MSU Certification in College Teaching Institute

Creating Effective Learning Environments: Five Easy Steps to Peer Instruction

Learning goals:

1. Observe and describe the basic components or steps of peer instruction and the conceptual understanding behind the steps of peer instruction.
1. Describe the elements of good clicker questions; use these elements to analyze clicker questions; create your own clicker questions in your discipline.
2. Begin a plan to transform a short segment of a standard lecture into one that utilizes peer instruction and personal response.

Workshop activities:

1. (0-10) Worksheet Part A; Handout clickers; start with simple clicker questions. Do three. End with metacognitive clicker question
2. (10-20) Part of prezi on peer instruction, including videos from PI module, classroom observation;
3. (20-30) Worksheet Part B: The steps of peer instruction. Reasons behind peer instruction.
4. (30-40) Worksheet Part C: Analyze clicker questions, identify strengths and weaknesses
5. (40-50) Report out. Open discussion on how to improve clicker questions.
6. (50-60) More practice with PI: Identify a person at each table to assist in the PI process during group discussions. Run a few clicker questions, first as standard questions, then on how to interact with groups.
7. (60-75) Worksheet Part D: Create clicker questions in your discipline. Start with a concept or idea, write answers and distractors, analyze within the context of Bloom's Taxonomy, and re-write towards a higher level of learning. Share with your group of three.
8. (70-80) Share out clicker questions created.
9. (80-90) Worksheet Part E: short report and then open discussion of challenges of implementation of peer instruction.

Creating Effective Learning Environments: Five Easy Steps to Peer Instruction

Part A: Introduction to clicker questions and peer-instruction.

This icon means answer as an individual. Commit to a response, express your current (pre) state of knowledge.

Articulate, debate, and revise: This icon means discuss and then agree (or sometime not) on an answer.

Let's do a few examples of clicker questions.

Now we will explore examples of peer instruction.

Part B:

Write down the steps of peer instruction that you observed in the videos.

1. Step One:

2. Step Two:

3. Step Three:

4. Step Four:

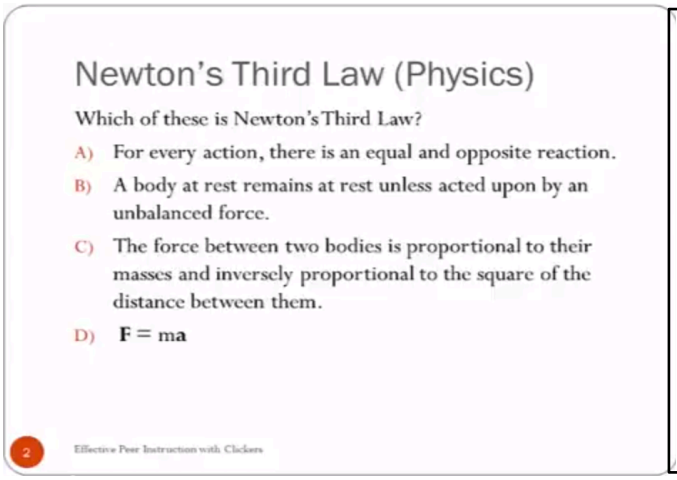
5. Step Five (if necessary):

Compare your steps (four or five) with those of your neighbors. Reach consensus, identify one of you to report out.

Part C: Analyze clicker questions and improving clicker questions: When writing clicker questions, it is useful practice to analyze the question in terms of three ideas:

1. **Where in the learning cycle the question is focused?** Where in your class might the question best fit, or more appropriately, what types of questions do you want to use/develop for different parts of your class's learning cycle? See learning cycle below.
2. **What is the Bloom's Taxonomy level of the question?** If it is fact checking or memorization, it is unlikely to develop deeper or conceptual understanding, and unlikely to lead to engaging student discussion. Questions at higher Bloom's levels of comprehension or analysis require students to think more, talk more, and learn more. Refer to Bloom's Taxonomy below.
3. **Does the clicker question contain believable distractors?** Questions that include mistaken elements of common or prior knowledge or misconceptions in the possible answers are very effective at challenging student's to overcome their commonly held, but mistaken beliefs. This is a key part of the peer instruction process – requiring students to individually express an answer prior to discussion or expert solution forces them commit to a position.

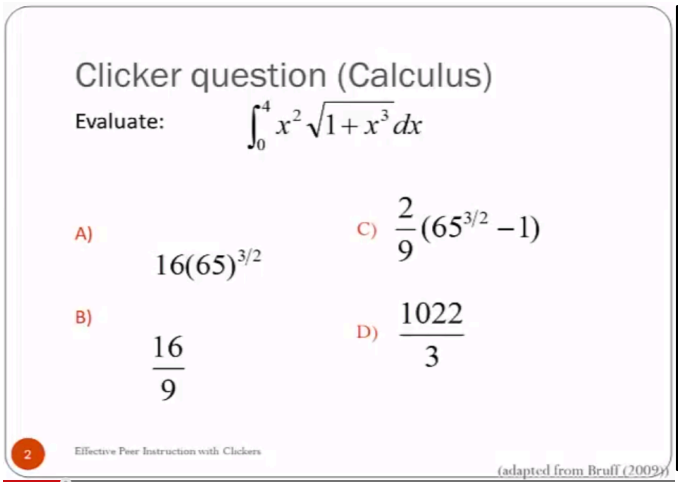
On the next page are three questions. Working in groups, analyze with the criteria listed above. Think about the *kinds of discussions do these questions elicit in the students.*



1. Where might this come in the question cycle?

2. To what level of knowledge on Bloom's taxonomy is the question directed?

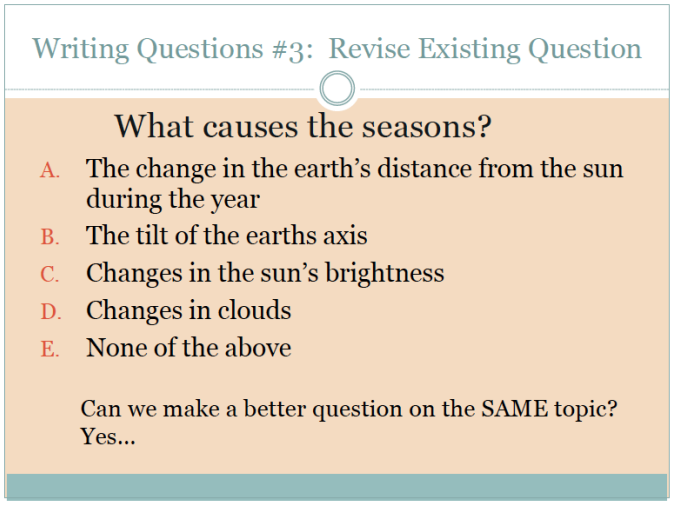
3. Are the distractors good? Bad? What type of discussion would this question engender?



1. Where might this come in the question cycle?

2. To what level of knowledge on Bloom's taxonomy is the question directed?

3. Are the distractors good? Bad? What type of discussion would this question engender?



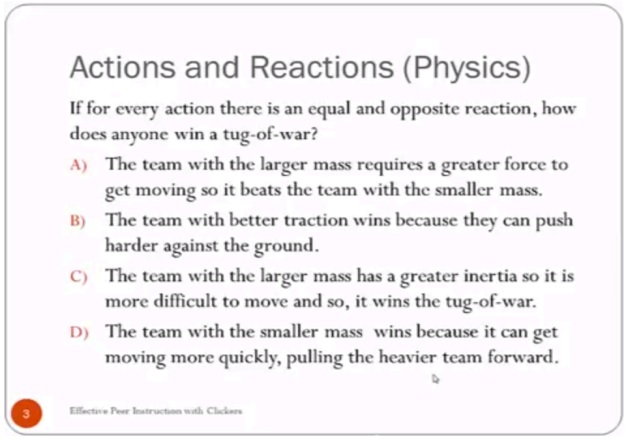
1. Where might this come in the question cycle?

2. To what level of knowledge on Bloom's taxonomy is the question directed?

3. Are the distractors good? Bad? What type of discussion would this question engender?

Great, now look at different versions of the same questions, shown below. They ask the 'same' thing, but in a different way. They would be appropriate in the same places of the question cycle.

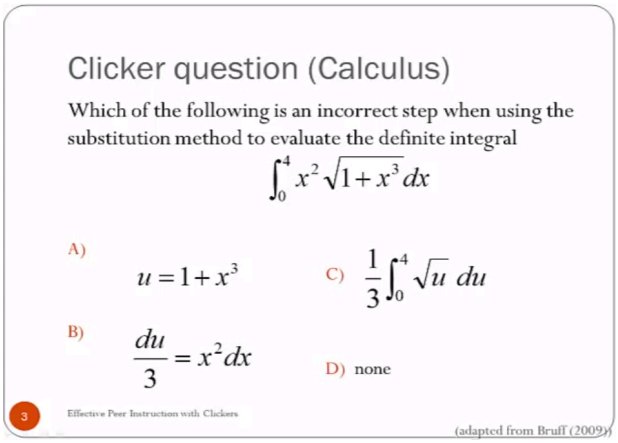
Let's analyze these version of the questions in terms of Bloom's taxonomy, the dis



1. Bloom's taxonomy?

2. Distractors?

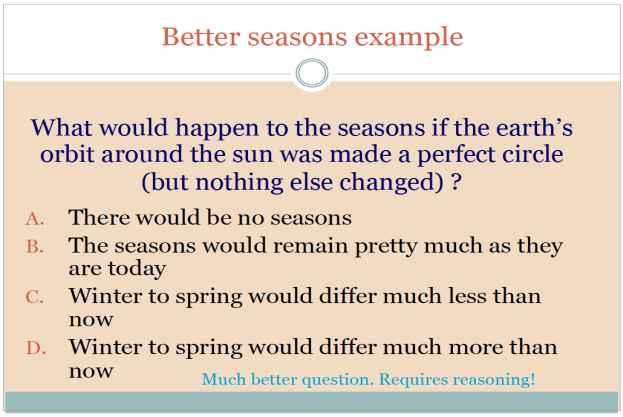
3. What type of discussion would this question engender?



1. Bloom's taxonomy?

2. Distractors?

3. What type of discussion would this question engender?



1. Bloom's taxonomy?

2. Distractors?

3. What type of discussion would this question engender?

Part D: Think about a topic you that you recently taught or learned. On your own, write a draft question that addresses one of the pedagogical goals from the Question Cycle (see last page). Include 3-4 plausible distractors.

Share your question with your group of three or a neighbor. Try to identify the Bloom's level and type of pedagogical goals in the question cycle of the question your neighbor provide.

Part E: Write down the top three fears/challenges/barriers you think you will face in implementing peer-instruction in your future teaching:

1.

2.

3.

Share with your group your concerns, and discuss strategies for overcoming them. We will share out at this point.

Resources and credits below:

Question Cycle

Courtesy of Rosie Piller

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 account when we…?
  - What needs to happen when you…?
  - Predict: Since X causes 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…?

During Instruction

- 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?

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

[1] *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.*

Bloom's Taxonomy, left to right…

Knowledge	*Comprehension*	*Application*	*Analysis*	*Evaluation*	*Synthesis*
know	restate	translate	distinguish	compose	judge
define	discuss	interpret	analyze	plan	appraise
memorize	describe	apply	differentiate	propose	evaluate
list	recognize	employ	calculate	design	compare
recall	explain	demonstrate	experiment	assemble	value
name	identify	dramatize	compare	construct	select
relate	locate	practice	contrast	create	choose
		illustrate	criticize	design	assess
		operate	solve	organize	estimate
			examine	manage	measure

Bloom's Taxonomy "Revised"
Key Words, Model Questions, & Instructional Strategies

Bloom's Taxonomy (1956) has stood the test of time. Recently Anderson & Krathwohl (2001) have proposed some minor changes to include the renaming and reordering of the taxonomy. This reference reflects those recommended changes.

I. REMEMBER (KNOWLEDGE)
(shallow processing: drawing out factual answers, testing recall and recognition)

Verbs for Objectives	Model Questions	Instructional Strategies
choose	Who?	Highlighting
describe	Where?	Rehearsal
define	Which One?	Memorizing
identify	What?	Mnemonics
label	How?	
list	What is the best one?	
locate	Why?	
match	How much?	
memorize	When?	
name	What does It mean?	
omit		
recite		
recognize		
select		
state		

II. UNDERSTAND (COMPREHENSION)
(translating, interpreting and extrapolating)

Verbs for Objectives	Model Questions	Instructional Strategies
classify	State in your own words.	Key examples
defend	Which are facts?	Emphasize connections
demonstrate	What does this mean?	Elaborate concepts
distinguish	Is this the same as. . .?	Summarize
explain	Give an example.	Paraphrase
express	Select the best definition.	STUDENTS explain
extend	Condense this paragraph.	STUDENTS state the rule
give example	What would happen if . . .?	"Why does this example. . .?"

illustrate	State in one word . . .	create visual representations
indicate	Explain what is happening.	(concept maps, outlines, flow charts
interrelate	What part doesn't fit?	organizers, analogies, pro/con grids)
interpret	Explain what is meant.	PRO| CON
infer	What expectations are there?	*NOTE: The faculty member can show them, but they have to do it.*
judge	Read the graph (table).	Metaphors, rubrics, heuristics
match	What are they saying?	
paraphrase	This represents. . .	
represent	What seems to be . . .?	
restate	Is it valid that . . .?	
rewrite	What seems likely?	
select	Show in a graph, table.	
show	Which statements support . . ?	
summarize	What restrictions would you add?	
tell		
translate		

III. APPLY
(Knowing when to apply; why to apply; and recognizing patterns of transfer to situations that are new, unfamiliar or have a new slant for students)

Verbs for Objectives	Model Questions	Instructional Strategies
apply	Predict what would happen if	Modeling
~~choose~~	~~Choose the best statements that~~	~~Cognitive apprenticeships~~
dramatize	apply	"Mindful" practice – NOT just a
explain	Judge the effects	"routine" practice
generalize	What would result	Part and whole sequencing
judge	Tell what would happen	Authentic situations
organize	Tell how, when, where, why	"Coached" practice
paint	Tell how much change there would be	Case studies
prepare	Identify the results of	Simulations
produce		Algorithms
select		
show		
sketch		
solve		
use		

IV. ANALYZE (breaking down into parts, forms)

Verbs for Objectives	Model Questions	Instructional Strategies
analyze	What is the function of . . .?	Models of thinking
categorize	What's fact? Opinion?	Challenging assumptions
classify	What assumptions. . .?	Retrospective analysis
compare	What statement is relevant?	Reflection through journaling
differentiate	What motive is there?	Debates
distinguish	Related to, extraneous to, not	Discussions and other
identify	applicable.	collaborating learning activities
infer	What conclusions?	Decision-making situations
point out	What does the author believe? What	
select	does the author assume?	
subdivide	Make a distinction.	
survey	State the point of view of . . .	
	What is the premise?	
	State the point of view of . . .	
	What ideas apply?	
	What ideas justify the conclusion?	
	What's the relationship between?	

	The least essential statements are What's the main idea? Theme? What inconsistencies, fallacies? What literary form is used? What persuasive technique? Implicit in the statement is . . .	

V. EVALUATE (according to some set of criteria, and state why)

Verbs for Objectives	Model Questions	Instructional Strategies
appraise judge criticize defend compare	What fallacies, consistencies, inconsistencies appear? Which is more important, moral, better, logical, valid, appropriate? Find the errors.	Challenging assumptions Journaling Debates Discussions and other collaborating learning activities Decision-making situations

VI. CREATE (SYNTHESIS)
(combining elements into a pattern not clearly there before)

Verbs for Objectives	Model Questions	Instructional Strategies
choose combine compose construct create design develop do formulate hypothesize invent make make up originate organize plan produce role play tell	How would you test. . .? Propose an alternative. Solve the following. How else would you . . .? State a rule.	Modeling Challenging assumptions Reflection through journaling Debates Discussions and other collaborating learning activities Design Decision-making situations

Web References:

- http://www.coun.uvic.ca/learn/program/hndouts/bloom.html
- http://www.fwl.org/edtech/blooms.html
- http://apu.edu/~bmccarty/curricula/mse592/intro/tsld006.htm
- http://152.30.11.86/deer/Houghton/learner/think/bloomsTaxonomy.html
- http://amath.colorado.edu/appm/courses/7400/1996Spr/bloom.html
- http://www.stedwards.edu/cte/bloomtax.htm
- http://quarles.unbc.edu/lsc/bloom.html
- http://www.wested.org/tie/dlrn/blooms.html
- http://www.bena.com/ewinters/bloom.html
- http://weber.u.washington.edu/~krumme/guides/bloom.html

References:
Anderson, L. W. & Krathwohl, D. R. (2001). A Taxonomy for learning, teaching, and assessing.
Bloom, B. S. (Ed.). (1956). Taxonomy of educational objectives: The classification of educational goals, by a committee of college and university examiners. New York: Longmans.
John Maynard, University of Texas, Austin
Marilla Svinicki, University of Texas, Austin

Resources for Peer Instruction:

General resources:

http://www.cwsei.ubc.ca/resources/clickers.htm excellent site with access to many clicker resources.

http://www.colorado.edu/sei/fac-resources/workshops-clickers-materials.htm is a great resource for faculty on training to use clickers.

http://blog.peerinstruction.net/ is the official peer instruction site from Julie Schell.

https://www.peerinstruction.net/ is a network of peer instruction users.

http://blog.sciencegeekgirl.com/ is Stephanie Chasteen's site, with lots of info from her workshops on clickers and peer instruction.

http://cft.vanderbilt.edu/guides-sub-pages/clickers/ Derek Bruff's page at Vanderbilt on Clickers and how to use them.

http://www.peerinstruction4cs.org/ Peer instruction for computer science.

https://ctd.ucsd.edu/services/peer-instruction-with-clickers/ Peter Newbury and UCSD's site on peer instruction using clickers. Like CWSEI, nice videos on peer instruction.

http://perusersguide.org/guides/Section.cfm?G=Peer_Instruction&S=Resources Good site on peer instruction in physics.

Example clicker questions:

http://www.cwsei.ubc.ca/resources/files/ClickerWorkshopMaterials/Example-questions-big-v3.pptx is a great resource of example clicker questions from Stephanie Chasteen.

http://www.cwsei.ubc.ca/resources/clickers.htm#questions has links to a wide variety of clicker question repositories from CU Boulder and UBC Science Education Institute.

http://www.colorado.edu/physics/EducationIssues/cts/index.htm lots and lots of physics concept tests (clicker questions).

http://www.physics.umd.edu/perg/role/PIProbs/ProbSubjs.htm more physics clicker questions from Joe Reddish at UMD.