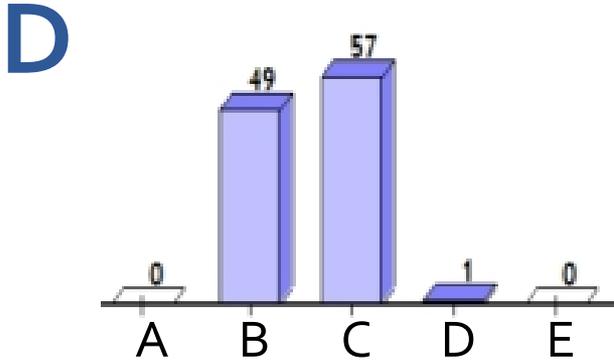
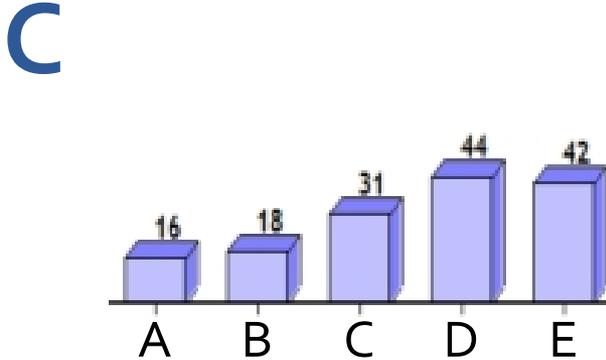
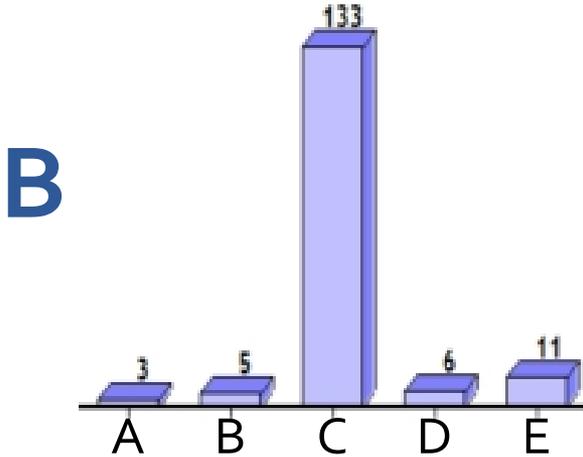
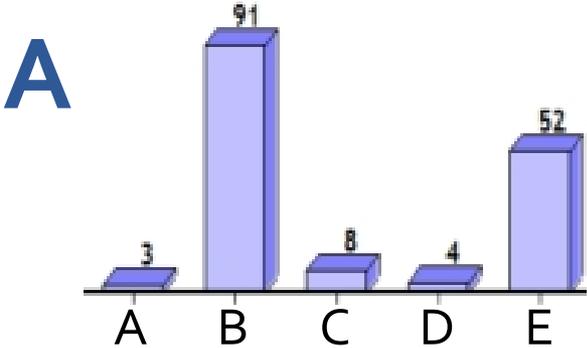


When you know the first-vote distribution (but they don't), you have lots of options.

Use the data (vote distributions) to help you decide!

This is where you show your agility.

You run a clicker question in class that has the correct answer of C. Which in-class student vote distribution below would make you the happiest?



Different clicker questions for different roles, at different times:

BEFORE LEARNING:
setting up instruction

AFTER:
assessing learning

assess prior knowledge

provoke thinking

predict

motivate

discover

exit poll

review / recap

"big picture"

demonstrate success

check knowledge

real world application

exercise skill

analysis

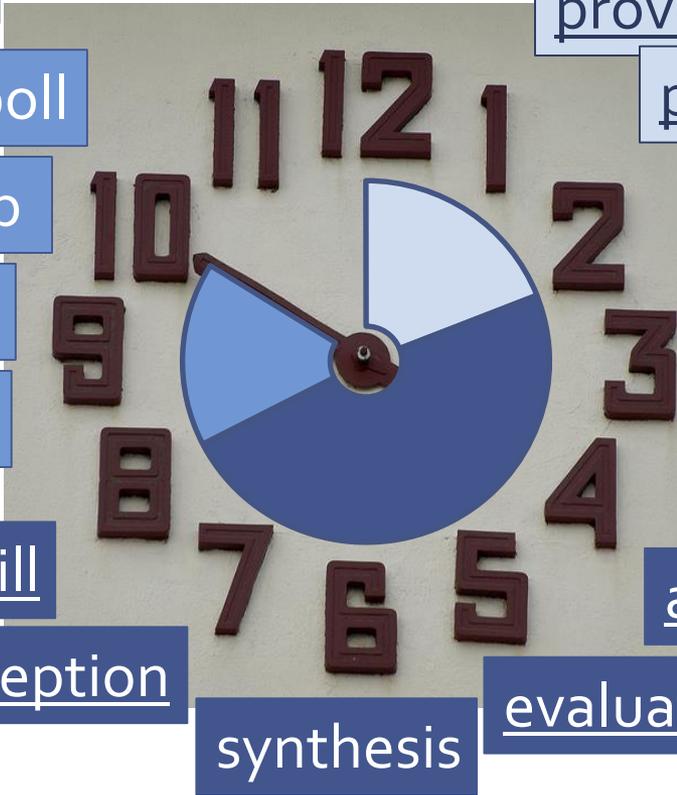
probe misconception

evaluation

synthesis

Today we're going to focus here, where peer instruction is most effective

DURING:
developing knowledge

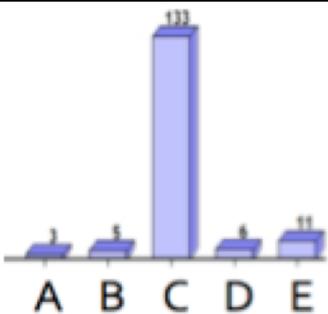
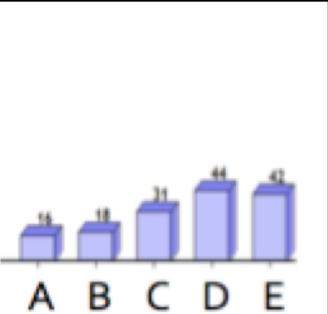
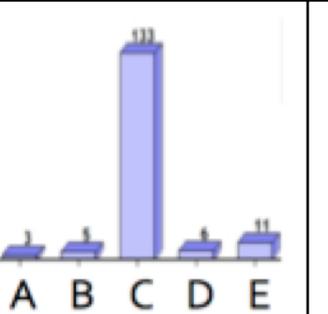
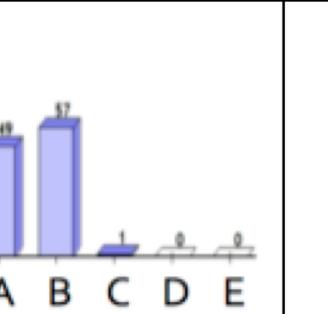


Activity: Reacting to student votes

- Join into small groups (~3-4 people)
- You have a worksheet showing distributions from a clicker question that has just been run.
 - This question is used during the 'developing knowledge' phase of the class.
 - Each group will work on two examples that are assigned to you.
 - You have 10 minutes.
- **Your task for each:**
 - How will you react to this distribution?
 - What instructions you give to the class (write down the words that you would say to the class).

Reacting to student votes:

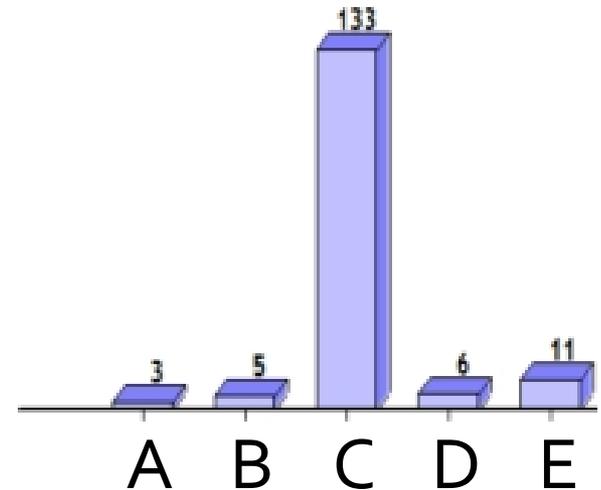
You have just asked students a new clicker question where they vote individually. They vote, with the following distribution:

	Example 1:	Example 2:	Example 3:	Example 4:	Example 5:
The vote shows:	 <p>(C is the correct answer)</p>	 <p>(C is the correct answer)</p>	 <p>(C is NOT the correct answer)</p>	 <p>(A is the correct answer)</p>	 <p>(Either answer is reasonable, but A is a better answer than B)</p>
What do you plan to do next?					
What do you say to the class?					

Example 1:

What do you think you should do with this first-vote distribution?

(C is the correct answer)

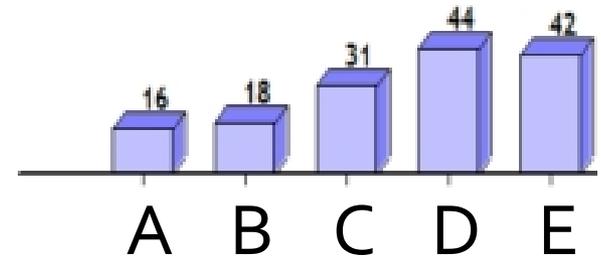


- Show the graph, state the correct answer. “Can someone who chose C explain why?” – don’t need to spend much time there.
- Instructor confirms the correct answer, says why it is correct.
- Provide a link to a resource for the students who were incorrect (or might need help later)

Example 2:

What do you think you should do with this first-vote distribution?

(C is the correct answer)

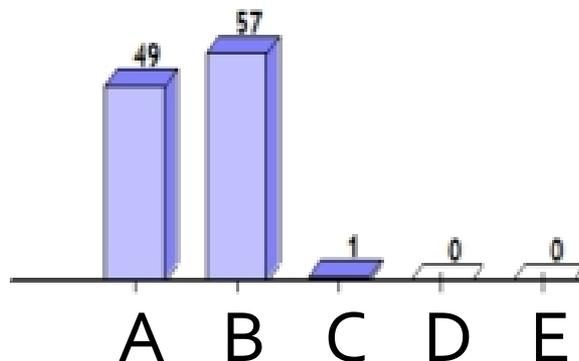


- Take it back a step: Have students paraphrase the question (to you or peers), to see if they understood it.
- Prompt: “how does this relate to the last class? Do you know of any tools that might help?”
- Send them to discuss in peers.
- Go over the key points again (re-teach).
- Consider your time, and the importance of the topic, when deciding what to do.
- “Here’s a clue – now talk about it again with neighbours”
- Ask the same question next class – retesting can be good!

Example 4:

What do you think you should do with this first-vote distribution?

(A is the correct answer)

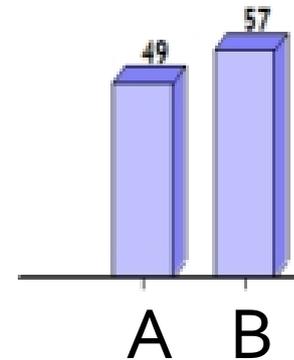


- Peer discussion: “talk to your neighbour about...”
“why did you choose what you chose?”
- “Find someone who chose the opposite answer as you, and discuss your reasoning.”
- Show or don’t show? Depends on the split.
- “You’re split between two answers – debate between A and B”

Example 5:

What do you think you should do with this first-vote distribution?

(Either answer is reasonable, but A is a better answer than B)



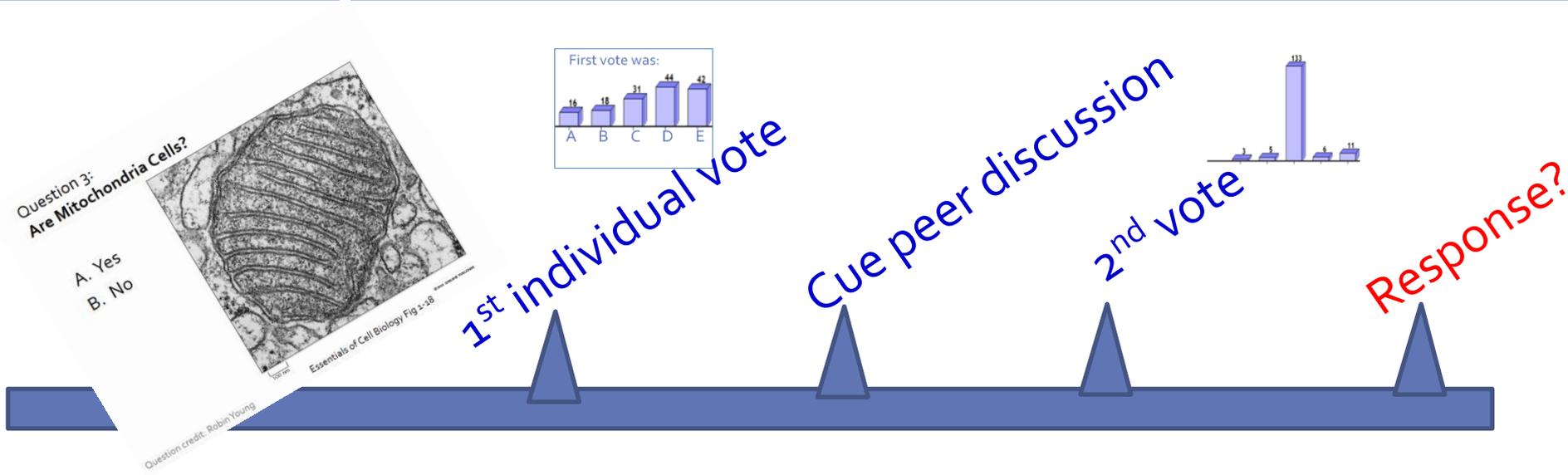
- Intervene a bit, and give some instructor feedback. Say why they are both correct, and which is better?
- Ask students to defend either A or B.
- “Both A and B are reasonable. Can you give me an argument for one or the other? Is there a reason why one is better?”
- “What information would you need to decide between A and B?”

A few notes on reacting: the goals are to understand where the students are, and set up a learning opportunity

- If a large majority got the question correct, peer instruction may not be necessary; instructor can confirm the correct choice and move on.
- Otherwise, students don't have a solid understanding; peer instruction may help.
- Cue the students for a **reasoning-based** discussion rather than an answer-based discussion (see Knight et al., 2013, *CBE Life Sciences Education*, 12(4), 645–54.)
 - “explain the reasons for your choice”
 - “explain what evidence you used to make your choice”
 - “find someone you disagreed with, and explain how you each got to your answer”
 - “explain why the options you did NOT choose were incorrect”²⁷

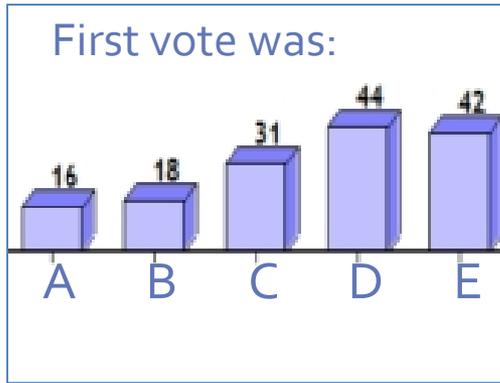
- Cue the students to be ready to participate in follow-up afterwards
 - This can decrease anxiety about speaking individually in class, as well as keep them accountable and on-task
 - e.g. “After we re-vote, I will select a group at random to give their group’s reasoning for their choice”
- Instructor (and TAs) should move through the room, helping students as they go.
- In general, do not show the vote histogram until fully done with the question
 - or if there is an almost exact 50-50 split which will spark debate.

Feedback after the second vote (after peer discussion)

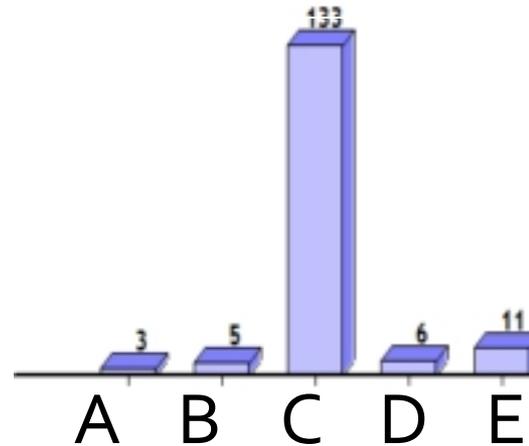


- Goals of the 2nd vote:
 - To see how their thinking has changed after discussion: are they getting it
 - to target feedback and correct any misconceptions
- With these goals in mind, let's practice.

Example 1



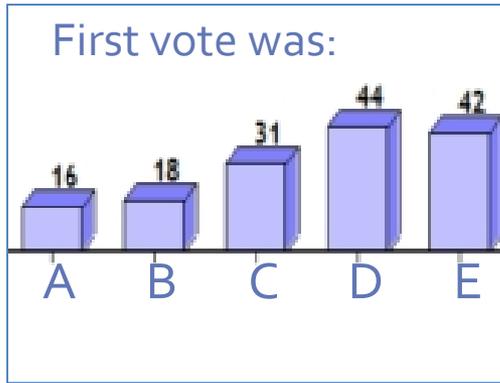
What do you think you should do with this **second-vote** distribution?



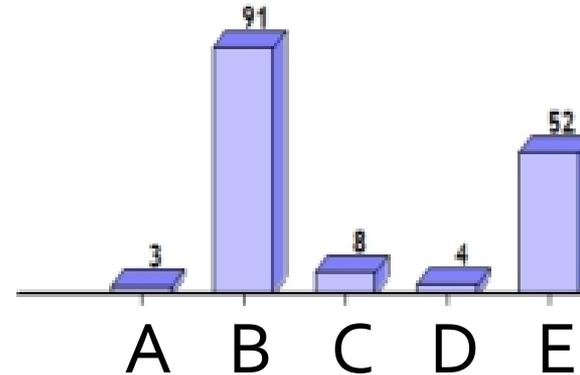
(C is the correct answer on this distribution)

- A) "Turn to your neighbours and explain the reasons for your answer choice"
- B) Instructor confirms the correct answer and moves on
- C) "Can someone who answered C tell us the reasons for making that choice?"
- D) "Would someone like to explain what answer they picked and the reasons they picked that answer?"
- E) Other

Example 2



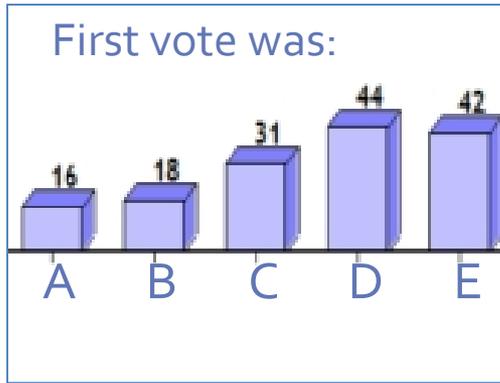
What do you think you should do with this **second-vote** distribution?



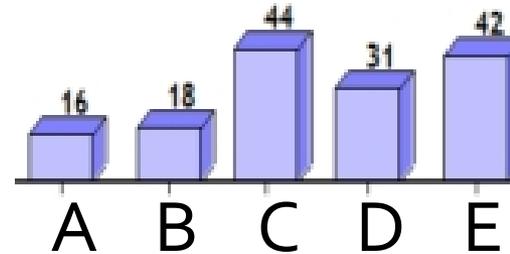
(B is the correct answer on this distribution)

- A) "Turn to your neighbours and explain the reasons for your answer choice"
- B) Instructor confirms the correct answer and moves on
- C) "Can someone who answered B tell us the reasons for making that choice?"
- D) "Would someone like to explain what answer they picked and the reasons they picked that answer?"
- E) Other

Example 3



What do you think you should do with this **second-vote** distribution?



(C is the correct answer on this distribution)

Your task:

Write an idea down individually.

A few notes on feedback: Goals are to check if students have learned from each other, correct any misconceptions, bring the group back together for next steps.

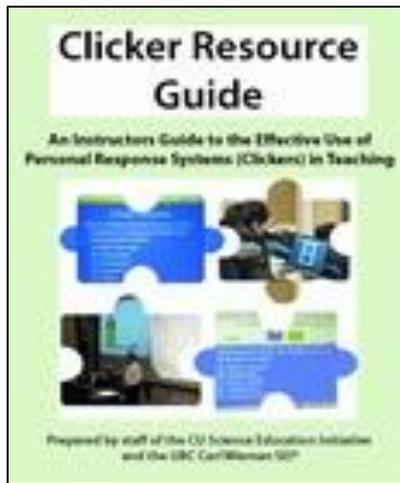
- If a large majority now got the question correct, further discussion may not be valuable; instructor can confirm the correct choice and move on.
- Otherwise, give students opportunities to articulate their reasoning to the class.
 - “Can someone from this group explain what your group decided on?”
 - “I’m seeing a lots of votes for both A and B. Can someone who chose one of these explain their choice?”
 - “Initially, there were lots of votes for C, and now there are none. I agree that C is incorrect – can someone who changed their mind explain what is wrong with C?”
 - Instructor’s role is to facilitate/support this, not necessarily to give the answers yourself at first.
- Showing the histogram can either support or sabotage their discussion!
 - Students are unlikely to articulate their reasoning if they see that they aren’t in the majority (even if they are correct!)
 - Best use: when fully finished, can show both first & second votes to reinforce that they learned from each other.

Resources

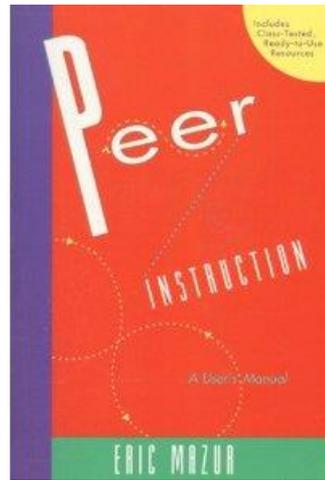
Check the clicker resources pages on the CWSEI website:

<http://www.cwsei.ubc.ca/resources/clickers.htm>

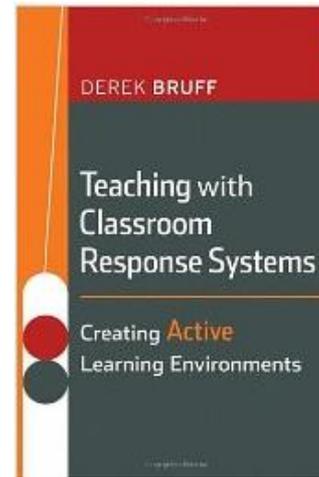
(with links to collections of peer instruction questions)



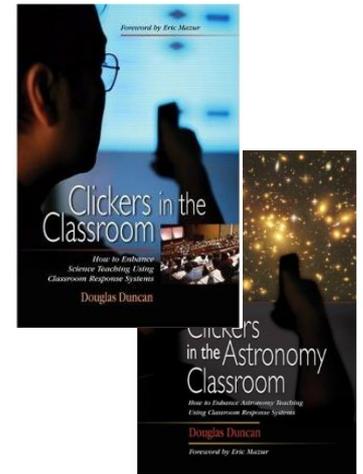
CWSEI



Eric Mazur
(1996)

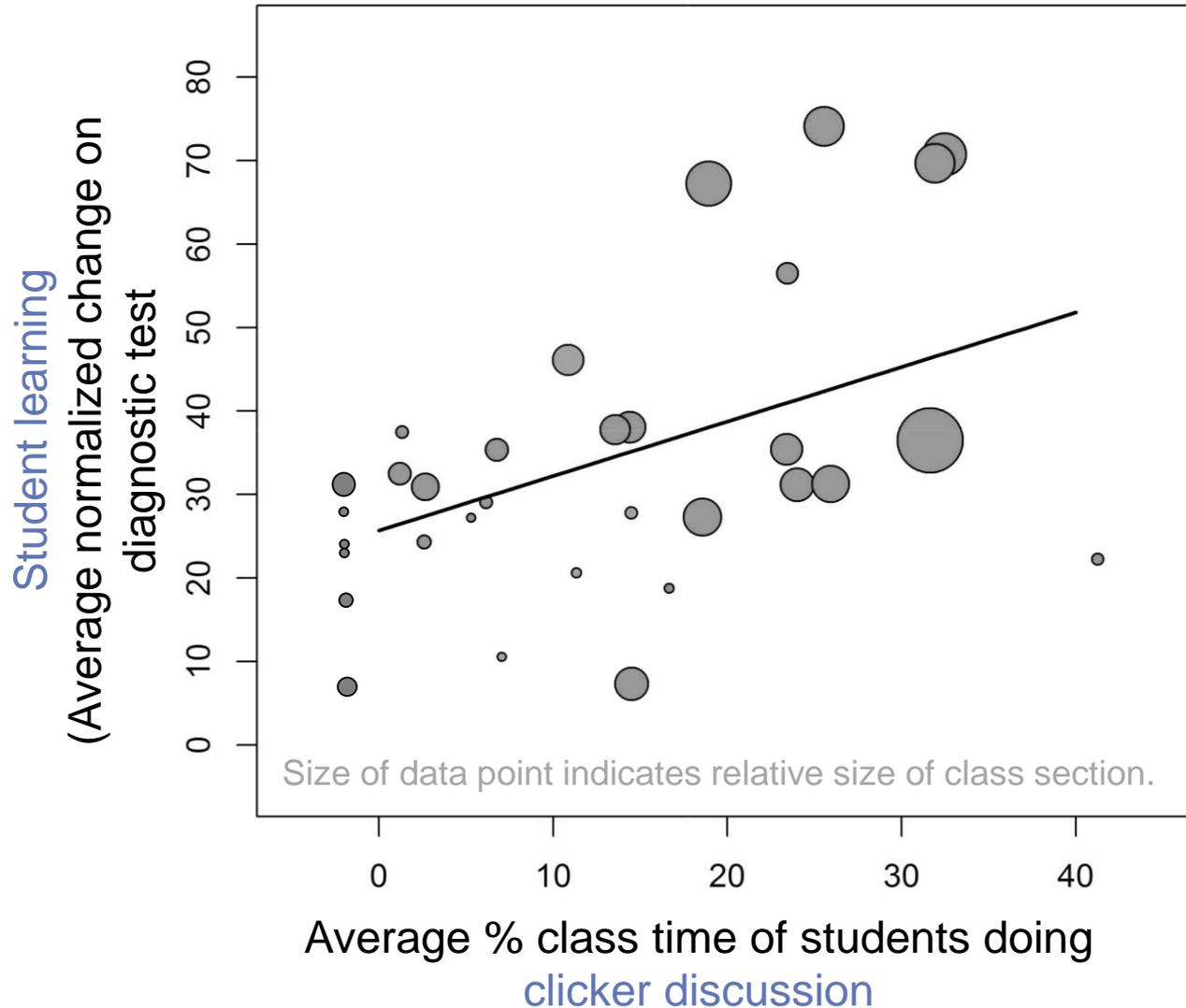


Derek Bruff
(2009)



Doug Duncan
(2004, 2005)

Supporting student learning with peer discussion



Data collected at UBC
Biology, 2014-2015
academic year.

From this
workshop,
what are you
going to try in
your class?

A laundry list of considerations & ideas...

- Number and difficulty level of clicker Qs in a given class?
- Use classroom atmosphere & #votes to decide how long to poll/discuss
- Participation points? (but not points for correctness, generally)
- Build impromptu questions/distractors from student responses – use the doc cam or text boxes in powerpoint
 - Answers can be student drawings, graphs, their written statements
- Useful for housekeeping as well (e.g. when to hold office hours, etc.)
- Valuable in small classes and big classes
- Access to the questions before class? Sharing clicker answers after?
- Writing questions:
 - don't need 5 possible options; don't need only one right answer! (sparingly)
- Overall course structure to support effective peer instruction: pre-class work, alignment with tests...
- **The instructor plays a critical role to set up and facilitate these opportunities for student learning!**

Thanks for your participation today

If you have further questions, feel free to contact us.

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