



News, Views and Careers for All of Higher Education

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Proving the Benefits of Peer Instruction

The University of Colorado at Boulder has gone clicker crazy. Thousands of its undergraduate students own the electronic devices, which instructors across the campus use to gauge how well students are grasping the material in their courses. The university has also been a leader in experimenting with emerging methods of teaching, as many professors incorporate [“peer instruction”](#) designed to encourage students to discuss concepts with, and learn from, each other. There, as elsewhere, though, many other professors [remain skeptical about new technologies](#) and new teaching methods.

Tin Tin Su, an associate professor in the university’s molecular, cellular and developmental biology department and a participant in Boulder’s [Science Education Initiative](#), has been among the professors who use the clickers in their courses, surveying students throughout a lecture to ensure that they were understanding the concepts.

Her own use of the devices confirmed the conclusions of studies she’d read showing that students who answered in-class questions using clickers were more likely to answer a question correctly after they’d had a chance to discuss it among themselves and then revote. But those studies left her with a nagging doubt: “Is the percentage of correct answers going up because they’re really learning from each other, or because a neighbor says, ‘Oh, B’s the right answer,’ and they’re adopting that student’s answer?”

Without knowing that, Su says, “the study’s only half done.”

So she and several colleagues decided to do the rest of the job, [the results of which](#) appear in the January 2 issue of *Science* magazine, [a special issue](#) on education and technology (subscription required). In an undergraduate genetics course, students were, on 16 occasions during the course of a semester, asked a pair of “isomorphic” questions, which have different facts but require students to apply the same principles or concepts. Instructors asked students one of the questions, had them “click” their answers, discuss the question with their neighbors, and then revote. Then, they were asked to answer the second question individually, via the clickers.

A significantly higher percentage of students answered the second question correctly than did so on either

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the original question or the first question when it was asked a second time (without revealing the results from the first query). And of the students who answered the first question wrong, but got it right when it was re-asked, 77 percent answered Question 2 correctly.

“This result suggests that most students who initially did not understand a concept were able to apply information they learned during the group discussion and correctly answer an isomorphic question,” the researchers write in their study. In addition, they note, 44 percent of students who answered the first question wrong both times it was asked still answered the second one correctly. “We speculate that when this group of students discussed [question 1], they were making sense of the information, but were unable to apply their new knowledge until presented with a fresh question on the same concept.”

The study is noteworthy, the researchers suggest, because by seeking students’ responses to a question that they have not answered before, and that they answer without directly discussing with their peers, the researchers show that students appear to improve their performance “primarily from student gains in conceptual understanding rather than simply from peer influence.”

That is especially true, they note, because the study also shows that a majority of the discussion groups would have included no students who answered the first question correctly on the first try. So some of the students who answered that question right on the second try appear to have done so having gleaned important conceptual knowledge from the discussions with their peers.

Su, the Colorado professor, said she hoped that the study, by showing that peer instruction helps students learn, would encourage professors who are wedded to a lecture-only format to consider incorporating peer discussion and other more collaborative methods into their curriculums.

But the researchers said they recognized that yet another step would be necessary to show how peer instruction stacks up against instructor-only teaching. So as a followup study this last semester, says Michelle Smith, a science teaching fellow with the Science Education Initiative and a research associate in molecular and cell biology, the researchers repeated the experiment, substituting explanation by the instructor for peer discussion, and then adding a third test in which the students talk to each other, and then have the instructor add his or her own explanation of the concept.

The results are not yet in, Smith says, but early data suggest that a combination of peer instruction and professor-led discussion produces the best performance.

— [Doug Lederman](#)

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Comments

I’m a fan of peer instruction, and I’m not surprised by the results so far, but I see another useful way to extend this study. There is at least one other way that students can “skate” on the efforts of others; namely,

by taking cues, not to the right answer per se, but to the right *approach* to use to answer the question. In this case, high-scoring students might know how to utilize several approaches correctly, but still might not be able to select the correct approach in some other context (real-world, or even just the final exam) lacking the immediate cue of peer interaction.

It would seem entirely feasible to test against this concern as well—and it's the sort of concern for which "teaching to the test" would be an entirely beneficial activity....

CJ, at 8:35 am EST on January 5, 2009

Control group

What of student learning when the professor explains the concept again?

Jack, at 9:30 am EST on January 5, 2009

Short Term Memory

It sounds as if a good follow-up would be to give the students a bunch of questions, each requiring a different methodology, to make sure that they have learned to identify the proper methodology — rather than just recall it from short-term memory, where they've been able to place it after asking listening to their peers' solutions.

[Dennis G. Jerz](#), Associate Professor of English — New Media Journalism at Seton Hill University, at 11:05 am EST on January 5, 2009

Benefits of peer instruction

I use the same technique in class sizes over 100. I also do a pretest and post test. I am going to continue to use the "take individually, discuss, take again, professor discuss correct answer" technique. However, I have not found a significant difference in the student learning from the classical "professor just lecture" technique. That being said, the students seem to be more attentive and interested when I use clickers. The big difference is class size. My gains when class sizes are less than 40 are over 40% while the learning gain when class sizes are over 100 is less than 15%. Size makes the primary difference. Thanks for pointing out the study. I will have to look it up to see if I am missing something in my teaching.

George, at 11:05 am EST on January 5, 2009

George,

Interesting post. Could you clarify something, though? When you talk about gains relative to class size, were you talking about gains from clickers in particular or from the other techniques you mentioned?

Thanks in advance.

Suzanne, at 12:41 pm EST on January 5, 2009

Did the group doing the study contain both believers and nonbelievers?

One of the few things that is usually true in the study of education goes something like this:

Innovative methods OFTEN work well in the hands of the innovators. Innovations SOMETIMES work well at large. Studies of how the innovation works done by the innovators ALWAYS report that it works great.

Raoul Ohio, at 3:20 pm EST on January 5, 2009

Clickers...

I believe these devices.

I am not impressed with the studies so far, though. I would like to see better comparisons of large numbers of questions.

I am excited to attempt to improve the studies I do in my own classroom. A very serious complication for my classes is simply the fact I teach in 3 different classrooms. Resolving the technological snags is remarkably more tedious than anyone would have anticipated.

Technology is so helpful... when it works.

Aaron, at 5:05 am EST on January 6, 2009

Whatever happened to that radical idea of different intelligences and different people learning differently?

Every new idea, approach, gadget gets marketed as the absolute end answer to “failing” education, and the 50% who were learning just fine, thanks, get dumped again.

Judith, at 6:05 pm EST on January 6, 2009

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