

## Writing Effective Clicker Questions

Creating good clicker questions that move beyond simple memory and recall questions can be difficult. Here is some information to help you think about how to engineer effective clicker questions.



**Clickers should be used for the following types of purpose:**

- To expose and clarify students' misconceptions
- To differentiate between easier and more difficult concepts
- To promote interactivity and discussion in large group case-based learning
- To elicit and discuss diverse points of view when there is no correct answer (e.g. ethics)
- To administer an effective review session/mock exam that gives immediate feedback
- To assess mastery of content
- To provide immediate feedback on the value of the learning session



**Consider the following questions when drafting clicker questions:**

- What student learning goals do I have for the question?
- What do I hope to learn about my students by asking this question?
- What will my students learn about each other when they see the results of this question?
- How might this question be used to engage students with course content in small-group or classwide discussions or by creating a time for telling?
- What distribution of response do I expect to see from my students?
- What might I do if the actual distribution turns out very differently?



**Engineer questions deliberately.**

**Each question should have a pedagogical goal**

Identify what students should learn from the question.

- Use a variety of clicker questions (application questions, critical thinking questions, student perspective questions, monitoring questions).
- Use clickers for purposes other than quizzes and taking attendance.

- Use a variety of types of clicker questions. Some courses lend themselves to particular types of questions but experimenting with different kinds of questions (application questions, critical thinking questions, student perspective questions, monitoring questions) can help instructors use clickers in ways that engage students and meet course learning goals.

### **Avoid simple factual questions or those that rely on memory recall as opposed to understanding**

- Strive for questions that get students to reason qualitatively and to draw conclusions from a conceptual model.

### **Design questions to “catch” students in likely misunderstandings and points of confusion**

- Draw on student responses and questions to homework and class readings to generate answer choices for questions.
- Design ambiguous questions to help students reason and think defensively.

### **Design questions to illicit a broad spread histogram of responses, indicating several popular choices**

- This is a signal of an effective question as it provides good material for class-wide or small group discussions

### **Use a sequence of related questions to develop a complex idea or set of related issues – present a concept in different contexts**

### **Use familiar situations for new concepts to develop understanding**

### **Consider when and how a question is presented:**

- If a question is posed before presentation of subject material, students will draw on preexisting knowledge, apply intuition, and extrapolate from prior course material
- If it is presented after, they will draw on whatever was just covered regardless of its relevance



### **FAQ about Clicker Questions:**

#### **Where can instructors find clicker questions?**

- Some textbooks come with question banks that contain questions written intentionally for in-class use with classroom response systems or for other purposes such as exams, which instructors can adapt for use as clicker questions.
- Many instructors routinely ask free-response and rhetorical questions during class sessions, and often these questions can be turned into effective clicker questions.

#### **What are some strategies for constructing answer choice for clicker questions?**

- Creating answer choices for clicker questions that students will choose requires instructors to know what their students understand, what they do not understand, and the kinds of misconceptions and perspectives they have.
- Examine student responses to free-response questions asked in other contexts and at homework problems

- Have students respond before class, by email or online quiz, and use these responses to create questions and/or answers
- Look for answer choices for potential clicker questions in student responses to open-ended questions, ones asked on assignments in previous courses, on homework questions, or during class. This can lead to answer choices that better match common student misconceptions and perspectives.

### **How challenging should clicker questions be?**

- The difficulty of a clicker question is often shaped by the instructor's learning goals for students, as well as the function of the question in the classroom.
- Instructors using clicker questions to create times for telling or generate small-group or classwide discussion often find that more challenging questions engage students more in these processes.
- A steady stream of challenging clicker questions can mentally exhaust some students. A few easy questions here and there can give students a break from more difficult questions and bolster their confidence by showing them what they know.

### **How can instructors improve their clicker questions?**

- Consider dropping or revising unpopular answer choices (those that are not chosen by many students).
- Take notes on students' comments in response to a clicker question. Constructing answer choices involves trying to predict how students might respond.
- Share and discuss the clicker questions with colleagues interested in teaching, both in your own discipline and in other disciplines, with clickers.
- Immediately after class, take a few notes about how particular clicker questions played out during class. A little reflection right after class can help in refining and improving clicker questions over time.



## **Bloom's Taxonomy and Clicker Questions:**

### **Knowledge / Recall** - Remembering facts, terms, concepts, etc.

- Questions would check for basic recall of common terms, specific facts, basic concepts, principles, methods and procedures
- *Question Cues:* list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.

### **Comprehension / Understanding** - Explaining/interpreting the meaning of material

- Questions about comprehension require students to understand facts and principles, to translate verbal material to mathematical formulas, to estimate the consequences implied in data, or to interpret verbal material, charts, and graphs.
- *Question Cues:* summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend

### **Application** - Using a concept or principle to solve a problem

- Questions would require students to apply concepts or theories to a situation or practical setting, to solve mathematical problems, to construct graphs and charts, or to demonstrate the correct usage of a method or procedure.
- *Questions Cues*: apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover

**Analysis** - Breaking material down into its component parts to see interrelationships/hierarchy of ideas

- Questions would require students to recognize unstated assumptions and logical fallacies in reasoning, to distinguish between facts and inferences, to evaluate the relevancy of data, and to analyze the organizational structure of a work of art, music, or writing.
- *Question Cues*: analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer

**Synthesis / Creation** - Producing something new or original from component parts

- Question would require students to integrate learning from different areas in order to view information in a new way.
- *Question Cues*: combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite

**Evaluation** - Making a judgment based on pre-established set of criteria

- Questions might require students to judge the logical consistency of presented material, the adequacy with which the conclusions are supported by data, or the value of the work of art (either by internal criteria or external standards).
- *Question Cues* assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize



## A Taxonomy of Clicker Questions:

### Content Questions

- **Recall Questions** - These questions ask students to remember facts, concepts, or procedures relevant to a class session or course. They do not assess students' understanding of these facts, concepts, or procedures, merely their memory of them.
- **Conceptual Understanding Questions** - They can be useful for promoting enduring understandings of course material – conceptual understandings that will last far beyond the duration of the course itself.
- **Conceptual Questions in Quantitative Disciplines** - Ask students conceptual questions about a particular topic before having them engage in computational questions on that topic. These questions help students understand the big picture of a problem before delving into complex computations.

### Application Questions

- **Procedural Questions** - This is a common type of application question, particularly in quantitative disciplines which requires students to apply knowledge of a procedure or technique to a particular problem or situation.

- **Critical Thinking Questions** - These questions require students to analyze relationships among multiple concepts or make evaluations based on particular criteria.
- **One-Best-Answer Questions** - Since in-class clicker questions are often used more for engaging students than assessing them, these questions need not have single correct answers.

### Peer Assessment

- Some instructors have students assess each other's presentations, papers, or other work during class with clickers. This provides students with potentially valuable feedback on their work and helps students better understand the criteria by which quality is judged in a particular course or discipline.

### Process Questions

#### **Student Perspective Questions**

- An instructor can ask students a variety of clicker questions that are not designed to assess their learning but to surface their perspectives instead. These questions can be used to help instructors get to know their students.
- They can be used to help students in a class get to know each other.
- They can be used to help students see the relevance of course content to their own lives by demonstrating how many of their peers are affected by topics covered in a course.
- Clickers allow an instructor to collect response to such questions in such a way that students are not aware of the individual answers of their peers

#### **Confidence Level Questions**

- It can be helpful to ask student how confident they are in their answers, following a true-or-false question.
- Another way to ask a confidence-level question is to ask students how confident they are that they could answer a particular content question, respond well to a particular essay question, or solve a particular problem were they asked to do so. This kind of question can be asked of more than just multiple-choice questions. These kinds of confidence-level questions can be useful in determining tasks for which students need assistance and can work very well at the start of a session designed to prepare students for an exam.
- A fairly simple way to assess student's confidence in their answers to content questions is to include an "I don't know" option as an answer choice.

#### **Monitoring Questions** - progress, feedback, teaching style, etc.

- Monitor progress on a semester-long assignment such as a paper, project, or presentation.
- Ask students after the first or second assignment of the semester (a problem set, a short paper, a lab report) how long it took them to complete that assignment. This provides a sense of how difficult the assignment was - useful information to have when planning future assignments.
- Quiz students on various points made in the course syllabus throughout the semester in order to remind students of those points.
- Ask students prior to the first exam which of a set of possible study strategies is likely to be most effective in preparing for the exam.
- Ask the kinds of questions that frequently appear on end-of-semester course evaluation forms that students complete and ask them during the semester.

- Gather feedback on teaching styles.
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