

Using classroom voting and improving learning

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www.psy.gla.ac.uk/~steve/ilig/

EVS = Electronic Voting Systems
a.k.a. PRS, clickers, audience response systems,

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Part A.

Introducing ourselves, and EVS

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Starter question

What is today's date (in November)?

Enter the number from, 1 to 9 ...

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Job roles

Which option best describes your job / role?

1. You teach some undergraduate students
2. You offer pedagogical advice or support to teaching staff
3. You offer technology advice or support to teaching staff
4. Other: you are a vice chancellor, janitor,

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Insider / outsider

Do you work for / in the University of Wolverhampton?

1. Yes AND I'm associated with
Learning Lab / Institute for Learning Enhancement
2. Yes BUT not associated with those units
3. No, I'm an outsider like the speaker

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Preliminary attitude to EVS

Which of these best describes your present, provisional attitude to using EVS?

1. Already know I'm going to use it
2. Have a good idea and hope it's practicable for me to use it
3. Waiting to see if a good idea occurs to me or is mentioned
4. Doubt if I'll use it, but could be convinced
5. Very unlikely to use it
6. Would never use it, and am here to monitor the enemy

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Hands up

Who has (does anyone have) a notion of how they might use EVS in their own classes / audiences?

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Why use handsets? -- initial idea

Main problem with large classes (thought to be):
Lack of interaction, extreme passivity

A simple theory: learning depends on the time spent actually thinking.
Answering questions at least requires thinking.

Benefits to learners: Requires thinking (about topic)

1. Allows all learners, not just one, to generate an answer
2. And to register that answer
3. In privacy
4. And so to affect what happens next

Benefits to teachers:

Checking if ideas were grasped
Finding out a class' state of understanding and where its difficulties are

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Part B.

Dramatic learning gains

Hake
Mazur

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Hake

Hake (1998) published a survey of 62 courses (6,542 students) all studying the same subject, all using the same standardised test, and using it both pre- and post-.

He graphed the mean gain on each course against whether or not it had used the method of "Interactive engagement".

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See fig. 1 in:

Hake, R.R. (1998) Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses *Am.J.Physics* 66(1), 64-74

Hake's
results

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Mazur

Crouch & Mazur (2001) published an analysis of 10 years of Mazur's MIT course.

Again, the standardised pre- and post-test.

He concludes he has doubled the amount of learning, but the graph suggests that really, he tripled it.

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See fig.2 in:

Crouch, C.H. and Mazur, E. (2001),
"Peer Instruction: Ten years of
experience and results" American
Journal of Physics 69, 970-977

Mazur's
gains

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Part C.

Alternative pedagogic aims / applications for EVS

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Five levels

In this talk, I'll be drawing attention to 5 levels:

1. Generic educational aims
e.g. critical thinking, deep learning, experience of group
work, autonomous learners
2. Specific learning aim or objective for a particular course
e.g. deep understanding of concepts, remediating errors
3. A learning activity e.g. Mazur's Peer Instruction, JITT,
4. Question design, question-set design
e.g. brain teaser questions, diagnostic trees of questions
5. The technology e.g. EVS, One Minute Papers,

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High level purposes or functions

- Engaging students with subject matter.
- Feedback to the learner on what they do and don't know
- Exam practice, combined with interactive remediation.
- Feedback to the teacher to adapt their teaching.
- Attendance checking
- Summative assessment
- Getting a new group acquainted with each other

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Which do you imagine is the most important?

1. Engaging students with subject matter.
2. Feedback to the learner on what they do and don't know
3. Exam practice, combined with interactive remediation.
4. Feedback to the teacher to adapt their teaching.
5. Attendance checking
6. Summative assessment
7. Getting a new group acquainted with each other

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Which do you think experienced EVS users value the most?

1. Engaging students with subject matter.
2. Feedback to the learner on what they do and don't know
3. Exam practice, combined with interactive remediation.
4. Feedback to the teacher to adapt their teaching.
5. Attendance checking
6. Summative assessment
7. Getting a new group acquainted with each other

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Techniques (question uses)

1. SAQs ("self-assessment questions")
2. Diagnostic tree of questions
3. To initiate a discussion (brain teaser questions)
4. Multi-step worked problem.
5. Course feedback: Formative feedback to the teacher.
6. Class exam, marking and feedback done in same session
7. Peer assessment
8. Community mutual awareness building.
9. Collecting data in experiments using human responses
10. Student designed EVS questions

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Which of these have shown the biggest learning gains?

1. SAQs ("self-assessment questions")
2. Diagnostic tree of questions
3. To initiate a discussion (brain teaser questions)
4. Multi-step worked problem.
5. Course feedback: Formative feedback to the teacher.
6. Class exam, marking and feedback done in same session
7. Peer assessment
8. Community mutual awareness building.
9. Collecting data in experiments using human responses
10. Student designed EVS questions

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Question design

There's a whole art to question design, depending on the purpose. Only touch on it here.

Sources:

A bit on my website
Bloom's taxonomy
CAA centre:

http://www.caacentre.ac.uk/resources/objective_tests/

Assertion-reason questions (next slide)
Brain teaser questions (slide after that)

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Assertion-reason questions

The idea here is not to ask about the truth of facts, but about which of several true reasons explains a (true) fact.

In an atom, electrons do not spiral into the nucleus despite the strong electrostatic attraction. Is this due to:

1. The Pauli exclusion principle
2. Heisenberg's uncertainty principle
3. Planck quantization,
4. de Broglie's wave-particle relation

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Brain teaser questions

Mazur calls them "ConcepTests".

The point is to provoke debate, internal and between peers.
Cf. Socratic questioning, and "catalytic assessment"

Remember the old logo or advert for Levi's jeans that showed a pair of jeans being pulled apart by two teams of mules pulling in opposite directions.

If one of the mule teams was sent away, and their leg of the jeans tied to a big tree instead, would the force (tension) in the jeans be: half, the same, or twice what it was with two mule teams?

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Part D.

Some specific EVS applications that I'm impressed with

Mazur's peer instruction
Student-generated questions
Diagnostic trees of questions
Class exam with instant interactive feedback

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Mazur's peer instruction

Mazur's peer instruction is a method of teaching that may (but need not) use EVS;
Is grounded in a psychology of how peers aid learning
Is addressed at a long researched principal weakness of his particular subject matter (mechanics)

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Peer Instruction: Mazur Sequence

1. Concept question posed (brain teaser)
2. *Individual Thinking*: students given time to think individually (1-2 minutes)
3. Students provide individual responses
4. Students receive feedback – poll of responses presented as histogram display
5. *Peer Discussion*: students instructed to convince their neighbours that they have the right answer.
6. Retesting of same concept
7. Students provide individual responses (revised answer)
8. Students receive feedback – poll of responses presented as histogram display
9. Lecturer summarises and explains 'correct' response

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Getting students to design the EVS questions

Basic idea (for a class that has seen EVS used as part of lectures?):
Students have to design a test MCQ,
complete with reasons why each response option is right or wrong
Have to aim for a question that discriminates (splits class)
Why? Same reason underneath as Mazur: the factual question requires them to generate reasons

Andy Sharp has done this (see his paper in REAP online conference)
Nick Bowskill is trialing this as part of his PhD
See my wonderful new paper in BJET "Catalytic assessment: understanding how MCQs and EVS can foster deep learning"

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Diagnostic trees: Feedback to teachers

We all get into EVS to "engage" the students i.e. to get feedback to them.

But talking to experienced EVS teachers, they say what they now personally value the most is the feedback from learners to teachers

Can make this the centre: contingent teaching, using diagnostic trees of questions e.g. for revision sessions.
Ernst Wit (teaching statistics)
Tim Drysdale (electrical engineering)

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Class test: Feedback to learners

But feedback to learners is crucial too.

The class test:
30 minutes privately working out their answers
5 mins keying them in
Then Lecturer goes through the aggregated answers, explaining the right answers, and responding to questions.

Essential point: solo work, on the spot marking, explanatory feedback that is not a monologue (guessing what learner needs to hear) but interactive i.e. dialogic
This is actually better than standard "good" practice

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Part E.

Evidence that EVS is (almost)
always seen as good
=> safe to try

Draper & Brown, 2004

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Does it work? Evaluation overview

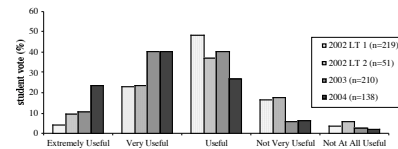
Exam results: At Strathclyde in Mechanical Engineering, first year dropouts have were 20% in 1998, but since using EVS are 3%.

Attendance (when voluntary): in Glasgow Statistics large group tutorials for level 2: rose from roughly 20 to 80 (out of 200) when EVS introduced.

Attitude data: (see handout) over all the applications at Glasgow, in all cases except one, a large majority of students said it was of overall benefit. The same is true of teachers.

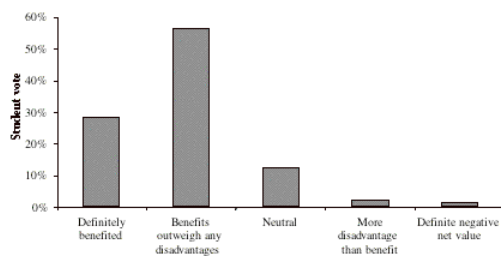
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Simple “how useful?” question



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Net benefit as judged by students



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Part F.

Theoretical ideas

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Why might EVS be good?

A good first approximation for the benefit of ALL magical new teaching ideas is: what % of time is each learner (re)processing the ideas?

Our study showed that a minority actually decided on an answer when a show of hands was the method; a large majority when EVS was used.

Privacy often doesn't matter; but sometimes does.

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Why might EVS be good (2)?

A fundamental problem for all human groups is that, with speech, there is no way of finding out what the group opinion as a whole is (its mean, its spread (StdDev), degree of consensus, ...). Speech is just no good at this.

EVS does it, provided the issue can be expressed as an MCQ. This is a fundamental supplement to innate human capabilities.

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Question for discussion

When does most of the learning in HE happen?

1. At the moment the teacher speaks
2. During the lecture: could test it at the end of the hour
3. During the following 24 hours
4. During the following month
5. During revision for exams
6. Years later

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Part G.

Time to take stock,
before ending

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Summary (1)

It's safe to introduce (students almost certain to welcome it
So starting with minimal change to existing habits is OK

But big gains depend not on the technology (5) but on the
teaching method (3) it is used to support.

AND not on generic educational aims (1) but on attacking
specific defects with your current course (2)

Given such a diagnosis, there are many general kinds of
learning activity that EVS can serve (3)

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Summary (2): what to do

So what you should do to benefit from EVS adoption:

1. Identify a significant defect in your current course
2. Imagine how EVS could contribute to a solution (a novel learning activity) that addresses the defect
3. Implement this redesign (drawing on technical support as necessary: you have to focus on the pedagogy, and content, and class management,

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Attitude to EVS

Which of these best describes your attitude to using EVS at this moment?

1. Already know I'm going to use it
2. Have a good idea and hope it's practicable for me to use it
3. Still waiting for a good idea on why/how to use it
4. Doubt if I'll use it, but might still be convinced
5. Very unlikely to use it
6. Would never use it
7. Too desperate for coffee to answer thoughtfully

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The End

All my other answers are hiding somewhere here:
www.psy.gla.ac.uk/~steve/ilig/

... but you can ask me anyway:

Questions?

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