The Gentle Art of Questioning

WRITING GREAT CLICKER QUESTIONS

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Agenda:
1. When and how we can ask questions
2. About clickers
3. Best practices
4. Writing questions

Workshop developed using materials from SEI and Rosie Piller

Exercise #1: Question Goals

- What *goals* might clickers be used to achieve? Or, put another way, what might you use clicker questions to accomplish in your class?
- Feel free to talk to your neighbor if you finish brainstorming on your own.

Possible question goals (when to ask)

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**BEFORE
Setting up instruction**

Motivate
Discover
Predict outcome
Provoke thinking
Assess prior knowledge

**DURING
Developing
knowledge**

Check knowledge
Application
Analysis
Evaluation
Synthesis
Exercise skill
Elicit misconception

**AFTER
Assessing
learning**

Relate to big picture
Demonstrate success
Review or recap
Exit poll

When to ask questions 1: Before & After

Before Instruction

- **Motivate** students
  - Why is it important to…?
  - What might we want to…?
  - What kinds of things can go wrong?
- Help them **discover** information
  - What do we have to take into acount when we…?
  - What needs to happen when you…?
  - Predict and show: We have seen that X happens when we do Y. What do you think will happen when…?
- Assess **prior knowledge** or **provoke** thinking/discussion
  - What do you think about…?
  - Would you/do you…?
  - What do you think will happen if…?

After Instruction

- Have students **recap** what they have learned
  - What steps did you go through to solve the problem?
  - What are the most important things to remember?
  - Exit poll: What did we learn today?
- Ask them to relate information to the **big picture**
  - How does this lead into the next topic?
- Demonstrate **success** and **limits** of understanding
  - *Ask questions that students have built an understanding of during the class.*
  - *Ask questions that go beyond what was done in class*

See also the Bloom's Taxonomy handout for question stems

When to ask questions 2: During

- Test **knowledge** of facts
  - What are the three types of…?
  - Can you define…?
- Test **comprehension** of concepts
  - Which statements support…?
  - What examples can you think of?
- Test **applications** of concepts
  - What would happen if…?
  - Which of the following are X?
- Help them **analyze** what they are learning
  - Based on the symptoms, what would you say is going on?
  - What is the relationship between…?

- Test their ability to **evaluate**
  - Here are two solutions. Which is more appropriate and why?
  - Which of these is more important?
- Provoke them to **synthesize** their understanding.
  - How would you test…?
  - Propose a way to…
- Elicit a **misconception**
  - *Ask questions where a common student misconception will result in a particular response*
- Exercise a **skill**
  - How would you…?
  - What is the next step in this problem?

See also the Bloom's Taxonomy handout for question stems

Anatomy of Peer Instruction

Ask Question

...Lecture...

(Maybe vote)

Class Discussion

Peer Discussion

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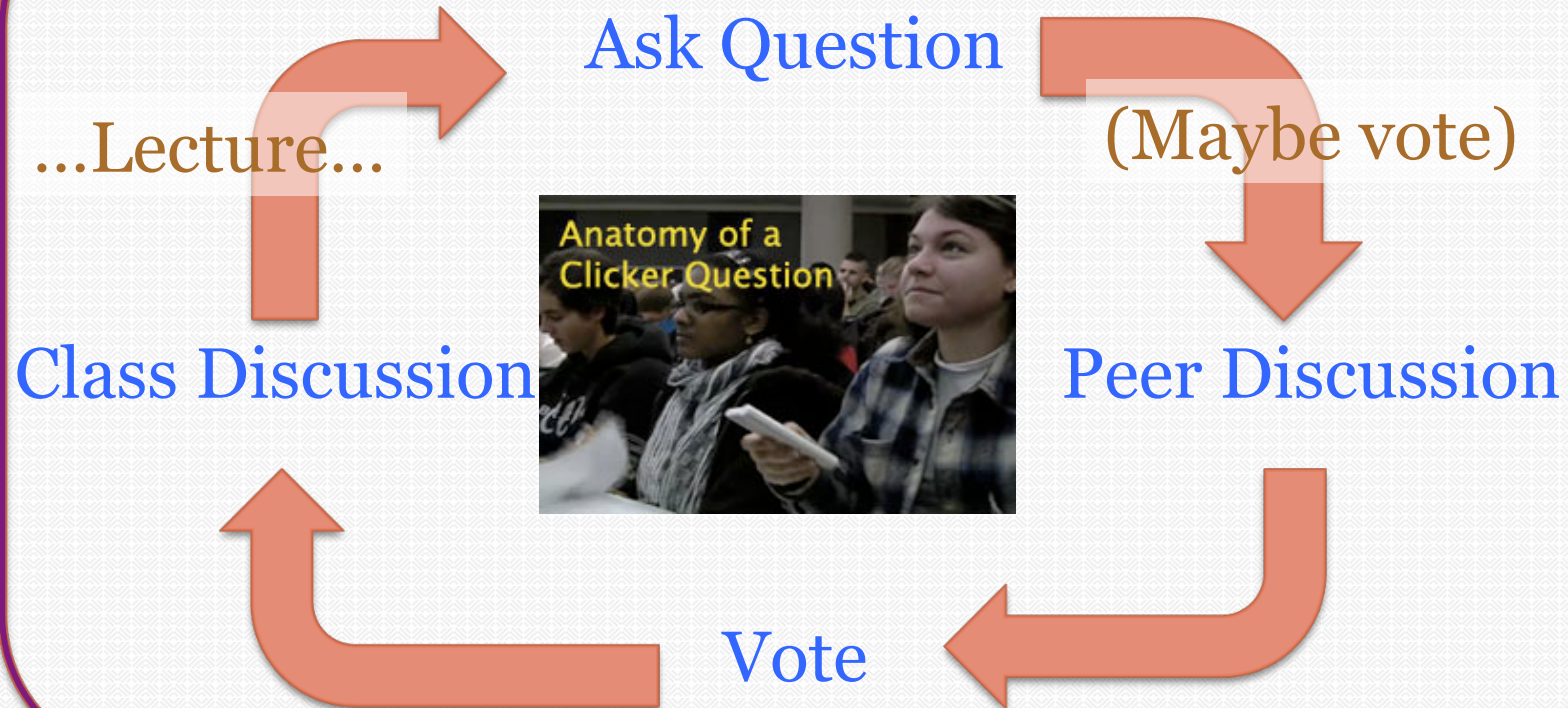
* See also: Peer Instruction, A User's Manual. E. Mazur.

What is special about clicker questions?

* From other types of in-class questions

- Similar in terms of goals
- Multiple choice
- Anonymous (to peers)
- Every student has a voice – the loud ones and the shy ones
- Forced wait time
- You can withhold the answer until everyone has had time to think (choose when to show the histogram)

What does this tool help us to do?

Exercise #2: Write a draft question

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- Choose one of the question goals (slide #3 on page 2 in handouts)
- Write a draft question that aims to achieve this goal.

Tips for writing clicker questions*

*particularly for use with peer instruction

- **Don't make them too easy**. You can ask multiple choice questions at higher levels of Bloom's! Don't just test memorized facts.

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

- Use questions that emphasize **reasoning or process** over the right answer. Students need to be convinced that understanding strategies will get them a good grade.

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

- 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.

- **Consider creative questions.** You can survey your students, ask them how well they understand, break problems into parts, 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

See also "Tips for successful clicker use" handout

Exercise #3: Revise your question

- Use what we've just talked about, and the "tips" in your handouts, to revise your question
- If you wish, swap with your neighbor and discuss.

Bloom's Levels and Associated Verbs*

Lower order cognitive level = LOC
Higher order cognitive level = HOC

LOC or HOC	Bloom's Levels and Associated Verbs
LOC (1)	**Knowledge**: arrange, define, duplicate, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce state
LOC (2)	**Comprehension**: classify, describe, discuss, explain, express, identify, indicate, locate, recognize, report, restate, review, select, translate
LOC or HOC (3)	**Application**: apply, choose, demonstrate, dramatize, employ, illustrate, interpret, operate, practice, schedule, sketch, solve, use, write
HOC (4)	**Analysis**: analyze, appraise, calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test
HOC (5)	**Synthesis**: arrange, assemble, collect, compose, construct, create, design, develop, formulate, manage, organize, plan, prepare, propose, set up, write
HOC (6)	**Evaluation**: appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, core, select, support, value, evaluate

Credit: Jenny Knight, University of Colorado, Boulder. October, 2011

* Original by Bloom (1956). Recently, Anderson and Krathwohl, [(2001). A Taxonomy for learning, teaching, and assessing.] have suggested that synthesis should be level 6 and evaluation should be level 6. Many put these two levels into practice simultaneously, using 5/6 as the Bloom's level.

Exercise #4: Rate and Swap

- Use the Bloom's Taxonomy worksheet to rate the Bloom's level of your question
- Swap your question with a neighbor. Do you agree on the Bloom's level of your question?
- Can you think of a way to "Bloomify up" the level of your question?
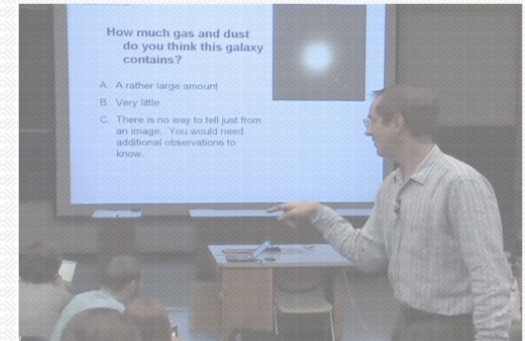
Other tips on question writing

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Jot down any ideas you got from discussion, or the gallery walk, here.

PI Step #1. Ask Question

What can you do when asking a clicker question to help students process it?

- Ask several times during lecture
- Ask challenging, meaningful questions
- Don't post until ready
- Give time to read (read silently)
- Don't read question out loud

PI Step #2. Peer Discussion

Why is peer discussion important?

- Students learn more deeply by teaching each other
- Makes them articulate answer
- Lets you see inside their heads

How can you help make it work?

- Make it clear why you're doing this
- Circulate and ask questions / model
- Use questions they want to discuss
- Allow enough time (2-5 mins)
- Make wrap-up discussion focus on the reasoning

PI Step #3. Wrap-Up Discussion

What might you do to facilitate an effective wrap-up discussion?

- •Establish culture of respect
- •Consider whether to show the histogram immediately
- • Ask multiple students to defend their answers
- • Why are wrong answers wrong and why right answer is right

Action Plan

What will you do to implement ideas you heard about in this workshop?

OR what key ideas will you share with a colleague? (See Clicker Tips sheet for summary!)

1.

2.

3.

References & Resources

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- **Clicker Resource Page from the Science Education Initiative:** http://STEMclickers.colorado.edu. Has clicker question banks (in the sciences), an instructors' guide, and videos of classroom use. Useful books (such as Eric Mazur's *Peer Instruction* are cited there.

- **Workshop handouts** will be at http://blog.sciencegeekgirl.com

- Many materials in this workshop (particularly the questioning cycle and the participant exercises) were adapted from **Rosie Piller,** Making Students Think: The Art of Questioning. Short papers published in: Computer Training & Support Conference, 1995; ISPI International Conferences, 1991 and 1996; ASTD National Conference on Technical & Skills Training, 1990. Related workshop description at http://www.educationexperts.net/mstworkshop.html.

- Other materials (particularly sample clicker questions and goals of clicker questions) adapted from **Ian Beatty's** Technology Enhanced Formative Assessment (TEFA) program. http://ianbeatty.com/crs

Thanks!