Opening-up Education: Promoting Active Learning with Students and Staff

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Project Overview

› Relatively small-scale “pilot project” rolling-out clickers to two schools (~500 students in total) – broadly following the guidance from Jefferies et al. from Hertfordshire in “Increasing Student Engagement and Retention Using Classroom Technologies”
  – Local distribution, training & academic “champions”
  – Local rather than centralised support as it’s a small-scale project

› Focus in the first instance on “active learning” as well as “attendance monitoring” via clicker IDs...

› Ethics & evaluation:
  – Students gave informed consent when they were supplied with their clicker and we’ll be presenting some cohort-level data on that basis
  – Focus groups involving students and (separately) staff were conducted near the end of the year, and a mid-year survey: all participants gave consent for dissemination of anonymous results
Project Overview: Clickers

- Early decision to go with *hardware* clickers based on
  - research suggesting students’ own devices are a distraction and less effective than a dedicated clicker
  - and anecdotal suggestion that it lowers the barrier to entry for busy/reluctant staff (this is a *staff engagement* project as well as being student-focused)

- This decision was eventually backed-up by our own evaluation:
  - Student survey: 50:50 divided between “happy to use own device” and “would prefer a clicker”
  - Staff focus group: “phones would be a distraction” & “[the University] should provide learning facilities”
  - Student focus group – divided: some wanted a hybrid hardware and software option, some were (like staff) in favour of hardware only for similar reasons
Project Overview: Web database

- Focus on simplicity for staff
  - (no centralised automatic repository)

One big button to upload session files

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Step 3: processed results from your uploaded file

Success, you have uploaded your file. The feedback below is from your uploaded file.

- There is a total of 31 questions in your uploaded file
- There is a total of 372 responses to these questions.
- There is a total of 12 clickers used.
- There is a total of 0 unidentified clickers used.

The file you uploaded was created on 2014-09-23 14:32:39

The file you uploaded was created on teaching week 0

Choose upload

Select a Module

This quiz has been assigned to module 'Introduction to Computational Mathematics' (MA4100).

Upload a session

Assign this quiz to a different module

This quiz has been assigned to 'Dr James Denholm-Price' (ku13043).

Assign this quiz to a different user

upload
Staff engagement with clickers/website

- 19 staff submitted data from a total of 127 quizzes to the database over 151 days of operation
- Quizzes generated between 18 and 2472 responses (varies by class-size & number of questions), with
- 43985 responses in total
- from 524 clickers
  › 437 registered by students, 9 of which never used
  › 87 unregistered
Web site: Data views for staff

- “Session” data aggregated together at subject-level
- Subject-level: Used by Tutors to visually identify students topics for discussion in group tutorial sessions
- Faculty-level: Informed student support intervention in December/January
Web site: Data views for students

› Simple “widget” embedded into VLE

› Hypothesis: showing students a record of “engagement” might influence their behaviour
  – Student focus group answers: Predominantly No!

“Attendance monitoring will make no difference, motivation will make a difference ... I know what I missed and I don’t need to look at my attendance”
(Majority representative view.)

“Having a lot of red crosses made me attend a particular module; it has motivated me to attend”
(Just one student!)
Feedback from staff and students

SURVEYS AND FOCUS GROUPS
If you had a choice, what device would you use instead of a clicker?

› Over 96% of responding students found the clicker easy to use.

› 43% prefer their standalone “clickers” to phone/tablet
  – Anecdotally, it might be to separate “life” from “study”...

What device would you prefer to use in-class?

- My phone
- My tablet
- Something else I own
- I prefer not to use my own device

![Bar chart showing preferences for in-class device usage by Maths and Life Sciences students. The chart indicates that the majority choose their own device, with a significant preference for their own phone.]
Students engagement with focus groups

“I like clickers because they give immediate feedback”
Our students views on clickers

“I’m used to carrying my Clicker, it stays in my bag”

“A mobile phone will be too distracting, but no excuse if you forget your Clicker”

“A phone is a switch off from the lecture; you may miss too much if you use it instead of a Clicker”
**Students engagement with focus groups**

“It’s a more personal experience to speak to other students rather being one of 200”

“There is never an overload; more questions are good for revision, around 5 questions for each new concept.”

“Talking to peers could clarify the concepts and could help, but only if the teacher has been teaching the right things”
I feel that the quizzes have been beneficial to my learning.

Only 15 students somewhat/disagree out of the 216 respondents (7%)
Our staff views on clickers

- The staff would prefer for the students to use clickers and not their mobile phones.
  - Mobile phones can distract the students
  - Students may not have a mobile phone or may not be able to install the relevant app on their phone and students may not have reliable access to Wi-Fi.

“The University should provide Clickers or whatever technology they choose, the student shouldn’t worry about it.”
Staff engagement with focus groups

“*It makes us think about how we run our sessions*”

“*With a click of a button the students can find out if they got something wrong*”

“I can feel if the question has gone as well as I hoped, when the students are discussing and talking about the question then I know they have gone well and they are not playing around”
What worked

› We engaged 19/20 academic participants

› Staff said:
  – Encourages staff to reflect on their class content
  – Gives wider participation by students

› Students said:
  – They liked it
  – They recognised “active learning” when they experienced it and rated it as more important than “attendance” monitoring

› As a side-effect
  – “engagement” information becomes available for engagement assessment for individual students and intervention
  – and feeds into a faculty-wide process for doing-so
What didn’t work

› Main metric for judging staff engagement was counting uploads (*i.e.* “Are they engaging with the data process?”) which is the wrong metric!

– A better “metric” would have identified some staff asking non-subject/non-pedagogic questions such as “What’s your favourite colour?”

– Metric must improve *and* pedagogic training must improve

› *E.g.* encourage more peer reviewing

› But what *is* a good metric?
What is your favourite colour?

“Some haven’t thought of the questions and put it for the sake of it”
“I don’t agree with using clickers for attendance because it’s inaccurate, irrelevant and they should be focusing on enhancing our learning.”
Where’s the “OER”? Zooming-in to one module
1st Year Linear Algebra

› 2012/13:
  – 15 credit Linear Algebra module with 4 biweekly formative & summative randomised e-assessments (Numbas) over 10 lecture weeks

› 2013/14:
  – Revised framework => 30 credit modules, Linear Algebra reduced to just topics from introduction up to Gaussian Elimination
  – 4 “Flipped Learning” weeks of one module, notes-based materials and 4 Numbas e-assessments (1% credit each)

› 2014/15:
  – Linear Algebra over 5 weeks up to Gaussian Elimination & now Eigenvalues and Eigenvectors too
  – 5 “Flipped Learning” weeks, Numbas e-assessments redesigned to replace notes+quizzes (still 1% credit each)
Numbas “OER” e-assessments

> [https://numbas.mathcentre.ac.uk/](https://numbas.mathcentre.ac.uk/) user “jdp”

### 1.1 Introduction to Matrices

Example 1 -- Give the dimensions of the following matrices:

\[
A = \begin{pmatrix}
  1 & 2 \\
  4 & 5 \\
\end{pmatrix}
\]

a) \[
A = \begin{pmatrix}
  4 & -5 \\
  9 & -8 \\
\end{pmatrix}
\]

has dimensions \( \square \times \square \)

Example 1 -- Give the dimensions of the following matrices:

\[
A = (8)
\]

a) \[
A = \begin{pmatrix}
  -1 \\
  9 \\
\end{pmatrix}
\]

has dimensions \( \square \times \square \)

Example 1 -- Give the dimensions of the following matrices:

\[
A = (-6, 5)
\]

has dimensions \( \square \times \square \)
Co-created by a student for students

› Summer Internship project (Faculty-funded) combined text-based “notes” with e-assessments in Numbas with embedded videos and links to other resources in the feedback.

› Side-effect: He learnt HTML, LaTeX etc. and developed his project management skills in the process.
Why go the OER/e-assessment route?

› Notes-based flipping did not work!

**Summative assessment scores**

- Unflipped
- Flipped
- Flipped OER

Assessment period

<table>
<thead>
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<th>Unflipped</th>
<th>Flipped</th>
<th>Flipped OER</th>
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Formative performance

Unflipped participants

Flipped + OER participants

Quiz number
Can we reach “gold standard” performance?

› Even students with an unlimited amount of time and a marks incentive won’t necessarily get 100% on a “long” question

› “Flipped OER” results might be able to approach the “Lecture” if recall was perfect and fatigue not an issue
Does Peer Instruction work? And can registered clickers do more?

› 48% average “learning gain” over 5 weeks of using “Peer Instruction” with the Flipped+OER materials
  – Ranging from 16% to 80%

› “Clickers Project” means individual responses can be traced after class and support offered to individuals clearly struggling with concepts

› Also allows “inter-week learning gain” to be examined, e.g.

<table>
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<th>23%</th>
<th>31%</th>
<th>46%</th>
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- 59%

(40% individual)
Students with poor attendance were identified and referred to a workshop intended to inculcate better study habits.

However, in this pilot year for most students this was a one-off event. Nevertheless there is some evidence that the intervention did have some effect. Taken across the year the rate of decline in attendance was less for the group of students who were referred than for those who were not.
Attendance statistics

- For one of the first year core modules the correlation between the final results and the attendance record is fairly high (0.697).
- The mean mark for those with less than 50% attendance is 40.5 (47.25 if zero marks are excluded) and the mean mark for those with more than 50% attendance is 66.73. (There is a statistically significant difference between the groups whatever test you perform.)
- So we are not entirely wasting our time :-)

![Student Marks v Attendance](image-url)
Now what?
Back to the big picture...
The Future

› Pilot goes Institution-wide with
  - Level 4 this year
  - Giving students access to quiz-level data
  - Hybrid clicker solution (s/w & h/w option)
  - Now we’re large-scale (following Jefferies et al.)
    3-level training & centralised support

› Evaluation: Institution-wide focus groups covering all project “users”
  - Students as end-users
  - Academic staff as end-users and providers
  - Professional support staff (e.g. Library, Admin, Technical – AV support & IT support) as providers and users
Longer-Term/Speculative Future

› Integration with “Business Intelligence”
  - Move from a manual clickers web site upload to automated collection of “session” data
  - Supervised automation of student-level and cohort-level data analysis

› Continuous evaluation – take advantage of students having clickers to enable
  - General feedback usually assigned to surveys etc. captured continuously (“how was class today?”)
  - Student support (identifying engagement issues)
  - Institutional feedback (“how was your lunch?”)
Unanswered questions:

How do you support staff to write good subject-specific questions?

How do you measure a “good question”?