

**JANET RANKIN:** A common active learning technique that people often use, or maybe the first technique that they use, is personal response systems. So that's an opportunity for students to respond to a question.

And that can be anything. It's usually a multiple choice question, but it doesn't have to be. And it can be anything from a show of hands-- who thinks the answer is A, who thinks the answer is B, who thinks the answer is C-- to dedicated devices and applications that allow students to respond to questions.

So there's pros and cons for each of the different techniques, but the essence of all the techniques is that students are given an opportunity to think about the answer that they think is correct, and then respond to that.

And there is evidence to show, research that shows, that when students make a claim, when they're asked to make a public response, a public claim as to what they think the correct answer is, that makes them more committed to the answer. And then they're more likely to remember or to even notice if their answer is incorrect.

It primes the student for learning. And that's the biggest advantage for any of these personal response systems. The disadvantage with having students raise their hands is that in a big lecture hall, it can be hard to count, right?

It can be hard to say, OK, how many people raised their hand when I said A? How many when I said B, etc. So that can take up time and it can be pretty inaccurate.

The other thing that people do sometimes is they'll use like, just a sheet of paper. They'll put on letters and then the students can fold the paper up. And depending on how they want to vote, they just hold it up so that really only you can see it.

Point of fact is other students can kind of tell what the other students answered. And if I know that a friend of mine always gets the answer right, then I might just look and see what he or she said and then answer the same.

So it might not give us a real accurate measurement of what every student thinks. The other problem with that is this can be hard to read in a big lecture hall.

Sort of the first kind of digital or electronic personal response systems were these dedicated clickers, is what they're called. And students literally, they log into the system. They turn their devices on. And you ask a question, and then the students respond A, B, C, D using the touch pad.

Some clickers lets students actually type answers, so open response. They can actually type a word, or a number, or a set of numbers. So that can give you a little bit more flexibility.

And then the software on the instructor's computer will create a histogram of responses. So you know right away the distribution of responses.

If you have more than 70% of the students get the question right, you probably just want to state the correct answer and move on. You can also say, if you didn't get it right, here's some extra resources or go to the TA office hours, or whatever.

But in general, if more than 70% of the students get it right, you can move on. One thing I like to do is if I really have a resounding, say 75%, get it right, I like to ask a follow-up clicker question that says, how confident were you in your answer?

Because sometimes students will just guess. And if you give them the opportunity to say, yeah, I got it right, but I don't really know why-- that might be the situation sometimes, that a lot of people get it right, but not that many people know what's going on. So you want to know that too.

If between 30 and 70 get it correct, then I like to move into the pair share. So I like to say, OK. Let's divide up. Looks like we have a pretty good split of answers.

So let's talk to each other and we can do some peer-peer learning where peers can try to argue their point to whoever is sitting next to them. And then I ask them to vote again. Now, when things are working well, people actually converge to the correct answer.

And generally speaking-- I think it was Eric Mazur has a preliminary research study that shows that when you put two students with the incorrect answer together, they actually tend to converge to the correct answer because they argue each other out of their respective wrong answers. So that can be pretty effective.

You do have to have a pretty good distribution of incorrect answers for that to work. If two students had the same incorrect answer, generally, speaking they stay embedded with the

incorrect answer.

If less than 30% of students get the correct answer, you probably just want to stop and reformulate your explanation and really go over everything again, because that's really not a lot of people that know what's going on. So that's the general ballpark for how to proceed with the clicker questions.

In between the pieces of paper and the clickers are some newer technologies, new applications. One is there's a few applications for web-enabled devices, like Socrative, which is a software that you can download. The instructor downloads it and then students log into a room using their web-enabled device.

So they log in and then no one has to buy anything extra, but you are assuming that every student has a web-enabled device, and you are saying you're happy if they take them out in your class, which may not be true for everyone. So that's the issue with that, access and also whether you want the smart phones out.

An application that I think is a really great compromise is something called plickers, with a P, P L I C K E R S. And with that, the instructor downloads an application on his or her smartphone or web-enabled device, it has to be a device with a camera.

And then the instructor downloads these PDFs, which are just pieces of paper with these patterns on them. They're all different, and I believe you get 40 patterns for free and they're reusable.

And so each one is unique and you give them to the students. And students then vote A, B, C or D. There's four sides to the shape and four letters, A, B, C, D.

And if they think the answer is A, they hold it with the A at the top. If they think it's B, they hold it with the B at the top, et cetera. And you can use your web-enabled device, and you scan the crowd with the software, and that actually picks up the responses and creates a histogram.

So I think that's a really nice compromise, because it gives you the histogram, it has student anonymity, and students don't need anything but the piece of paper that you gave them.

And you can actually reuse the piece of paper. We printed sets on card stock, which are pretty durable. And we can use them over and over again, so the students don't need any extra technology.

For educators that are thinking about using some kind of personal response system for their students, there's a couple different levels of how far in to get and how fast.

The first step would be to construct some really good, thoughtful questions that students can answer in a multiple choice way. That would let you use the clickers, or a show of hands, or any of the other methods.

It is important to construct the clicker questions in a way that students know they're really meaningful, that you're not just asking kind of silly questions. You want to ask them questions that are a bit rich and that also lend themselves, as I said to, if students, you know if a decent number don't get them right, that lend themselves to that peer-peer interaction, that sort of debate with each other.

So want to think carefully about your learning outcomes, what you want students to know or be able to do by the end of the class. And you want to construct questions that help them get there and test whether they're there or not.

So you might use one, or two, or three questions in a class. And that might be it, that might be all you do. But you do want to make sure that you construct the questions thoughtfully.

The next-- sort of if you want to go further in, is to think about what it is, really think critically about, your learning outcome. What do I want students to get out of this class, this particular class?

And then construct a series of clicker questions that really help students understand whether they get it or not. Help them argue their point with others or encourage them to argue their opinion or point with others.

And then ultimately, come to a realization or come to attain the learning outcomes really by engagement with the clicker questions and by engagement in a subsequent discussion.

So where the clicker questions are really the core of your class and the learning happens sort of threaded among those questions.