Interactive lectures and Electronic voting systems

What is EVS?

An Electronic Voting System (EVS) presents a multiple choice question (MCQ) to an audience and up to 10 alternative response options are displayed. The handsets (like domestic TV remote controls) are distributed to each audience member as they arrive, and allow everyone to contribute their opinion anonymously. An example of this can be seen on a TV show such as 'Who wants to be a millionaire'. After the specified time (e.g. 60 seconds) elapses, the aggregated results are displayed as a bar chart. Thus everybody sees the consensus or spread of opinion, knows how their own answer relates to that, and contributes while remaining anonymous. It is thus like a show of hands, but with privacy for individuals, more accurate and automatic counting, and more convenient for multiple-choice rather than yes/no questions.

Why should institutional management be interested?

- EVS can be applied in almost all disciplines
- EVS applies to lectures (central to low cost mass teaching) and introduces interactivity.
- Introducing EVS is low risk: student attitude measures have been markedly positive in almost all cases both from the start and after years of use
- EVS is used to implement "Interactive Engagement" (Hake), and a specific variety of this "Peer instruction" (Mazur), which is almost the only application of technology that has been demonstrated to raise exam results consistently by a substantial amount
- EVS contributes significantly to both individual learning and community building in a class
- A wide variety of types of pedagogic application may be (and have been) implemented with the same equipment

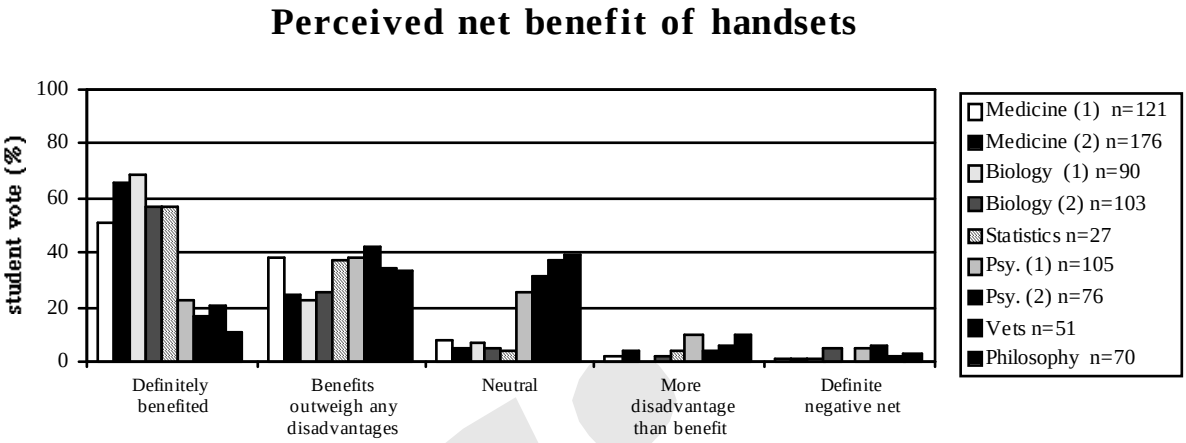
Some pedagogical applications

1. Assessment: class tests can be administered and interactive feedback given and discussed all in one session. Although limited to an MCQ format, a turn round of less than 60 minutes combined with interactive feedback where students ask for clarification as needed makes this far superior not only in cost but in quality for students to any other assessment method.
2. Formative feedback on learning within a lecture.
3. Formative feedback to the teacher on the teaching i.e. "course feedback".
4. Peer assessment.
5. Community mutual awareness building.
6. Collecting data from experiments using human responses: e.g. in psychology, politics, physiology, medicine, economics etc., thus demonstrating a phenomenon that is being taught.
7. To initiate a discussion (e.g. using "brain teaser" questions, as in Mazur's "peer instruction"). "Contingent teaching": a lecturer/tutor can be responsive and alter class designs according to the diagnositc feedback he/she gets during the learning process. This requires teachers to be adaptive and confident
8. Having students design EVS questions (and answers, and explanations) and use them in a presentation to the class.

Subjects that have used EVS at Glasgow University in the last six years

Accounting and Finance, Biology, Computing Science, Dentistry, Engineering (both electrical and mechanical), English literature, French, Management, Medicine, Philosophy, Physics, Psychology, Statistics.

Student attitudes to EVS



Responses to: "What was, for you, the balance of benefit vs. disadvantage from the use of the handsets in your lectures?" with the response options from "definitely benefited" through neutral to "definite negative net value" in assorted classes. The "n" shown is the subset of the class present and responding at the time the evaluation question was put

Behavioural evidence

- Exam results: Hake did a six-thousand student survey of mechanics data for introductory physics courses, all using a standardised test. Classes using the method of Interactive Engagement achieved on average twice the learning gain than those that did not.
  Poulis et al., and Crouch & Mazur have both published in journals on their statistically significant increases in exam marks. The former show a near doubling in the pass rate; the latter showed, like Hake, an average 2-fold and at best a 3 fold improvement in learning gain.
- Attendance: In one case (statistics) attendance increased from about 20 to about 80 (out of 200): a fourfold increase.
- Retention: At Strathclyde University, first year dropouts in mechanical engineering were nearly eliminated.

Practicalities

- Required equipment: a handset per student, receivers, software (often free from the manufacturers), a laptop or other PC, one or more data projectors.
- The equipment can be entirely mobile, thus avoiding room booking constraints, although requiring a bit more setup effort per session
- There are three ways of managing the handsets: requiring students to buy them, having them associated with a specific lecture theatre (managed by a technician) with students picking up a designated handset from its own pigeonhole, or handing them out as students enter. All take time on the first occasion, but go fairly smoothly if used as part of the routine of a class.
- To promote new adoption, it is important to have a single point of contact where the lecturer can obtain advice and assistance on all aspects (hardware, software, setup, pedagogic advice, room bookings); and furthermore, to attend their first usages to assist as much as possible including operating the software for them. Typically lecturers become self-sufficient in time, but at first they need their full attention on the changes to the teaching they are making, not on the equipment.

- Designing questions: many lecturers have little trouble adding useful questions to their lectures, but the learning benefits often increase as the lecturers get better at redesigning sessions around questions.
- In the long run, other things may be altered to fit better. At Strathclyde, over the past 10 years, lectures using EVS have moved to a 2 hour, rather than separate 1 hour slots; and the seating was reorganised into groups of 4 to further facilitate peer discussion.

Conclusion

Overall, EVS can be applied to teaching almost any subject, and a modest but measurable improvement can be expected from the outset. In cases where major improvements to the pedagogy can be and have been made, large improvements have been achieved with effects on exam results, attendance, and retention. Central support for new and prospective adopters can make a big difference, but may need to cut across traditional organisational boundaries between support for software, computer hardware, audiovisual equipment such as data projectors, room bookings, pedagogical advice, and assistance in the lecture theatre itself.

For more information see, www.reap.ac.uk
Steve Draper, July 2007