CLICKERS IN LARGE LECTURE ROOMS

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Abstract
Transferring knowledge and training skills for large audiences is quite challenging if one considers that the actual generation of students belongs to the zapping generation. Interactivity and feedback from the audience are key features for lecturers concerned with the effectiveness of their lectures.

A powerful tool in activating students is a student response system. It allows obtaining highly accurate and immediate statistics on the opinion of the audience. Moreover, students feel more involved and consequently more motivated to take part in the solution of conceptual problems.

Asking questions to students and getting them into vivid discussions with each other clearly results in a better learning effect.

Keywords: student response system, large audience, immediate feedback, student activation, audience participation

Clicker : a definition
A clicker is essentially a small remote control, about the size of a credit card. By means of a RF signal it communicates with a receiver that is plugged into the teacher's computer. IR versions exist as well. They are cheaper but more limited in range. Students keep their own clicker with them during the complete term. They get their clicker after having paid a deposit. Each clicker is identifiable by means of a specific code. For privacy reasons though, we don't trace the student's answers. But the tracing facility allows one to do a quick assessment and have the results at once.

Figure 1:   A clicker from TurningPoint® *(from www.turningtechnologies.com)*

Who needs it?
Transferring knowledge and training skills for large audiences is quite challenging. It is even more so considering that the actual generation of students belongs to the zapping generation. These students are particularly familiar with living in a multitasking environment. They are used to deal with information coming from several sources simultaneously. Some of our students can watch TV, listen to music on their mp3 player, chat with friends on their computer and answer text messages on their mobile phone, not sequentially, but simultaneously. It is arguable whether this is an optimal way of staying focused, but that's what they do, and for them it is all common behaviour. A conventional lecture for a large audience easily reduces all the communication channels to one: the lecturer speaks to the audience. Staying focused on one channel is already hard for trained listeners, it is even more so for students today.

When the number of students in a lecture hall is exceeding 100, teaching in an interactive way becomes nearly impossible. Using different tools offers variation, but the effectiveness of class room time is often not very high, though very efficient. It is easy for an individual student to hide and consequently not to feel addressed to at a personal level. Lecture time will always benefit from more involvement from students.

Strength of an audience response system
Being part of a large audience easily leads to distraction for a listener and being distracted is not noticed by the instructor. If, on the contrary, this instructor is addressing questions to the audience, it gets harder to fall asleep. But asking questions to an audience as a whole is not very effective, as not everyone will feel engaged to think about the appropriate answer.

With a student response system, every student is involved in the process, because his individual answer will be processed. It allows the instructor to get highly accurate statistics on the opinion of the audience. Students will consequently be more motivated to take part in the solution of conceptual problems.
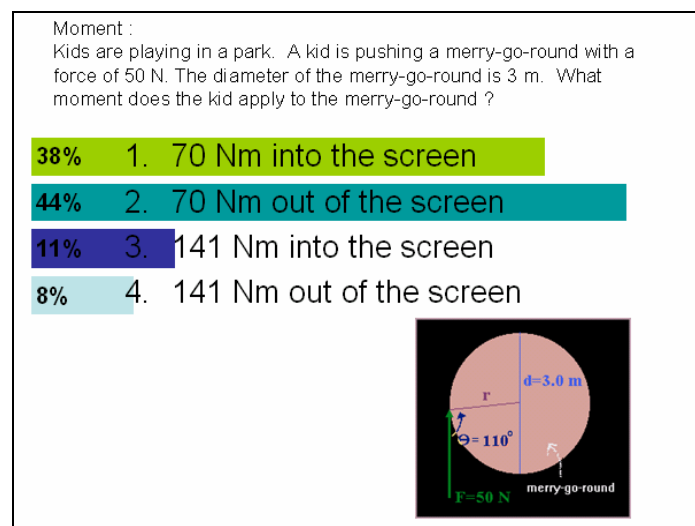

Figure 2:   Slide showing the multiple choice question and the answer distribution.

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Understanding key concepts is vital for a course like mechanics as all calculations are based on a limited set of basic concepts. Making students think about very simple conceptual problems is a first step in making them aware of the intrinsic properties of a concept. Only later dealing with more complex equations and calculus becomes an issue.

Old-school methods where all students raise their hands when they think an answer to a multiple choice question is right do not lead to reliable results as students are influenced by one another. A more sophisticated approach is one where students are holding a card in the air which displays the answer of their choice (A, B, C,...) in the forward direction. There is no reciprocal influence, but counting all the answers is a very labour-intensive job.

Technology is at hand to cope with all the issues discussed above. We use remote controls and software from TurningPoint® [1] technologies. They are easy both to adopt and to use and do all the work at once.

The results from the polls can be saved and consulted later on. This offers the possibility to measure the effect of a change in approach, from one year to the next.

It is important to face students with moments of friction or conceptual conflict in their learning process [2]. Asking conceptual questions, which often seem simple and basic at first glance, is a good way for students to validate their own learning. A good set of questions is of crucial importance. Questions that are too easily solved diminish the challenging aspect of the poll. If they are too difficult on the contrary, students might get disappointed. A good question is one where the audience gets polarised by two or even three different answers. This is an excellent starting situation for a discussion in which a student has to convince his neighbour of his answer. So, peer instruction [3] can be used in a very natural way in combination with clickers. Students become aware of misconceptions and from this awareness emerges eagerness to learn and understand things properly. It is very important to give feedback to the students and to explain why the right answer is correct and why the others are incorrect.

Another benefit of this technology is that students can give their opinion on sensitive or controversial issues. In this case it is clear that the privacy of students has to be respected.

Downside of the system
The only apparent drawback of this technology is the cost. Even a basic clicker (we don't include more sophisticated types of clickers which can be used for more complex responses) is already quite costly. Students are a bit unwilling to pay the deposit [4]. Those who do on the contrary, are very enthusiastic about the system. Key features to successfully spread clickers among your students are: keep the deposit as low as possible, use the clickers in every single lecture of your course, use it in more than one course. Students will quickly become aware of the benefits of a response system for their own learning if they may use it frequently.

In the United States and China clickers are already widely spread in schools and colleges. They are making their way into European education as well. Probably, schools, colleges and

universities will be able to negotiate on the price as soon as the purchase of larger amounts will be considered.

Our experiences

We introduced clickers in 2006-2007 for first year students in industrial engineering. The amount of the guarantee we charged corresponded to the price of a clicker. Clearly, this amount was unacceptable for the majority of the students. When term started, about 50% of the students had a clicker. At the end of the course, only 25% was still using it. Another major reason for this decrease is the fact that clicker questions were only used systematically in one course (Mechanics). In Physics it was used later in term, after many students returned already their clicker, and not in every lecture.

The effect on the activation of the students during a lecture is spectacular, even for those who have no clicker. Asking conceptual questions and showing the statistics on the answers from the audience (even if it reflects only the answers from the fraction that has a clicker) on a big screen, is a powerful trigger to get students' attention.

Making good questions requires considerable effort and discipline from the instructor. In the field of basic science and technology courses, many good questions can be found on websites from colleagues (the Galileo project from Harvard University [5] is a nice example). But even the search for a few applicable questions can be rather time-consuming.

Students who used their clicker were very enthusiastic about it, to say the least, and would certainly be happy when this teaching tool would be implemented into more courses.

Conclusion

Class room time, which is very precious as it is often the only moment offering direct contact between students and teacher, can be made more interesting and exciting for students by a response system as it facilitates interaction and engagement. The available technology is easy to use, although the cost is a downside.

A good set of conceptual multiple choice questions is of crucial importance. Clickers are a nice tool to reveal common misconceptions and good feedback from the instructor after a peer-to-peer discussion is vital for putting things right.

The response system will confront the student with his own understanding of the learning material and moreover tell the instructor whether the audience grasped the essential elements of newly introduced material.

References

[1]   http://www.turningtechnologies.com/

[2]   Vermunt, J.D., Verloop, N., Congruence and friction between learning and teaching. Learning and Instruction, 9, 257-280 (1999).

[3]   Catherine H. Crouch and Eric Mazur, Am. J. Phys., 69, 970-977 (2001).

[4]   The Chronicle of higher education, February 20 2006,

        http://chronicle.com/wiredcampus/article/1028/clicking-along-despite-glitches

[5]   http://www.seas.harvard.edu/galileo/

Biographical Information

Joris Verheyden holds a Ph.D. in Physics from the University of Leuven. He is teaching Mechanics to first year industrial engineering students at the Hogeschool voor Wetenschap & Kunst. He is responsible for the course "Scientific project" in the second year. One of his main interests is in the field of science promotion amongst school kids with the aim of increasing the interest in scientific and technical studies. Based on his conviction that motivation is a consequence of enthusiasm and wonder, he believes that personal interaction between teacher and student is the strongest foundation for qualitative learning outcome. Teaching for large audiences consequently drove him into new technologies that enable interaction and provide reliable feedback on the proceedings of his students during lecture time.

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