Making concepts in Biochemistry 'click' using technology in lectures

Using clickers to gauge students' understanding

Determining how much students are learning during a lecture is far from easy. This was the challenge faced by Dr Peter Judge, who teaches Thermodynamics to first-year undergraduates in the Biochemistry Department. Students consider the course to be particularly hard because of its strong mathematical component, and they have difficulty developing the skills needed to apply the material learnt in the lecture to calculation questions.

Dr Judge had tried giving students problems to solve during lectures, but had received negative feedback. He felt the need for a new method that was both motivational and effective in assessing the progress of all the students. Electronic clickers presented an engaging possibility.

The Biochemistry Department purchased a set of 120 electronic voting 'clickers' from Turning Technologies. The clickers are credit-card sized with an alphanumeric LCD display, and students 'vote' by pressing one of ten buttons. Their selection is then transmitted to a USB receiver on the lecturer's computer, and collated and displayed in a bar chart on a custom slide in PowerPoint.

Experience with the clickers in Hilary Terms 2014 and 2015 suggested that the devices worked best when Dr Judge set four or five multiple-choice questions over the course of a lecture. The questions would be calculation- or definition- based, and he would give students five possible answers. Having revealed their choices on the bar chart, he would explain how to approach the calculation in order to obtain the correct answer.

A range of positive outcomes to choose from

Much to Dr Judge's delight, an exam question based on material where clickers had been used was the second most selected question on the paper and received the highest average mark. This positive outcome was reinforced by students' enthusiastic feedback. For example, use of the clickers was described as 'engaging', helping to maintain students' focus.

Overall, Dr Judge's experience suggests that the use of clickers in lectures can provide multiple benefits to students and teachers alike. This is because:

- Students can contribute anonymously. Even if they make a mistake, they are unlikely to be the only one and they are encouraged to participate, knowing that they cannot be singled out.
- The lecturer can gauge the pace of the lecture and decide whether to move on or re-emphasise the points already covered.
- 'Superficial learning' can be turned into 'deep learning', since students are forced to think on the spot, rather than simply copy down notes or annotate handouts.

Top tips: posing the right questions

Dr Judge strongly encourages other lecturers to experiment using clickers, in particular those teaching mathematical or physical science concepts, where practising calculations would be useful to students. In particular he says that 'the key is designing the right questions': too easy and students become

complacent and switch off; too difficult and students become discouraged. The frequency of questions is also important: too many and the flow of the lecture is interrupted; too few and their impact is lost.

Well-pitched questions cannot only help to 'identify and challenge misconceptions' but also 'highlight the fact that the students are encountering new material, or being asked to think about familiar ideas in novel ways'. Lastly, 'don't be afraid to set a question that the majority of students will get wrong'- these can be some of the most effective at making the students stop and think.

Winner, OxTALENT 2015 award for innovative teaching with technology. The text in this case study has been adapted from Peter Judge's entry for the OxTALENT competition.