A better way to do in-class review

by Carl Wieman

As we approach the start of a new term of teaching, most of us are thinking about what we should review at the start of the course. For many years, like most faculty, I used to spend a lecture or two going over material I expected most students would have previously seen, but likely had forgotten to some extent. Then I actually collected data on the effectiveness of this approach and was surprised to find out that it was less than useless. I subsequently found a much better method for reviewing.

Rather than helping students improve their memory and understanding of the material, this standard method of reviewing primarily diverted their attention to thinking about things other than the class they were in, and this made it harder to get them reengaged when I started to discuss new material. This was particularly true when part of the class was review and part was new stuff.

It is easy to understand why this method of review fails, and in retrospect, I feel stupid that I did not recognize it sooner. There is a well-established result from cognitive psychology that familiarity with a topic makes people erroneously believe they understand/have-learned it. There is another common phenomenon which can be observed at most faculty meetings, which is that when a person is being lectured on something they believe they already know, they will become quickly bored and start thinking about other things (or checking email, etc.). The combination of these two effects means that no student who has previously heard about the topic being reviewed is going to pay attention. And for those few students who have never heard anything about the topic, such a brief review will be useless to them as well.

The better way I found to do review is to replace ALL review lecturing with problems that the students solve in class that cover the material I want to review. This is particularly easy to do if they have clickers,[1] but it can also be done using paper and pencil. Doing the problem gets them actively thinking about the relevant material and testing their understanding. If they get the problem wrong, and often even if they don't, they are then primed to ask questions and listen to responses and explanations to learn why. Also, if there are things that everyone in the class already knows, I can see that immediately from their problem solutions, and so I can quickly move on and avoid wasting class time talking about that topic. That leaves more time to spend on the topics where many could not do the problem and are thereby primed to learn.

With this approach, I also gain a good sense of what topics individual students, and the class as a whole, have and have not mastered, something not provided by my review lectures.

For courses that are not part of a sequence there can be much greater diversity and uncertainty as to students' preparation. For this situation, we developed a somewhat more elaborate version of this approach to review that turned out to be highly effective and ended up saving class time in the long run. The students first complete the review questions individually, and then work through them in small groups, getting multiple opportunities to get the correct answer. In this way students also get the opportunity and inducement to learn during the review process. It also makes students more aware of particular weaknesses in their background relative to other students, and so they are more likely to go learn the necessary background material. This is discussed in more detail in a short paper.[2]

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[1] www.cwsei.ubc.ca/resources/clickers.htm

[2] An Improved Design for In-Class Review, E.J. Maxwell, L. McDonnell, & C. Wieman, J. College Science Teaching, 44(5), pp. 48-52 (2015). www.cwsei.ubc.ca/SEI_research/files/Chem/Maxwell-Mcdonnell-Wieman_In-ClassReview_JCST2015.pdf