Arguing again for e-exams

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Get these slides (pdf)

Get the demo
http://transformingexams.com

Acknowledgement
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Targeting...

• Supervised
• High stakes
• On campus
• Large scale

(image credit: Dr Fluck UTAS)

What we are not specifically addressing here is off campus, online only, distance education, cross institutional students – there are some existing e-solutions to address these needs.
Drivers

Policy
• Realising ‘unfulfilled potential’ in higher education
  – Also - is a lack of e-exams in higher education hampering the wider uptake of ICT in other areas of education? Ref- TAS
• National participation targets - Higher student numbers...
  e.g. UQ: 2007-2012 = 30K extra annual exam sittings.
• Graduate attributes of Australian institutions - Feature current knowledge, skills for the modern world... this means ICT skills.
• Strategic & E-learning plans - significant activity with MOOCs, online learning, blended learning, flipped classrooms all depending on ICT success.
  – An internal UQ survey of senior teaching leaders placed ‘e-assessment / online marking’ at the top of their priority list for development.

Drivers

Practical
• Hand written assessment decreasing
• Technology provides and opportunity to enhance exam questions and scenarios
  – Some examples to follow later
  – More Examples at TransformingAssessment.com
• Increasing use of ICT, study, work social
  – 98% ownership of mobile WiFi enabled devices
  – 91% (2012 UQ survey), 97% (2013 UQ survey) laptop ownership highest of any device
  – 80% of students accessing online LMS weekly
So?

All of this ....leads to a growing disconnect between the way high stakes testing is conducted using pen on paper exams and students’ everyday experiences.

Are e-exams are the next step on from computer assisted marking and e-assessment of progressive assessments?

An e-exams solution is needed ... But!

[Argument Map – of a ‘wicked’ problem!]

bit.ly/eexam-map
Some More Issues

- Fairness & Equity -> equivalent environment
- Highest stakes -> must be reliable and robust
- Many stakeholders - needs/concerns
- Security (end-to-end ref IT security principles)
- Invigilation (easy to identify misconduct)
- Administration (reduce manual/double handling)
- Sustainability, efficiency, facilities, spaces, equipment, set-up, logistics, processing, workflows...

Sustainable facilities

Provision of facilities must be sustainable

- How to provide computer hardware and facilities for large infrequent e-assessment events (exams):
  - Use existing campus computer labs? (Finite in number, small 20~ish room size, problematic layouts/poor design [Dermo, 2012])
  - Build dedicated e-exam space? (good design, but costly, although capital cost done once, still finite, potentially low utilisation out of exam periods)
  - Hire / build temporary lab space? (costly and reoccurring)
  - Share facilities between institutions? (scheduling issues)
  - Provide each student with hardware? (costly ~ give or rent to students? - reoccurring, maintenance?, low utilisation?)
  - Rent or build options are not scalable or sustainable.
- Given the already high ownership of suitable equipment by students -> how can we make use of this equipment?
Issues - BYOD

• Given high ownership of laptops – we can leverage these
  – But ...
    • Diversity of devices (hardware, operating systems (Windows, Mac, Linux), software applications.
      – Need a ‘cross platform’ solution
      – Need to provide same (equivalent) software environment
    • A potential source of unauthorised assistance
      – Need ability to completely control student owned equipment for the exam duration – ref security principles.
    • Students have a lot ‘invested’ in their devices (for work, for study, for personal and social uses, etc)
      – Need to respect this domain, maintain privacy and integrity of student equipment.
      – Need to return student equipment as ‘untouched’ when done - separation of the exam environment and the student owned ‘host’ equipment.
    • Equipment does fail on occasion
      – Need appropriate back-up facilities and processes, data progressively saved, provide power, spare laptops etc

Issues

Varying technical infrastructure between / within Institutions

• How to:
  – Be applicable across the higher education sector
  – Fit into existing software and hardware landscapes
  – Leverage existing infrastructure
  – Cater for flexible needs
  – Not be a nightmare to support...
A basis for further development

- The well developed ‘eExam’ system (v4) (Andrew Fluck, UTAS) – ticks many boxes:
  - Bootable USB sticks.
  - Full operating and application suite onboard.
  - Typed student responses (human marked)
  - Student owned equipment used as host and left untouched.
  - Open source code base, commodity components.

eExam (v4) Modes

- Modes (phases of introduction)
  1. Paper replacement – computer optional (a typewriter) essay, short answer, limited multiple choice.
  2. Post-paper – a computer becomes compulsory
     - Adds multimedia prompts, video, audio and software tools can be made available in the exam so that students can construct a response.
- Responses need to be human marked either on-screen or printed then shuffled...
  ...the current project is seeking to address this! (v5)
Software tools can be made available in the exam

Ref: Dr Fluck, UTAS
### The Current Process – how it works

#### Prep

![Prep Diagram](image)

#### Post Exam

![Post Exam Diagram](image)

(credit: Dr Fluck UTAS)

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### e-Exam system for BYOD

Current project improvements for v5 – adds:

- On-board LMS for computer marked question types (Moodle) [demo available]
- Electronic answer reticulation/workflows [in progress - TBA]

Modular architecture so academics / institutions can choose the features and mode of operation that suit them...

- **System prep by IT personnel**
  - Bootable USB stick
    - OS + Browser + LMS + other tools
    - Database for quiz (only via web interface) or Exam Script (read only)
    - Written answers (student editable)
    - Server to collate student responses
  - HDD, network interfaces (IP stack, Bluetooth, infrared etc) excluded or restricted
  - Interface components used by student: Keyboard, Screen, Mouse…

- **Exam prep by academic**

  - **Student Owned Device**
    - Student (view questions, use software tools and type answers)
Modes of use

• **Non wireless** mode *demo available*
  – Exam / LMS is on-board the stick itself.
  – Duplicating equipment to reverse copy student answer files/databases from the USB sticks to a collation location
  – Fall back in all cases - manual copying each student’s answer file(s)

• **Ad-hoc wireless** mode [feature TBA]
  – Exam / LMS will be on-board the stick itself.
  – Periodic connections to upload/update student answers on a collation server in background or via a student initiated final submission with confirmation shown on screen

• **Wireless/Network always on** mode – *demo available*
  Needs reliable, redundant, high capacity wireless/network in the exam room (best to use wired!) or just use as a secure boot image for computer labs to serve as a gateway to the institution’s LMS.
  – Doesn’t require an LMS on-board the stick
  – Web browser to access a LMS server via restricted connection
  – Custom network config by institution IT (done once, reused)

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Current e-Exam v5 Demo

Desktop. Choice of modes. Background image unique for each exam for added security.
Paper equivalent and replacement exams via word processor. Links to on-board media / software tools.

Computer marked question types via on-board LMS. Integrated multimedia.
Current e-Exam v5 Demo

Computer marked question types via institutional LMS
(needs network for restricted connection – e.g. demo can *only* connect to UQ Blackboard and no other server.)

What else it could do

Computer marked question types (Moodle)

**Standard [already in the demo]:**
- Calculated (Wildcards and datasets, calculated MCQ)
- Matching
- Embedded Answers (Cloze Test / Gap Fill – text with multiple choice, short answers and numerical answers)
- Short Answer (sentences)
- Numerical
- True/False
- Short essay (with response template)

**Custom types:**
- Algebra, Multinumerical, Spreadsheet,
- Chemistry Molecular editor questions,
- Music (key signature, scales, intervals)
- Hot spots, drag and drop (labels, text, images),
- Set splitting,
- Missing words, Gapfill,
- Regular expression...

*Marking: delayed, Certainty-Based Marking... manual override.*
Examples – Confidence questions

- Confidence based approaches penalise guessing. Students need to choose a response and declare their level of certainty. Available in Moodle now.

<table>
<thead>
<tr>
<th>Certainty level</th>
<th>C=1</th>
<th>C=2</th>
<th>C=3</th>
<th>No Reply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mark if correct</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Penalty if wrong</td>
<td>0</td>
<td>-2</td>
<td>-6</td>
<td>0</td>
</tr>
</tbody>
</table>

**Certainty v Mark Expected**

University College London

Qu. 7:
Which structure shown below represents meso 2,3-dichlorobutane, A, B or C?

Three structures, A, B and C

http://www.ucl.ac.uk/lapt/

Examples – Short text response

Students type in a short sentence response which can be marked by computer based on pattern matching.

Available in Moodle now.

Example question

A boy climbs slowly to the top of a slide and then slides down it. At which point will his kinetic energy be a maximum? Note: Your answer should ignore the effects of friction.

You should give your answer as a short phrase or sentence.

Kinetic energy will be at maximum when at the bottom of the slide.

Examples - embedded applets

Moodle Quiz

Examples - Virtual Labs / Sims

Conduct experiments via locally run simulations\(^1\) or internet connected hardware\(^2\)


\(^1\) http://phet.colorado.edu/

\(^2\) http://www.transformingassessment.com/moodle/course/view.php?id=72
Examples – Augmented Reality Experiment

Web cam

AR markers

AR software embedded in question

http://www.transformingassessment.com/moodle/course/view.php?id=70

Examples – Virtual 3D Spaces

As if the student was doing the activity in the LMS

Set up Quiz in the LMS. Results are stored in the in grade book.

A set of scripts for Moodle and VW that acts as a bridge.

Student undertakes assessment in the virtual world

(e.g. Sim-on-a-stick)

Online (Second Life) examples see http://www.transformingassessment.com/secondlife.php
Examples – Serious Games

• Serious games, simulations, role plays. Business, science, history, language/communication.

Research program outputs

• The e-Exam system is situated within a wider research program to develop:

  – A working prototype of an exams platform and documentation allowing others to reproduce it
  – A set of example questions that can be used in e-exams
  – A research-informed set of good practice guidelines on e-exam processes and procedures.
  – A guide on preparing students for e-exams.
Further Information

Contact: m.hillier@uq.edu.au

Project website and demo
http://transformingexams.com

References upon request.

Citation