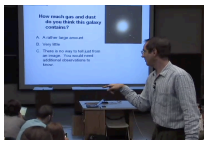
Facilitating Clickers Effectively

Sponsored by i>clicker



Dr. Stephanie V. Chasteen
Science Education Initiative
University of Colorado – Boulder
Stephanie.Chasteen@colorado.edu

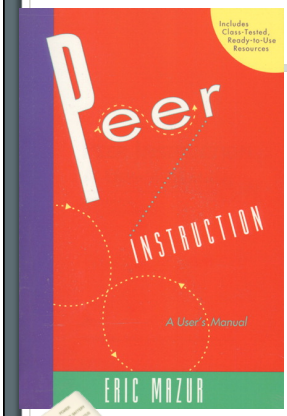
Clicker resource page at http://STEMclickers.colorado.edu

Handouts at http://blog.sciencegeekgirl.com

There is a poll open
Tell us if you're having trouble finding it.

Agenda: Brief intro -- Effective Questions -- Facilitation Matters

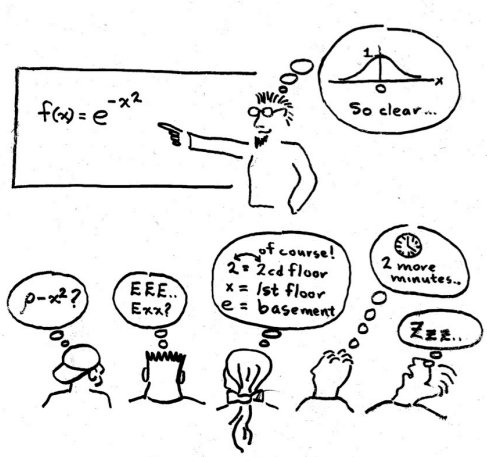
Peer Instruction and Clickers



- 3-5 questions per class
- Students discuss & vote
- Improved learning (multiple studies)
- Used by ~30% of physics faculty*

* Dancy & Henderson, AJP, 2010

Intro

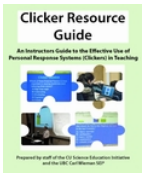


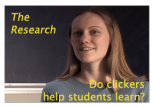
U. Colorado Clicker Website

http://STEMclickers.colorado.edu

Clicker resource page

- Downloadable Instructor's Guide
- Question banks
- Workshops
- Literature / Articles
- Short videos





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Clickers are a tool for questioning

But not a magic bullet!

Don't equate the pedagogy with the technology.
So what IS the pedagogy?

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Why question?

1. Why do we ask students questions in class?
2. Why might we use *clicker* questions?

Chat Discussion
Think on your own, then share ideas in the chat.

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Clickers help students learn…

t h e l e a r n i n g c y c l e

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

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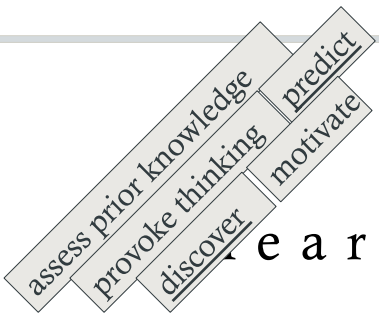
Clickers help students learn…



learning cycle

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

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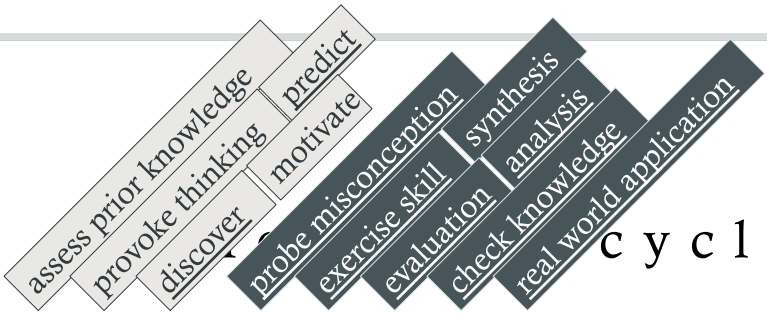
Clickers help students learn…



cycle

BEFORE	DURING	AFTER
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Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

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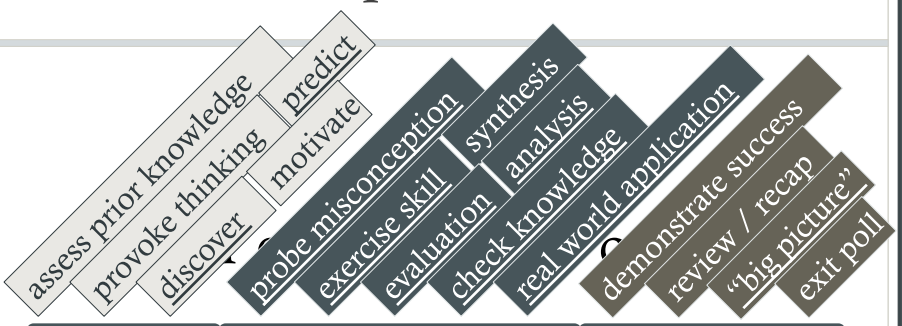
Clickers help students learn…



setting up instruction | developing knowledge | assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

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Clickers help teachers teach…

- Are they ready for the next topic?
- What do they already know?
- Do they care about this?
- What DO they care about, anyway?

BEFORE | DURING | AFTER

setting up instruction | developing knowledge | assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

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Clickers help teachers teach…

Where are they in the activity?

Are they getting it?

Do I need to intervene?

Did they notice key idea X?

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

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Clickers help teachers teach…

Did they get it?

Can I move to the next topic?

Did that activity work?

How did I do?

BEFORE	DURING	AFTER
setting up instruction	developing knowledge	assessing learning

Adapted from Rosie Piller, Ian Beatty, Stephanie Chasteen

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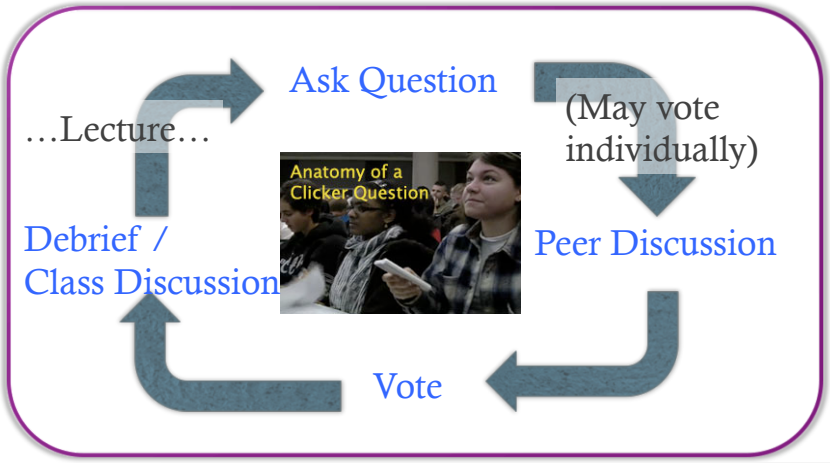
Anatomy of Peer Instruction



* See also: Peer Instruction, A User's Manual. E. Mazur.

Clicker Choreography

See handouts

Clicker choreography

These are in your handouts

1. Present the question. Don't read it aloud.
2. "Please answer this on your own."
3. Give the students sufficient time to make a choice.
   "Do you need more time?"
4. "Please vote."
5. Check distribution of votes privately.
6. Depending on the distribution of votes, proceed.

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Clicker choreography

These are in your handouts

6. Depending on the distribution of votes…
   - Have students discuss with peers (usually)
   - Have a class discussion
   - Discuss question yourself

More on this later…

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

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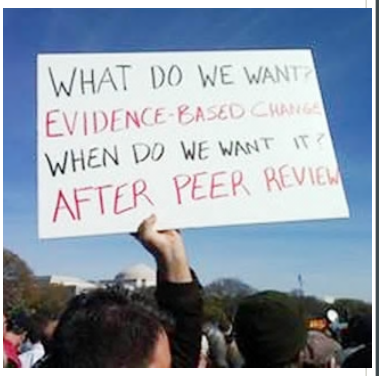
Clickers help students learn (the research)

Research shows that:

- Courses using peer instruction outperform traditional lecture courses on a common test
- Students can better answer a similar question after talking to their peers (especially difficult questions!)

See http://STEMclickers.colorado.edu for various references



What do we want? Evidence-based change.
When do we want it? After peer review

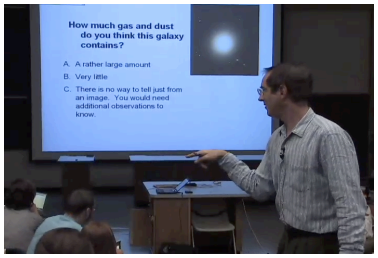
Clickers & Classroom Culture

Research shows that students say that clickers:

- Help them show up for class and participate
- Make them feel part of the class community
- Make their "voice" heard in class
- Hold them accountable for learning
- Increase group learning outside the classroom
- **But only if clickers are used well!**

Part 1

Effective Questions



Example Question: History

In your opinion, which has had the most positive impact on the modern world?

A) coffee
B) tea
C) chocolate
D) spice
E) sugar

Good discussion/debate question, before or after instruction

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Example Question: Superpowers

Which superpower would you rather have? The ability to…

A. Change the mass of things
B. Change the charge of things
C. Change the magnetization of things
D. Change the boiling point of things

No-one-right-answer also works in the sciences

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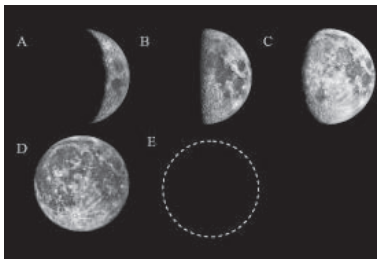
Question: Ian Beatty, UMass-Amherst
Image: Thibault fr on Wikimedia

Example question: Astronomy

You look to the eastern horizon as the Moon is rising and discover that it is in the new moon phase. Later that same day when the moon is setting, which of the moon phases shown below would the Moon have looked like?



Helping with visual literacy and application of a concept to daily life.

Center for Astronomy Education, Ed Prather

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Example of a less effective question

"Apprized" means

A) Appreciated
B) Compromised
C) Defied
D) Noted

No need to talk to your neighbor; you know it or you don't! Does not encourage reasoning.

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Another example of a less effective question

What causes the seasons?

A) The change in the earth's distance from the sun during the year
B) The tilt of the earth's axis
C) Changes in the sun's brightness
D) Changes in clouds
E) None of the above

Can pattern-match to find the answer because "tilt" would have been mentioned during lecture

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Better seasons example

What would happen to the seasons if the earth's orbit around the sun was made a perfect circle (but nothing else changed) ?

A. There would be no seasons

B. The seasons would remain pretty much as they are today

C. Winter to spring would differ much less than now

D. Winter to spring would differ much more than now

Much better question. Requires reasoning!

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Let's try it!

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

A Private Universe; Annenberg Media

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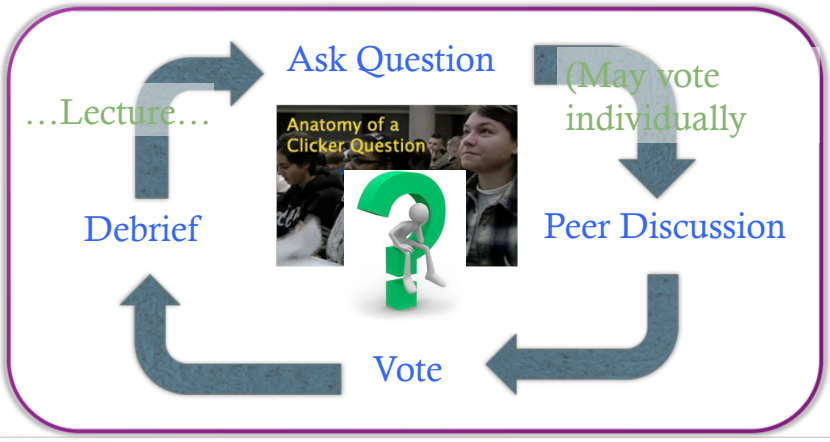
Any burning questions?



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What makes a good clicker question?

See handout

clarity	Students should waste no effort trying to figure out what's being asked.
context	Is this topic currently being covered in class?
connection to learning goals	Does the question make students do the right thing to demonstrate they grasp the concept.
distractors	Use tempting distractors. What do the "wrong" answers tell you about students' thinking?
difficulty	Use a variety of difficulty levels. 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"?

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Various question types

Mix up your question strategies to keep things fresh and help students practice different skills

Conceptual "one right answer"

Let's try it!

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

A Private Universe; Annenberg Media

Discussion "no one right answer"

How much do you personally think that cultural factors explain differences in evidence of violent behaviors between men and women?

A. Not much at all
B. A little
C. They are sometimes useful
D. They explain most of what we see
E. Don't know/ other

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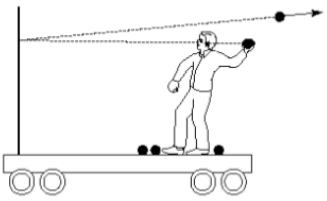
Stefanie Mollborn

Predict an outcome

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

Eric Mazur, "Peer Instruction" 5

Survey questions

Do you know someone who has cancer (or had it in the past)?

A. Yes, someone close to me

B. Yes, but I didn't know them well

C. No

D. Not sure

Origin unknown

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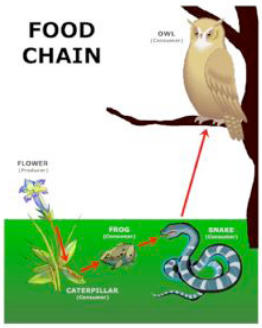
Beyond True/False: Embed reasoning in answers

In this food chain, would you expect to have more owls or more frogs? Why?



1. More owls because they are good hunters and can catch more food than frogs can.
2. More frogs because they are lower on the food chain.
3. More owls because they are higher on the food chain.
4. More frogs because they have more food to eat.
5. More frogs because they are smaller and need less food.
6. More owls because no predators eat them.

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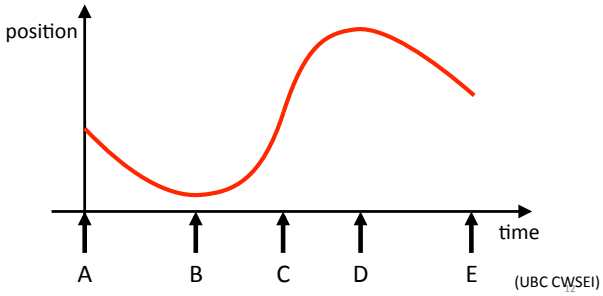
Cathy Wanat, Northampton High School

Images as Choices

John is walking to school. This graph shows his position as a function of time. When is John moving with the greatest velocity?



(UBC CWSEI)

Recap: question types

1. Conceptual "one right answer" questions
2. Discussion "no one right answer" questions
3. Predict an outcome (e.g., of experiment)
4. Survey questions / personal opinion
5. Embed reasoning in answers ("Slower, because gravity is acting against it." "Slower, because it loses energy to friction.")
6. Use images as answer choices

See TEFA handout

Question-writing tips

- **DIFFICULTY**: Don't just use simple quiz questions; use questions at a **variety of difficulty levels** *(see Bloom's)*
- **STRATEGIES**: Use a variety of **types of questions**
- **TIMING**: Use questions at **a variety of points in lecture.**
- **WORTHY OF DISCUSSION:** Use interesting, challenging questions that prompt discussion and **emphasize reasoning**
- **DISTRACTORS**: Use **tempting distractors** to challenge students' ability to reason

See handout

Effective multiple-choice questions have *believable* "distracters."

1) Talking with other instructors that have taught the course in the past.
2) Talking with your students one-on-one before class, after class, during office hours.
3) Using student responses to open-ended questions that you include in HW and exams.
4) Asking your students to come up with answers that will be used as the choices.
5) Use researched and documented student misconceptions.

D. Duncan, Univ. of Colorado 40

But…

The perfect question doesn't solve all problems!

Part 2

Facilitation Matters

Remember, not a magic bullet!

Or, "the perfect question doesn't solve all problems"

Implementation is also important.

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Student buy-in is key!

Option 1: Explain why you are doing this

Option 2: Demonstrate why you are doing this (better!)

In your handouts is a link to some example "framing" activities:
http://www.colorado.edu/sei/fac-resources/framing.html

The "Whiff of Credit"

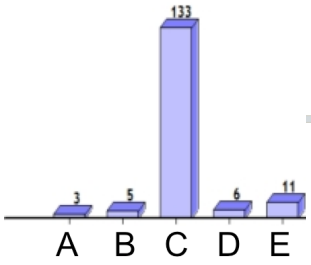
- May provide low-stakes incentive to have a good clicker score.
- Give points for trying, and maybe a little more for getting a correct answer.
- At the end of the semester, substitute the average clicker score for the worst homework score *if it is better.*
- Have clear policies on cheating.

Reacting to their votes)

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

After the individual vote (before peer discussion), you know the distribution & they don't!
You have lots of options. This is where you show your "agility."

What do you think you should do with this **first-vote** distribution?
(C is the correct answer)



A) "Turn to your neighbors and convince them you're right"
B) Confirm correct answer and move on
C) "Can someone who answered C tell us why they made that choice?"
D) Other

Discuss correct and incorrect choices

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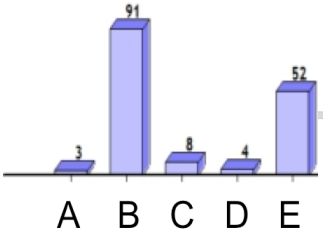
What do you think you should do with this **first-vote** distribution?



A) "Turn to your neighbors and convince them you're right"
B) confirm correct answer and move on
C) "Can someone who answered B tell us why they made that choice?"
D) other

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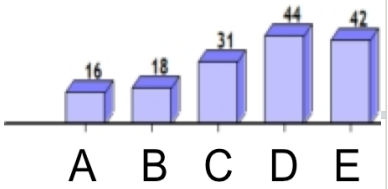
What do you think you should do with this **first-vote** distribution?



A) "Turn to your neighbors and convince them you're right"
B) confirm correct answer and move on
C) "Can someone who answered B tell us why they made that choice?" (etc.)
D) other

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Chat Discussion

Peer Discussion: Challenges & Solutions?

Best Practices:
- Create student buy-in
- Circulate
- Use "good" questions
- Allow enough time (2-5 mins)
- Focus on reasoning in wrap-up

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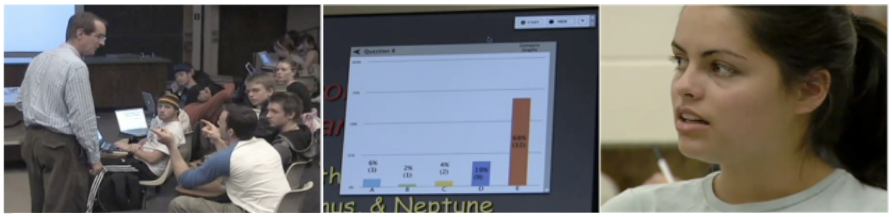
Chat Discussion

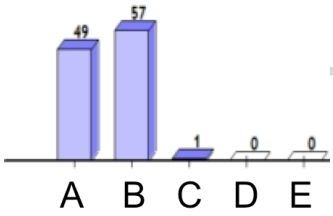
Wrap-Up Discussion: Challenges & Solutions?



Best Practices:

- Establish a safe, respectful environment
- Encourage sharing of ideas somehow
- Don't necessarily show histogram immediately
- Ask multiple students to defend their answers
- Emphasize reasoning: Why wrong answers are wrong and why right answer is right

What do you think you should do if this is the **second-vote** distribution?



A) "Turn to your neighbors and convince them you're right"
B) confirm correct answer and move on
C) "Can someone who answered B tell us why they made that choice?" (etc.)
D) "Would someone like to explain why they picked the answer they did?"
E) other

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Giving the answer stops student thinking!

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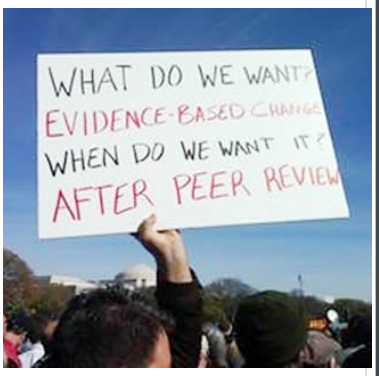
What about content coverage?

Facilitation Matters (the research)

Research shows that:

- Peer discussion + instructor explanation of question works better than either one alone
- Instructor explanation is particularly un-helpful for strong students.
- Students prefer time for individual thinking & peer discussion.
- Students prefer 2-5 challenging questions interspersed with lecture
- High-stakes points have a negative effect on conversation quality



See http://STEMclickers.colorado.edu for various references

Action Plan

- Take a few minutes to write down your action plan to implement ideas you heard about in this part of the workshop.
- Email it to yourself!

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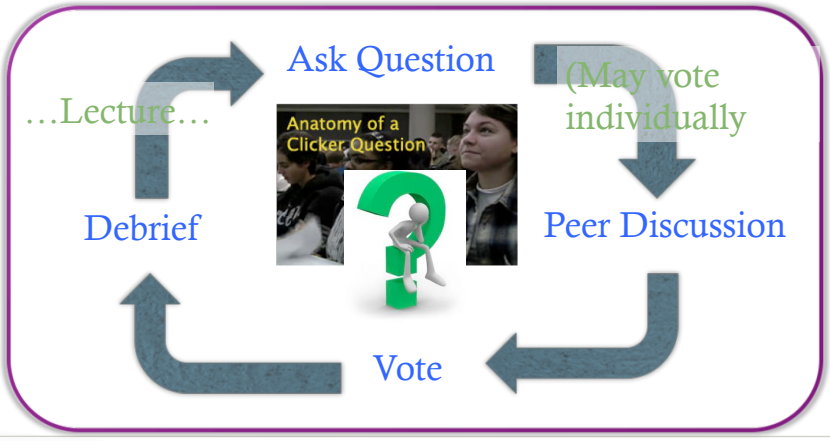
Thank you!

- **Clickers resource page** (videos, question banks, workshops): http://STEMclickers.colorado.edu
- **My web and blog:** http//sciencegeekgirl.com
- **The Active Class blog:** http://theactiveclass.com
- **Email:** stephanie@sciencegeekgirl.com

Look for announcements of future webinars, and handouts and slides from today's session at iclicker.com or our twitter stream **@iclicker**

Any burning questions?



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