Activity

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Clicker Questions: Thinking About Your Learning

Educator: Carl Wieman, Professor, Physics
Context: In all classes, most recently; Physics of everyday life for nonscientists and Introduction to Quantum Mechanics
Keywords: content, metacognition, clickers
Student Activity Time: 5-10 minutes

Students reflected on their thinking and learning by responding to clicker questions and then discussing the question and answer with their peers, and then as a class with the instructor.

Introducing the Reflection Activity

In various Physics and Engineering courses, students reflected on their learning by responding to a clicker question, discussing the question in small groups, seeing the histogram of responses, and listening to the educator discuss the responses. The purpose of this reflection activity was to support students in actively thinking about their learning throughout a class.

Periodically throughout each class section, the educator crafted questions related to the course content to ask students. Then the educator engaged students in using their clickers to respond to the question. After students responded to the question, they talked about the question and their answers in small groups and responded again. During these small group discussions, the educator listened to gauge what students were thinking. After these small group discussions, the educator showed students the histogram and talked to students about the right answer and what was wrong with incorrect answers that a number of students had chosen. In this follow-up discussion, the educator asked students to offer up their group's justification for each of the answer choices, including "why you think a student might choose this answer" for incorrect options. This discussion helped students consider different perspectives and reasoning—helping students reflect on the class material.

In terms of outcomes, such reflection activities are embedded with the material throughout the class session. These reflection activities require students to be active learners. In doing so, they understand the material better, see the gaps in their learning and knowledge, recognize what areas they need to study, and more readily engage with the educator to improve their understanding.

Recreating the Reflection Activity

	Description
1	Identify the learning goal and possible associated student difficulties. Design a clicker question.
2	Invite students to respond to the clicker question and talk about the question in a small group, and then revote.
3	Listen to students' discussions to understand their thinking.
4	Present clicker responses and discuss the student reasoning where correct and incorrect or incomplete.

In the words of the Educator: Tips and Inspiration

Provide rationale for the reflection activity. In my experience, it is important to get students to buy into the whole process, especially the group discussion part. For most students, this structure is new and different from what they are used to so explain to them how this is being done to enhance their learning and use their time in class most effectively. I have measured how much students learn from class, and it dramatically improves (up to a factor of x10) when the material is covered as part of a challenging clicker question compared to when it is just presented by telling them.

Form a balanced question. I've found that questions need to be challenging, but do-able. Often times clicker questions are too simple and/or involve simple memorization, so they don't really engage students. The questions need to seem worthwhile and challenging to students and motivate them. On the other hand, questions that are too challenging can just leave students frustrated. You need to achieve the proper balance when writing clicker questions.

Listen to the student discussions. I believe it's very important to talk through the results with students—that is when they do their reflection and learning, but you cannot do this well without understanding their thinking, which you get from listening to them first.

What was the inspiration for the reflection activity? I've been doing Science Education research for the last 20 years and reading the literature in the field. This area of research started because I was curious about why my graduate students did or did not develop into being physicists, specifically why their coursework wasn't preparing them for this future. This interest resulted in me becoming passionate about supporting students in being metacognitively aware—resulting in the use of reflection activities in my teaching, such as clicker questions.