



Coming soon to a lecture theatre near you: the 'clicker'

Sotiris Mastoridis, Fifth-Year Medical Student, Imperial College School of Medicine, London, UK

Sara Klaididis, Foundation Year-2 Doctor, North Central Thames Foundation School, London, UK

SUMMARY

Background: It has become commonplace for undergraduate medical students to attend lectures alongside 300 or more of their colleagues in large amphitheatres. The Audience Response System (ARS) is a technology that aims to address what has, as a consequence, become an inherently one-way learning environment, where audience participation is greatly impeded.

Context: Students' experiences of lectures at Imperial College School of Medicine have been changing with the incorporation of this new technology, and here we discuss whether by enabling

student participation through the use of hand-held remote controls, or 'clickers', such systems can help bridge the communication gap between the speaker and the students. In addition to our own experiences of the equipment, we also summarise the feedback given by medical students.

Innovation: Within the context of a digital presentation a lecturer poses a question, along with a number of possible answers. Students are then able to submit their selection using the clicker with which they have each been equipped. Using radio-frequency technology, the ARS is able to handle data in real time, and to

immediately display a histogram of the spread of responses for all to see and compare.

Implications: The ARS confers benefits to lecturers and students alike. For the lecturers these benefits centre on an immediate awareness of the audience's comprehension of the material, as well as of the progress of individual students. For the students, using clickers to answer questions during lectures appears to enhance their enjoyment, as well as to improve concentration and knowledge retention. Among the drawbacks that we discuss are the monetary cost of the technology, in addition to the training hours required for its implementation.

The ARS confers benefits to lecturers and students alike

Such systems can help bridge the communication gap between the speaker and the students

INTRODUCTION

These days if you arrive late to your lecture, chances are you'll be faced with the option of either finding a seat on the steps in the aisles or moving to the 'overflow room' offering a live-feed of the lecture. It's a sign of how crowded lecture theatres are becoming, and more often than not the ability for audience and lecturer to interact suffers as a result.

Lecture handouts, blackboards, overhead projectors and digital presentations are useful tools in improving a teaching format heavily dependent on the lecturer's natural flare, and the student's individual levels of concentration and diligence. They do little, though, to amend what is inherently a one-way learning environment, and especially so in classes of up to 400 students. Recently we were introduced to an Audience Response System (ARS) at Imperial College School of Medicine. Here, we discuss whether, by enabling student participation through the use of hand-held remote controls, or 'clickers', such systems can help bridge the communication gap

between the speaker and the students. In addition to our own experiences of the technology, we also summarise the feedback given by medical students who responded to a short questionnaire, made up of six questions scored on a five-point Likert scale (Table 1). The questionnaire was designed and distributed by the authors to a group of 44 medical students attending a lecture at Imperial College (response rate = $38/44 = 86\%$). All respondents were in their penultimate year of their undergraduate studies (MBBS).

WHAT ARE 'CLICKERS'?

Many of us already know of clickers from television game shows, where contestants are given the opportunity to 'ask the audience' for their help on a particular question. Indeed, clicker development was closely linked to the world of showbusiness. In the late 1960s, the Audience Studies Research Centre in Hollywood began using ARSs to assess audience impressions of unreleased motion pictures and advertisements. Today, clickers are used in a number of fields ranging from

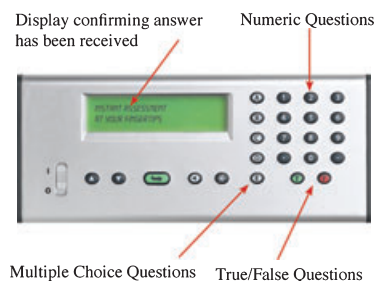


Figure 1. An example of a 'clicker' and its layout

market research to medical education.

In their simplest form, clickers resemble television remote control units, and work in a similar way. More modern designs are specific to the purposes they serve, for instance incorporating 'True' and 'False' buttons, and using radio-frequency technology as opposed to infrared (Figure 1). In essence, a lecturer is able to incorporate a question into his digital overhead presentation, and then ask students to submit their responses using the keypad on their individual clicker. The responses are then transmitted to a central receiving device that handles the data in real time, enabling it to immediately display a histogram of all of the students' answers. The result is that the

Table 1. A summary of medical students' feedback regarding the use of 'clickers' during lectures

Questions (Likert descriptives)	(n)	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
'I have found clickers easy to use'	38	14 (37%)	17 (45%)	3 (8%)	3 (8%)	0 (0%)
'I believe clickers make lectures a more enjoyable experience'	38	8 (21%)	19 (50%)	9 (24%)	0 (0%)	1 (3%)
'I believe clickers enhance my level of concentration during a lecture'	38	12 (32%)	20 (53%)	3 (8%)	3 (8%)	0 (0%)
'I believe clickers improve my retention of lecture content'	38	6 (16%)	23 (61%)	7 (18%)	2 (5%)	0 (0%)
'I would benefit from online access to a record of my clicker sessions and how they compare with those of my peers'	38	8 (21%)	17 (45%)	5 (13%)	7 (18%)	1 (3%)
'I believe clickers should have a permanent role in undergraduate medical education'	38	11 (29%)	19 (50%)	8 (21%)	0 (0%)	0 (0%)

Questions were answered on a 5-point Likert scale where 1 = strongly agree, and 5 = strongly disagree.

Table 2. Weighing up the benefits and drawbacks of using the Audience Response System (ARS)

Possible benefits

- breaks up the monotony of long lectures
- can improve attentiveness, attendance and knowledge retention
- allows lecturer to immediately assess understanding of taught concepts
- allows students to compare themselves with their peers
- allows tracking of student progress and identification of those in need of further assistance
- helps get around problem of a 'vocal minority' who may give a skewed impression of students' comprehension
- anonymity prevents any embarrassment of the students

Possible drawbacks

- considerable cost associated with the purchase of hardware and software
- a number of training hours are required on the part of educators in order to get to grips with the technology
- can promote a lazy lecturing style if speakers become too dependent on the technology
- may be detrimental to content coverage
- students may vote randomly and confuse the lecturer
- loss of the fear element associated with 'on-the-spot' questioning, which can aid memory

Most students believe it would also be beneficial if they could access an online record of their clicker sessions

lecturer receives instantaneous feedback on student comprehension, whereas students are able to confirm the correct answer and simultaneously see how they are fairing in relation to their peers.

GOOD FOR STUDENTS

Using the ARS in the lecture hall, we found ourselves to be psychologically invested in the questions being asked, forced into coming to a decision within the few seconds allotted and keen to be right. Some students would even become quite competitive with it. A few would show off their expertise in their short discussions with their neighbours, whereas others would rapidly realise that their knowledge had many more gaps than they had previously thought, and so would resolve to study harder. All this amounted to improved attentiveness. Rarely would one see students doze off in a clicker session, an otherwise not uncommon occurrence. In keeping with our impressions, 84 per cent of the students we surveyed either agreed or strongly agreed that clickers enhanced their level of concentration in lectures.

The ability to compare our own responses with those of the rest of

the class was also extremely useful. It can offer reassurance in those instances where you give a wrong answer but then realise that many others are in the same boat, or, if the others in the class do get more questions correct than you, it can push you to revise those topics in which you are performing relatively poorly. The feedback we collected shows that most students believe it would also be beneficial if they could access an online record of their clicker sessions, and of how these compare with their colleagues, something not yet available at our university.

Most students like clickers. Studies have shown that students enjoy using them, that they find them useful and that they believe that they should be incorporated into their teaching.^{1,2} Students will be even more pleased to learn that investigators have shown clickers to improve knowledge retention, and, crucially, to either improve or do no harm to their exam scores.^{3,4} What remains unclear, and requires more systematic study if firm conclusions are to be drawn, is what exactly it is about clickers that produces these improvements in student outcomes. Is it the improved attentiveness, the sense of enjoyment or the active

learning process? We suspect it may well be a combination of all the above (Table 2).

GOOD FOR EDUCATORS

Lecturers are, one hopes, happy when their students are learning and enjoying their learning experience, as described above. But, beyond this, there are elements of the clicker system that are of more direct benefit to the lecturer's task. We've become accustomed to the lecturer who suddenly pauses, and asks questions of his audience, only to be met by a long silence. The lecturer, looking out at a theatre of over 300 medical students, is just trying to gauge whether his audience understands what he is saying, whether they are interested and whether they are concentrating. With well-constructed questions, the clicker system can give the lecturer an immediate assessment of whether or not students have absorbed the material. Any misunderstandings can be rectified, thereby preventing further problems and retaining the students' attention.

Lecturers are also able to take attendance using the clickers. Although students may not appreciate this, it has been shown

The clicker system can give the lecturer an immediate assessment of whether or not students have absorbed the material

that attendance is improved in instances where clicker performance is included in the final grades of the students.⁵ By matching students to their clickers, it is possible for the educator to track their progress session to session, as well as to flag up those students who are in need of further support.

On the other hand, lecturers will need to take the time to receive training in how to use the software, as well as how to make best use of what the new technology has to offer.

MAKING BEST USE OF THE TECHNOLOGY

In our experience the potential is there for clickers to be used inappropriately. Educators have a duty to take the time to research how best to make use of the new technology. ARS questions are 'best understood as a tool rather than a teaching approach'.¹ We have attended lectures where the entire scheduled hour has been devoted to clicker questions. As would be expected, most ARS studies show that when time is used up on including clicker questions, there is a resultant decrease in content coverage.⁶ From our involvement in clicker sessions, we found it preferable for clickers to be used intermittently, five times or so in a 50-minute session, for instance, thereby providing welcome breaks in the lecture in which to test our understanding of the topic without sacrificing course content.

It is important, then, that clickers do not end up driving course content when the opposite should be happening. It is also important to remember that clickers do not represent a substitute for good lecturing technique: an uninspiring lecturer will continue to be uninspiring, whether he uses a clicker or not.



Figure 2. Asking basic questions, such as the colour of a banana, is a simple way to check the system is working at the start of a session

At the very least clicker sessions must be planned in advance. The technology must be tried and tested by the lecturer, with a back-up plan in place, should it fail (Figure 2). Communicating to students the purposes served by using the clickers is essential, as is proper instruction on their use. It is important that the questions posted serve a clear goal, and are pitched at the right level. In our experience, questions testing factual recall were not as useful as those testing concepts: the latter were also more likely to promote class discussion. The decision of whether to use the system to check for attendance, and whether to track students' scores is a difficult one, and must be made according to the needs of each individual setting. We found that, from a student's perspective, we were

satisfied with an arrangement whereby we entered our college identification number, not to check for attendance, but to reward those who have done particularly well in sessions.

CONCLUSION

Our overall experience of the introduction of clickers into lectures at Imperial College School of Medicine has been a positive one, and our poll suggests that other students would agree. It is clear to see that, if used correctly, they offer an increased sense of participation, improved attentiveness and a greater enjoyment of lectures. Although some educators may feel that they can manage perfectly well without these technologies, they should be reminded that with

ever-increasing class sizes it becomes more difficult for students to feel engaged in the teaching: we tended to view lecturers who used clickers as more aware of our needs, and generally found their teaching style to be more immediate and targeted. This assessment is also borne out in the literature.⁶ With more widespread use we may get clearer data on how ARSs can be used most effectively in medical education, but what does seem increasingly likely is that some day soon

clickers will be coming to a lecture theatre near you.

REFERENCES

1. Simpson V, Oliver M. Using Electronic Voting Systems in Lectures, 2006. Available at <http://www.ucl.ac.uk/learningtechnology/assessment/ElectronicVotingSystems.pdf>. Accessed on 23 March 2010.
2. Draper S, Cargill J, Cutts Q. Electronically enhanced classroom interaction. *Australian Journal of Educational Technology* 2002;**18**:13–23. (Also available at <http://www.ascilite.org.au/ajet/ajet18/draper.html>. Accessed on 22 March 2010.)
3. Knight JK, Wood WB. Teaching More by Lecturing Less. *Cell Biol Educ* 2005;**4**:298–310.
4. Crouch CH, Mazur E. Peer instruction: Ten Years of Experience and Results. *American Journal of Teachers* 2001;**69**: 970–977.
5. Cue NA. A Universal Learning Tool for Classrooms? 1998. Available at <http://celt.ust.hk/ideas/prs/pdf/Nelsoncue.pdf>. Accessed on 22 March 2010.
6. Caldwell JE. Clickers in the Large Classroom: Current Research and Best-Practice Tips. *CBE Life Sci Educ* 2007;**6**: 9–20.

[Clickers] offer an increased sense of participation, improved attentiveness and a greater enjoyment of lectures

Corresponding author's contact details: Sotiris Mastoridis, 16 Brunswick Mansions, 8 Handel Street, London, WC1N 1PE, UK. E-mail: sotiris.mastoridis@gmail.com

Funding: None.

Conflict of interest: None.

Ethical approval: This paper does not describe research on human subjects. The article describes a simple evaluation exercise. The data was collected by questionnaire and the anonymity of participants was guaranteed. Ethical approval was not required.