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LETTERS TO THE EDITOR

A 'Strong Case' Exists for Classroom Clickers

To the Editor:

Good that you have Michael Bugeja's article on clickers ("Classroom Clickers and the Cost of Technology," *The Chronicle* Commentary, December 5, 2008), and good that it sounds a warning about cost concerns with educational technology (especially costs to students). Not so good that the author did not parallel it with some reference to the very strong case for using clickers appropriately, and at no cost to the students, as part of the "Highly Interactive Paradigm" (it has other labels) revolution in classroom instruction. A good source for that is Richard Hake (see Google for references).

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To the Editor:

Years of extensive systematic surveys, observations, and peer-reviewed research on personal-response systems — "clickers" — contradict many of the points raised in Mr. Bugeja's article. This simple tool, when used well, can result in a remarkable transformation of a university classroom, increasing how much students learn from and enjoy a given course through increased interaction and engagement with their instructor and peers. No other single tool achieves as many benefits for such low cost.

Mr. Bugeja argues that "manufacturers substituted 'student' for 'audience'" when adapting clickers from audience-response systems in Hollywood. We do not find it interesting to hypothesize about intentions of manufacturers or their profit motives, but rather to adapt their tools for our needs. As with any technology, a clicker is simply a tool, and depending on the hands of the craftsman, it can either be an expensive toy or a vehicle for classroom transformation. Here at the University of Colorado at Boulder we use iClickers, which are designed to be technically simple and robust. Students buy the iClicker once, for about $40 ($20 used), and use it in multiple courses. That's it. From there, it's up to the instructors.

Now, if instructors substitute "student" for "audience," there is a problem. Decades of research on learning and cognition show that students learn more when they are engaged interactively. But it's hard to change university classrooms to encourage active learning, given a myriad of institutional constraints, such as fixed, stadium-style seating. Clickers, however, offer an easy, cost-effective way to engage students in the material, by (1) asking students a question that's challenging, but not too hard; (2) giving them adequate time to discuss the question with their neighbors before they give their final vote; and (3) asking students to explain their answers, including why the wrong answers are wrong.

This method of using clickers with peer instruction is modeled after that of Eric Mazur at Harvard University. Research here and elsewhere has shown that it increases student learning across several disciplines compared to traditional lectures. Additionally, several studies show that, after talking to their neighbors, students gravitate toward the correct answer, and the experience of talking to their neighbors substantially contributes to learning. In addition, clickers give students a chance to practice communicating their thinking to their peers, a skill that they would not acquire while passively listening to a lecture. Classes that use clickers to ask simple quizlike questions without peer discussion aren't achieving these full benefits.

Obviously, teachers don't need clickers in order to ask students thoughtful questions and have them discuss the answers with each other. But clicker technology itself provides several key benefits that promote active engagement. It focuses the class clearly on a question and then makes students commit to an answer, instead of retroactively deciding that they would have answered correctly. It also permits the safety of anonymity. (Mr. Bugeja quotes Ira David Socol's claim that clickers are "no more sophisticated pedagogically than raising your hand." Come now. If most people are raising their hands for answer A, will you still bravely raise your hand for B? And once you know the answer to the question, your own reasoning process has been short-circuited.) Lastly, clickers offer a computer tabulation of responses, giving both instructors and students real-time systematic feedback about student understanding.

Mr. Bugeja hypothesizes that students would vote against the use of clickers because the costs outweigh the benefits. Research suggests otherwise. In our own large introductory-physics courses, 95 percent of students stated that clickers helped them learn the material. Studies in other disciplines suggest that students are more likely to value clickers when they're used to promote discussion, rather than to ask simple questions or take attendance.

Sure, clickers cost students money. But students are paying thousands of dollars to sit in your classroom. Clickers can make this experience more educationally productive, for a marginal additional cost. Let's not concern ourselves with the business of the manufacturers. We're in the business of supporting the development of thinking minds.

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To the Editor:

The commentary by Michael Bugeja includes the kind of speculation — contradicted by data — that hinders the progress of effective teaching. Why is it that faculty members who would never design a computer, a bridge, or a telescope without examining the relevant data feel so free to ignore existing data when speaking about teaching?

There is over 10 years' experience and much published research on the effect of having students discuss challenging conceptual questions during a lecture rather than simply listening and taking notes. The results are unequivocal: Students with active minds learn significantly more than those who listen passively and take notes. Catherine H. Crouch and Eric Mazur found this is true with 10 years of data at Harvard; we find the same results at the University of Colorado; and Richard R. Hake finds the same in a survey of 6,000 students in 52 classes at different institutions. Clickers are simply a method for getting students to really take part in peer discussions. Holding up colored cards is OK, but students themselves report that the accountability provided by clickers greatly increases their participation.

April Trees and Michele H. Jackson surveyed hundreds of students. These comments are typical:

I like clicker questions because it helps me understand key concepts and it makes me read the chapters in the book. I think clickers are critical to learning more information about the topic being taught."

It's not that I like [clickers], as a matter of fact, I hate them; but I think that they're really useful [in improving learning and grades].

It is the striking learning gains in data quoted above that caused a University of Colorado Nobel Prize winner, Carl Wieman, to change the focus of his research and devote himself full time to improving science teaching. That decision was not taken lightly. We now have a large research group of faculty members, postdocs, and graduate students whose data provide answers to the topics about which Mr. Bugeja speculated.

Most of the practices he describes are what our research shows to be worst practices. We see them fail, too. When instructors use clickers as part of peer instruction and explain to students that they will attend class more, work harder, learn more, and be rewarded for that, peer instruction and clickers produce learning gains. When instructors ask low-level memorization questions and don't explain why they are using clickers, students call them dumb and worthless. The data are so repeatable that we have posted a document that shows "How to Succeed" and "How to Fail" when using clickers. It may be found at http://www. colorado.edu/its/cuclickers/instructors.

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