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Ask the audience (yes, all of them)

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Lectures are an effective method of one individual communicating with an audience but this one-way content transmission encourages passivity and disengagement from members of the audience ([1], p. 223; [2], p. 16). One method to increase engagement is to ask questions but in reality this only engages students who 'volunteer' an answer ([3], p. 19). An approach which encourages more active learning may be beneficial.

There is a first year mathematics module of around 180 students at Nottingham in which the lecturer uses multiple-choice questions for an interactive session in an examples class. The students fill their responses out on an Optimal Mark Reader (OMR) sheet so the lecturer can get a detailed report on the responses. This report is useful in directing future classes but takes time to process. The students also give a 'show of hands' so the lecturer can give in-class feedback. While giving each student the chance to participate in the session, the practical difficulties of counting hands mean this approach does not scale very efficiently. Also, Wit [2] reports students experiencing inhibitors such as "fear of ridicule by the lecturer or their peers" (p. 16) so the lack of anonymity may preclude a comprehensive and honest response. Anonymity can be addressed somewhat through holding up more discreet coloured cards matching different responses but not completely and the problem of counting remains. Often you see new technology crying out for a problem to solve; here I see a problem waiting for improved technology. Asking around, I found other lecturers that were interested in using questioning to improve engagement in more traditional lecture scenarios.

A *response system*¹ is a system through which questions can be put to an audience whose members each have a remote device and their responses are collected and collated. Usually this involves numbered responses to multiple-choice questions transmitted wirelessly through radio or infrared to a control device or PC. Response systems are thought to bring two-way communication in lectures and provide an active learning opportunity to every member of the audience [4]. With individual responses, each student is able to feel a personal connection with the lecturer's feedback on the possible answers. Wit [2] says that, having chosen some answer, "the psychological investment in that answer turns the student from a passive attendee into an active participant for whom the outcome has some emotional value" (p. 16). This is a form of engagement and personal interaction even in an audience of many which can be missing from more automated assessment/feedback systems. A response system also allows the lecturer to receive feedback from the students, a feedback direction traditional lectures do not facilitate, and this can highlight conceptual differences between understanding of the lecture content by the lecturer and students, of which the lecturer may be otherwise unaware ([5], pp. 54-5).



Fig 1 – Keepad remote response device

The University of Nottingham owns Keepad TurningPoint voting kits (Fig 1). A Keepad device is a small remote with a keypad of digits 0-9 and a USB dongle to connect the controllers via radio to a PC. The TurningPoint software acts as an interface for the voting devices. A TurningPoint plugin interfaces with PowerPoint slides, while a program called TurningPoint Anywhere allows responses to be collected without PowerPoint. It is important to discover the practicalities of using the system and, as there is effort involved in using such a system, it is important to ask: is there a benefit to doing so?

Is the technology practical to use?

As well as limited trials in my office, I was able to use the TurningPoint system in a class I was teaching on careers skills for mathematicians at Nottingham Trent University. Despite a licensing problem on the day caused by the use of different versions of the TurningPoint software, I found it to be fairly reliable and easy to use, once you are used to a couple of quirks in the authoring software. Forcing use of PowerPoint to display questions is potentially problematic. Stopping in a session to ask questions will mean less material can be covered but if more effective learning can be produced this may be worthwhile.

Does an educational benefit emerge?

Many published studies of response system use report on student and teacher perceptions of the benefits of systems on learning (see, for example, [2], [6]), which are generally positive. King and Robinson [7] note this as a weakness of the published research and attempt to determine whether there has been “any significant change in the academic performance” of students taught using a response system

(p. 197). Also noticing this trend, Kennedy and Cutts [8] aim to assess the association between individual student response system use and learning outcomes (p. 263). The results of these two investigations are not so positive.

King and Robinson evaluated the differences between cohorts of students taught with and without response systems. They found “no significant difference in the overall grades,” no difference in attendance patterns and “negligible” impact on student retention (p. 197). Kennedy and Cutts found that while students who were “frequent users” of a response system and were “relatively successful” in answering questions performed “significantly better” in formal assessments and “low responders” did not, they also found that students who were “relatively less correct” in their responses over the course of the semester tended to perform “more poorly” in formal assessments, “regardless of whether they were high or low responders” (p. 266). This undermines the constructivist principles of this approach, which would predict that students who were “relatively less correct” but “high responders” would still nevertheless benefit from the experience of responding. Kennedy and Cutts suggest students who attend and answer correctly are those predisposed to improved performance regardless of the technology use (p. 267). These results suggest the benefits of response systems are extremely limited.

Looking to some of the pioneers of response system use in the USA tells a different story. Dufresne, et al [9] report that their use of a response system to provide active learning opportunities through small group and class-wide discussions had a positive effect on students’ attitudes and motivation and consequently on retention of students. Crouch and Mazur [10] report on the use with

peer discussion over an extended period of time by several instructors with differing styles and find clear evidence that students' "grasp of the course material" and performance in formative and summative assessments improves above that of "courses taught with traditional instruction" (p. 971).

Kennedy and Cutts address these results directly, saying: "it is not clear whether this change was predominantly a result of the altered teaching and learning method - both implementations involved a radical shift in this regard - or the introduction of the... technology" (p. 263). King and Robinson note that in their evaluation of two cohorts, the "only major difference" was one cohort was taught using a response system, while other factors, including "instructor pedagogical practices," "largely remained the same" (p. 197). This points to a difference in approach between the usage of Dufresne, et al and Crouch and Mazur to that studied by Kennedy and Cutts and King and Robinson. The findings of the latter authors that response systems are of little benefit are based on their use without any pedagogic change, which backs up the suggestion of Draper [11] that the benefits from use of technology are linked to changes in pedagogic practice that occur as a consequence and not intrinsic to the technology.

Conclusions and further reading

So did I recommend use of this technology? In the case of the lecturer with the multiple-choice questioning in examples classes I certainly did. The technology provides a more efficient method to replicate the current practice which should be to the benefit of all involved. We will see in the autumn whether this works in practice! In more general cases, my reading indicates that using response systems to simply replace occasional questioning in lectures has little benefit. However, if response systems are used to facilitate a pedagogic change towards more active learning the indication is this can be quite beneficial. There is plenty of advice on interesting approaches in the literature and online. A good place to start is the interactive lecture webpages by Steve Draper at Glasgow (<http://www.psy.gla.ac.uk/~steve/ilig/>) and the review article by Simpson and Oliver [4].

References

1. Rosenthal, J.S. (1995) Active-Learning Strategies in Advanced Mathematics Classes. *Studies in Higher Education*, 20(2), pp. 223-228.
2. Wit, E. (2003) Who wants to be... The Use of a Personal Response System in Statistics Teaching. *MSOR Connections*, 3(2), pp. 14-20.
3. d'Inverno, R. (2003) Making Lectures Interactive. *MSOR Connections* Feb 2003, Vol. 3 (No. 1), pp. 18-19. Available via: <http://mathstore.ac.uk/headocs/31lectureinteractive.pdf> [Accessed 11 September 2009].
4. Simpson, V., and Oliver, M. (2007) Electronic voting systems for lectures then and now: A comparison of research and practice [online]. *Australasian Journal of Educational Technology*, 23(2). Available at: <http://ascilite.org.au/ajet/ajet23/simpson.html> [Accessed 11 September 2009].
5. Boyle J.T., and Nicol D.J. (2003) Using classroom communication systems to support interaction and discussion in large class settings. *Association for Learning Technology Journal*, 11(3), pp. 43-57.
6. Draper, S.W., and Brown, M.I. (2004) Increasing interactivity in lectures using an electronic voting system. *Journal of Computer Assisted Learning*, 20(2), pp. 81-94.
7. King, S.O., and Robinson, C.L. (2009) 'Pretty Lights' and Maths! Increasing student engagement and enhancing learning through the use of electronic voting systems. *Computers & Education*, 53(1), pp. 189-199.
8. Kennedy, G.E., and Cutts, Q.I. (2005) The association between students use of an electronic voting system and their learning outcomes, *Journal of Computer Assisted learning*, 21(4), pp. 260-268.
9. Dufresne, R. J., Gerace, W. J., Leonard, W. J., Mestre, J. P. and Wenk, L. (1996) Classtalk: a classroom communication system for active learning. *Journal of Computing in Higher Education*, 7, pp. 3-47.
10. Crouch, C. H. and Mazur, E. (2001) Peer instruction: ten years of experience and results. *American Journal of Physics*, 69(9), pp. 970-7.
11. Draper, S.W. (2009) Catalytic Assessment: Understanding How MCQs and EVS Can Foster Deep Learning. *British Journal of Educational Technology*, 40(2), pp. 285-293.

Notes to article

¹It is a fairly reliable cliché that articles on this topic mention the "Ask the audience" feature from the game show 'Who Wants to be a Millionaire?' but there is no such consistent terminology for the technology itself. Simpson & Oliver [4] report use of: "Electronic Voting Systems", "Audience Response Systems", "Personal Response Systems", "Group Response Systems" and "Classroom Communication Systems". In personal conversation I have also heard "Student Response Systems". "Electronic voting" is a term also used in technology-enabled electoral polling and perhaps suggests the system is used only for 'opinion' questions when it certainly has no such limitation. "Classroom Communication System" is evocative of a desirable scenario but suggests more of the technology that the simple operation it performs. It is a system for collecting responses from individuals in a group; whether this develops "classroom communication" is dependent on the particular use. Here "response system" will be used as this describes well what the system does: it collects and collates responses.