e-Exams
The story so far…
(2013-2015)

Compiled by Mathew Hillier, Dec 2015

TransformingExams.com

Transforming Exams Across Australia

Australian Government Office for Learning and Teaching
National Grant ID15-4747

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Demo & Guides

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Is this your exam space?

The dissonance of it all!

Real world of work

World Economic Forum – How will digital change your working world. https://agenda.weforum.org/wp-content/uploads/rtr2m8vm1-628x330.jpg

Exams

Exams at Monash Caufield in 2015 (mathew.hilier[at]monash.edu)

We are faced with a growing disconnect between the way *high stakes testing* is conducted using pen on paper exams and students' everyday experiences of study, work and life.

21st century employability skills

Ways of thinking	• creativity and innovation • critical thinking, problem solving • learning to learn, metacognition
Ways of working	• communication • collaboration (teamwork)
Tools for working	• information literacy • ICT literacy • discipline resources and tools
Living in the world	• citizenship – local and global • life and career • personal and social responsibility (including cultural awareness and competence)

http://atc21s.org/

Binkley, M., Erstad, O., Hermna, J., Raizen, S., Ripley, M., Miller-Ricci, M., & Rumble, M. (2012). Defining Twenty-First Century Skills. In Griffin, P., Care, E., & McGaw, B. Assessment and Teaching of 21st Century Skills, Dordrecht, Springer.

21C learners

- skilled use of tools
- active learning rather than passive receiving of knowledge
- authentic learning experiences rather than contrived tasks
- construction rather than instruction
- task (not process) oriented
- just in time learning
- search not memorise
- utilise social networks
- doesn't know answer but knows where to find it
- Google not libraries
- collaborate not compete.

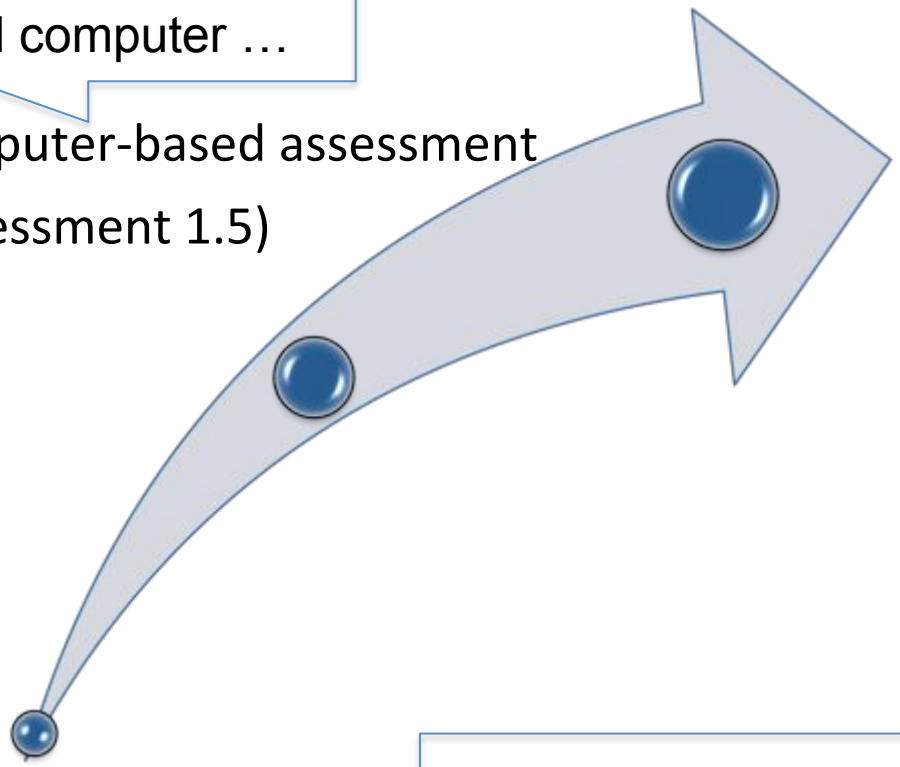
Elliott, B (2007)

Bobby Elliott and assessment 1.5 to 2.0

Add computer …

Computer-based assessment

(Assessment 1.5)



Traditional assessment
(Assessment 1.0)

Ye Olde style…
mostly paper-based
mostly classroom-based
very formalised (in terms of administration)
highly synchronised (in terms of time and place)
highly controlled (in terms of contents and marking).

Tool-assisted assessment
(Assessment 2.0 and beyond)

21C

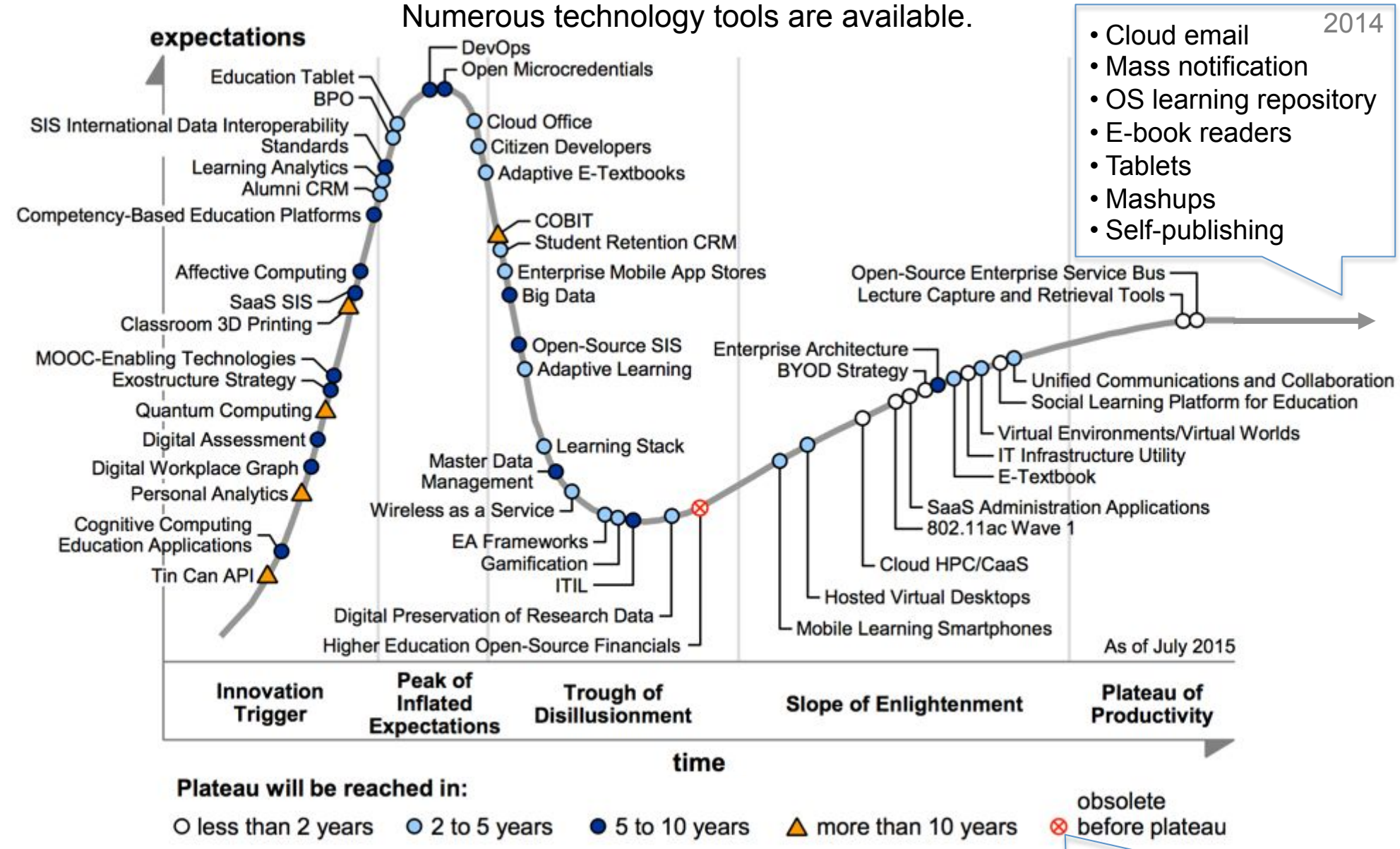
- user-generated content, blogs,
- the power of the crowd, wikipedia
- data on an epic scale,
- architecture of participation, easy use
- network effects,
- openness. OER, Mashups

Future → Web 3.0.,
IoT, Ubiquitous

Elliott, B (2007) “Assessment in the age of Web 2.0” Scottish Qualifications Authority. http://wiki.cetis.ac.uk/images/d/de/Assessment_2_v2.pdf

Hype Cycle for Education 2015

Numerous technology tools are available.



2014
- Cloud email
- Mass notification
- OS learning repository
- E-book readers
- Tablets
- Mashups
- Self-publishing

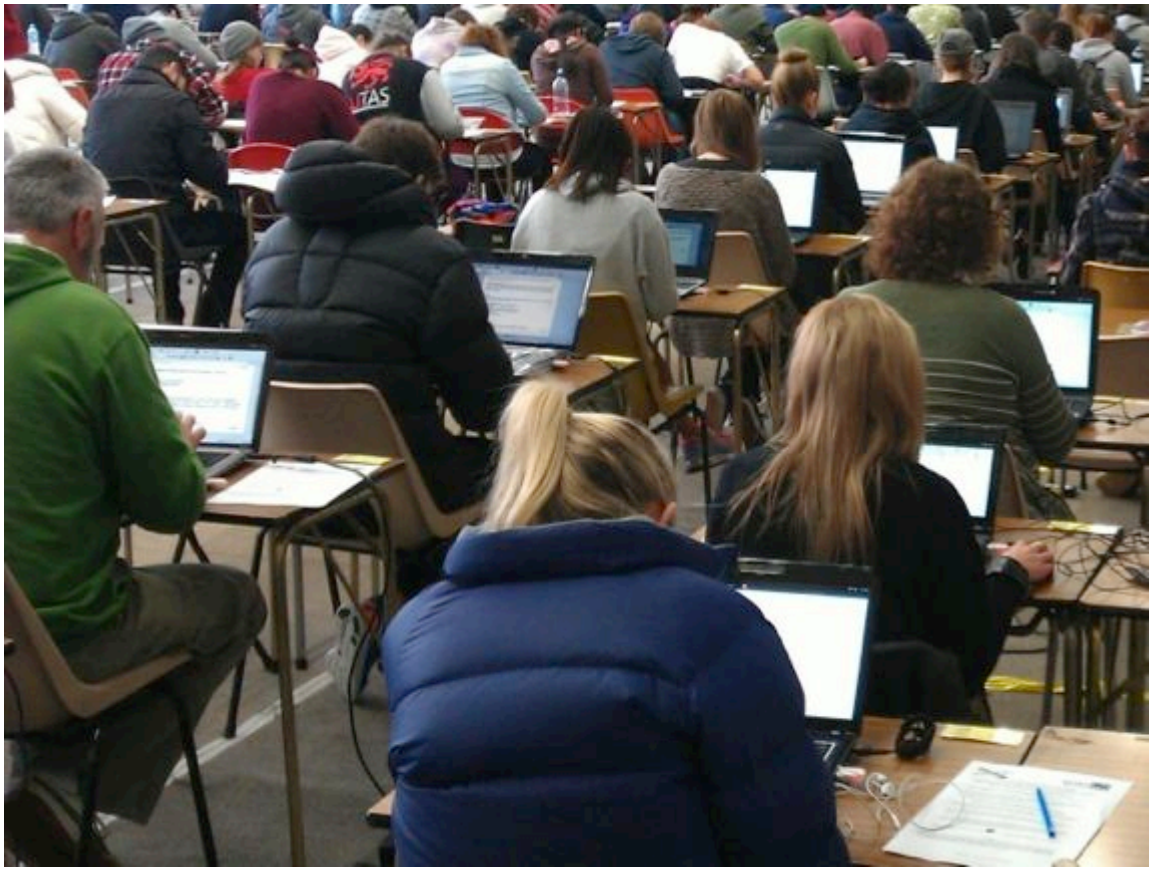
2014
- MOOCS
- Low/mid range handsets

Source: Gartner (July 2015)

Targeting...

- Supervised
- High stakes
- On campus
- Large scale

(image credit: Dr Fluck UTAS)



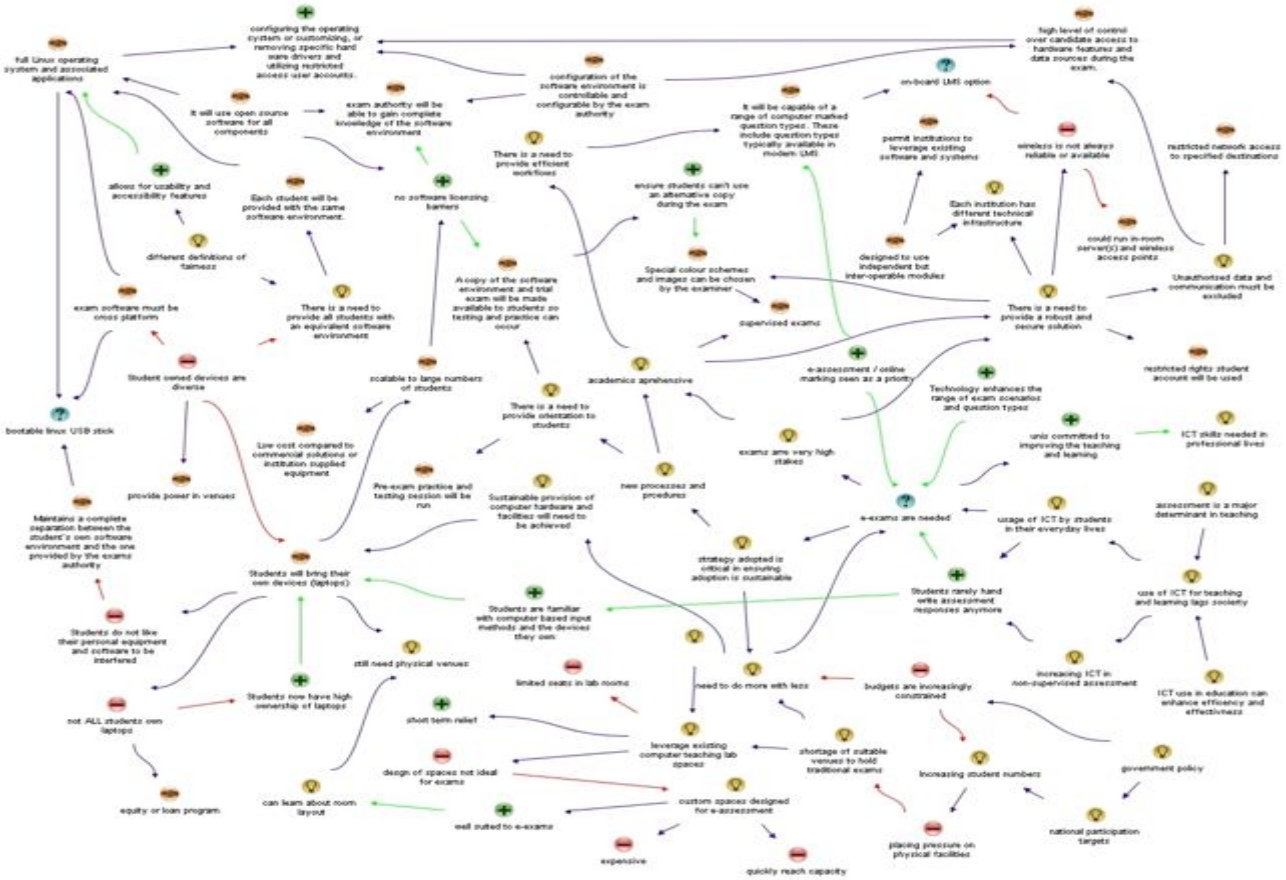
*What we are **not** specifically addressing here is off campus, online only, distance education, cross institutional students – there are extra issues (later!) and some possible e-solutions to address these needs.*

Why e-Exams?

Rationale: Concerns, drivers, possible solutions for e-Exams.

A truly '**wicked**', 'messy' problem and a long road to get it right!...

Presented rationale at 2013 and Seed grant findings at 2014, 2015 conferences.
More to come … and explored in depth in Hillier & Fluck (2013)
http://www.ascilite.org.au/conferences/sydney13/program/papers/Hillier.pdf



ta.vu/eexam-map

e-Exams: Online, Offline, On Campus or Distance

There are trade-offs for any e-exam solution.

	On Campus (controlled spaces)	Distance (at home)
Online (net)	• Space issues for institutions. • Improved exam management efficiency. • Equipment: need computer labs to cater for 2000 at once or BYO. • More secure: live IT monitoring/ control and spaces are supervised. • Needs reliable network.	• No space issue for institutions. • More efficient exam management. • Students supply equipment. • Less secure: IT monitoring but wider spaces are unsupervised. • Needs reliable network.
Offline	• Space issues for institutions. • Less efficient exam management. • Equipment: need computer labs to cater for 2000 at once or BYO. • More secure: IT control possible, spaces are supervised. • Network reliability not an issue.	• No space issue for institutions. • Less efficient exam management. • Students supply equipment. • Less secure: no useful monitoring/supervision • Network reliability not an issue.

A Possible Future

An evolution rather than a revolution. Some aspects may occur quicker than others depending on particular implementation, technical models chosen, socio-cultural-policy environment conditions. Outlook for Australasia. (Denmark and Norway already have 'internet in exams').

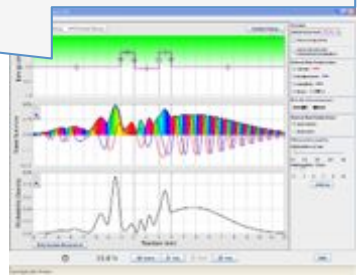
	About now	2015-2020	2020-2025	2025 and beyond
Medium for high stakes assessments	Paper	Paper-replacement – students can opt to type instead of handwriting (uses USB drive to boot BYOD). Some post-paper exams appearing.	Post-paper exams common. All questions and materials are digital, a computer is required to respond to assessment challenges.	Fully computerised, internet enabled exams with candidates using a range of software and input devices.
Connectivity	None	None to some use of restricted ad-hoc networks for response reticulation in post-paper exams.	Mix of offline and online exams limited to selected resources. Connections logged.	Open internet access but all transactions are fully logged inclusive of communication, timing, sources.
Authenticity of assessment	Scenarios are written descriptions, with monochrome illustrations	Full colour diagrams and video begin to provide more authentic scenarios	High fidelity, data-driven simulations	Real-time links to global databases
Candidate identity assurance	Manual comparison of face with ID card photo by a trusted supervisor	Practice continues, linked to local database via handheld device.	Practice continues, but laptop camera takes pictures of the keyboard user at random intervals.	Practices continue, with two-factor authentication incorporating biometrics such as face recognition.
Materials provided/ allowed	A range of published books, electronic calculators and stationery equipment bought into the room by students	Digital equivalents begin to replace some materials. E.g PDFs.	e-books, high resolution images, video, simulations, all software tools are provided (open source).	Practice continues with increasing diversity of subject-specific software tools.
Assessment workflow	Bundles of scripts are physically transported to assessors	Practice continues, but digital response scripts can be duplicated, archived and e-mailed.	Digital responses, extends to data files created using subject specific software. E-workflows, banked and tagged questions.	Digital response files are accompanied by performance metrics for individual students, and interaction logs
Achievement measurement	On quality of solution, and written process	Practice continues, analytics of selected response items.	Practice continues, but analytics increasingly detailed. E.g. time taken per question, marks gain.	Detailed analytics, keystrokes/screen touches available – the solution process dominates assessment.
Continuous assessment improvement process	Year-on-year bell-curve comparisons regulate overall difficulty of exam.	Some data on overall ease or difficulty of individual questions/ options is available.	Individual questions are rated for discrimination and reliability etc.	Question ratings take into account all candidate interactions within the assessment.

Source: Hillier & Fluck (2015) http://transformingexams.com/files/hillier_fluck_2015_exam_futures.pdf

Where we are going: Post-paper exams

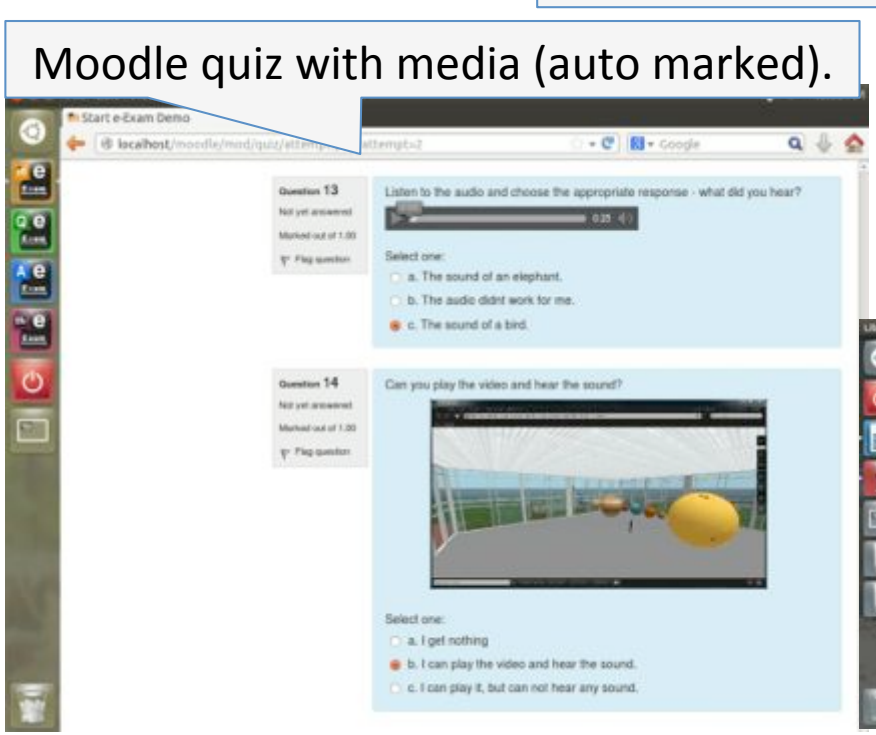
We need greater pedagogical flexibility and more authentic assessments in the exam room. … alignment!

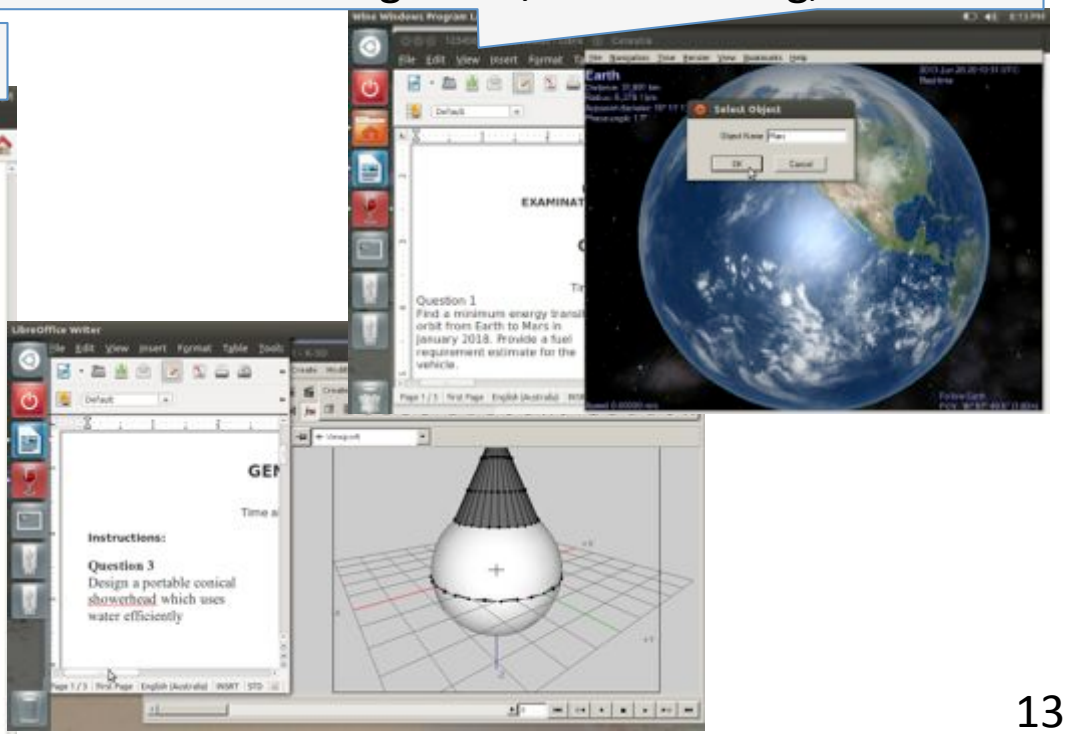
Simulations, tools of the trade, virtual experiments…



'Windows' software via WINE. E.g. CAD / 3D modeling, Celestia.

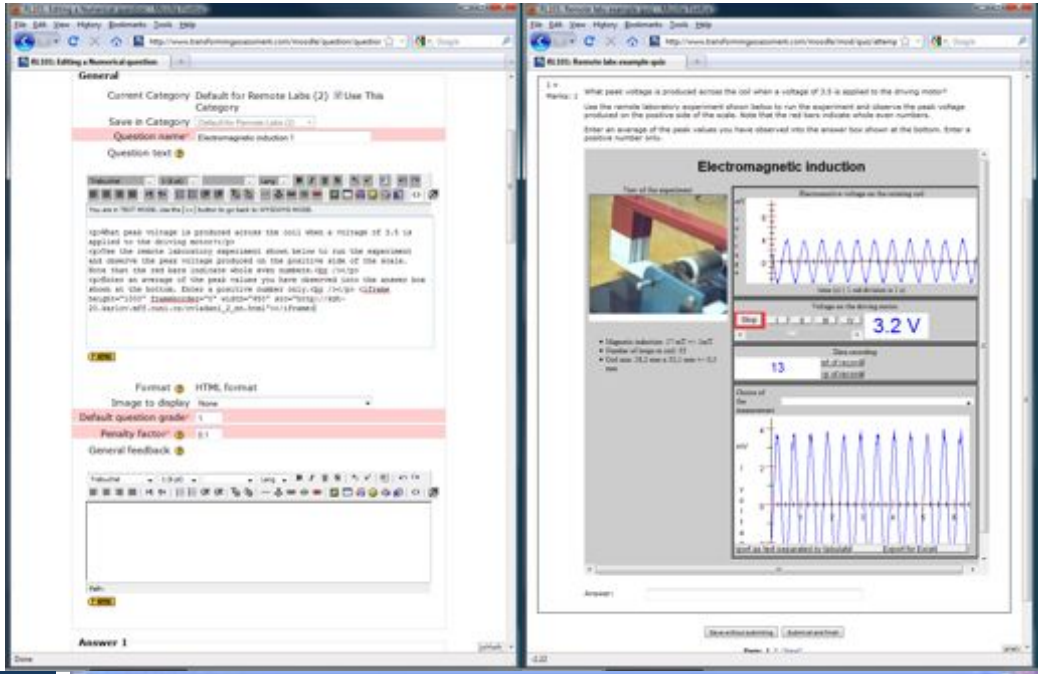
Moodle quiz with media (auto marked).

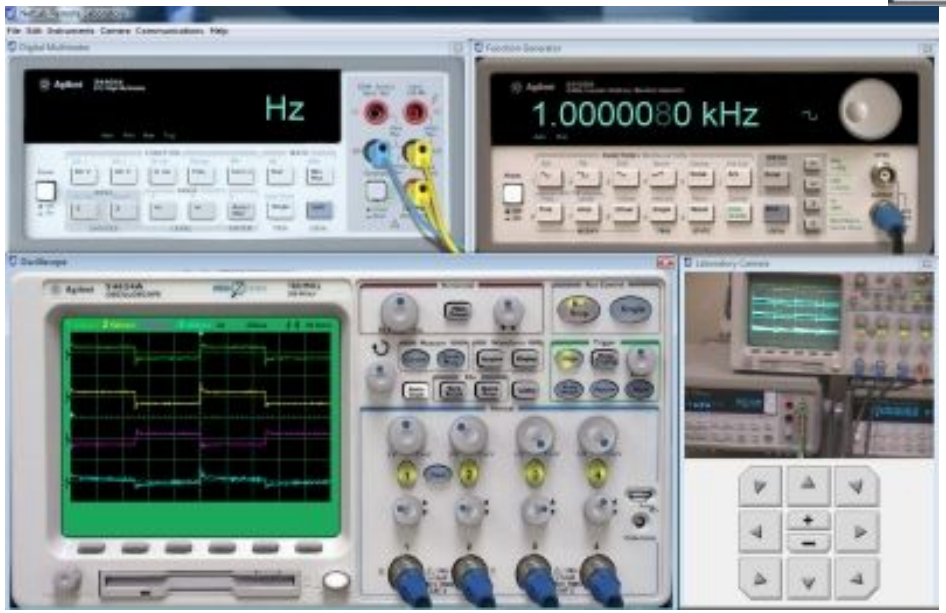


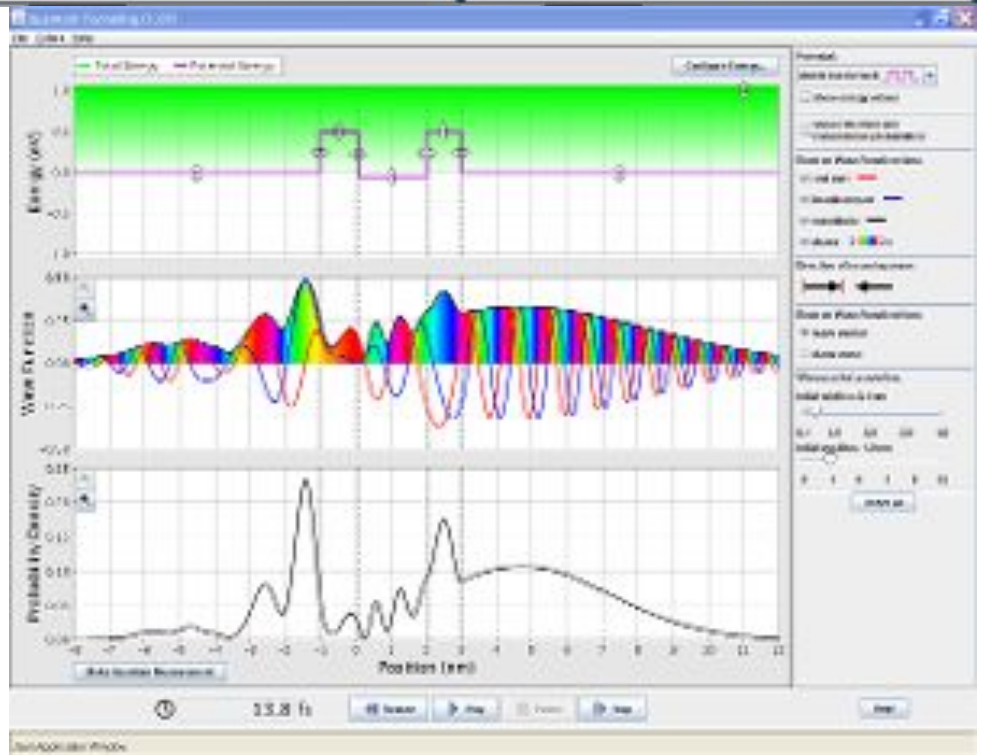


Simulated Labs

Physical hardware can be connected to the internet or we can use **software simulations** of labs and experiments.



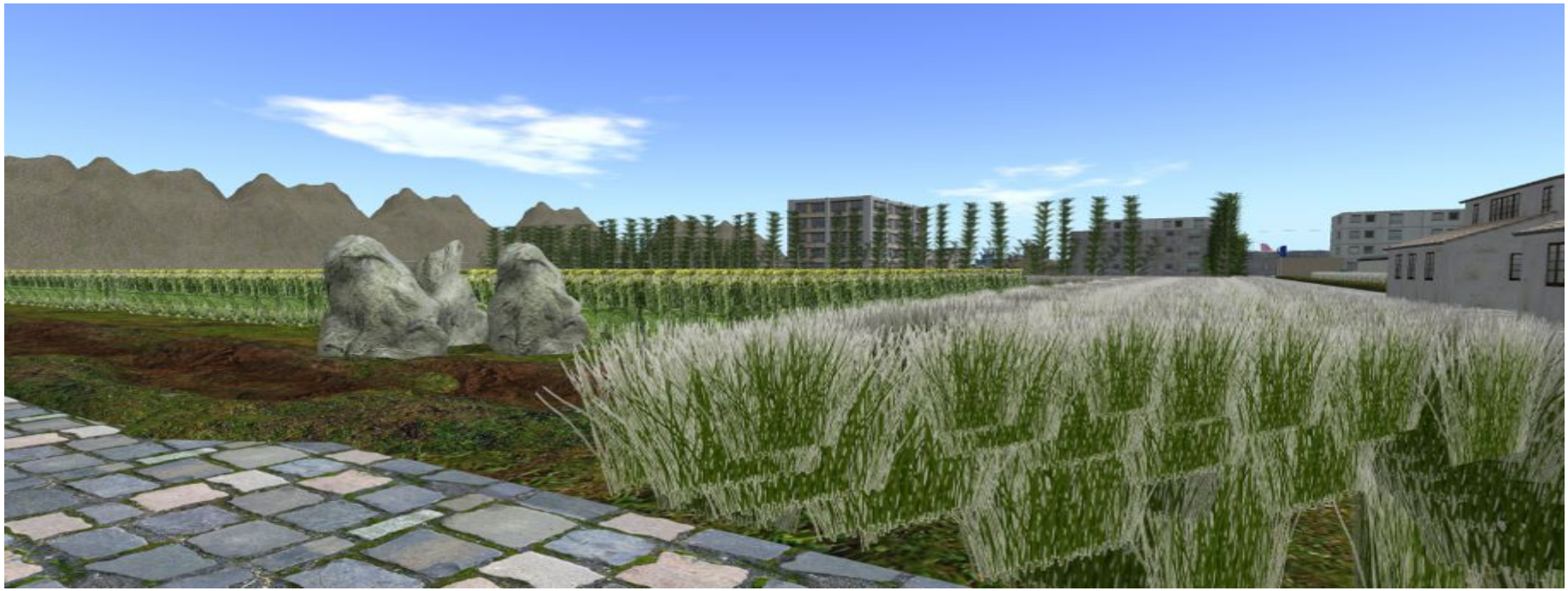




Virtual Immersive Environments

Scott Grant (Monash University, Australia)

http://www.virtuallyenhancedlanguages.com



TA webinar http://transformingassessment.com/events_1_april_2015.php

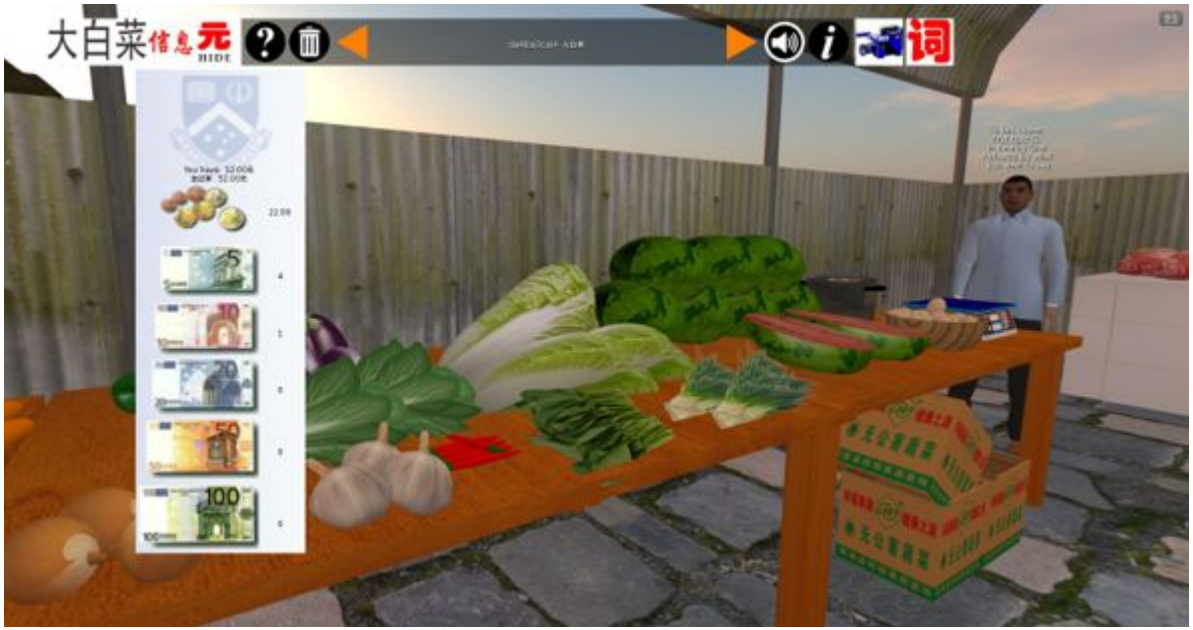
Virtual Immersive Environments

Task Based Learning or Task Based Language Learning (TBLL).

Includes communication activities, using language to carry out tasks, language use that is meaningful to the learner and has a purpose, and communication activities that reflect real-life activities with authentic materials.

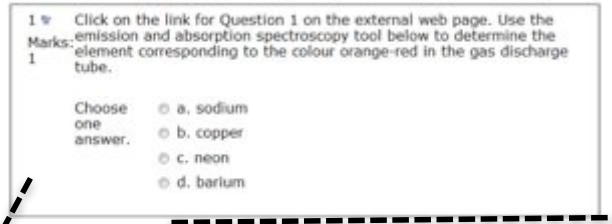
Learn by doing:

Purchase supplies then cook noodles – all in Chinese.



Moodle and OpenSim Working Together

Undertaking an assessment activity in the VW initiates data transfers to the LMS.



Data flows as if the student was doing the activity in the LMS

moodle

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

SLOODLE
Simulation Linked Object Oriented Dynamic Learning Environment

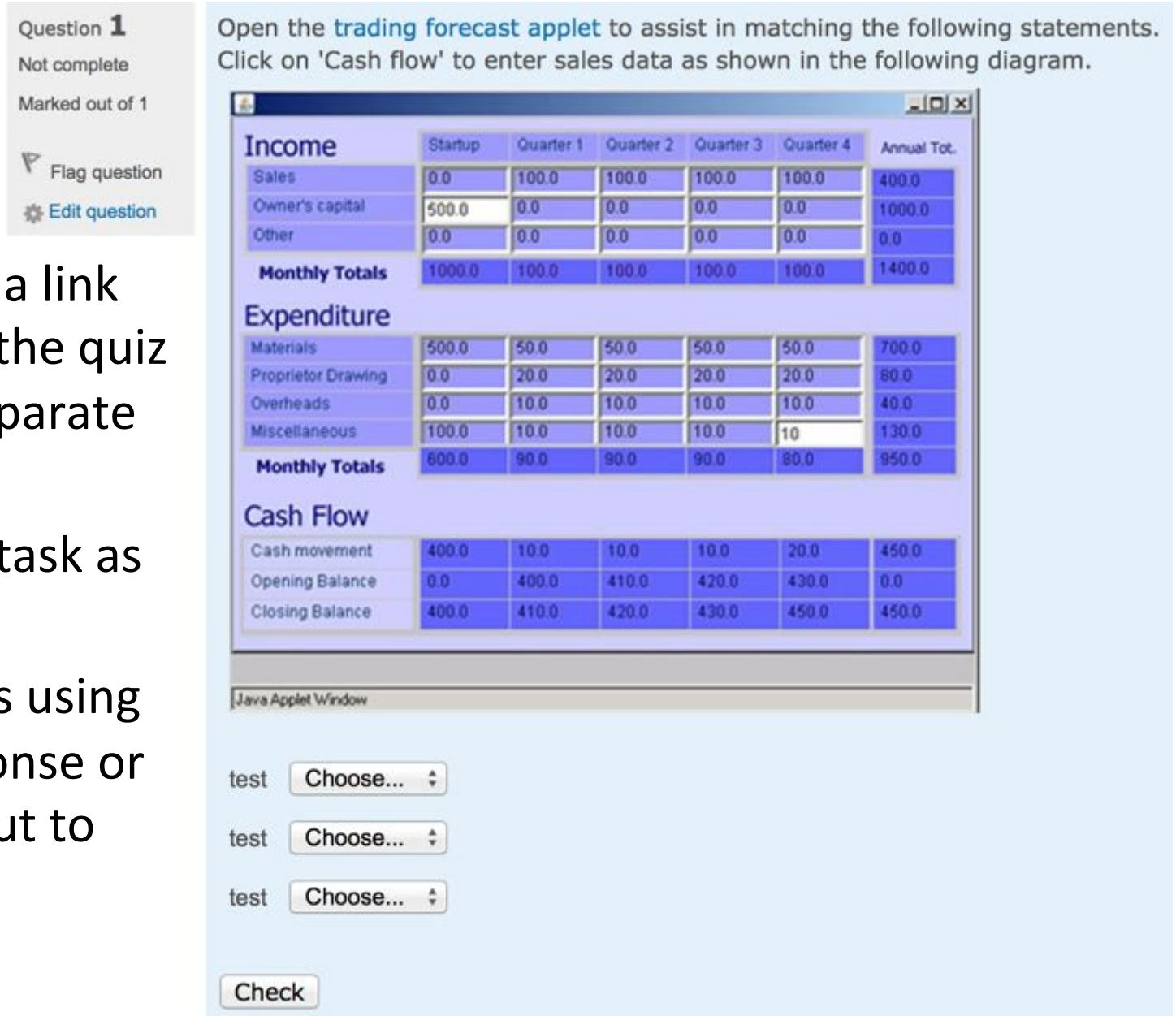
A set of scripts for Moodle and VW that acts as a bridge.

OpenSimulator

Student undertakes assessment in the virtual world

Videos: Transforming Assessment Youtube Channel

Basic Examples - Interactive apps



1. Student clicks a link embedded in the quiz to launch a separate app.
2. Undertakes a task as instructed.
3. Then responds using selected response or numerical input to suit.

Basic Examples - spreadsheet in quiz

Spreadsheet linked to quiz

Question **2**

Not complete

Marked out of 1

Flag question

Edit question

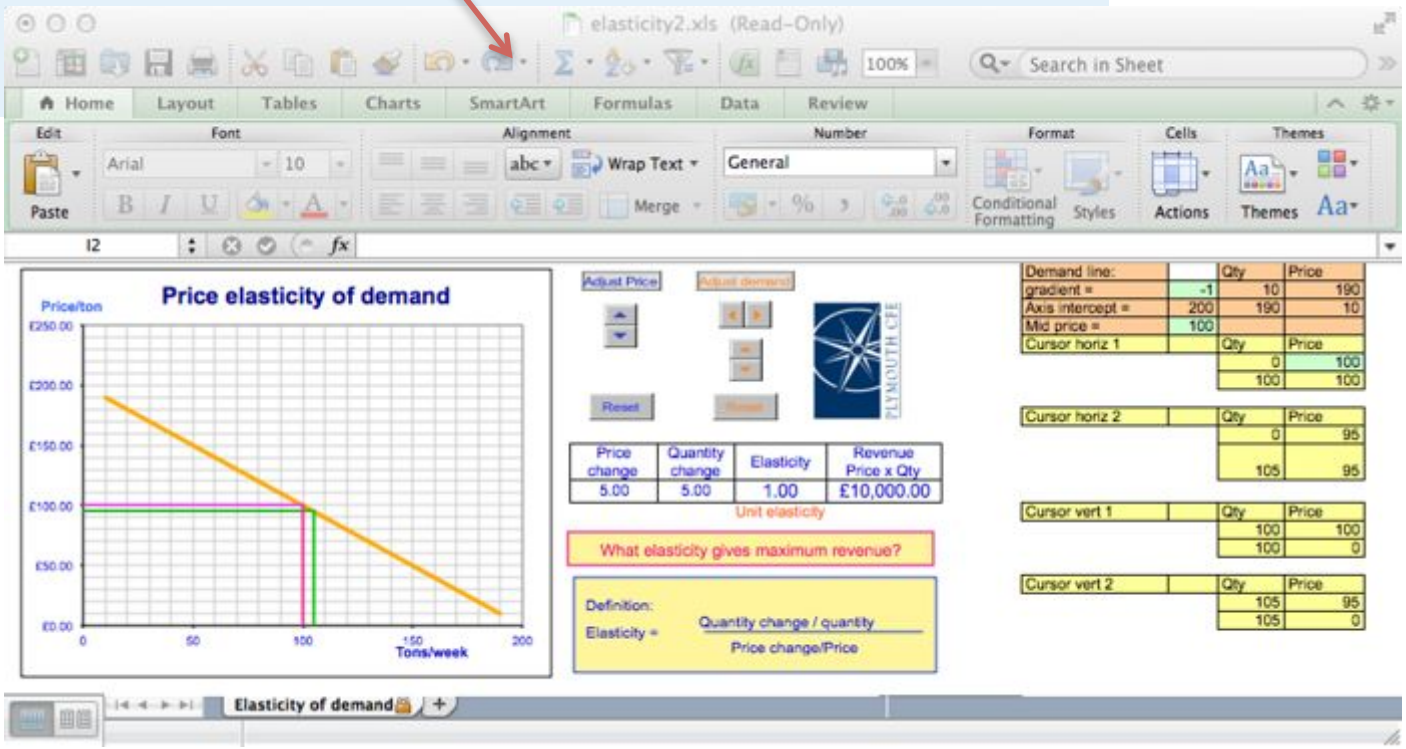
Use the elasticity spreadsheet to assist in matching the following statements.

For an elastic demand, as the price increases — Choose...

For an elastic demand, as the elasticity increases — Choose...

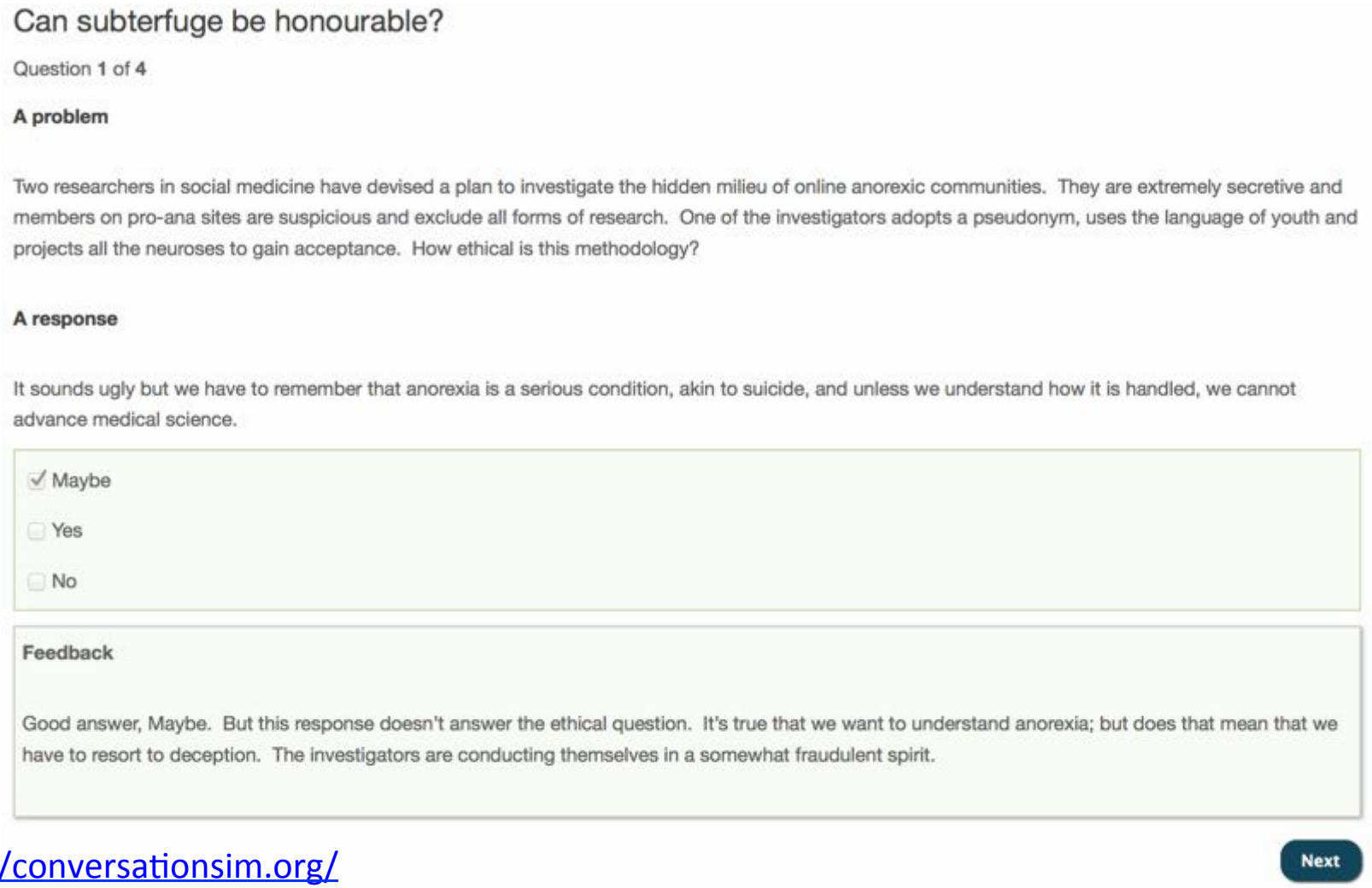
For an inelastic demand, as the elasticity increases — Choose...

Check



Examples – Conversation Sim (Monash)

Students respond to a series statements via MCQs (maybe, yes, no) with feedback per choice to simulate a conversation e.g. Moodle lesson activity.



http://conversationsim.org/

Nelson, R & Dawson, P (2013) Assessment-as-learning: introducing the Conversation Sim ,TA webinar/e-Assessment Scotland, 21 Aug http://transformingassessment.com/eAS_2013/events_21_aug_2013.php

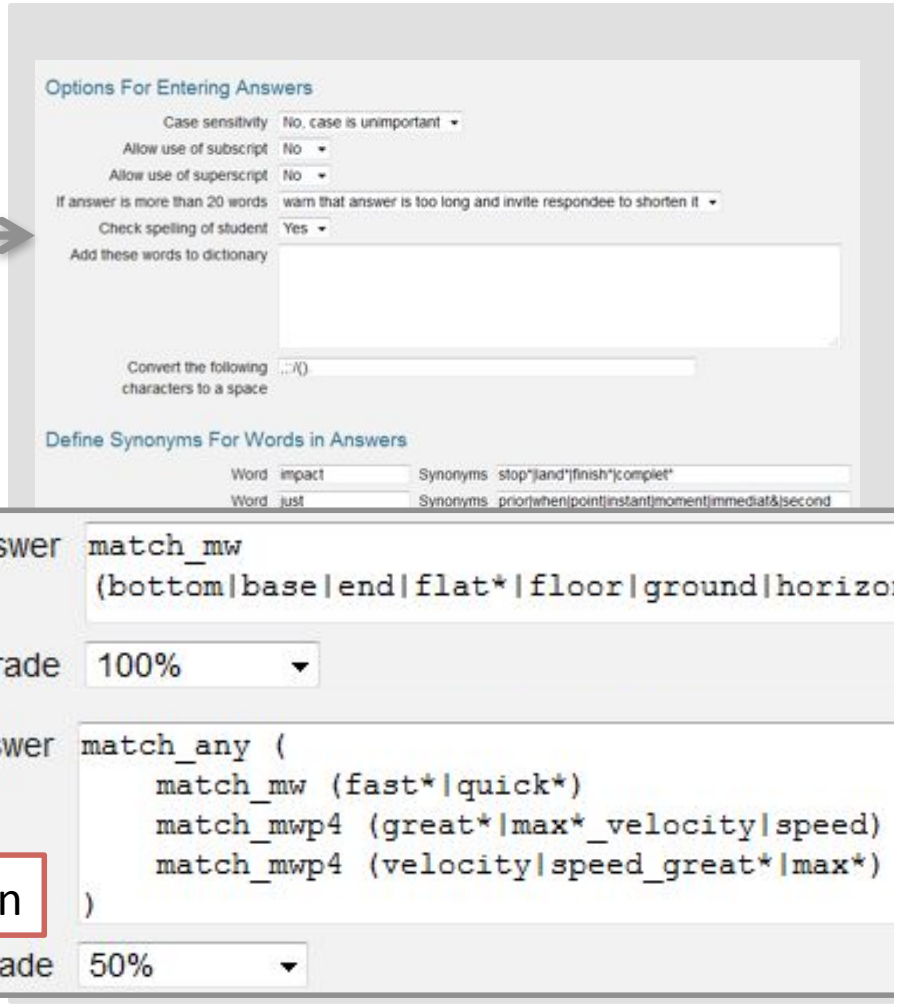
Examples – Short text response

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

Available in Moodle now.

Example question

Example settings



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.

evaluation

Sally Jordan, Open Uni UK, TA webinar, 5 June 2013 transformingassessment.com/events_5_june_2013.php

Examples – Confidence questions

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

Certainty levels and consequences

Certainty level:	C=1	C=2	C=3	No Reply
Mark if correct:	1	2	3	0
Penalty if wrong (T/F Q)	0	-2	-6	0

Qu. 1:

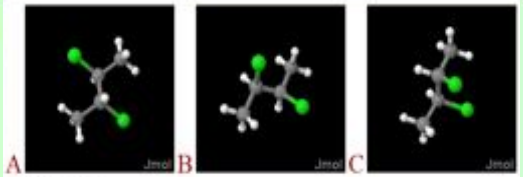
Which structure shown below represents meso 2,3-dichlorobutane, A, B or C?

[Click on the text below to open a window with the three choices]

Three structures, A, B and C

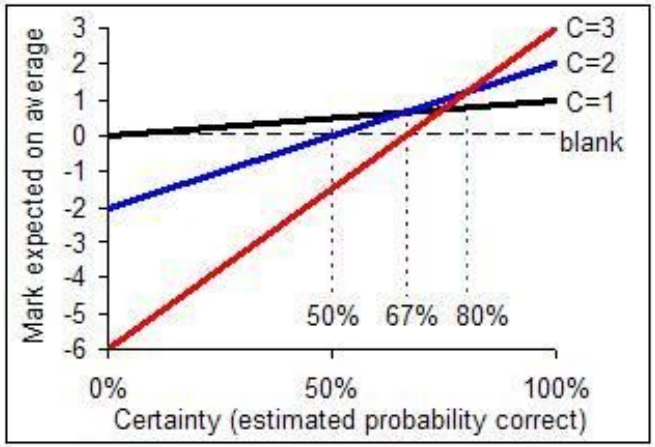
Choose one of the following:

- C
- A
- B



No Reply | **Certainty:** | C=1 (low) | C=2 (mid) | C=3 (high)

Certainty v Mark Expected



University College London

Tony Gardner-Medwin, UCL, TA Webinar 6 April 2011
http://transformingassessment.com/events_6_april_2011.php

e-Exam System Affordances

Pertinent Features	Affordances
A 'Whole computer' environment (OS, LMS, applications…) on a stick.	Vastly expanded pedagogical scope over that of a browser window.
Typed student responses via Word processor, constructed via apps (human marked) or on-board learning management system quiz (computer marked).	Caters for introduction to advanced uses. Components added/removed to suit. Electronic collection facilitates analytics, item response analysis…
No live network required during exam, even for LMS questions.	Robust. Greater control. (network could be used for admin)
Student owned equipment used as host and left untouched.	An ethical approach to scalability (no invasive software to install)
Modular, open source code base and commodity 'off the shelf' components.	Leveraging popular and sustainable projects for better efficiency. Fully 'known' (no 'blackbox'). Available!
One version works on most Intel based laptops - Apple, 'windows', Linux, that have a USB port.	One software version can serve all. Streamlines development and maintenance.

Bootable 'live' USB drive

Where we are now: Paper Equivalent (UQ)

Word doc! Question types used: short answer/essay, matching, construct a table, label a diagram/image (by filling a table). Manual marking.

Question 2. Match the following host-MOTA r
below).

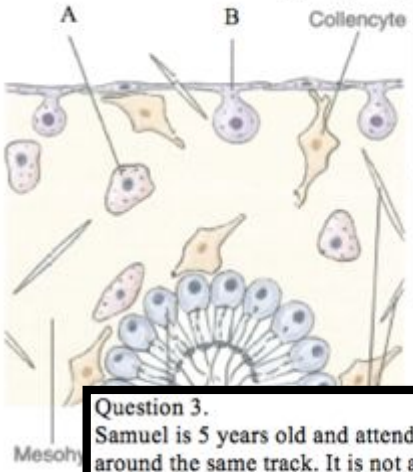
Possible descriptions:

a) Mauris id mi id orci interdum semper.
b) Sed eu neque ut est dignissim fringilla.
c) Vivamus in dolor euismod, luctus liber
d) Mauris vehicula eros a viverra pellente
e) Curabitur eu mi at nibh commodo variu
f) Aenean eget orci porta, malesuada lore

Please write or type the letter of the descriptions listed

Answer a to f.	**Terms**
f	I. Paxogen
a	II. Sitabosis
c	III. Fakeasalism
e	

Question 5: For the following diagram please provide the names for **THE XING** in the table below.



A	Label goes here. Constructed response question.
B	Blue text makes it easier to see which questions have been answered and which have not!
C	Use minimum row heights to provide plenty of space, but don't use double carriage returns!
D	Doing so means the layout is less likely to be disrupted.

Question 3.
Samuel is 5 years old and attends racing cars 5 days per week. Eamon is 10 years old and rides a superbike around the same track. It is not a selected response item so some text will be expected.
In the table below, give two (2) examples of flippant faxadism relevant to his age range (4-6 years), and describe how Samuel and Eamon differ in their abilities to perform faxadism.

[4 marks]

Two different examples of flippant faxadism (one per row)	Describe Samuel's abilities (age 5)	Describe Eamon's abilities (age 10)
Type here	Minimum heights set for both rows	
		More details about setting heights appear later in these examples.

Question 7: Some rationales for punishment are **XEZT**
does this mean?

Please write / type your response inside the box below.

The student types their answer here. In this examp
a two row table. The response table row is created
cell has a minimum height set (by dragging the bo
and a minimum height cell instead of successive carriage returns to set the box height, the next question will be less likely to be disrupted when students type their responses. The initial size of the box should indicate the desired length of the response. The box will automatically expand when it gets full.

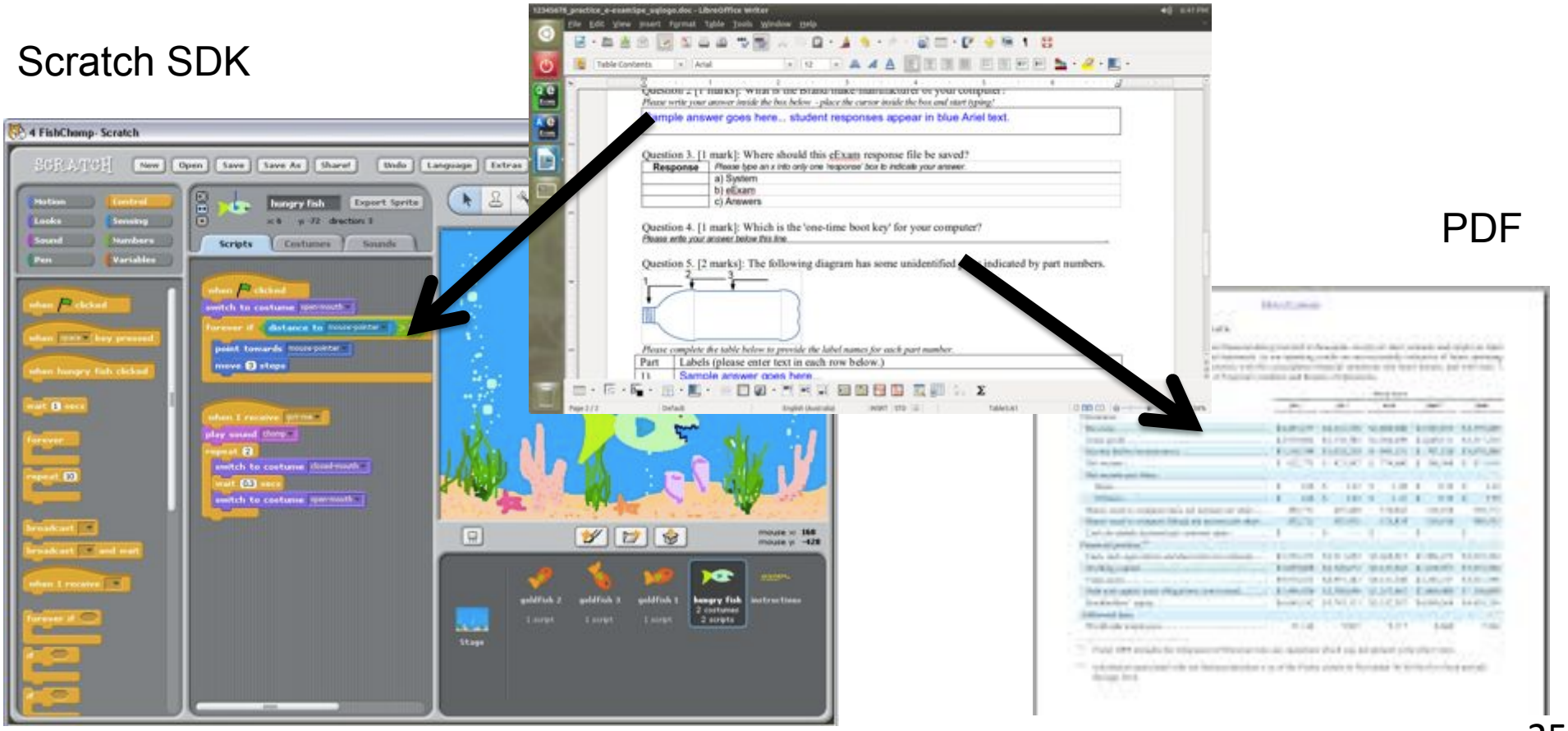
Where we are now: Paper Plus (UTAS)

Word doc, plus apps. Question document with links to launch local apps and resources: graphics, Scratch programming tools, presentation slides, PDFs. All on-board the USB stick.

'IT in Education' exams : Andrew Fluck, UTAS.

Exam doc

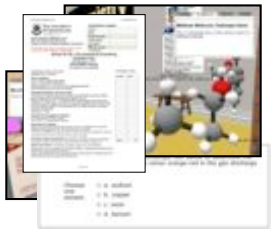
Scratch SDK



PDF

e-Exam Workflow used in Trials

Set-up: prepare exam learning materials



Academic creates exam learning material

Create master USB (tested)

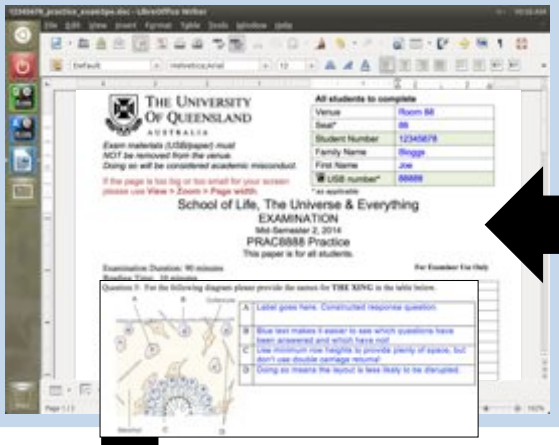
USBs duplicated per student

Pre-session:

Student laptop setup & practice.

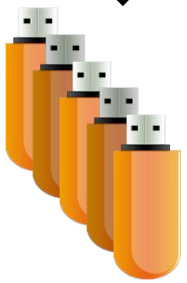
Exam room use

e-Exam system takes over laptop. Ubuntu Live USB. Libre Office.



1. Students enter room.
2. Given USB.
3. Boot laptop.
4. Do exam.
5. Return USB.
6. Leave room.

Post session: retrieve responses and assessment



Collect USBs (responses)

Responses retrieved from USBs.

Collated e-responses sent to academic.

First and Most Recent e-Exams UQ

VETS2100 S2 2014

Used standard teaching rooms, sought rooms with tables and power sockets.

DENT4092 S1 2015

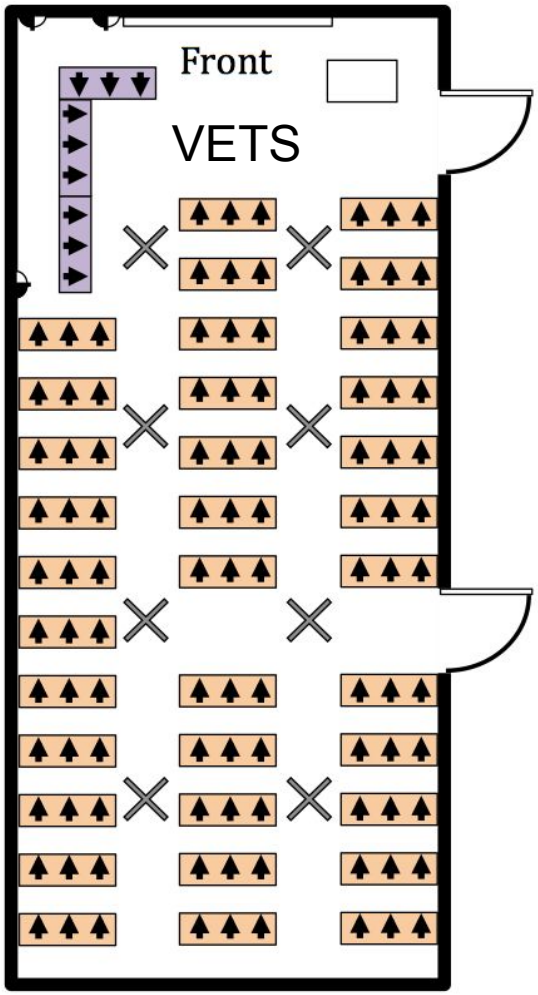
← VETS: hand-writers sat in rows. Attempted to separate typists and hand-writers where possible. DENT: typists at the back, → hand-writers at the front.

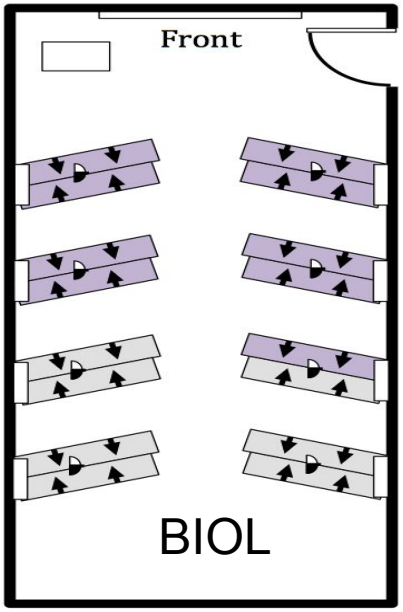
Spaces – Tried in a variety

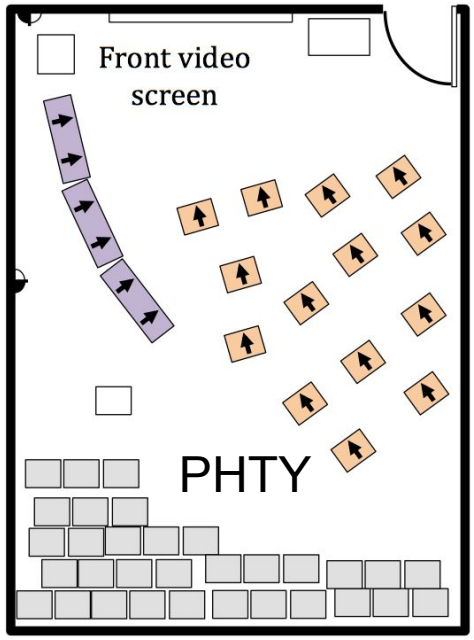
Floor Plans

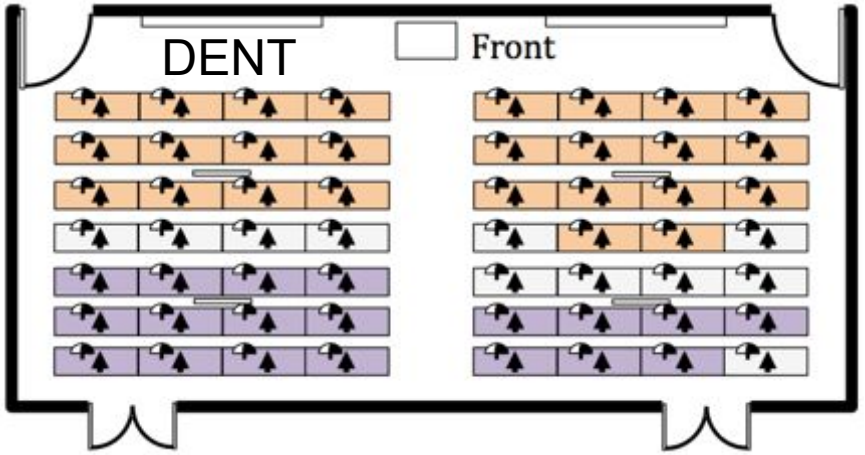
Purple = typists

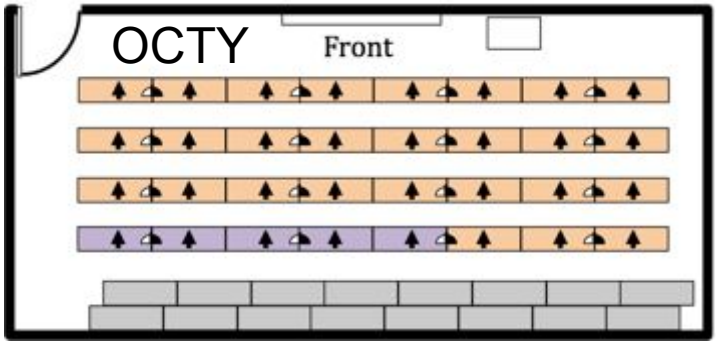
Orange = hand-writers

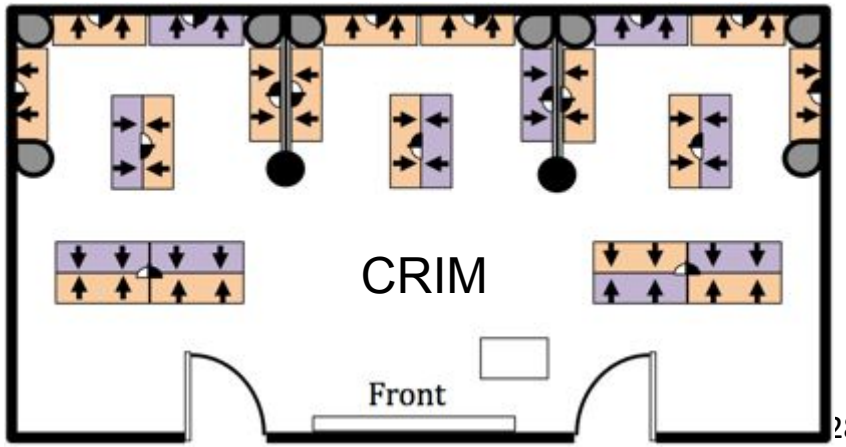










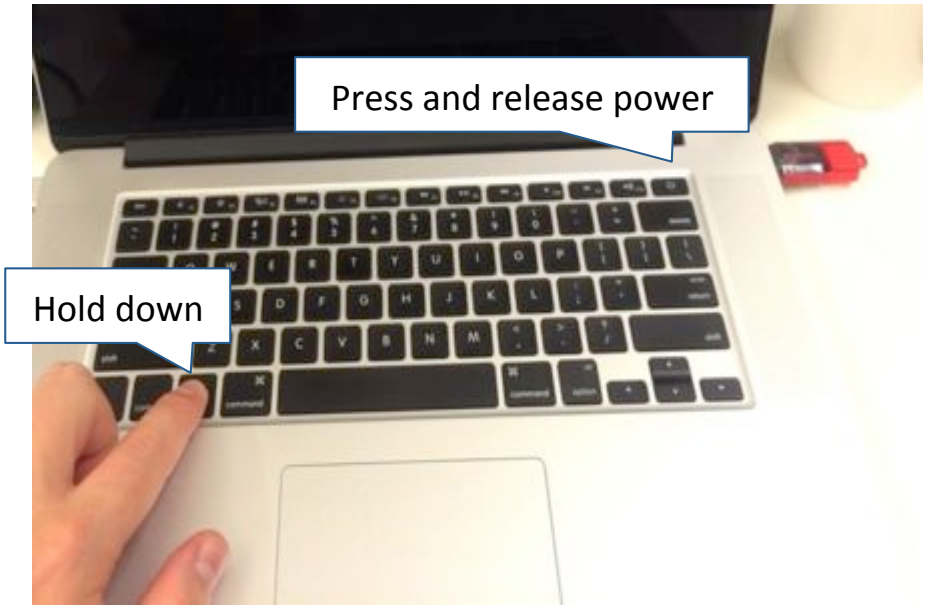


Walk Through of Current e-Exam Platform

1. Start with the computer turned OFF. Then insert USB stick

Apple

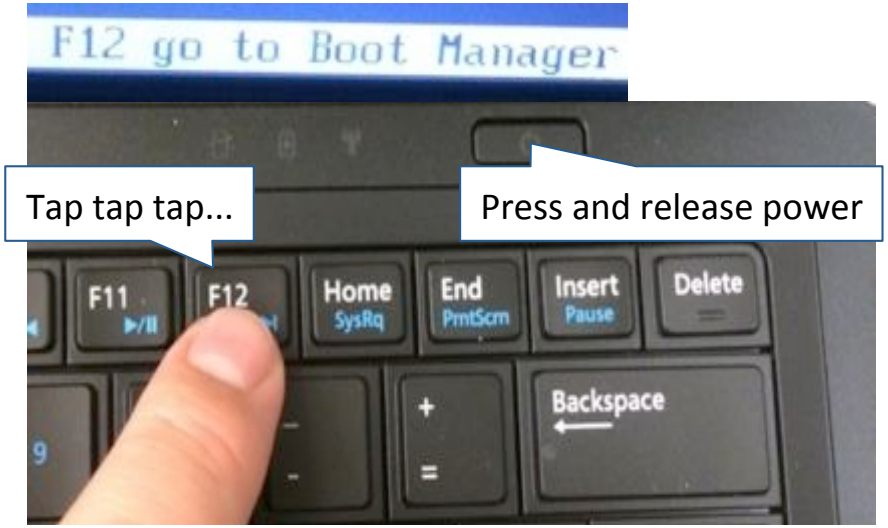
2. Hold down ALT *then* power on.



Keep holding ALT until you see…

Other/Windows*

2. Power on while tapping 'boot key' (e.g. F12 or…)



Keep tapping until you see…(or similar)

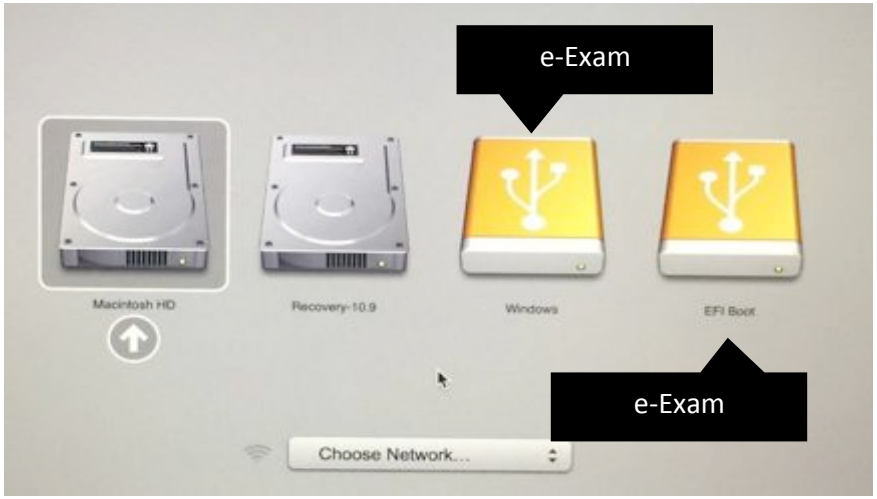
**Win 8: first need to disable secure boot.*

Walk Through

Apple

3. Select a yellow icon.

EFI boot or ‘Windows’



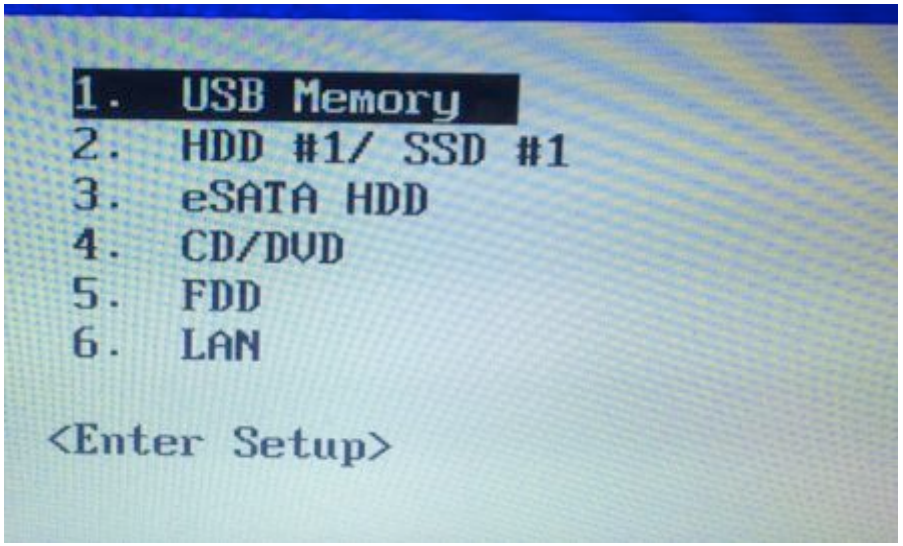
Could be either one! So just try.

If you get

Try the other one!

Other/Windows

3. Select USB device.



It might be labeled something else and probably wont be first.

Walk Through

4A. Some system messages may appear, if so just wait and see.

```
ata_id[292]: HDIO_GET_IDENTITY failed for '/dev/sdb': Invalid argument
```

4B. Exam system should start.

5. Arrive at e-Exam system desktop.

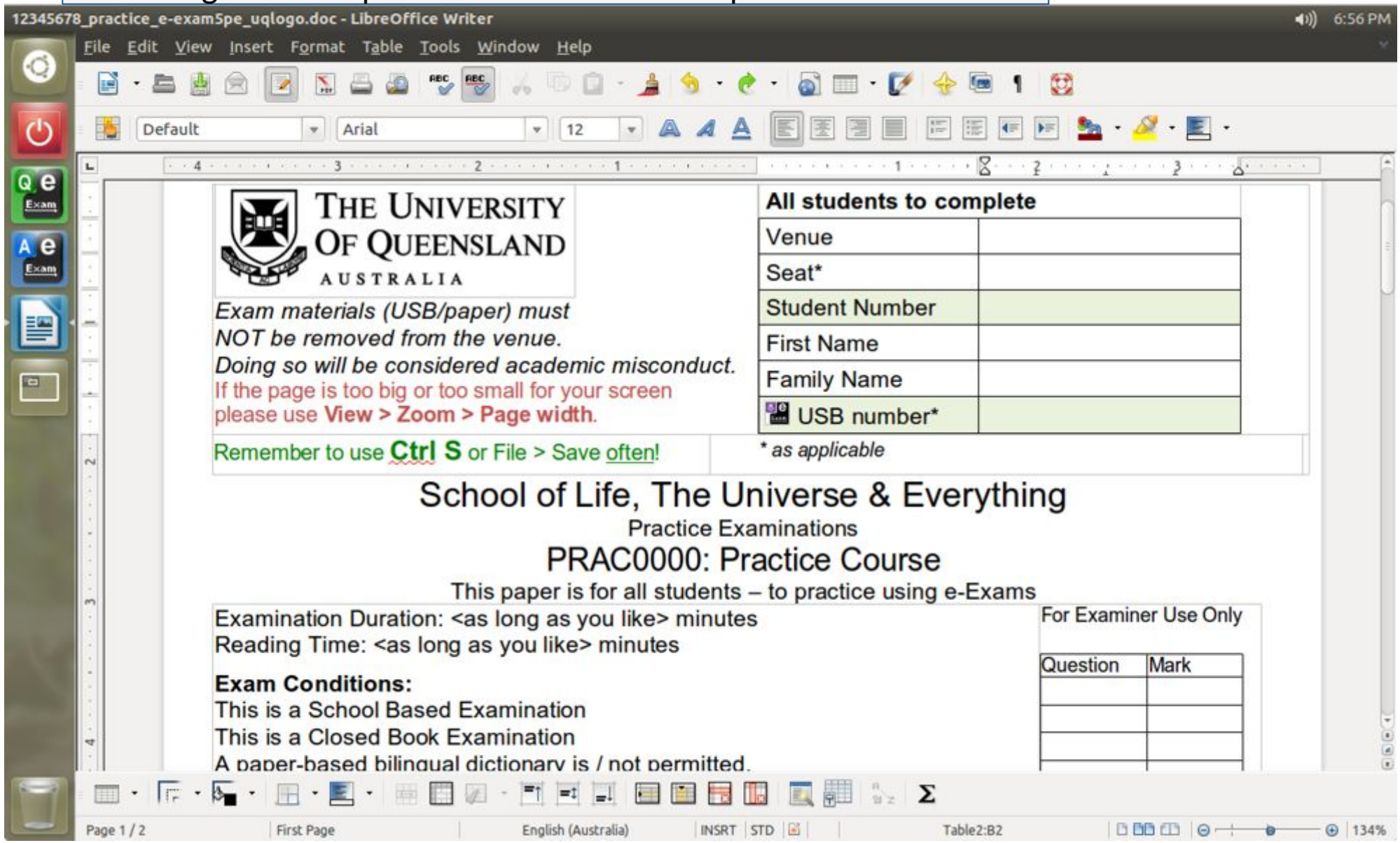
Walk Through

6. Student now types in their student ID number and name. Click Start Exam.

Walk Through

7. Exam file opens ready to enter exam details and responses.

Note: original file copied and student number prefixed to file name.



Walk Through

8. Student types responses into areas indicated.

12345678_practice_e-exam5pe_uqlogo.doc - LibreOffice Writer

File Edit View Insert Format Table Tools Window Help

Table Contents | Arial | 12

Please write your answer inside the box below - place the cursor inside the box and start typing!

Sample answer goes here... student responses appear in blue Ariel text.

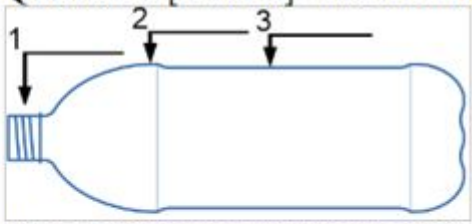
Question 3. [1 mark]: Where should this eExam response file be saved?

Response	*Please type an x into only one 'response' box to indicate your answer.*
	a) System
	b) eExam
	c) Answers

Question 4. [1 mark]: Which is the 'one-time boot key' for your computer?

Please write your answer below this line

Question 5. [2 marks]: The following diagram has some unidentified parts indicated by part numbers.



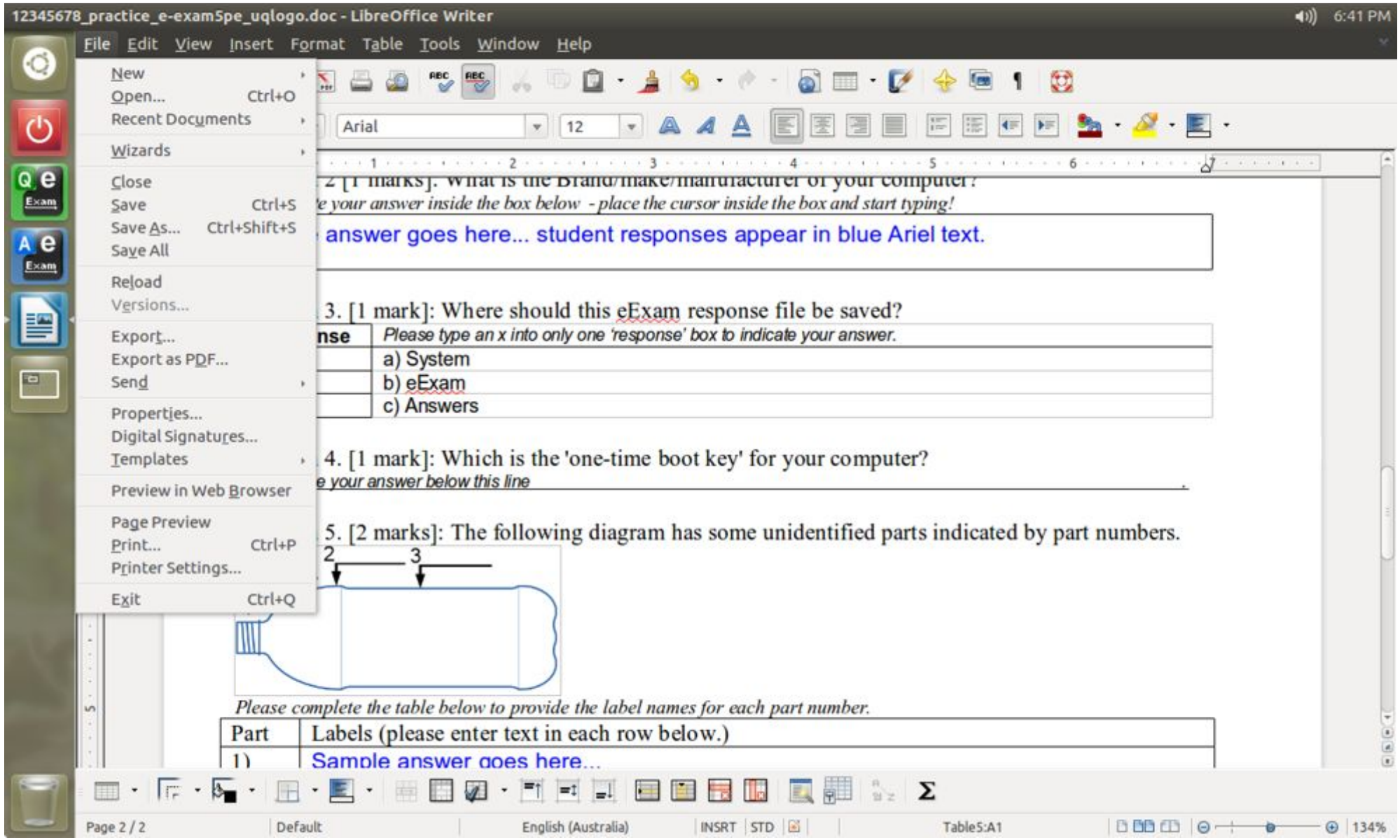
Please complete the table below to provide the label names for each part number.

Part	Labels (please enter text in each row below.)
1)	Sample answer goes here...

Page 2 / 2 | Default | English (Australia) | INSRT | STD | Table5:A1 | 134%

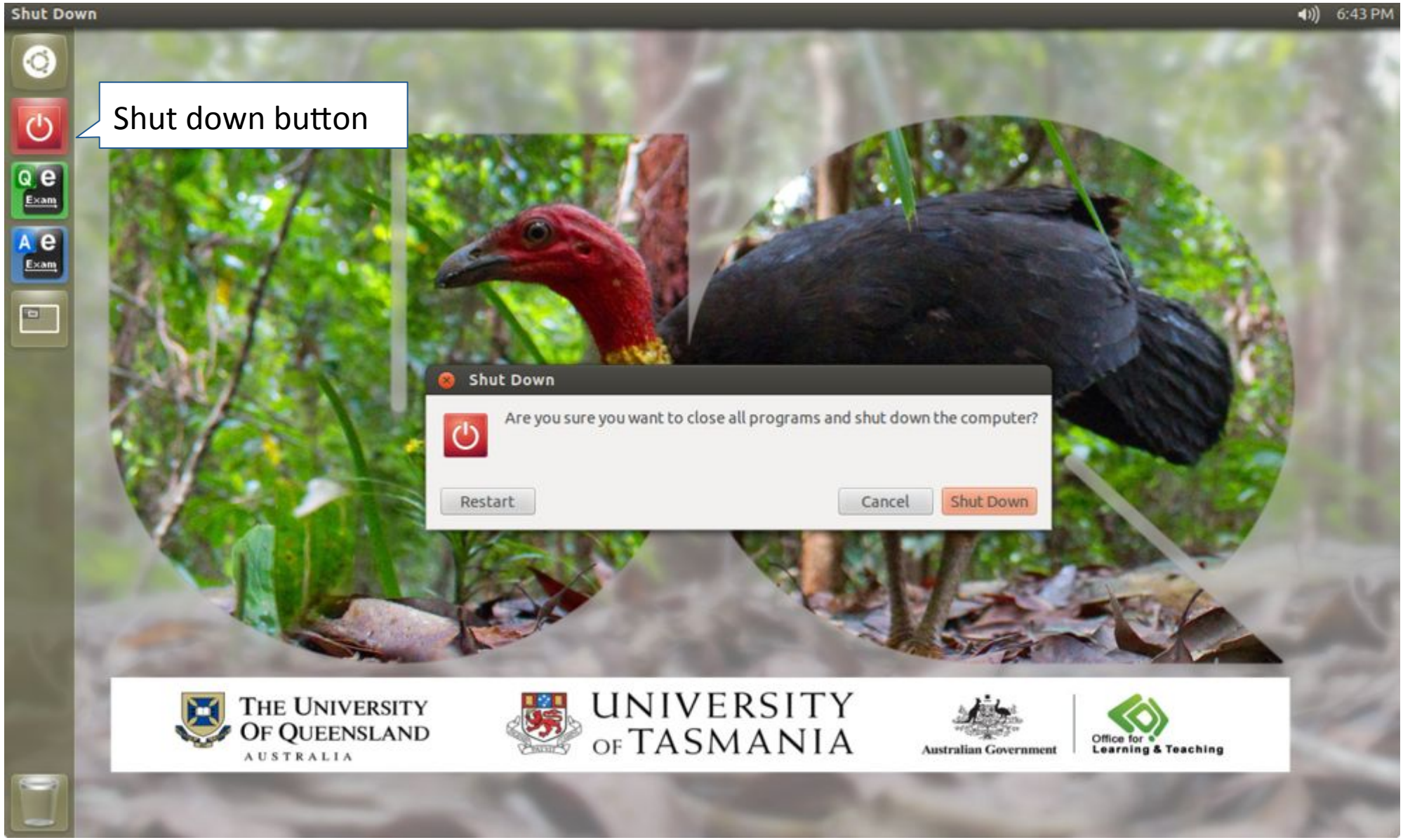
Walk Through

9. Remember to save (CTRL S). When done use File > Exit.



Walk Through

10. Shut down the system. When the system has powered off, hand in the USB Stick.



Ready?

I hope you are excited about the future - and ready to transform!

Trial Outcomes

Results from 2014-2015 trials follow.

e-Exams Seed Work 2013 to 2015

OLT Project leader / Presenter: **Dr Mathew Hillier**, University of Queensland
OLT Project collaborator: **Dr Andrew Fluck**, University of Tasmania
OLT Project system developer: **Marisa Emerson**, University of Queensland
UQ course academics:
Dr Arosha Weerakoon (Dentistry)
Dr David Booth (Zoology),
Elizabeth Springfield (Occupational Therapy),
Katrina Williams (Physiotherapy),
Prof. Malcolm Jones (Veterinary Biology),
Rebekah Scotney (Veterinary Technology) and
Dr Robin Fitzgerald (Criminology)

Get the demo and user guides

http://**transformingexams.com**

Acknowledgement: Support for this project has been provided by the Australian Government Office for Learning and Teaching. The views expressed do not necessarily reflect the views of the Australian Government Office for Learning and Teaching or participating institutions.

Australian Government | Office for Learning & Teaching

The University Of Queensland AUSTRALIA

University of Tasmania

UQ e-Exam Trial Outcomes

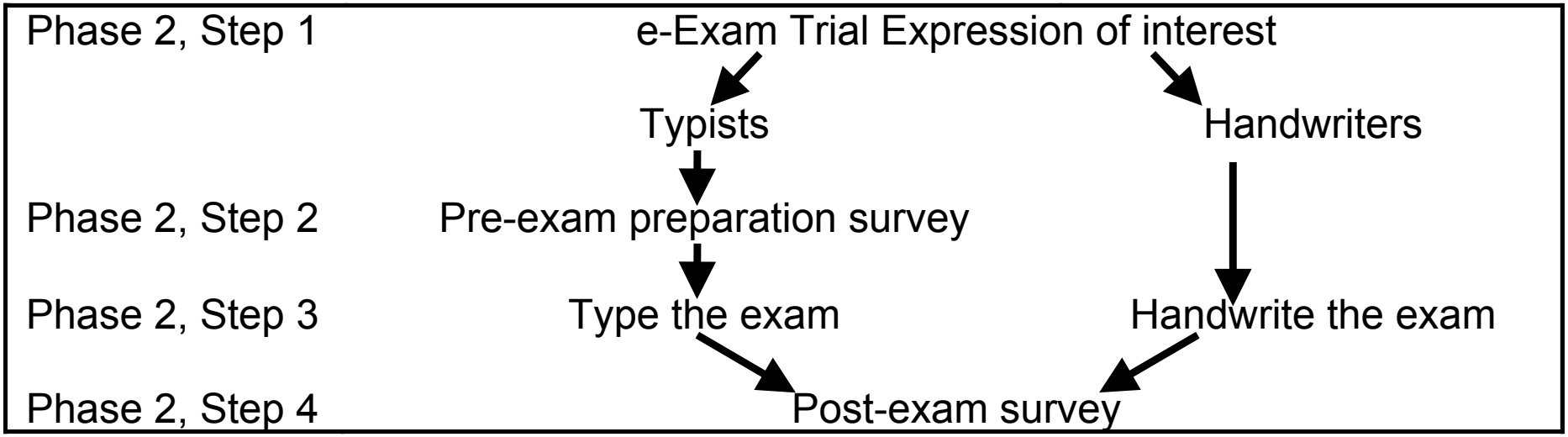
Data collected from students

Results available upon request, some at http://transformingexams.com/research.html

- 2013 pre-project online survey (UQ wide: brief results shown)
  - UQ students surveyed about their preconceptions about e-exams.
    ASCILITE paper Hillier 2014
    http://transformingexams.com/files/hillier_2014_ascilite_full_paper_prepress.pdf
- 2014-5 Trials pre-exam short survey (8 courses – typists only).
  - Conducted at the pre-exam practice setup sessions.
  - Covered: student preliminary impressions, technical hardware compatibility.
- 2014-5 Trials post-exam extended survey (8 courses – results shown)
  - Conducted at the conclusion of the exam (in the room - all students).
  - Covered: rationale, student exam experience, reaction to exam session conditions, e-exam system impressions, exam writing strategies and production, general non-exam writing strategies.
    Result for 2014 (six courses) http://transformingexams.com/files/Hillier_2015_ascilite_fp.pdf
- 2015 Analysis of text production (DENT only)
  - Marks v word count, typing v handwriting (more to come; language density…)

Research Study Phases

Phase 1	Institution wide online survey (see Hillier 2014, 2015).



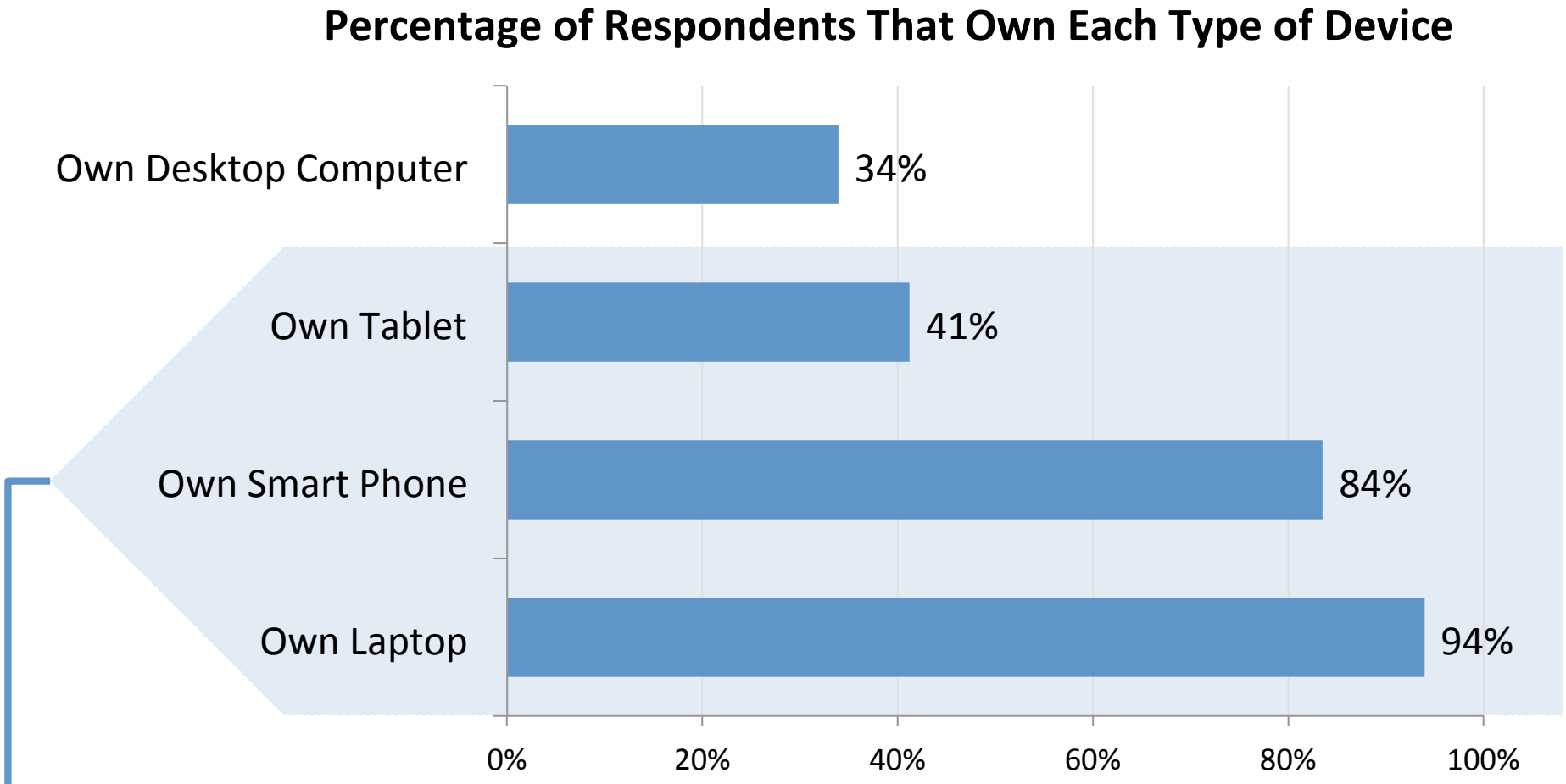
Participation in Phase 1: approx. 928 respondents (Nov 2013 - Nov 2014)

Participation in Phase 2: Eight courses (six in 2014 , two in 2015)

Phase 1 Survey Design

- Survey constructed to cover a range of possible concerns.
- Prior research Dermo (2009), Lim et al., (2006), Mogey and Hartley (2012), Sorensen (2013), Fluck, Pullen & Harper (2009), Fluck (2011), Fluck (2013), Hillier & Fluck (2013) provided a means to scope the issues.
- A survey by Dermo (2009) provided the core.
  - Acknowledge that we would be using it in a different manner (pre rather then post).
  - But! we never intended to replicate it, instead we used this as a means for eliciting student concerns across a range of issues.
  - Students would largely be responding speculatively based on their *preconceptions*. (instructions given to students accordingly)

Phase 1 Institution Survey



Mobile device ownership (excluding desktop computers) was an average of **2.3 devices per student** (standard deviation of 0.8).

Phase 1 The questions

Theme	**Five point Likert scale** from 1 "strongly disagree" to 5 "strongly agree"	M	SD
Affective factors	Using a computer for an exam is more stressful than a handwritten paper exam	2.9	1.2
	I am at a disadvantage when undertaking computerised exams	2.4	1.1
Teaching and learning	Computerised exams are consistent with contemporary learning approaches at university	3.8	1.0
	The potential for immediate feedback with a computer based exam could help improve my learning	4.0	0.9
	Computerised exams allow me to demonstrate my knowledge in more ways than paper based exams	3.0	1.1
Validity	Computerised exams are appropriate for my discipline/subject area	3.4	1.2
	Computerised exams need to include a variety of question types in order to test my knowledge fully	3.8	0.9
Reliability	The technology used in computerised exams is unreliable	3.0	1.1
	Computerised exams favour some students more than others	3.5	1.0
	Paper-based exams are fairer than computerised exams	3.2	1.1
Practicality	Technical problems make doing exams via computer impractical	3.3	1.1
	Doing exams in the campus computer labs is impractical	3.3	1.1
Security	Computerised exams are just as secure as paper-based exams	3.3	1.1
	It is easier to cheat in computerised exams than with paper-based exams	3.4	1.2
Production	I prefer typing rather than hand writing essay answers	3.8	1.2
	I work more effectively when I type on a familiar keyboard	4.1	0.9
	I would prefer to use my own laptop to undertake a computerised exam rather than use equipment supplied by the university	3.7	1.1
	I get hand cramps when handwriting exams of 1.5 hours or more	3.7	1.3
	I would like to be able to type answers in an exam	3.3	1.4
Adoption	I want computerised exams replace paper-based exams at university	2.8	1.3

Plus two open ended comment questions

Phase 1 Participation

- 488# students (37% males, 63% females) = 1%*
- 9% post-grad, remainder were undergrads (with an even spread across year levels).
- 45 programs, those with at least 10 are listed:

Program	N	Program	N
Applied science	25	Electrical engineering	13
Arts	60	Information technology	15
Biomedical science	24	Law	29
Business management	24	Mechanical engineering	25
Chemical engineering	11	Mechatronic engineering	13
Civil engineering	18	Pharmacy	16
Commerce	22	Psychological sciences	15
Computational mathematics and physics	13	Social sciences	10
Education	11	Software engineering	10

*Krejcie & Morgan (1970) state that for a population of 50,000 a random sample 381 would be sufficient to be representative in relation to opinions expressed by respondents to 95% confidence. (it wasn't random).
#analysis performed on responses received at Feb 2014. Subsequent responses up to Nov 2014 were 928.

Phase 1 Analysis

a. Themes drawn from open ended questions on currently held 'concerns' about e-exams and general comments. **Our focus here!**

b. Statistics* used to explore the *body of opinion* represented by Likert scales rather than as a search for a single truth. Tended to stick to non-parametric tests.

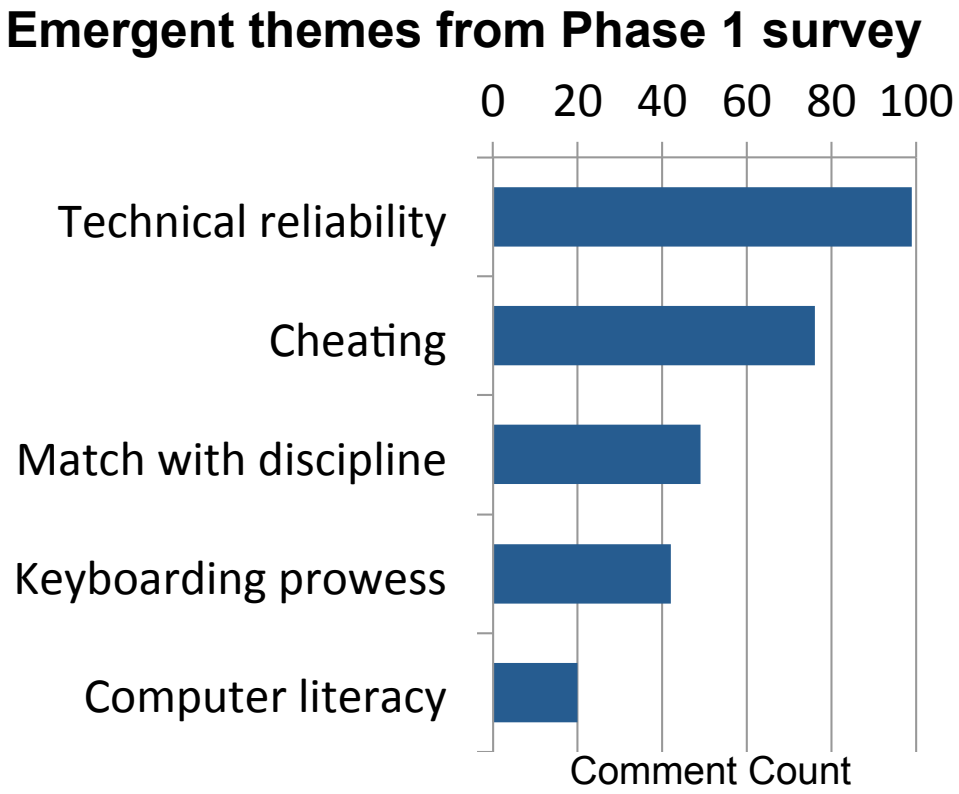
Reported further in Hillier, M. (2014). The Very Idea of e-Exams: Student (Pre)conceptions. Presented at the Australasian Society for Computers in Learning in Tertiary Education conference, Dunedin, New Zealand. Retrieved from http://ascilite.org/conferences/dunedin2014/files/fullpapers/91-Hillier.pdf

Phase 1 Themes

Preconceptions.

The technology being unreliable stresses me out more than the thought of doing the exam – *Law student*

A real programmer would be looking up the APIs for their language every time they wanted to do something, but they can't because they're forced to only use paper-based notes they have on hand. It's infuriating - *Computer science student.*

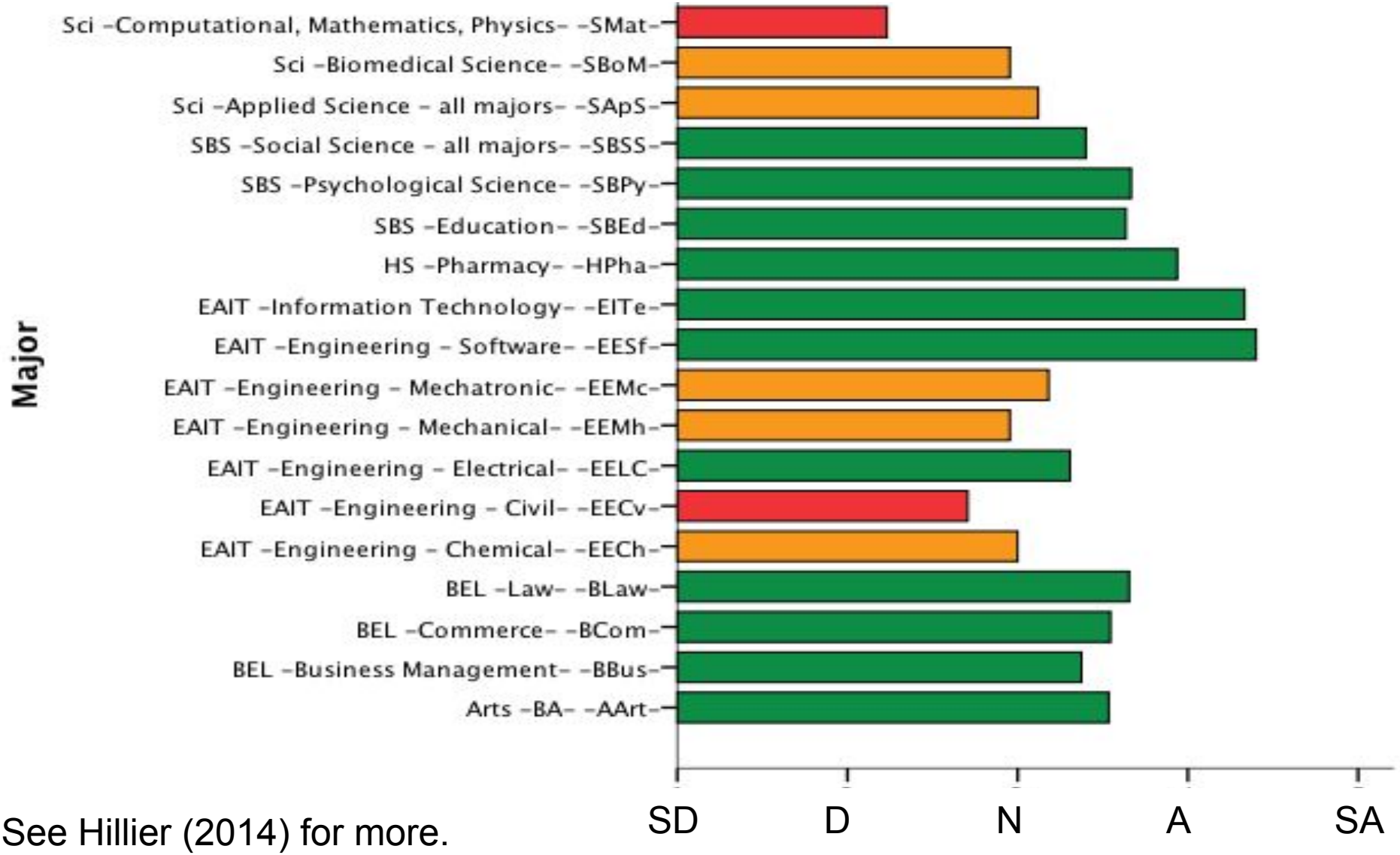


It's true that 'computerised exams favour some students more than others' - i.e., the ones that are proficient typists over the ones that aren't - but the same is true of paper-based examinations, which favour those with the ability to work through strong pain in their writing hand – *Arts student*.

As a mature aged student, I would feel at a disadvantage doing a computerised exam as I am not as computer literate as many of the younger students - *Chemistry student*.

Phase 1 Findings: Match to Discipline

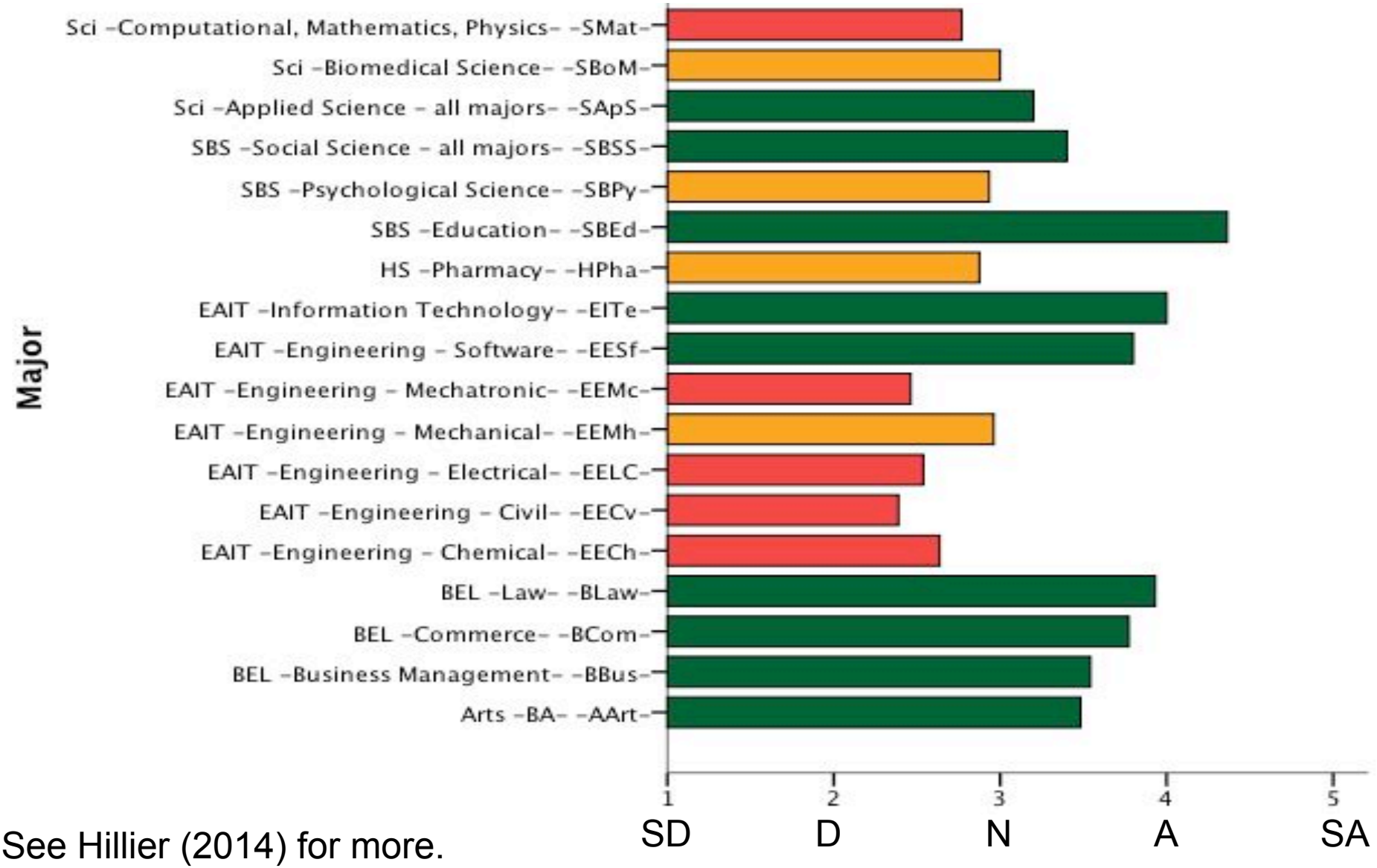
By program (major)



See Hillier (2014) for more.

Phase 1 Findings: I would like to Type

"I would like to be able to type answers in an exam" By program (major)

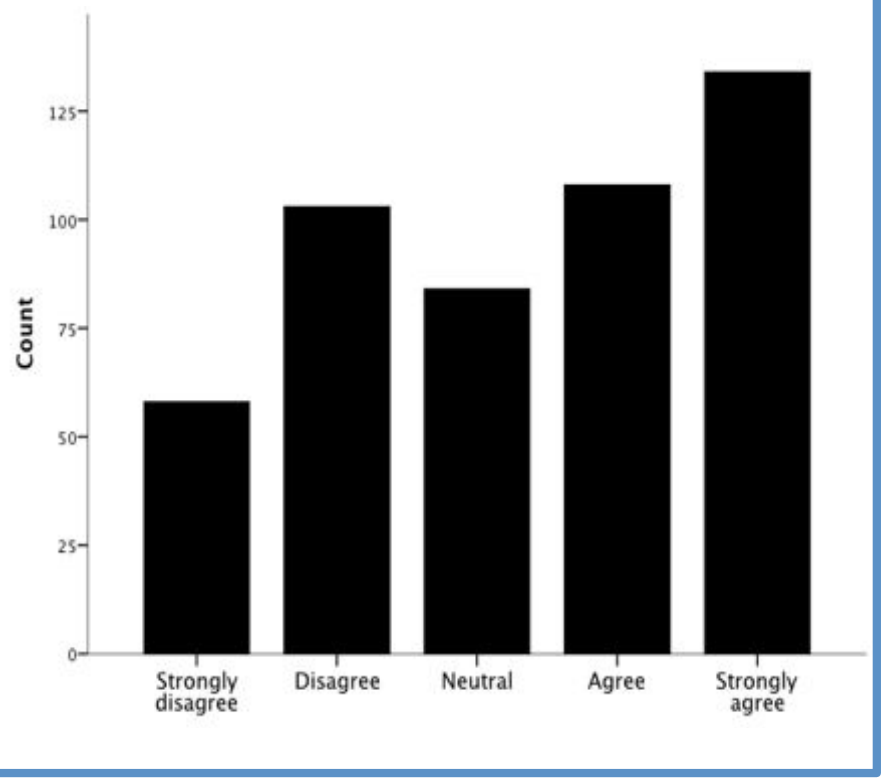


See Hillier (2014) for more.

Phase 1 Interim Conclusion

Students were

- Cautiously optimistic
- Just over half would like to see an e-exam option. Mean agreement (3.3) "I would like to be able to type answers in an exam."



- Were attune to the nature of their discipline and how the idea of an e-exam might fit.
- The fear of the unknown (?) esp regarding technical failures and reliability.

Phase 2: UQ e-Exam Trials 2014-2015

Data collected from students (opt-in)

- Via pre-project online survey (UQ wide – 2013-2014):

  Hillier, M. (2014). The Very Idea of e-Exams: Student (Pre)conceptions. Presented at the Australasian Society for Computers in Learning in Tertiary Education conference, Dunedin, New Zealand. Retrieved from http://transformingexams.com/files/hillier_2014_ascilite_full_paper_prepress.pdf

- Via pre-exam short survey (8 courses – typists only **next**).
  - Conducted at the pre-exam practice setup sessions.
  - Covered: student preliminary impressions, technical hardware compatibility.
- Via post-exam extended survey (8 courses)
  - Conducted at the conclusion of the exam (in the room).
  - Covered: rationale, student exam experience, reaction to exam session conditions, e-exam system impressions, exam writing strategies and production, general non-exam writing strategies.
  - (six 2014 courses) http://transformingexams.com/files/Hillier_2015_ascilite_fp.pdf
- Analysis of text production (DENT only)
  - Marks v word count, typing v handwriting (more to come; language density…)

The eight courses in the trials 2014-2015

Course	Minutes	Description
ANIM2014 Animal Biology	45	Mixed short answer and MCQ (type 'x') [split group]
BIOL2014 Zoology	50	Short answer (Multiple choice section done pen on OMR sheet) [split group]
CRIM2014 Criminology	70	Single long essay response section (and a Multiple choice section done pen on OMR sheet)
OCTY2014 Occupational Therapy	90	Mixed short answer and MCQ (type 'x')
PHTY2014 Physiotherapy	15	Diagnosis: watch video and write into table. Done in small groups of 16 prior to OSCE.
VETS2014 Veterinary technology	90	Theory, mostly short answer. (with internal and external groups)
CRIM2015 Criminology	90	Single long essay response section (and a Multiple choice section done pen on OMR sheet) [split group]
DENT2015 Research Methods in Dentistry	60	Theory, short answer, one calculation question

Conditions

- First 'toe in the water' trials.
- Participation was optional.
- Mid term exams worth 15% to 20% of the course grade.

Note: Split group = typists and hand-writers in different rooms.

Trial Phase Attrition

Number of typists at each stage of the trial (Survey responses)

Steps of trial	Yes	Maybe	Total typists	Attrition	No - hand-write
1 Expression of Interest	241		241		420
2.1 Pre - before try	124	17	141	100	38
2.2 Pre - after try	112	19	131	10	52
4 Exam (after)	98		98	33	549

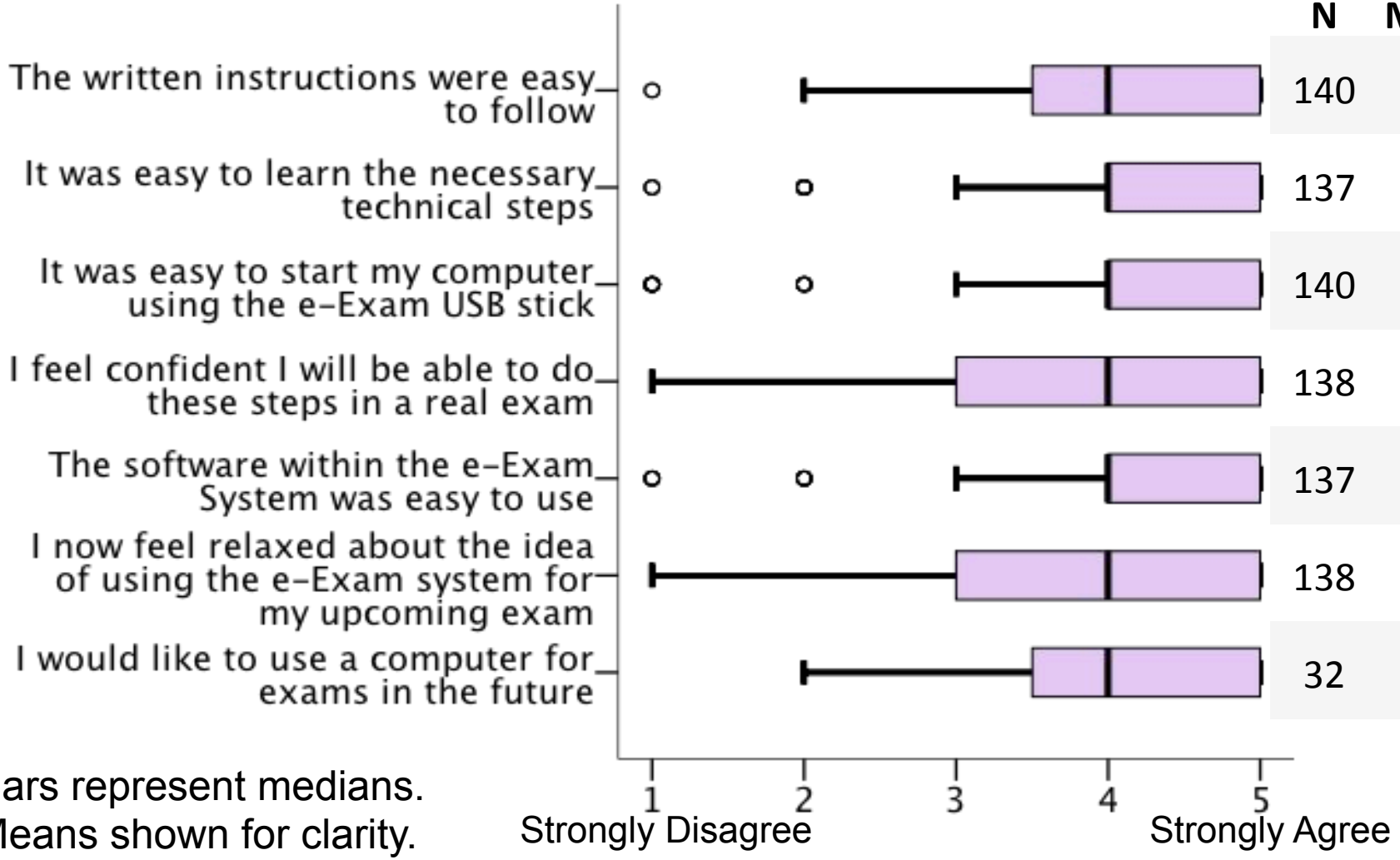
Table updated to include 2015 participants. Final typists based on returned surveys.

- *Not all respondents completed every question.*
- *A number of students electing to hand-write did not fill in the EOI and the post-exam survey so are slightly under represented.*
- *Similarly not all attendees at the pre-exam set-up session returned a survey (~ 90%+ did).*

Pre-exam First Impressions

Selected pre-exam session survey questions (typists only)

Students came to test their laptop and try the system a couple of weeks prior to the exam.



	N	Mean	SD
The written instructions were easy to follow	140	4.0	1.0
It was easy to learn the necessary technical steps	137	4.0	1.0
It was easy to start my computer using the e-Exam USB stick	140	4.1	1.2
I feel confident I will be able to do these steps in a real exam	138	4.0	1.1
The software within the e-Exam System was easy to use	137	4.1	1.1
I now feel relaxed about the idea of using the e-Exam system for my upcoming exam	138	3.8	1.1
I would like to use a computer for exams in the future	32	4.1	0.9

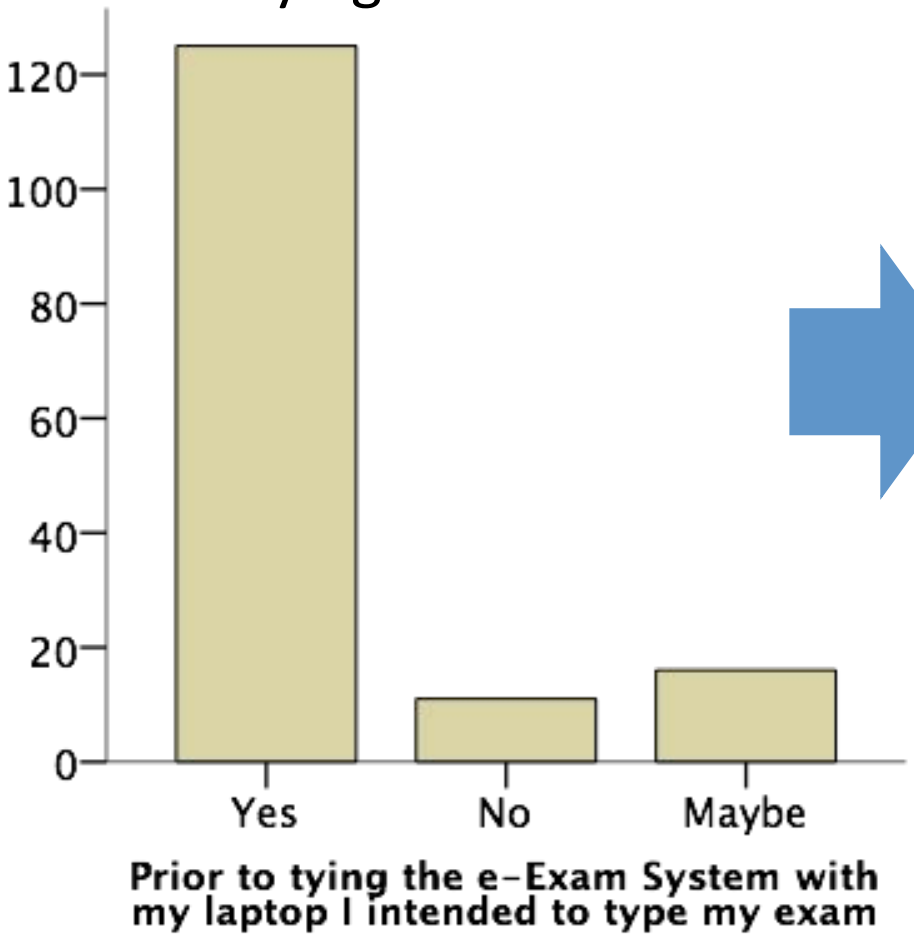
Bars represent medians.
Means shown for clarity.

Updated to include s1 2015 results.

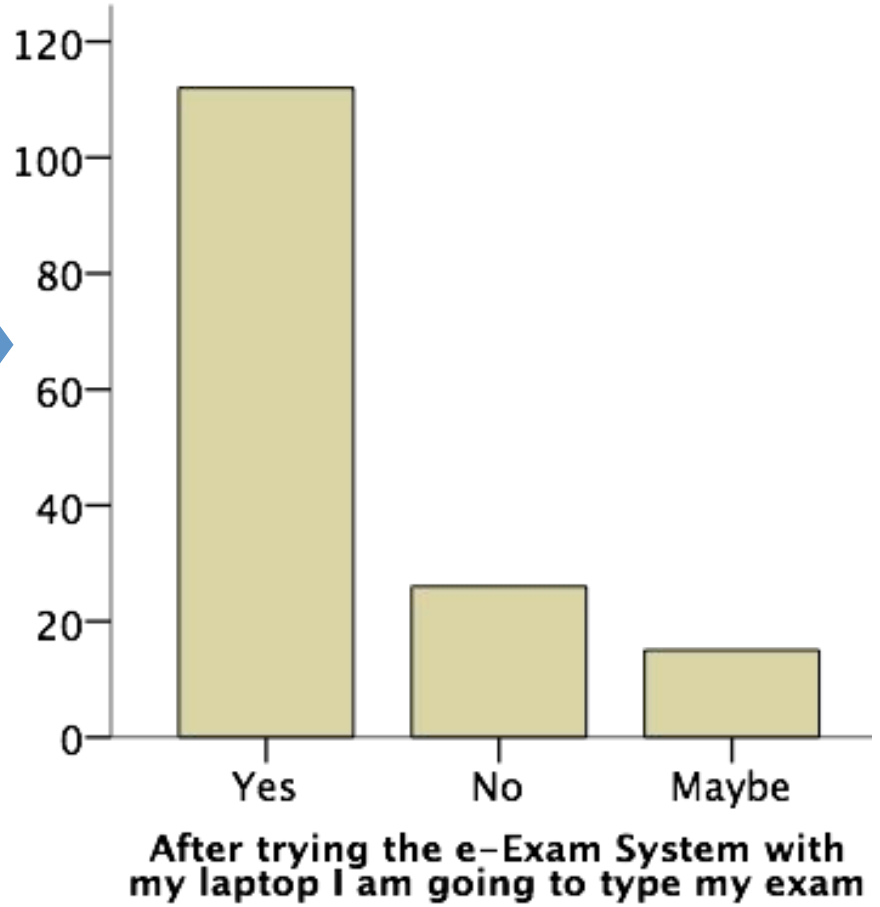
Trial Phase: Pre-exam Survey

Data collected from students at pre-exam set-up/ practice sessions (2014-2015).

Before trying e-exam

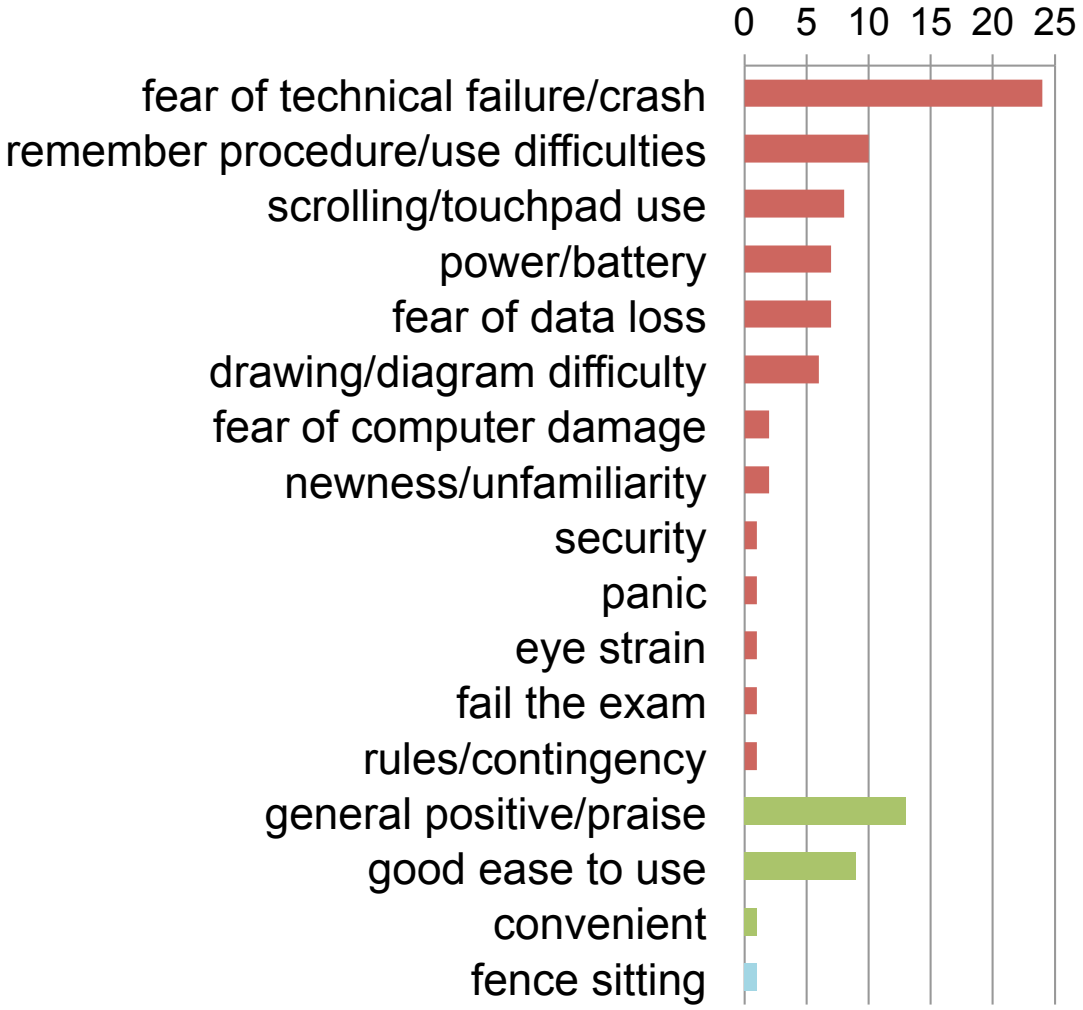


After trying e-exam



Trial Phase: Pre-exam Survey

Open text comments – concerns and praise [2014]



That my computer may freeze or not work properly.
Random technological malfunction.

Simply a different format of exam.
Remembering this for the exam.

Am I allowed to use a mouse? Will it affect the system? Scrolling opposite.

Would it save my answers properly.

Availability of power. Battery run out.

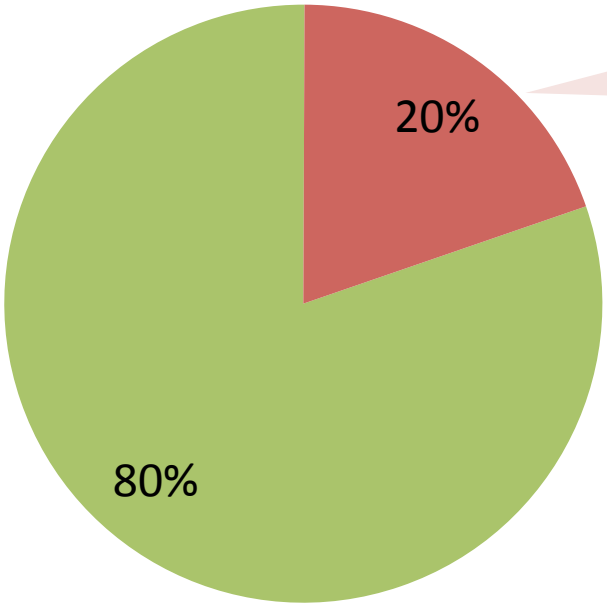
Doing something wrong and panicking

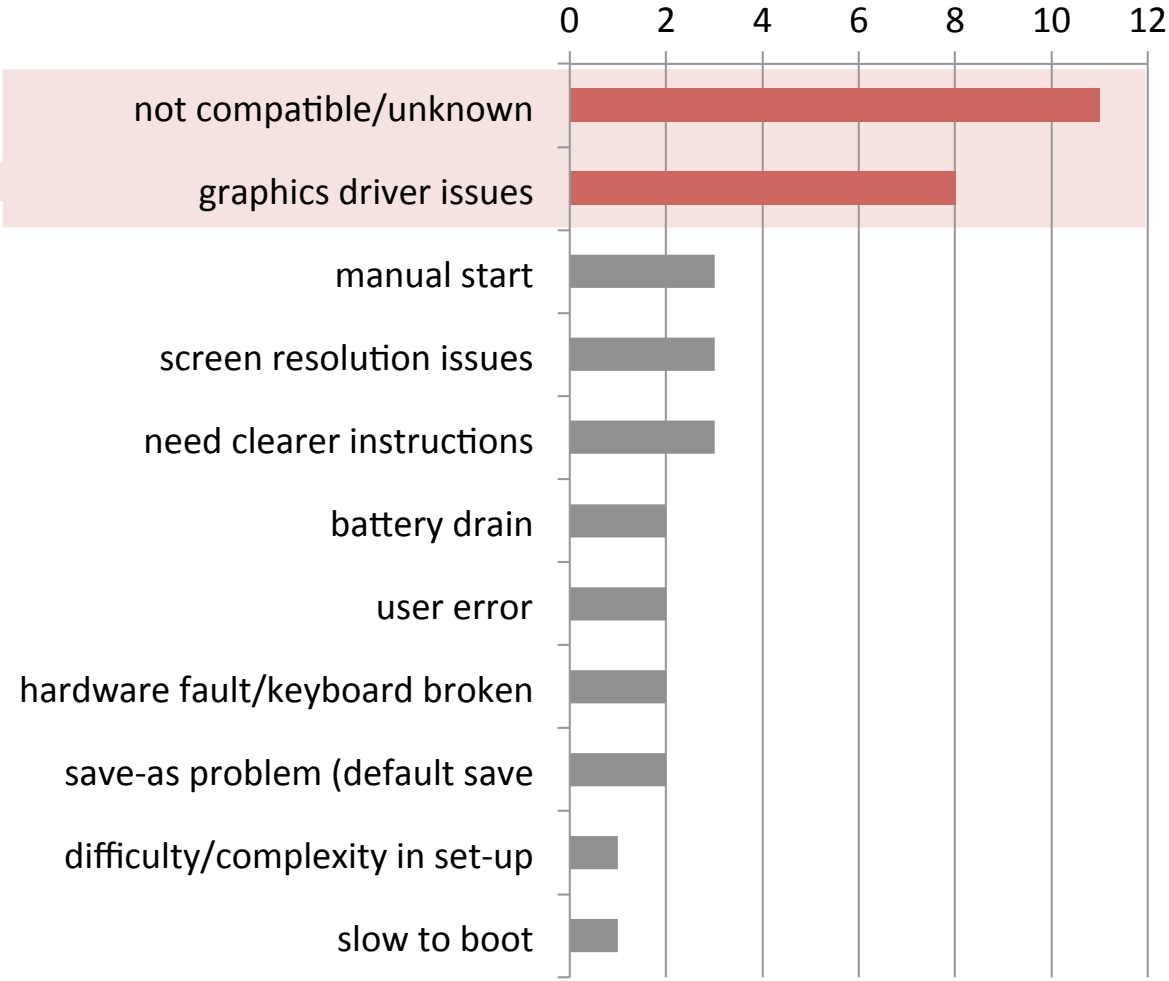
Good concept. Provides an alternative to written exams. Easy to navigate.

Fairly sure i'll use the laptop but just need to think about it a little more.

Pre-exam Laptop Testing

Number of laptops passed and technical issues [2014].



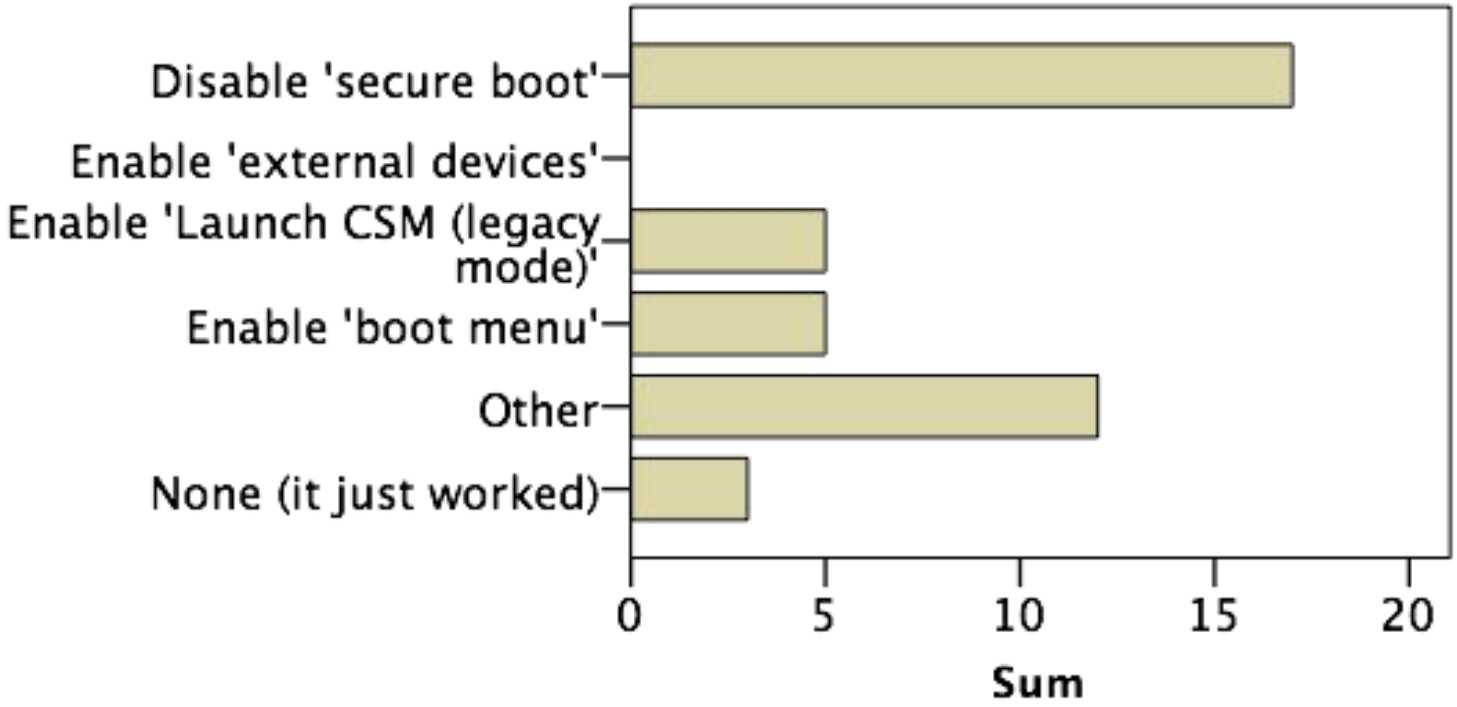


So… we had a pool of loan laptops.

Upgrade to next version of OS will help too.

‘Wintel’ Laptop Configuration

The required setting adjustments applied to allow the laptop to boot from the e-Exam USB stick (version 12.04). Collated semester 2 2014 onward.

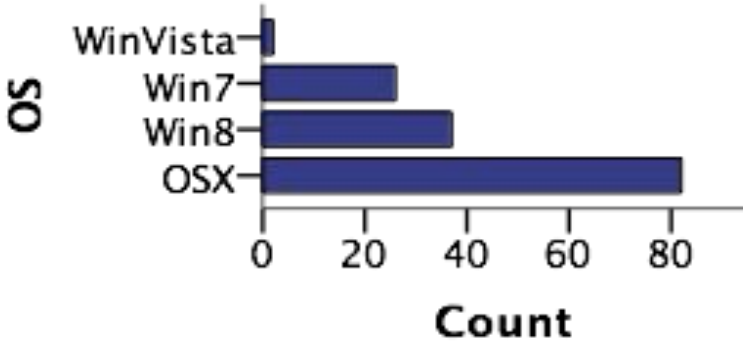


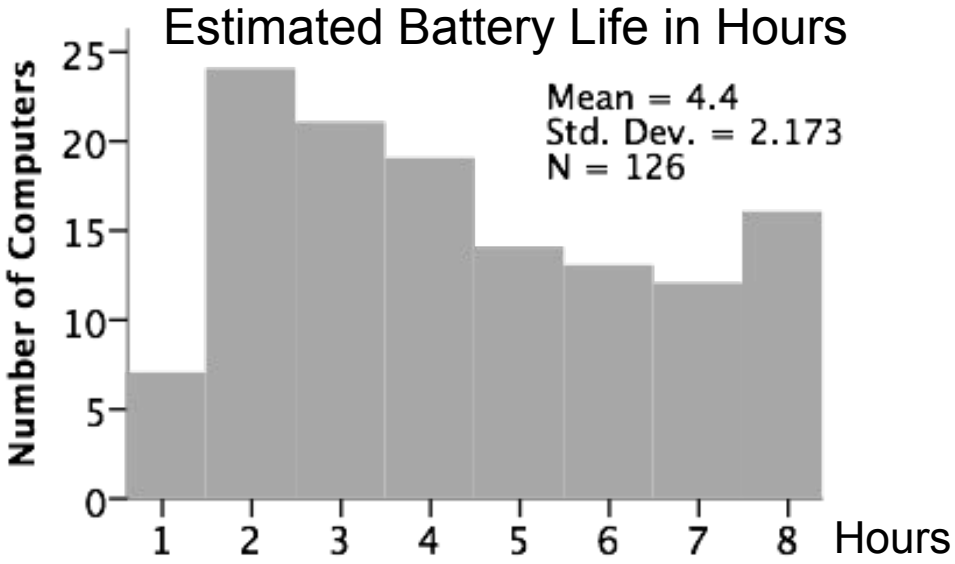
Note: Apple laptops do not require adjustment.

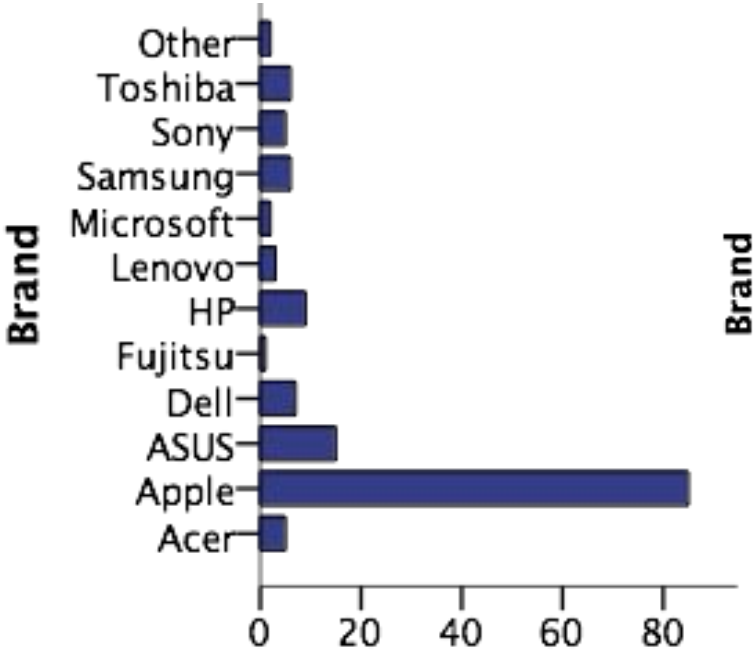
To do: Need to collate from earlier sessions.

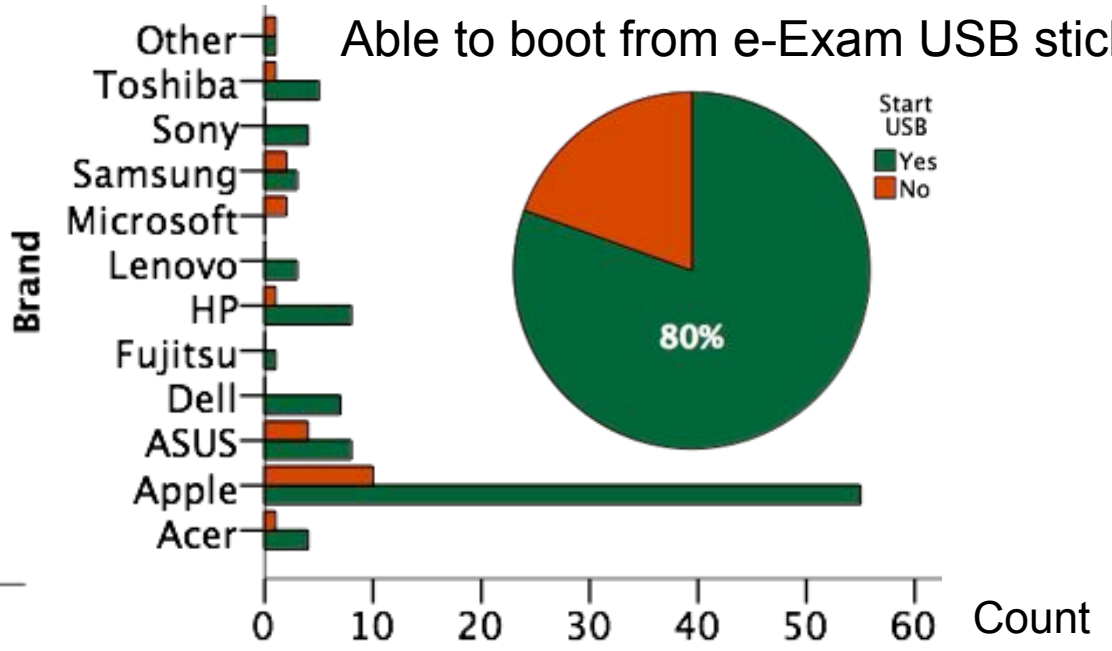
Brands and Operating Systems

BYO laptop stock









Includes s1 2015 results – 8 cohorts.

Phase 2: UQ e-Exam Trials 2014-2015

Data collected from students (opt-in)

- Via pre-exam project online survey (UQ wide):

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- Via pre-exam short survey (8 courses – typists only).
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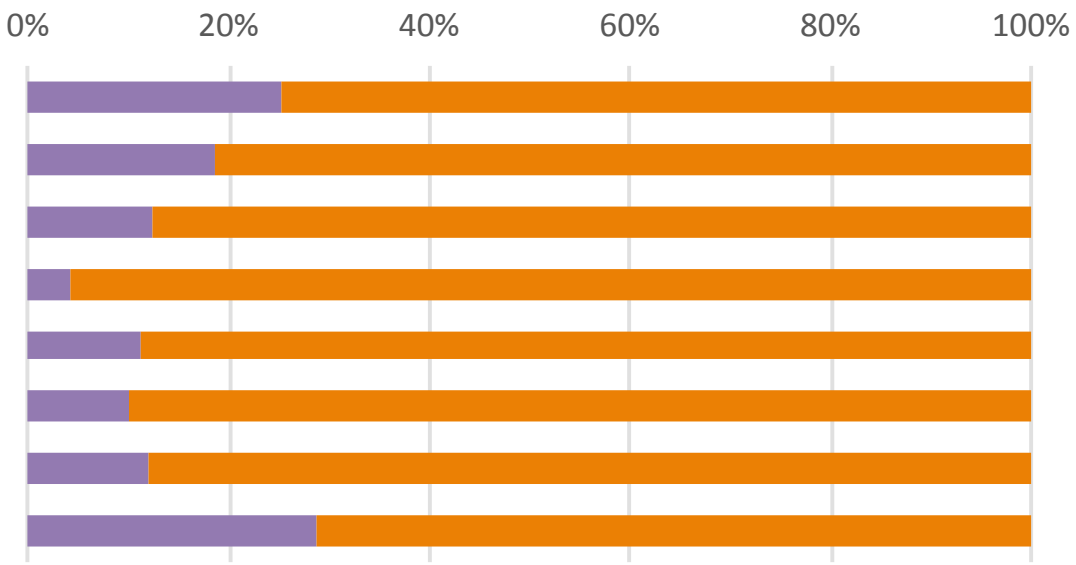
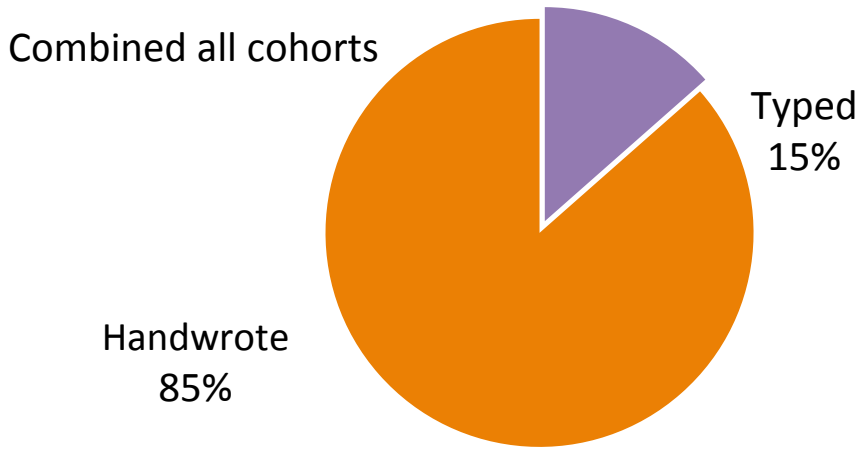
  - Conducted at the conclusion of the exam (in the room).
  - Covered: rationale, student exam experience, reaction to exam session conditions, e-exam system impressions, exam writing strategies and production, general non-exam writing strategies.
  - 2014 (six courses) http://transformingexams.com/files/Hillier_2015_ascilite_fp.pdf
- Analysis of text production (DENT only)
  - Marks v word count, typing v handwriting (more to come; language density…)

Typists and hand-writers by course

Cohort	Typed	Handwrote
CRIM2014	25.4%	74.6%
PHTY2014	18.8%	81.2%
VETS2014	12.4%	87.6%
ANIM2014	4.4%	95.6%
OCTY2014	11.1%	88.9%
BIOL2014	9.9%	90.1%
CRIM2015	12.1%	87.9%
DENT2015	28.8%	71.2%

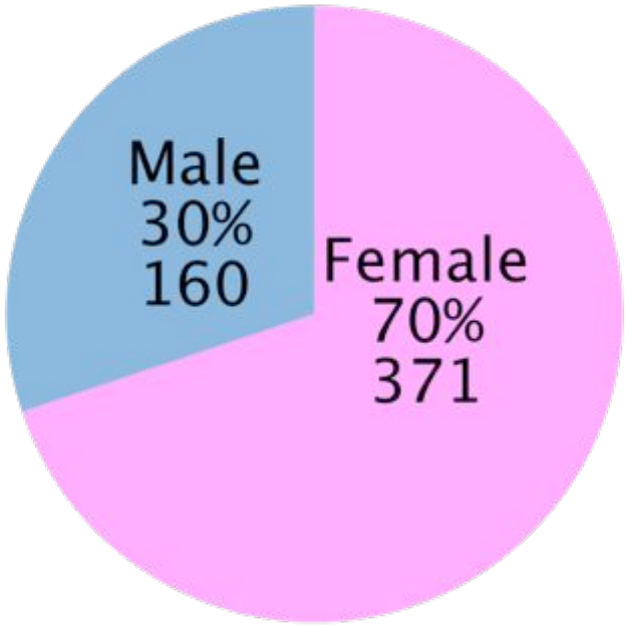




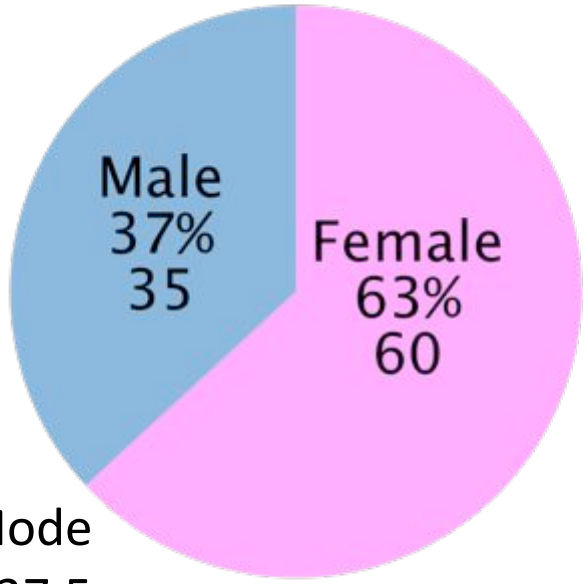
Proportion of typists and hand writers in each of the eight cohorts 2014 -2015

Gender ratios: Typists and hand-writers

All Eight Cohorts

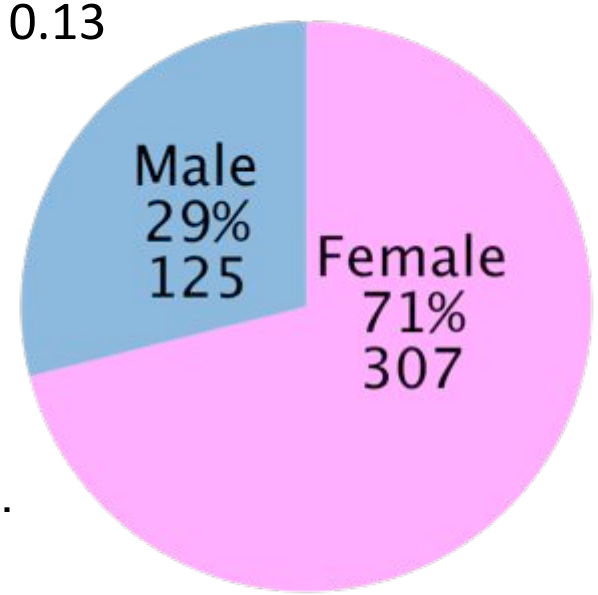


Typists
15%



	Mode
MW U	27737.5
Z	-1.516
Sig. (2-tailed)	0.13

Hand-writers
85%

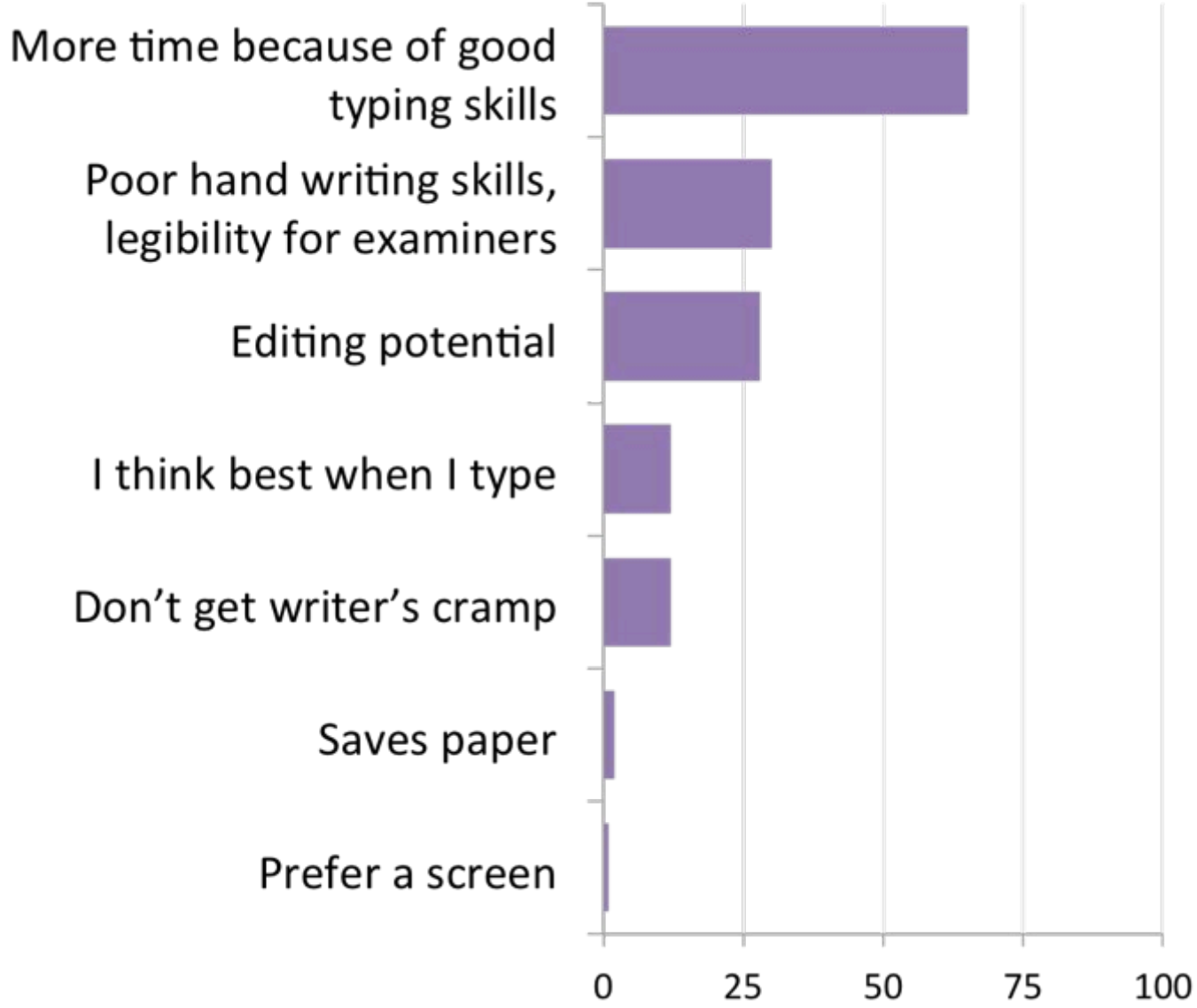


Finding: Gender did not play a role in the choice to type.

Includes s1 2015 results – 8 cohorts.

Reasons for typing the exam (2014)

(added 30 October 2014)



[2014]

Phase 2 Post-exam Typist's Comments

Quicker typing and the ability to edit or completely delete my answer without compromising on space.

You can write as much as you otherwise would but don't get a sore hand when typing.

I have terrible handwriting. Felt bad about it.

I could get info down faster and examiner could read it.

It is cleaner, I make lots of mistakes when I'm writing and it usually ends in lots of scribbles everywhere.

Typing is more natural for me. I think best when I am typing.

[2014]

Reasons for handwriting the exam (2014)

(added 30 October 2014)

[2014]

Phase 2 Post-exam Hand-writers

I felt more comfortable handwriting as nothing can go wrong & I wasn't relying on the computer system to complete my exam.

Three years of prior exams writing so stick with what you know.

I am worried about computer malfunctions.

I'm a slow typer and feel disadvantaged.

I was initially planning to type this exam but decided against it due to the unpredictability of machines

I think more about what I'm writing when I handwrite but my hand gets sore and it isn't fast.

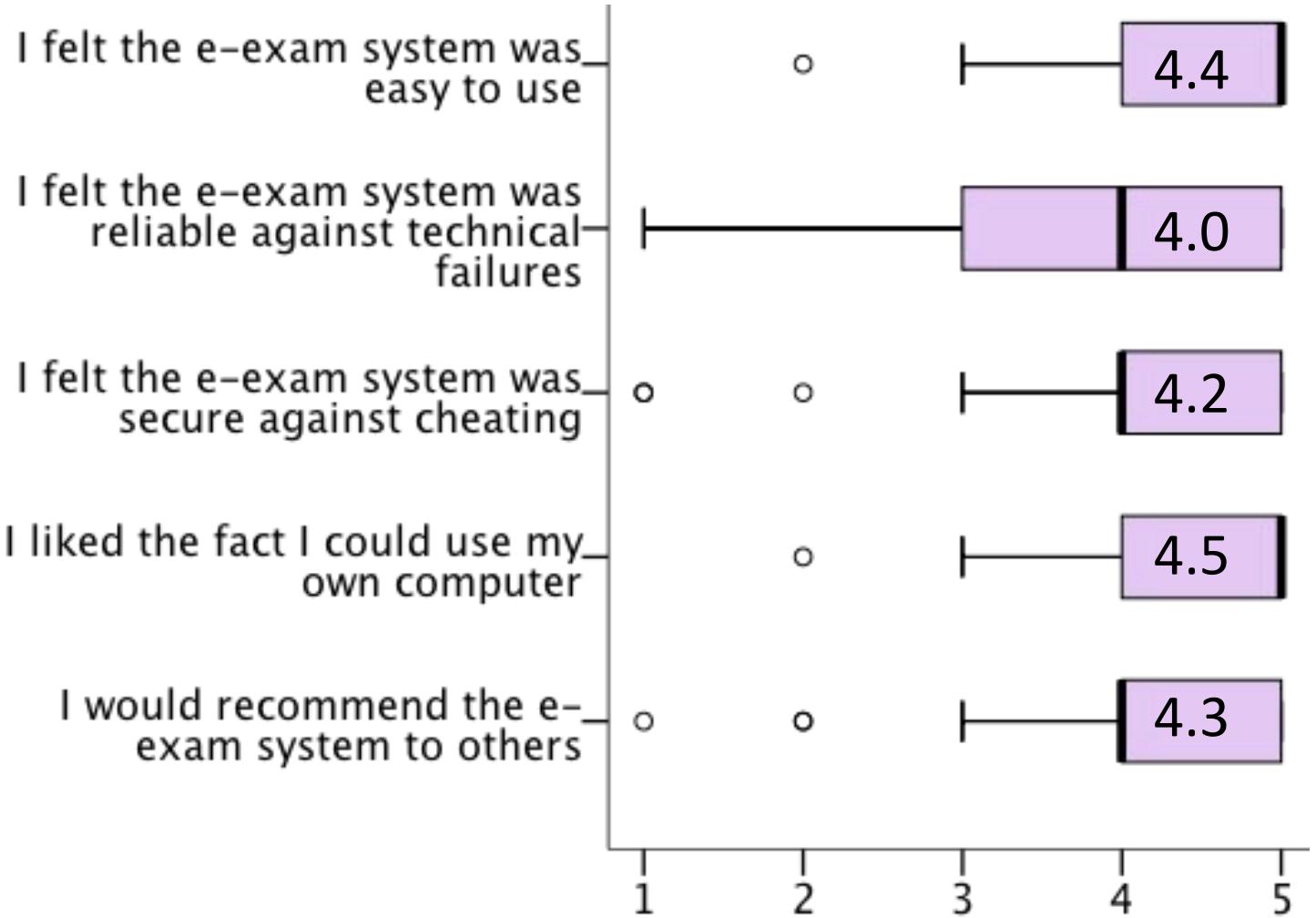
It's easier to handwrite. Though probably not easier for you to read my writing.

Lazy to bring laptop.

[2014]

Post-exam Impressions

Student (typists) impressions of using the exam system



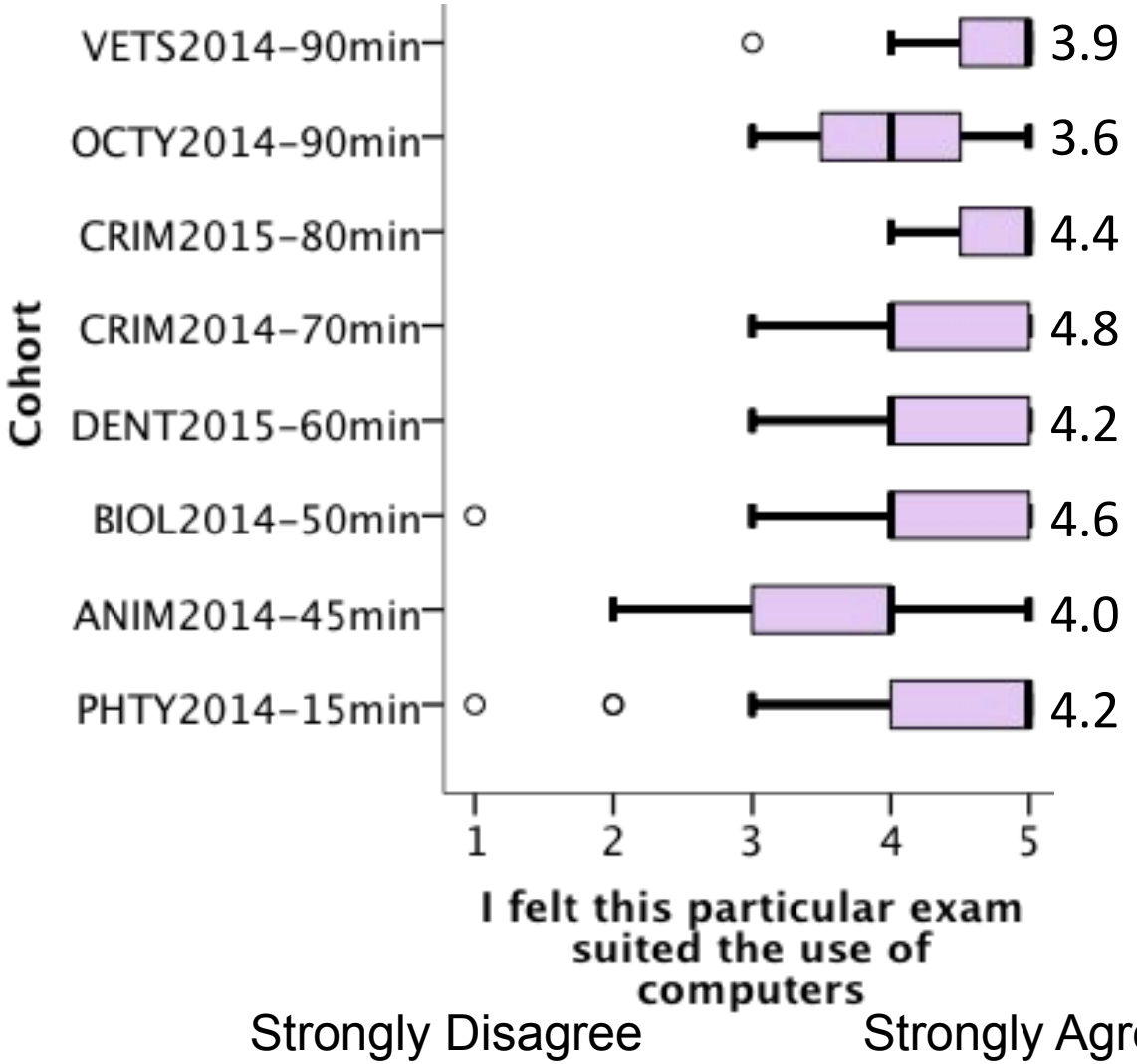
Boxplots: responses from typists.

Bars represent medians.
Means shown for clarity.
N = 91

Updated to include s1 2015 results – 8 cohorts.

Post-exam Impressions

Did typists think the exam suited the use of computers?



Boxplots: responses from typists by cohort.

Bars represent medians. Means shown for clarity. Overall mean agreement 4.2

Largely that was a 'yes'.

However two factors at play:

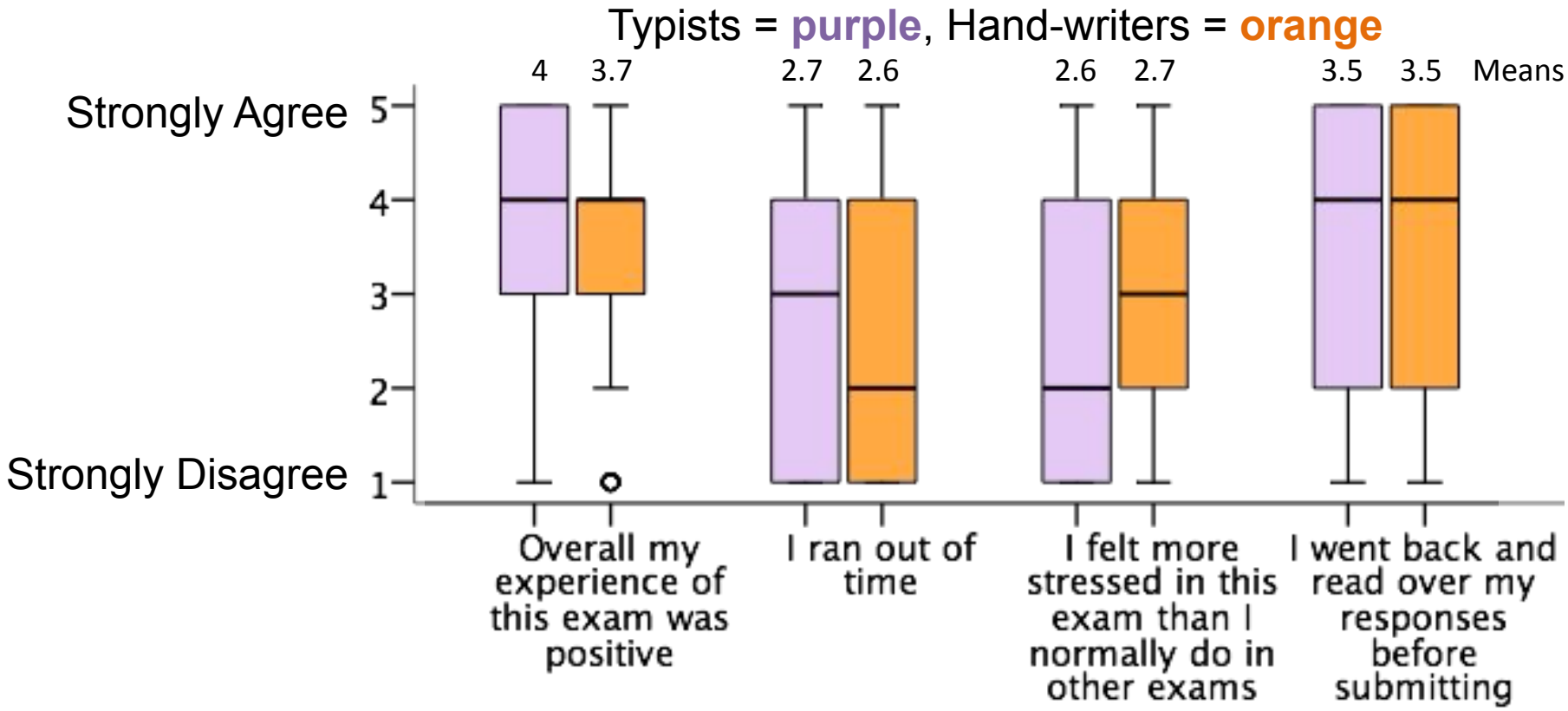
a) Self-selecting sample. Typists would be positive.

b) Exam was 'paper equivalent' thus not taking advantage of what was possible with IT e.g. multimedia, simulations etc

Updated to include s1 2015 results – 8 cohorts.

Reaction to conditions in the exam

Typists had a more positive experience overall but no significant differences were reported for time running out and stress levels.

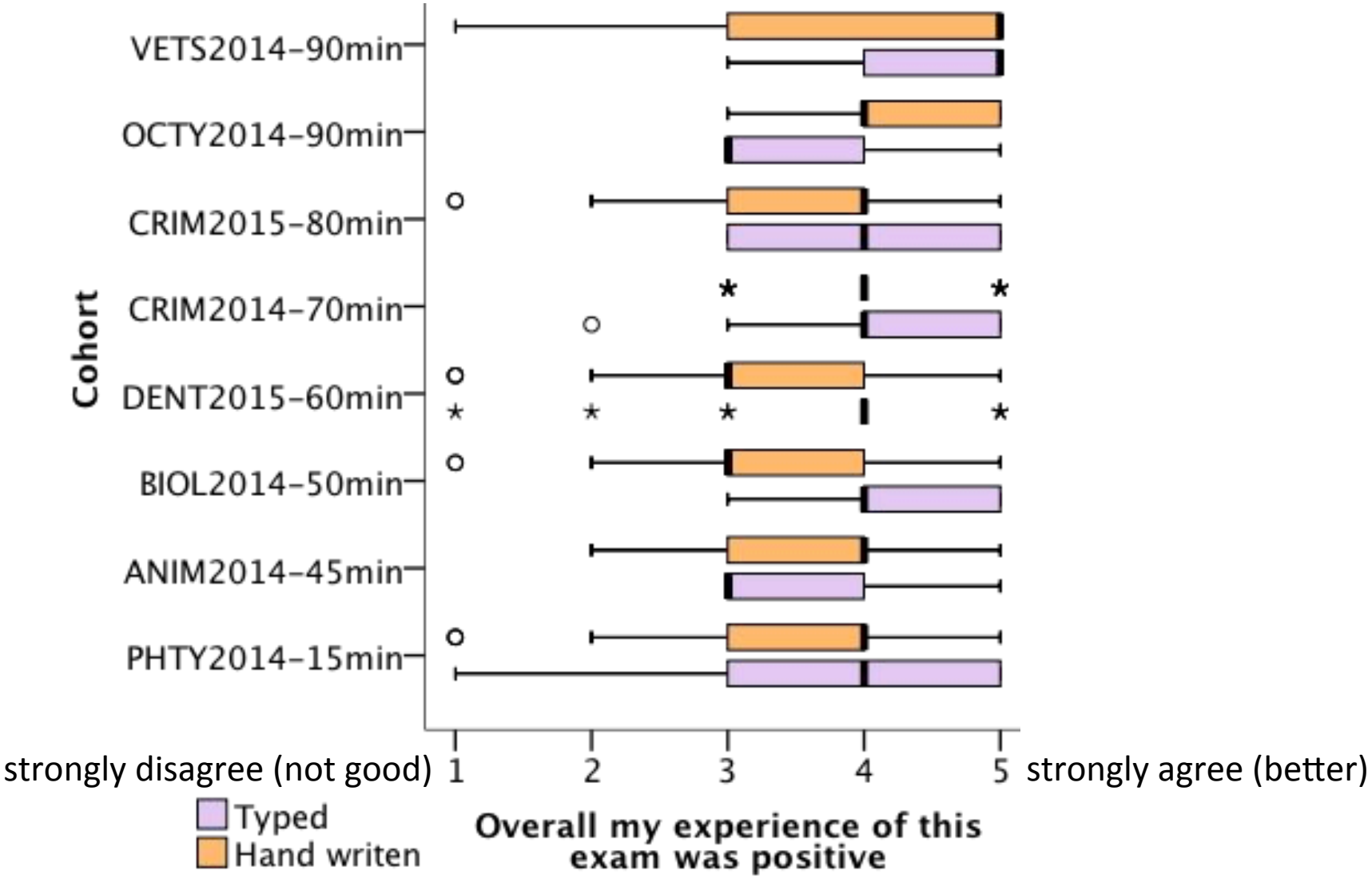


Mann-Whitney U	21172.5	23645	23065	24252
Z	-2.539	-0.647	-1.081	-0.447
Asymp. Sig. (2-tailed)	>.05	n/s	n/s	n/s

Updated to include s1 2015 results – 8 cohorts.

Reaction to conditions in the exam

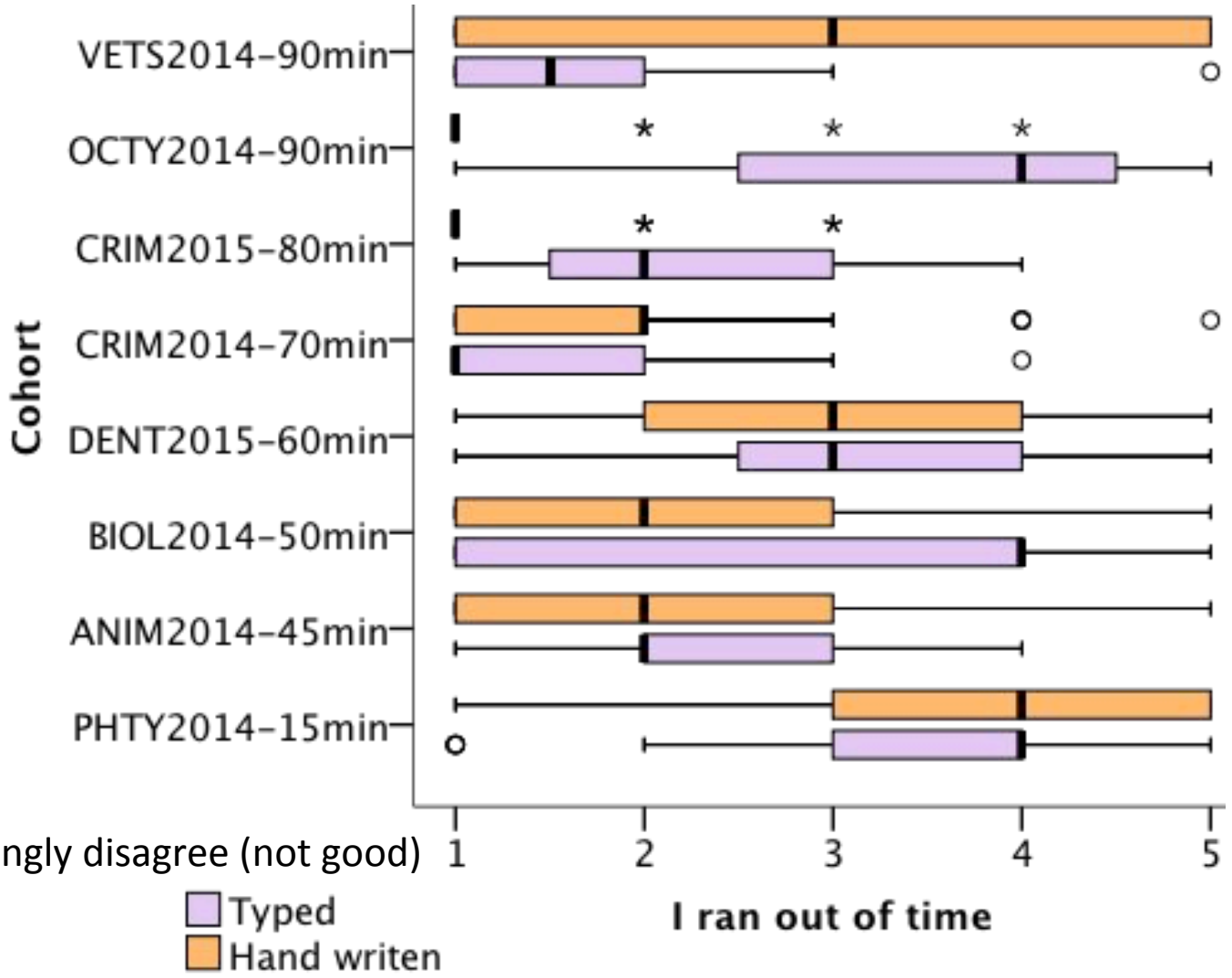
Overall exam experience by cohort



Updated to include s1 2015 results – 8 cohorts.

Reaction to conditions in the exam

Time availability by cohort

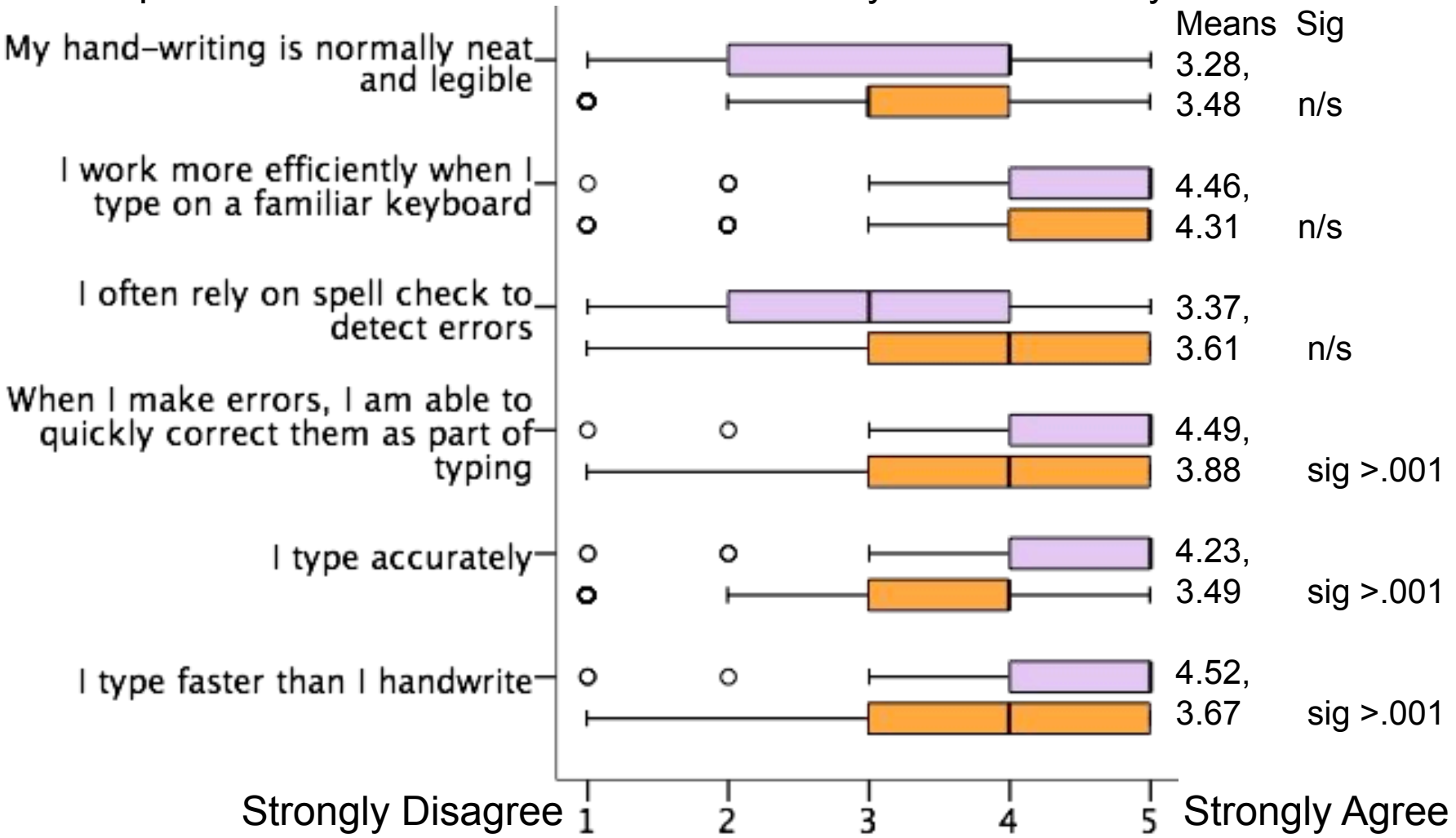


Updated to include s1 2015 results – 8 cohorts.

General keyboard and writing prowess

Student reported typing and writing skills

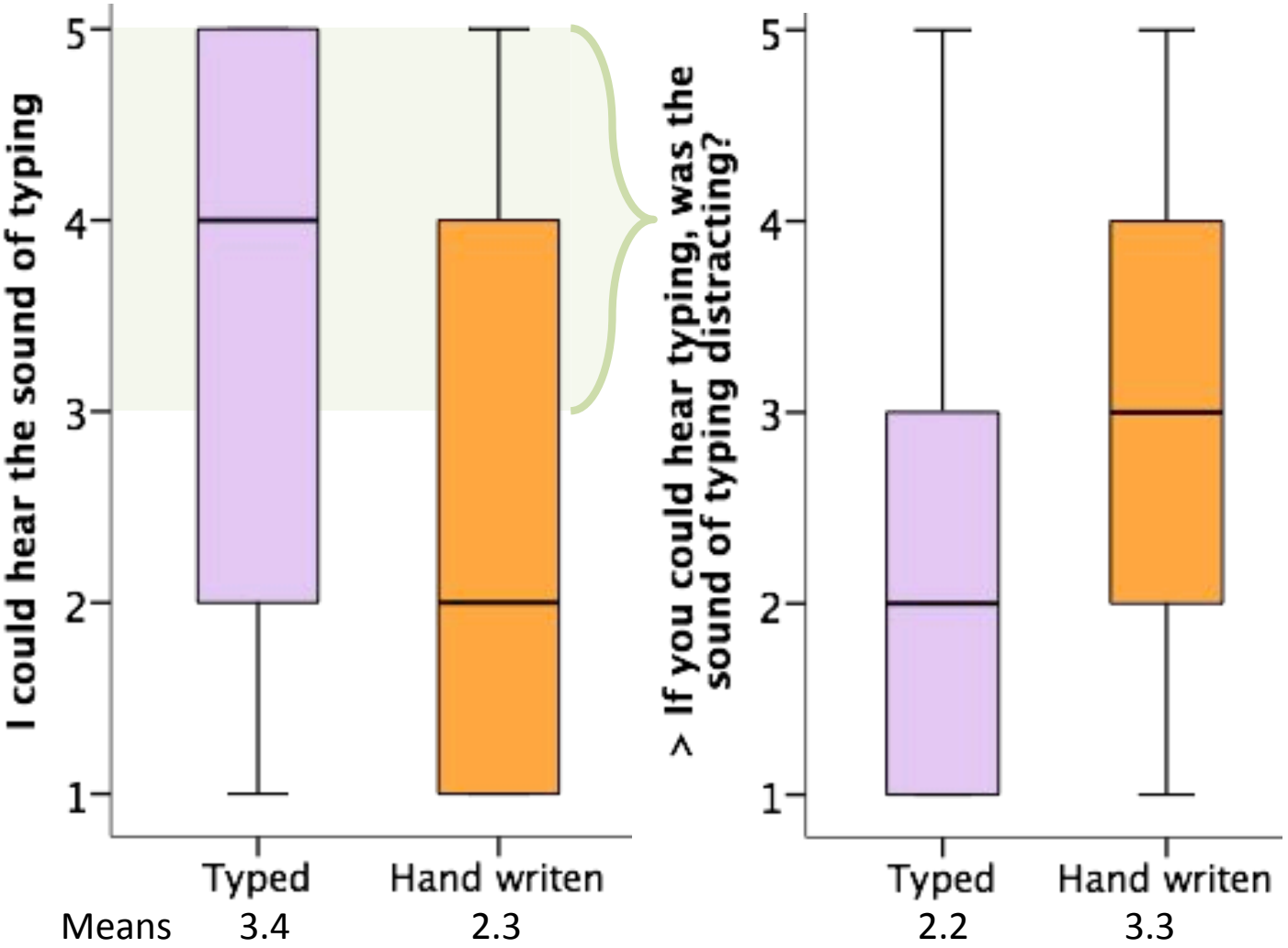
Key: **Purple** (top) = typists, **Orange** (bottom) = hand-writers
Bars represent medians. Means shown for clarity. Mann-Whitney U test results shown.



Updated to include s1 2015 results – 8 cohorts.

Was the sound of typing distracting?

In each boxplot **Typers (left)** and **Hand writers (right)**



Both exhibited significant differences to >.01 on Mann-Whitney U test
Likert Scale: 5 = Strongly Agree, 1 = Strongly Disagree

Updated to include S1 2015 results.

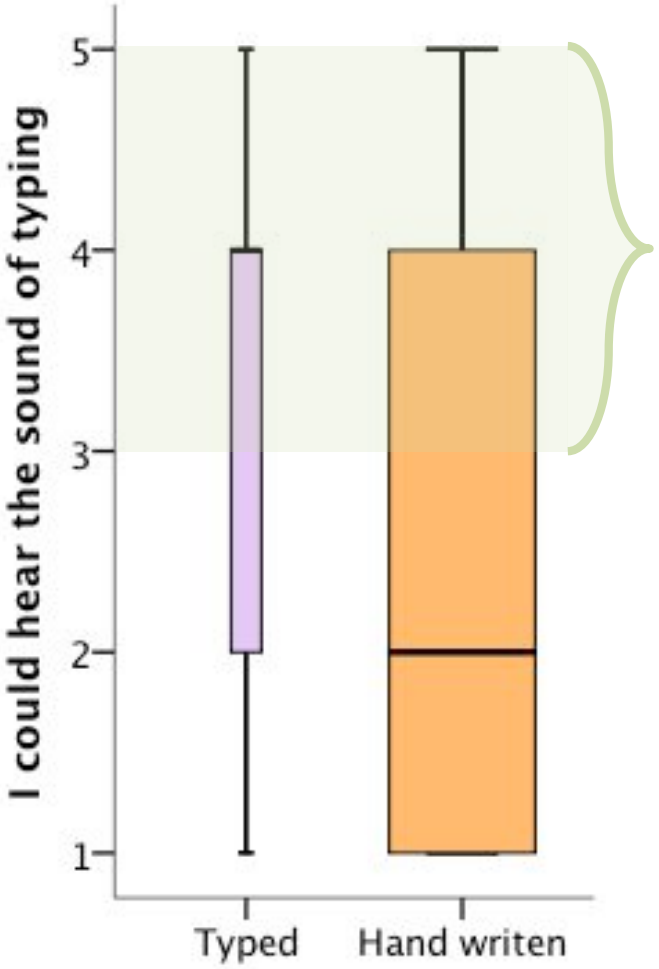
The cohorts ANIM2014, BIOL2014 and CRIM2015 were removed from the analysis because typists and hand writers sat in different rooms.

Those that could hear typing (who selected 5, 4 or 3) were included in the determination of distraction by typing sound.

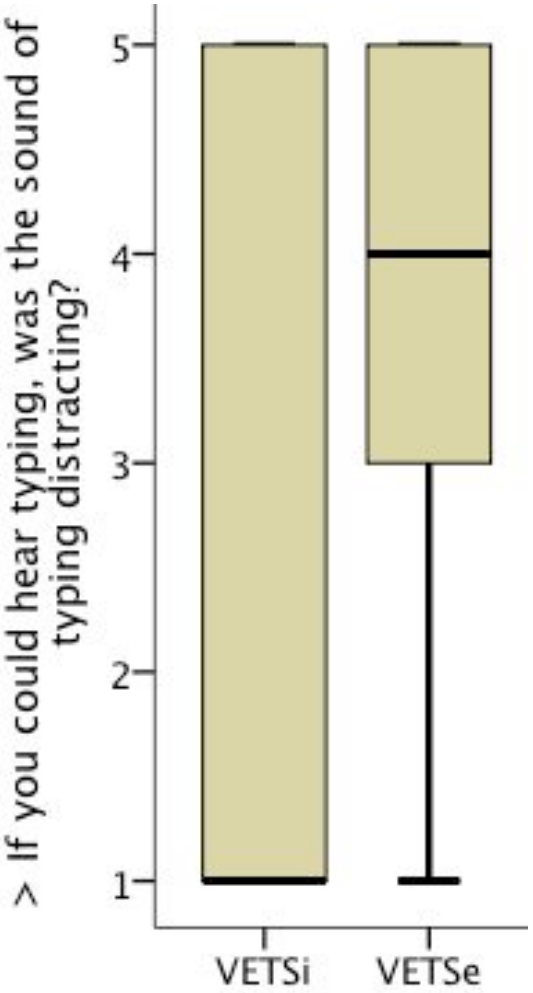
Cohort exams were held in different venues.

Was the sound of typing distracting (VetSci)?

In each boxplot **Typers (left)** and **Hand writers (right)**



Means 3.4 2.47



2.85 3.57

Likert Scale: 5 = Strongly Agree, 1 = Strongly Disagree

VetSci Course:

VETS both the internal and external cohorts used same room, but at different times (4 weeks apart).

VETS internal: warm day, ceiling fans and construction noise.
VETS external: cooler day, no fans, quiet.

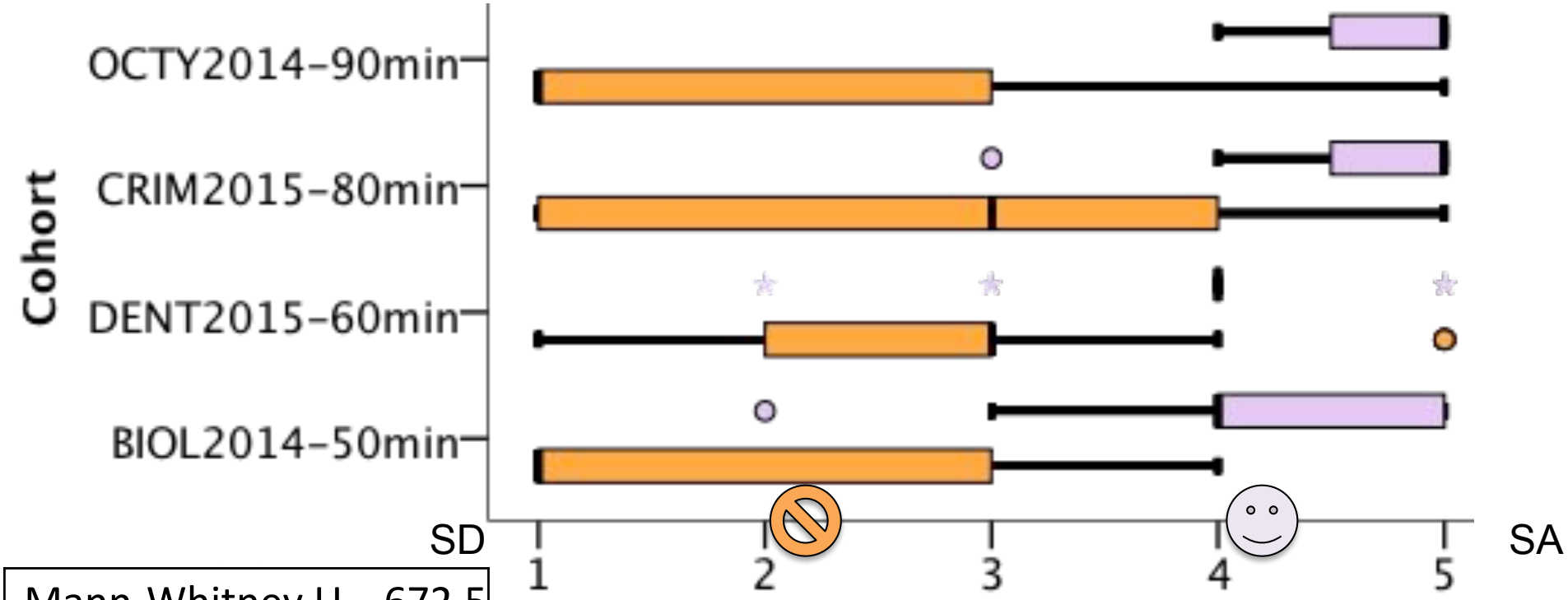
Environmental conditions and acoustics play a large role in the degree to which 'typing noise' becomes a distracting factor.

Hand-writers were not all quiet either!

Future Intentions

Typists were more positive towards future e-Exams, as expected, but hand-writers were not negative as a whole.

	Mean	N	SD
Typists	4.2	39	0.8
Hand-writers	2.2	167	1.2



Mann-Whitney U	672.5
Z	-7.961
Sig (2 tail)	>.001

Typists = **purple**, Hand-writers = **orange**

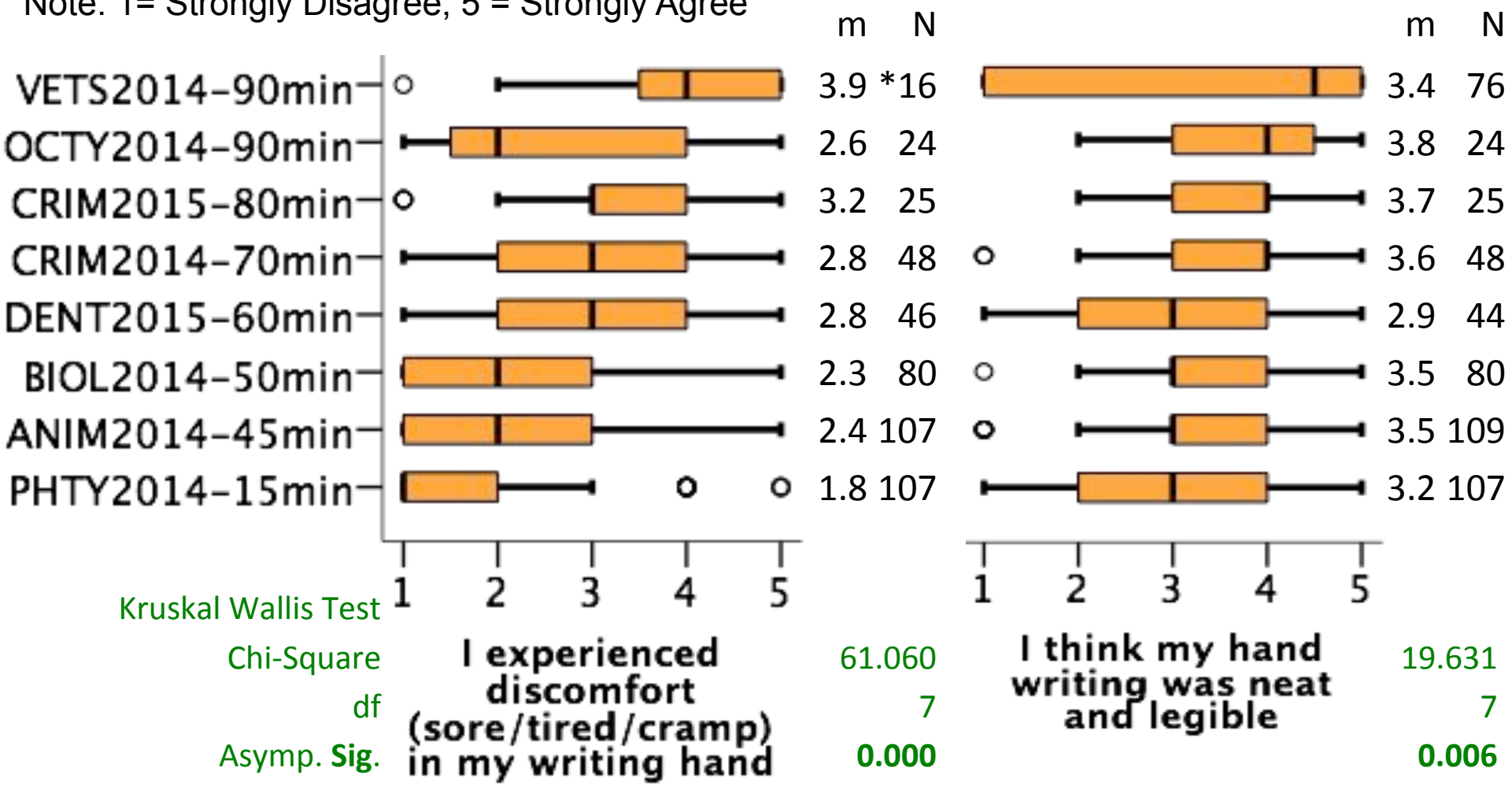
Updated to include s1 2015 results (4 cohorts - new question added in Semester 2, 2014).

Post-exam Impressions

Hand-writing in the exam

Boxplots: responses from hand-writers.
Bars represent medians.
Means and counts shown for clarity.
Note: 1= Strongly Disagree, 5 = Strongly Agree

Are some students over estimating the neatness of their hand writing?!



Kruskal Wallis Test		
Chi-Square	61.060	19.631
df	7	7
Asymp. **Sig.**	**0.000**	**0.006**

Updated to include s1 2015 results – 8 cohorts.

* Note 20% response rate by VETS for this item. All others near 90%

Trial Technical Issues

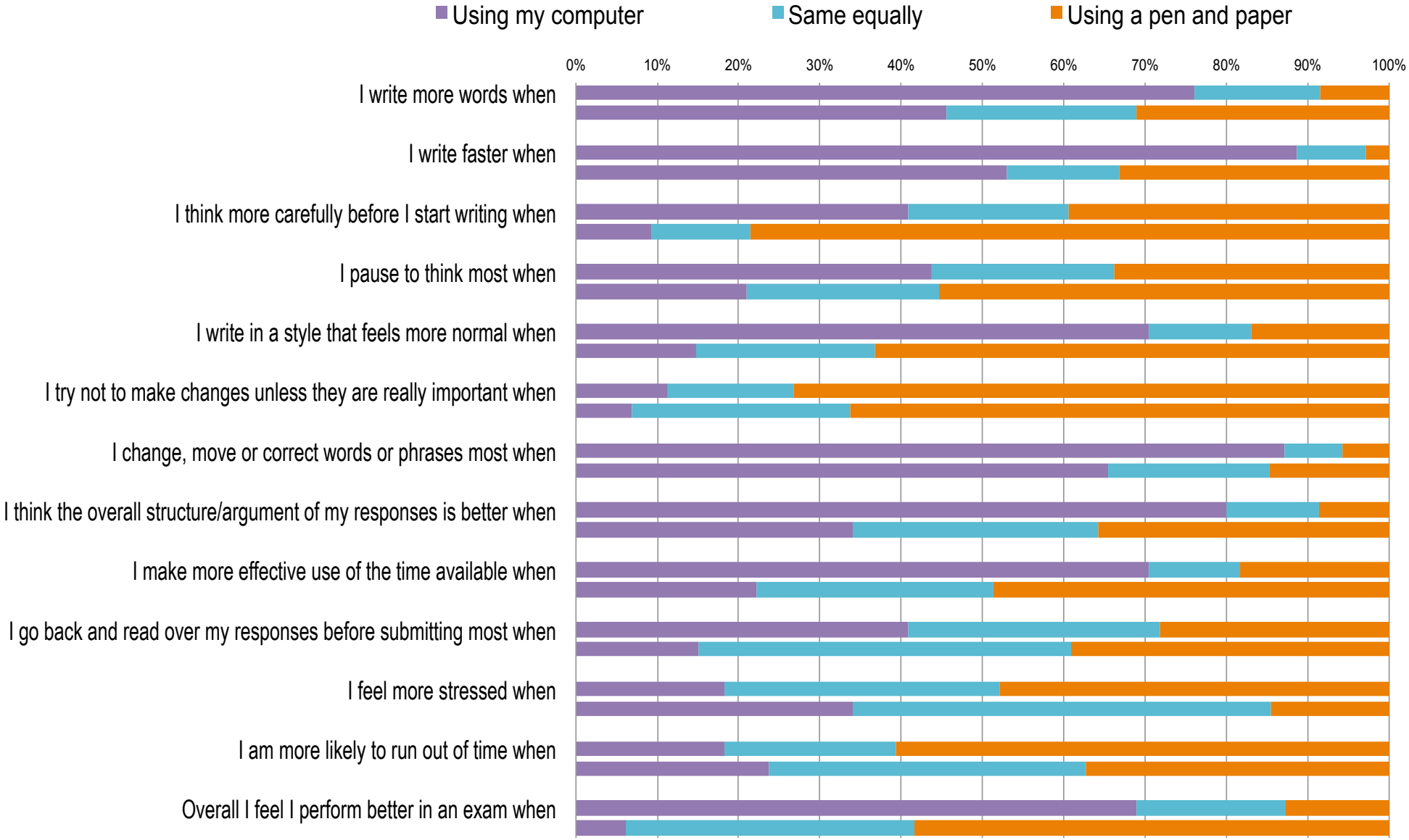
Issue log (2014): 15 of the 69 who typed reported 'technical issues' via the post-exam survey. 1 more was identified by observation. The majority were minor.

Issue	N	Notes, Additional Observations, Suggested Solutions
Boot/start up	2	In reality most participants needed assistance/forgot boot key. *Familiarity: need to practice!*
Entering ID	0	All good. (some students entered 's' rather than 8 digit number but system copes fine).
Using the software	1	Some did not know how to 'exit' gracefully (i.e. File save, file exit, shutdown). *Need to practice! Investigate an 'I'm finished' script/button.*
Battery	0	Most plugged in. *Power needs to be available.*
Saving files	0	All good. (noticed one student used 'save as' when save was 'greyed out') now fixed
Software crashed/ computer froze	4	1 x Old 2009 white Macbook. Office suite quit to desktop. 3 x System drive ran out of space causing the system to crash (now fixed).
Touchpad/ mouse	7	Sensitivity reported by participants. *Some adjustments were made.* *USB wired **mice** highly recommended! Investigate drivers.*
Scrolling	**15**	Two finger scrolling opposite to OSX, keyboard shortcuts. Small scroll bars. Sensitivity. *Familiarity: need to practice. Larger scroll bars. Investigate a user selectable option for touchpad/scroll behavior (and re-mapping of keyboard shortcuts).*

Further development is needed to address these issues.
Warnings remain in readme files available on public download sites.

Student consideration of general exam conditions when using computer versus pen [2014]:

All six cohorts. Response pairs: those who typed (line 1) & those that hand-wrote* (line 2)

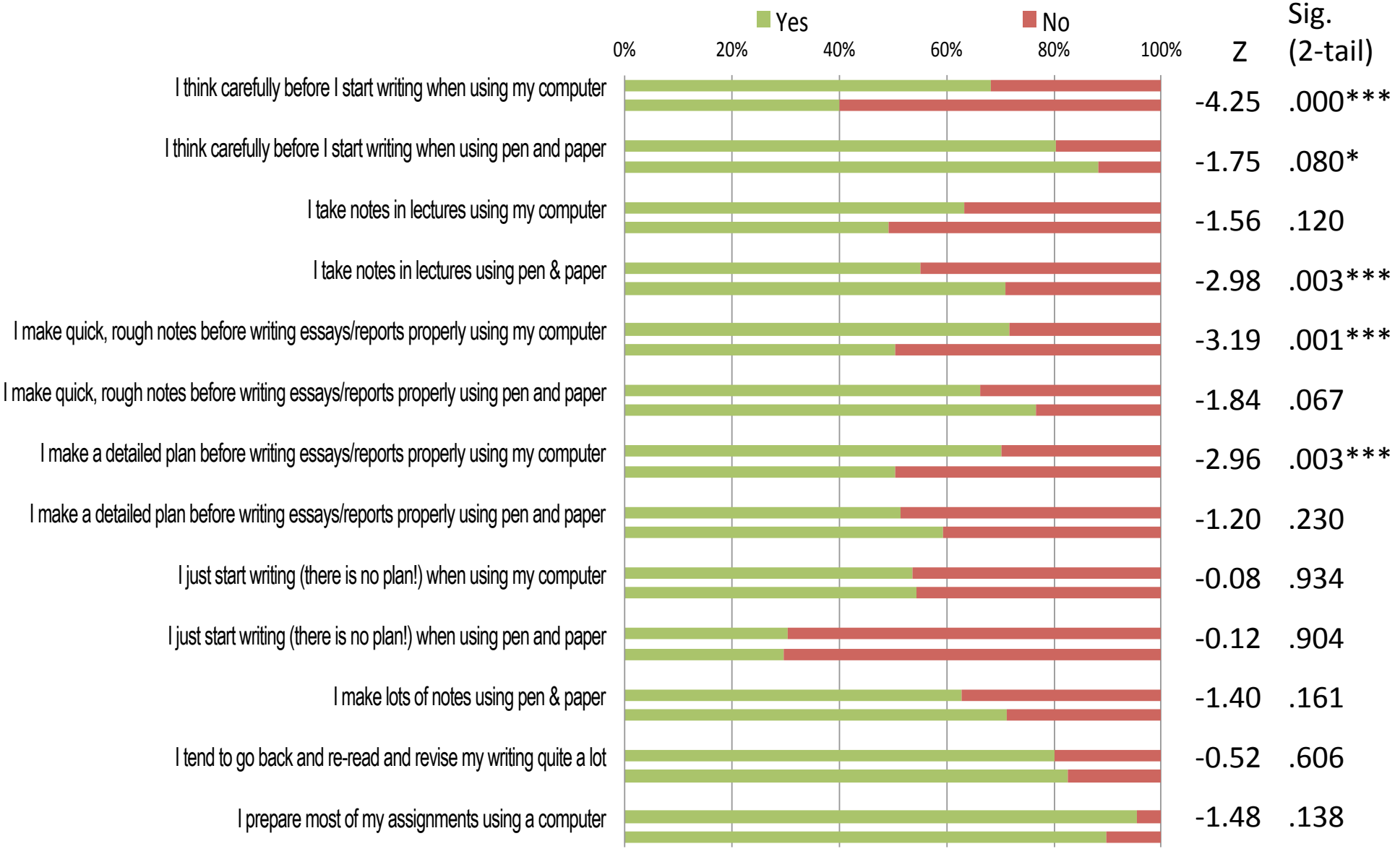


* Note - Many of those that hand-wrote their exam had no prior experience of using a computer for an exam so the results presented here are largely speculative on their part.
However, it is reasonable to assume that they drew on their general use of computers.

Note! Updated March 2015 edition places 'same equally' in the middle rather than on the right.

Writing strategies under non-exam conditions – general writing habits [2014]:

All six cohorts. Response pairs: Typers (line 1) and Hand writers (line 2)

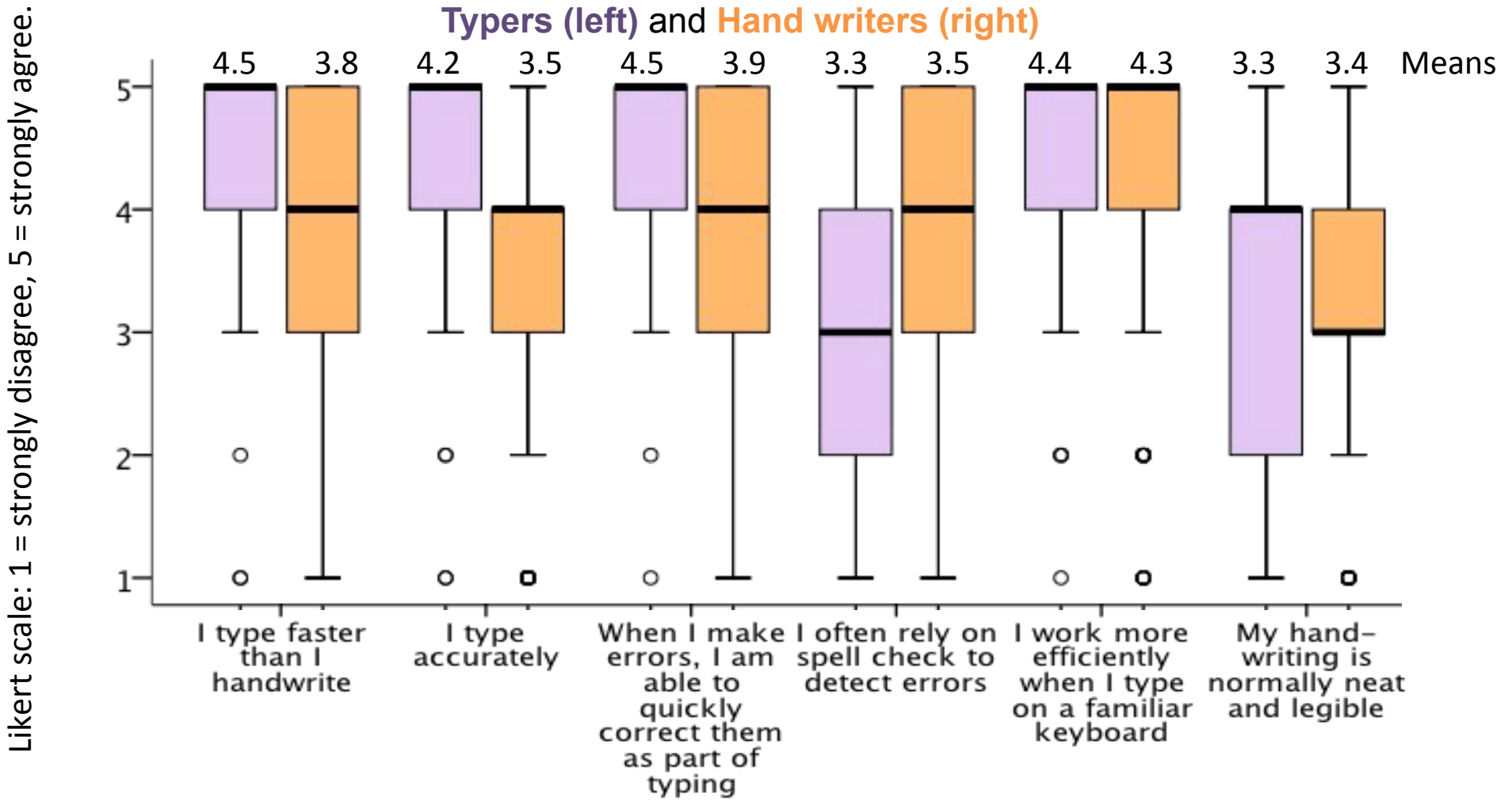


Nonparametric U & Z used to compare those who typed in the exam to those that hand wrote.

Note! The September 2014 edition of this chart was incorrectly reversed against the stats.

Typing and writing abilities

Student typing and writing in general



Mann-Whitney U	14703	13079.5	14514	18196.5	18969	19746.5
Z	-4.708	-5.677	-4.762	-1.694	-1.366	-0.676
Sig. (2-tailed)	>.001	>.001	>.001	n/s	n/s	n/s

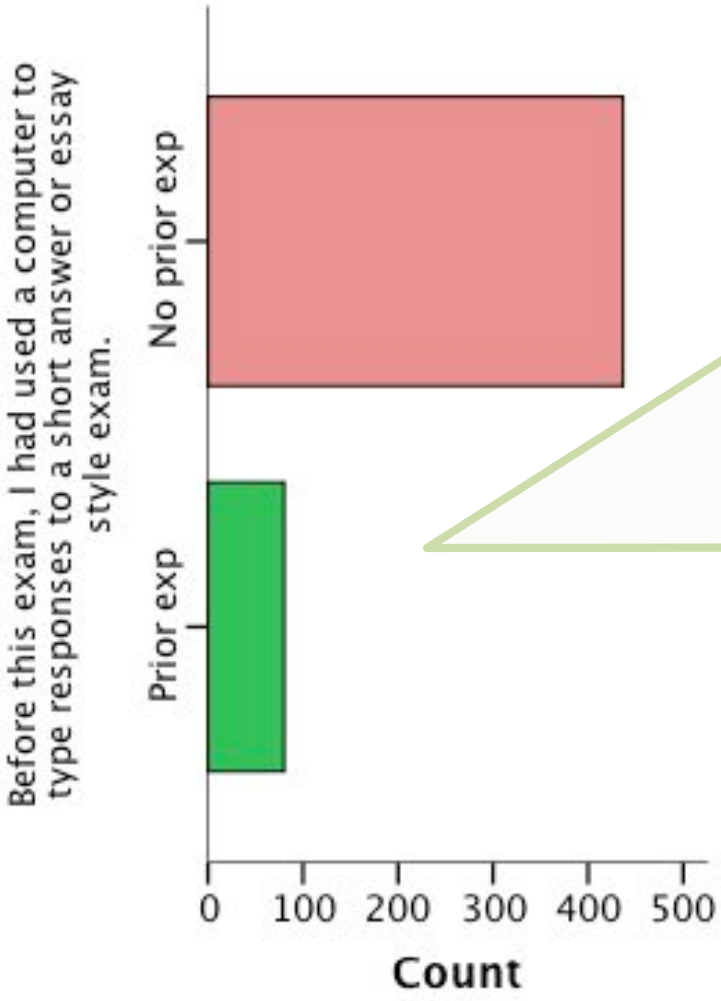
Updated to include s1 2015 results – 8 cohorts.

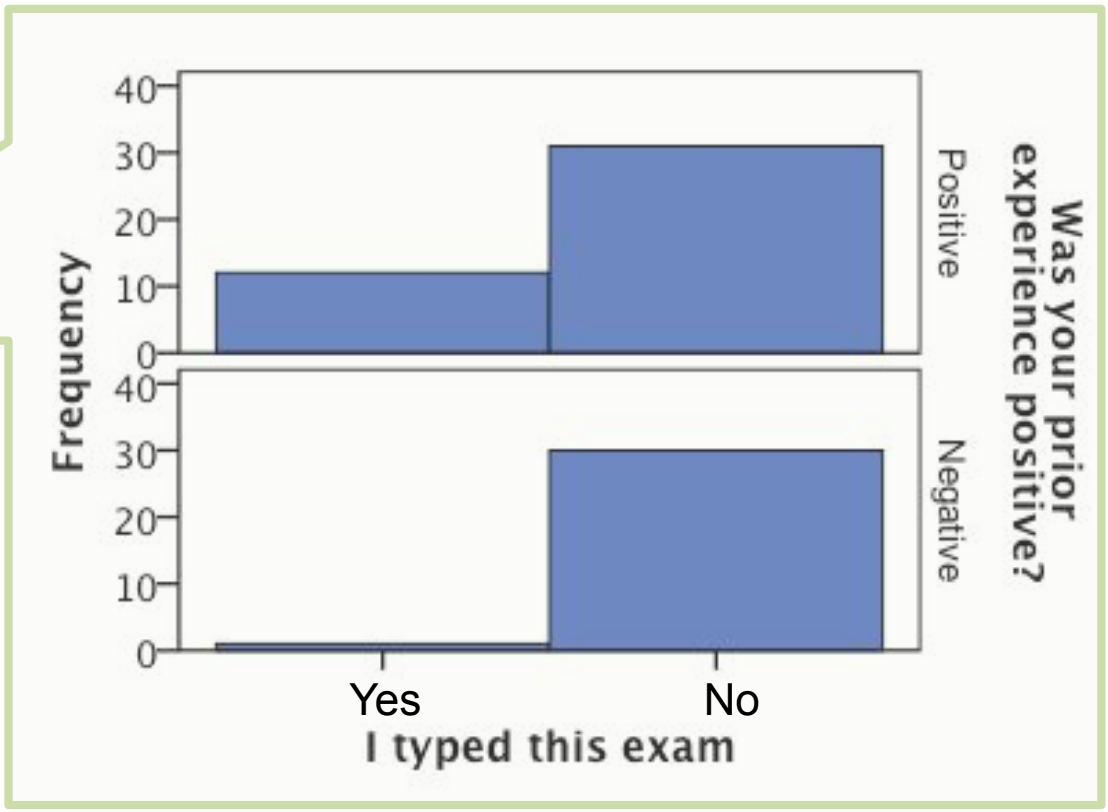
Did the nature of prior experience of e-exams impact on the decision to type this exam?

All participants, 6 cohorts [2014].

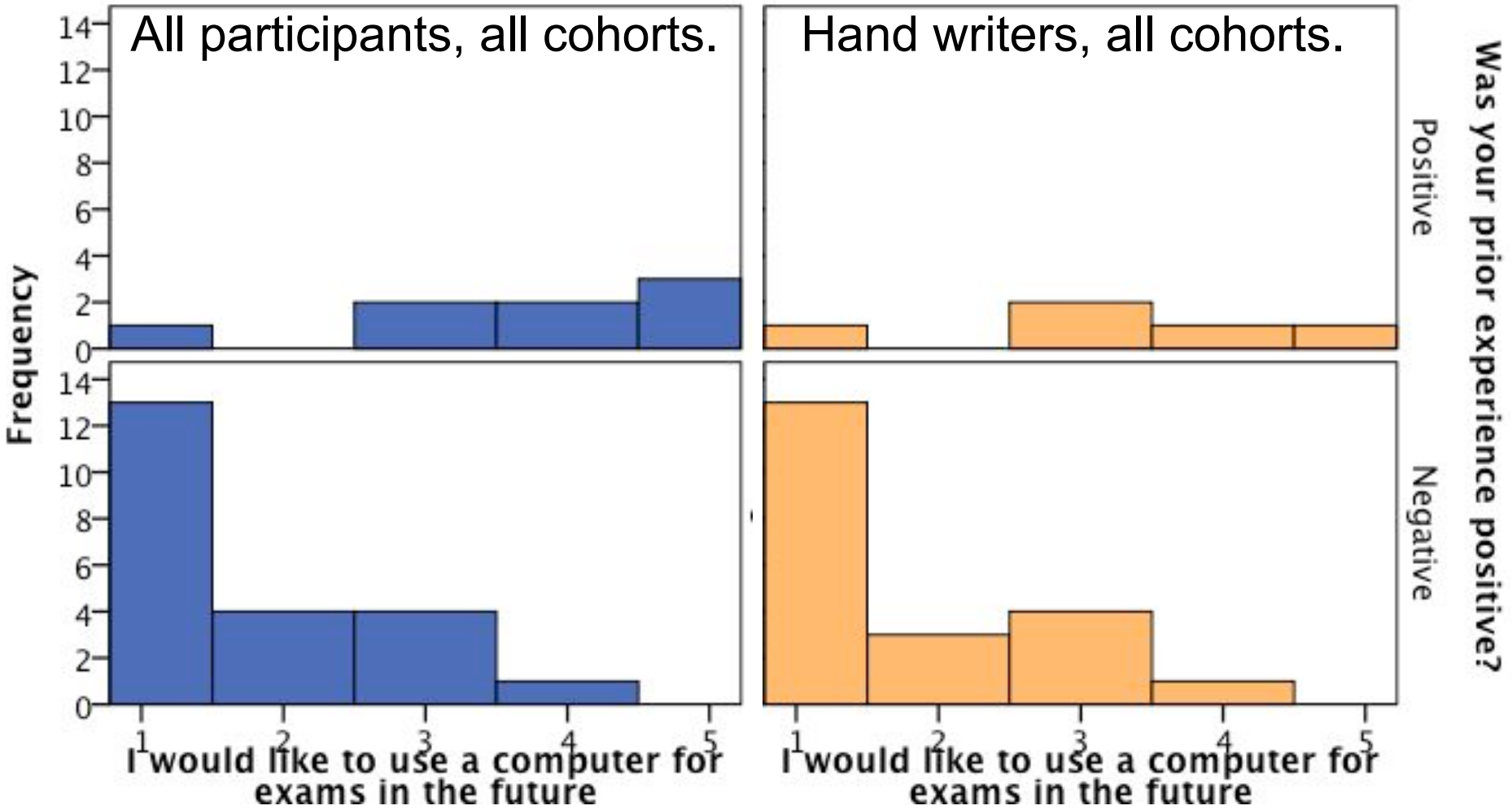
Of those with Prior exp.	All
Mann-Whitney U	502
Z	-2.734
Sig. (2-tailed)	>.01

Looks like a 'yes'!





Does the nature of prior experience of e-exams impact future intended use? [2014]



	All	Hand writers
Mann-Whitney U	22.5	21
Z	-3.262	-2.248
Sig. (2-tailed)	>.01	>.05

Looks like a 'yes'!

Phase 2: UQ e-Exam Trials 2014-2015

Data collected from students (opt-in)

- Via pre-exam project online survey (UQ wide):

  Hillier, M. (2014). The Very Idea of e-Exams: Student (Pre)conceptions. Presented at the Australasian Society for Computers in Learning in Tertiary Education conference, Dunedin, New Zealand. Retrieved from http://transformingexams.com/files/hillier_2014_ascilite_full_paper_prepress.pdf

- Via pre-exam short survey (8 courses – typists only).
  - Conducted at the pre-exam practice setup sessions.
  - Covered: student preliminary impressions, technical hardware compatibility.
- Via post-exam extended survey (8 courses – all students – **next**)
  - Conducted at the conclusion of the exam (in the room).
  - Covered: rationale, student exam experience, reaction to exam session conditions, e-exam system impressions, exam writing strategies and production, general non-exam writing strategies.
  - 2014 (six courses) http://transformingexams.com/files/Hillier_2015_ascilite_fp.pdf

- Analysis of text production (DENT only)
  - Marks v word count, typing v handwriting (more to come; language density…)

Analysis of Exam Responses - DENT

DENT Mid Semester Exam S1 2015 –

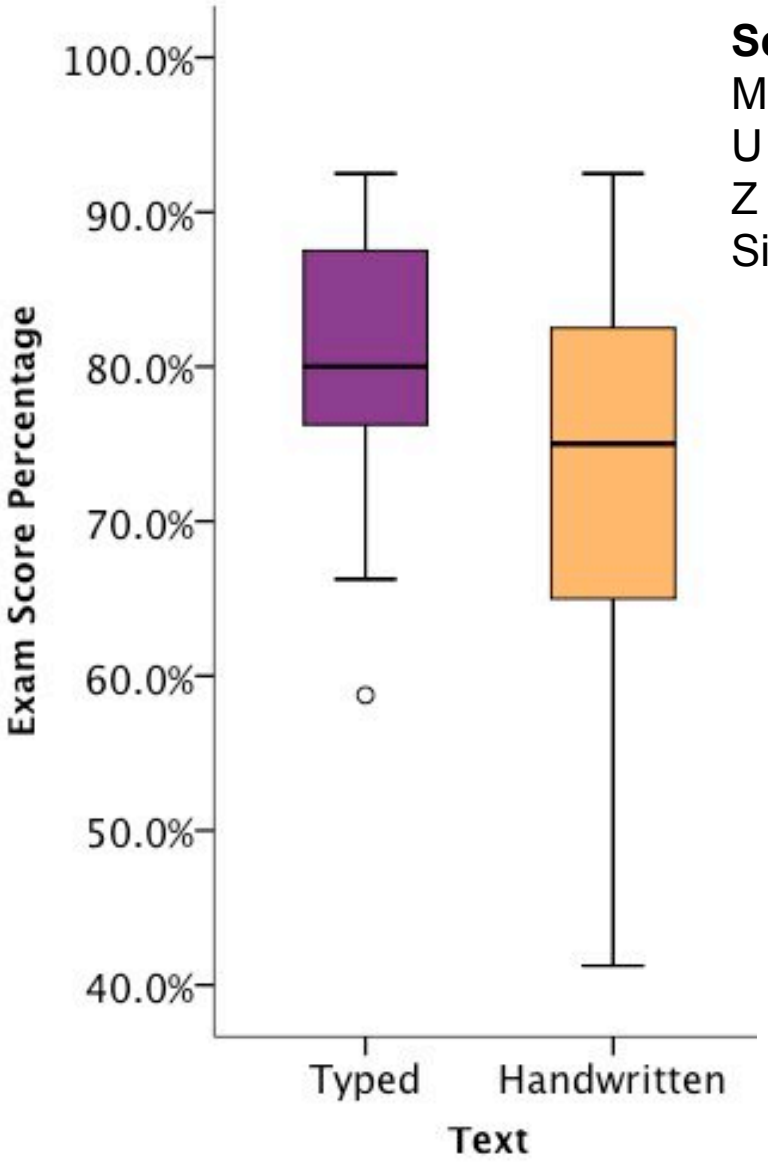
- Six short answer questions
- 20% of course
- Scripts N = 68
- 19 typed
- 49 handwritten

Analysis

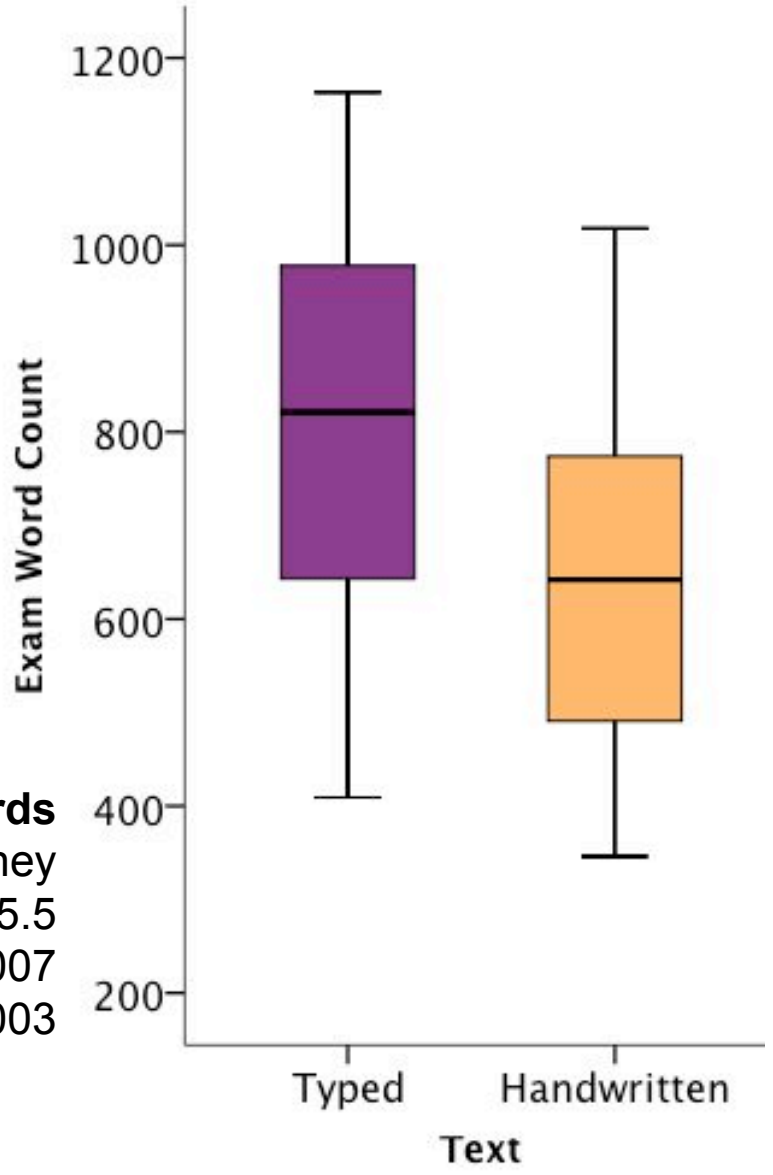
- Production (word count)
- Marks per question and overall

Production DENT

DENT Mid Semester Exam S1 2015 – Six short answer questions; 20% of course.



Score
Mann-Whitney
U 295,
Z -2.333,
Sig .02



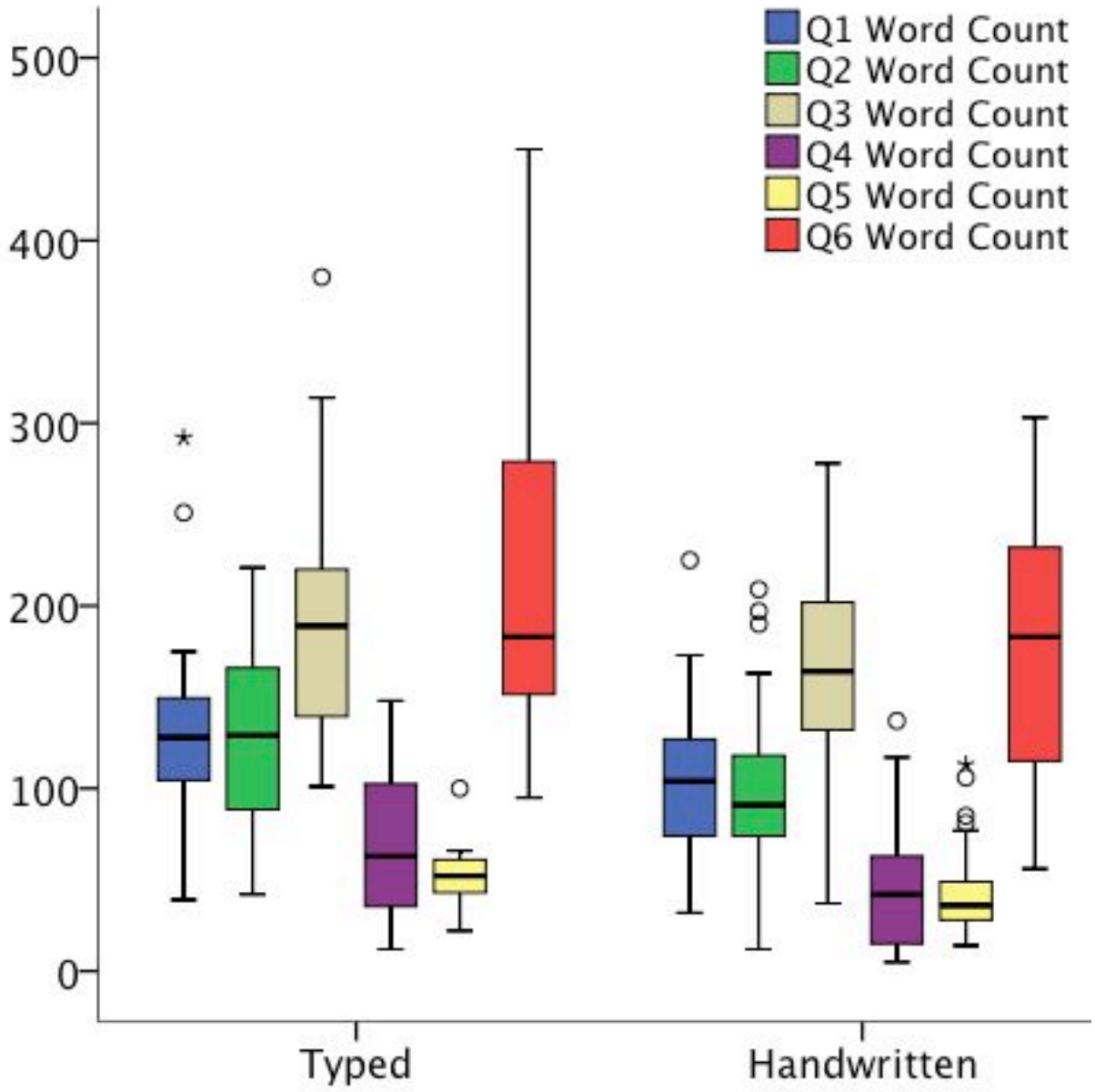
Words
Mann-Whitney
U 245.5
Z -3.007
Sig .003

Scripts N = 68 (19 typed, 49 handwritten)

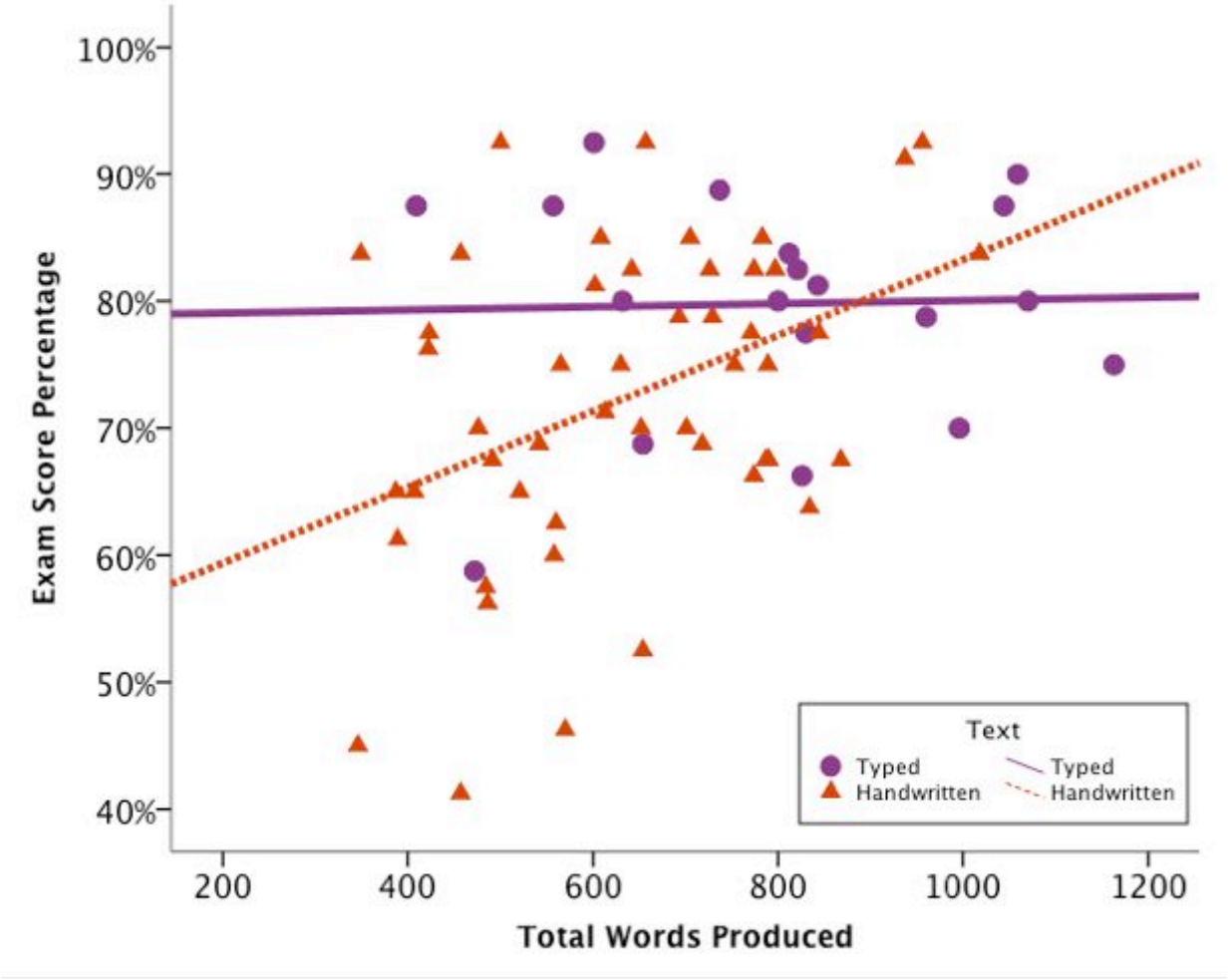
Word Count for each Question DENT

Comparing number of words typed and handwritten by question number.

Significance per question by mode.
Mann-Whitney:
Q1 >.05
Q2 >.05
Q3 NS
Q4 >.05
Q5 >.05 close
Q6 NS



Do more words mean better marks?



DENT 2015 exam.

It depends!

A higher hand written word count generally led to passing and better marks, but lesser words did not always result in poor marks.

Typists did better overall. More typed words only slightly increased marks.

Not claiming causation!

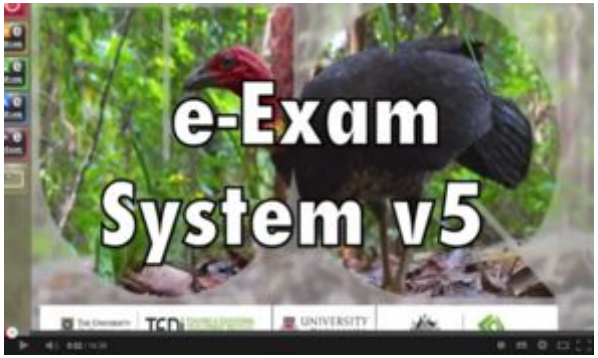
e-Exam Project Resources

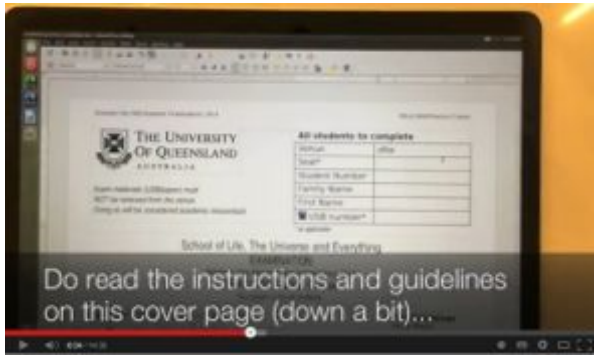
More information….

Demo set-up Guide,

Student Practice and User Guide

http://transformingexams.com





Demo videos start-up, use and recovery examples.

Apple http://ta.vu/eexam-demo-a

'Wintel' (Dell) http://ta.vu/eexam-demo-d

Contact: m.hillier[at]uq.edu.au

References

Dermo, J. (2009). e-Assessment and the student learning experience: A survey of student perceptions of e-assessment. British Journal of Educational Technology, 40(2), 203–214. http://doi.org/10.1111/j.1467-8535.2008.00915.x

Fluck, A. (2013). Implementation of on-campus digital examination practices. Presented at the Transforming Assessment in a Digital Era, Melbourne, Australia. Retrieved from http://www.eexams.org/stories/Documents/TA%20in%20a%20Digital%20Era%20-%20Fluck.pdf

Fluck, A. E. (2011). eExams for Transformation of Higher Education. Presented at the Australian Association for Research in Education Conference, Hobart Tasmania. Retrieved from http://www.aare.edu.au/data/publications/2011/aarefinal00107.pdf

Fluck, A., & Hillier, M. (2014). eExams Transforming Curriculum. In Now IT's Personal (pp. 151–158). Adelaide, Australia: ACEC. Retrieved from http://acec2014.acce.edu.au/sites/2014/files/attachments/eExams%20paperd%20-%20REV2b.docx

Fluck, A., Pullen, D., & Harper, C. (2009). Case Study of a Computer Based Examination System. Australasian Journal of Educational Technology, 25(4), 509–523.

Hillier, M (2015) "To type or handwrite: student's experience across six e-Exam trials", ASCILITE Conference, Perth, 29 Nov - 2 Dec http://transformingexams.com/files/Hillier_2015_ascilite_fp.pdf

Hillier, M & Fluck, A (2015) "A pedagogical end game for exams: a look 10 years into the future of high stakes assessment", ASCILITE Conference, Perth, 29 Nov - 2 Dec. http://transformingexams.com/files/hillier_fluck_2015_exam_futures.pdf

Hillier, M. (2014). The Very Idea of e-Exams: Student (Pre)conceptions. Presented at the Australasian Society for Computers in Learning in Tertiary Education conference, Dunedin, New Zealand. Retrieved from http://ascilite.org/conferences/dunedin2014/files/fullpapers/91-Hillier.pdf

Hillier, M., & Fluck, A. (2013). Arguing again for e-exams in high stakes examinations. In H. Carter, M. Gosper, & J. Hedberg (Eds.), Electric Dreams (pp. 385–396). Macquarie University. Retrieved from http://www.ascilite.org.au/conferences/sydney13/program/papers/Hillier.pdf

Lim, E. C. H., Ong, B. K. C., Wilder-Smith, E. P. V., & Seet, R. C. S. (2006). Computer-based versus pen-and-paper testing: students' perception. Annals of the Academy of Medicine, Singapore, 35(9), 599–603.

Mogey, N., & Hartley, J. (2012). To write or to type? The effects of handwriting and word-processing on the written style of examination essays. Innovations in Education and Teaching International, 50(1), 85–93. http://doi.org/10.1080/14703297.2012.748334

Sorensen, E. (2013). Implementation and student perceptions of e-assessment in a Chemical Engineering module. European Journal of Engineering Education, 38(2), 172–185. http://doi.org/10.1080/03043797.2012.760533

220 more at: https://www.zotero.org/groups/e-assessment/items/tag/e-exam

See e-Exam Project page at http://transformingexams.com/research.html

e-Exams Online Conference Recordings

View at http://ta.vu/eAS2014

1. Monday, 8 September - GMT 07:00: BYOD on-campus e-exams at University of Tasmania (UTAS). Andrew Fluck, University of Tasmania, Australia.
2. Wednesday, 10 September - GMT 07:00: Bring-your-own-laptop e-exam for a large class at NUS. Seow Teck Keong and Jeffery Tay, National University of Singapore.
3. Thursday, 11 September - GMT 07:00: Large scale fully online BYOD final exams: Not your parents multiple choice. Rob Peregoodoff, University of British Columbia, Canada.
4. Friday, 12 September - GMT 07:00: Finland's national matriculation exams goes electronic. Matti Lattu, Matriculation Examination Board, Finland.
5. Tuesday, 16 September - GMT 07:00: eOSCE - robust real time electronic marking for clinical examinations. Sebastian Hunkeler and Dr Philippe Zimmermann, Institute of Medical Education, University of Berne, Switzerland.
6. Wednesday, 17 September - GMT 07:00: Gamification of Clickers with BYOD. Paul Lam, Chinese University of Hong Kong.
7. Thursday, 18 September - GMT 07:00: Safe Exam Browser: A modular approach to secure and flexible online-exams. Daniel R. Schneider and Tobias Halbherr, Swiss federal Institute of Technology Zurich.
8. Friday, 19 September - GMT 07:00: Ten Years of e-Exams at Freie Universitat Berlin: an Overview. Alexander Schulz & Nicolas Apostolopoulos, Free University Berlin, Germany.

End

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