The Very Idea of e-Exams: Student (Pre)conceptions

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This paper explores the preconceptions of students as reported via a voluntary online pre-implementation survey administered in late 2013 on the topic of e-exams. The survey was conducted as part of a wider research program into the development and implementation of on-campus computerised examinations using BYOD. The survey at an Australian university received just over 480 responses from undergraduate students across a wide range of discipline areas including Arts, Commerce, Engineering, Humanities and Science. Twenty-four Likert scale items on e-exams covered pedagogical suitability, fairness, security, cheating, technical reliability, keyboard proficiency, physical comfort, equipment provision and preferences for pen-on-paper or computer based testing. Two open comments on concerns and opinions were included. Data was analysed using Man-Whitney's U Test across programs (discipline groups), gender and by level of experience of computerised exams. The survey was conducted with the intention of uncovering pre-conceived ideas held on the part of students with regard to the idea of e-exams ahead of a planned series of e-exam trials. A range of concerns were expressed by students both for and against the idea of exams that provide the planners of e-exam approaches valuable insights into the attitudes of one of the most significant stakeholder groups.

Keywords: e-exams, pre-implementation, survey, student perceptions

Literature Review

Computerisation has become increasingly common in the higher education sector and increasingly important for the success of students and institutions in an increasingly outcomes focused world. The use of computers for assessment is also increasingly rapidly. A recent survey across the UK higher education sector by Walker, Voce and Ahmed (2012) showed that the use of formative self-assessment online quizzes, online assignment submission and the use of social media tools are being increasingly used. As a result many students are undertaking the bulk of their formative coursework including writing and submitting assignments via computer (Mogey et al, 2010). However the computerisation of high takes examinations remains relatively rare with the vast majority of exams still taken using pen-on-paper.

The need to make a move towards the computerisation of exams has become apparent with a number of drivers at work. Hillier and Fluck (2013) detailed several of these including the demand by society for increasingly ICT literate graduates, opportunities in regard to curriculum change, increasing student numbers, constrained budgets and space shortages. In particular, they argue that a growing disconnect exists between the ICT enhanced formative learning that happens as a matter of course during the semester and the stark absence of technology in the exam room. This creates a jarring change for students when moving from formative learning activities into their high stakes exams. However, if we are to make such a large shift in high stakes assessment practice we will require the buy-in of many stakeholders including academics, administrators, policy makers and students. It is this last group that is the subject of this paper where we set out to explore the potential for the state-of-the-art and the state-of-the-actual in terms of the point-of-view of students.

Previous studies on students' perceptions of e-exams provide a rich source of the range of concerns expressed by students, however these studies have mainly occurred in the form of post-intervention studies that would understate any pre-conceived ideas likely to lead to resistance to change ahead of an implementation project. In most studies students were asked to reflect upon their prior use of assessment tools such as online quizzes, practice tests, or the use of assessment features found within online learning platforms such as Blackboard, Moodle or QuestionMark Perception. Prior studies undertaken within single disciplines include, Lim et al., (2006) who surveyed medical students in Singapore on their preferences for computer-based versus pen-on-paper tests that contained multiple choice and scenario based essay questions. Lim (ibid). found that 80% students preferred the computer based format when answering the scenario based questions due to increased quality of multimedia and the ability to self pace. Just over 50% of students surveyed preferred the computer based multiple choice tests. A study by Noubandegani (2012) looked at computerised TOEFL tests in which participants perceived disadvantage due to their poor typing ability and a reduced ability to review the whole test, but saw benefits in reducing handwriting problems and increased accuracy of scoring. Mogey and Hartley (2012) looked at essay based exams with divinity students in Edinburgh in which they tentatively identified some differences in the writing style and increased word counts for typists over pen-on-paper writers. Sorensen (2013) implemented formative and summative online quizzes for chemical engineering students in England who were then surveyed. Students liked the time and place flexibility offered by formative online quizzes, felt that such quizzes aligned well with contemporary e-learning approaches and added value to their learning. Two

larger studies that involved multidisciplinary research included Dermo (2009) who evaluated students' experiences of using QuestionMark Perception at the University of Bradford. The study by Sorensen (2013) also drew upon the questionnaire used by Demo (2009), although Sorensen used the quiz tools built into the Moodle LMS as the object in the study. Findings by Dermo (ibid) revealed students were most concerned about the fairness of using banks of random questions, the potential for technical problems, and the need for technical skills to undertake the test. Conversely students felt that health and safety was not a problem and that computerisation of an exam did not add to the stress of the exam. A series of studies was carried out by Fluck (Fluck, Pullen & Harper 2009; Fluck, 2011; Fluck, 2013) in which trials were carried out at University of Tasmania using his home grown 'eExam' system. Students from History, Law, Education and Medicine participated. Over the series of trials Fluck found that students had concerns about the noise generated by tapping on keyboards and the confusion caused by multi-window user interfaces. Fluck also found that students with a higher level of technical proficiency tended to favour computerised exams; as did having prior experience of e-exams.

Even though the findings from these studies provide helpful insights into students' perception of computerised examinations post-introduction, it is also important to anticipate the concerns that students hold prior to the introduction of e-exams in an institution. Fluck et al (2009) made the point that a prior positive exposure to e-exams had a strong influence in future preferences towards e-exams and therefore it was important that the first exposure was a positive one if adoption was to occur smoothly. The introduction of any new technology can face resistance from stakeholders (Dwivedi, Wade & Schneberger 2012) and it is therefore recommended that major stakeholders are included in the planning process early. It is also important to recognise that the lessons learnt from using low stakes quiz tools or general e-learning may not apply to high stakes e-exams. Online quizzes are often taken in an informal setting such as for homework and typically account for a small amount of the course grade. Exams by contrast are taken in a formal setting, usually under time pressure, with supervision, and serve as summative evaluation of the students' performance accounting for a large portion of the final course grade. These factors lead to much higher risk premium being assigned to exams with consummate expectations for integrity, security, validity and fairness. What seems to be missing from the literature is an account of student's concerns held prior to the implementation of any e-exams solution. It is the a-priori concerns we wish to examine in this study. In the absence of experience, the hopes and fears will be what drives the decision making of students in regard to adoption or resistance. We argue that such a body of opinion from one of the most important stakeholder groups would prove valuable in ensuring any potential e-exam solution addresses these concerns head-on.

Research context

This survey based study was conducted as part of a wider research program into the development and implementation of a scalable and sustainable approach to on-campus computerised examinations. It took place at a large, research intensive Australian university with a student population of just over 48,000. We set out to gather a body of evidence regarding the concerns held by students with respect to the potential computerisation of examinations from across a wide range of discipline areas. Based on our knowledge of the assessment practices within the institution we knew that there was almost no existing use of high stakes summative e-exams. However internal LMS statistics showed that formative or low stakes online quizzes were being used across about 12% of courses in 2012. As such we are reasonably confident that the survey responses represent the a-priori concerns of students with respect to high stakes e-exams.

Method

The survey consisted of 20 items across eight indicators, which sought the perceptions of students on the concept of computerised examinations. To build a survey instrument that would capture a range of student's concerns we drew heavily on the work by Dermo (2009) and his validated survey instrument. This was supplemented with the work of the other studies outlined in the literature review including the studies by Fluck (2009), Mogey and Hartley (2012) and an earlier review of the literature in Hillier & Fluck (2013). It is acknowledged that Dermo (2009) conducted his study with students following their use of a specific e-assessment tool (QuestionMark Perception) in a high stakes context. In our study we were not looking to replicate his method, instead we took the range of questions he used as representative of the kinds of issues and concerns that would likely be held by students in relation to the use of e-exams. Our aim for this study was to gather perceptions about the idea of e-exams rather then evaluating a specific e-exam tool. As such we expected that the majority of students would to respond to questions in a largely speculative manner. The issues covered by Dermo's work included "affective factors" (how students feel about e-exams), "teaching and learning" (how e-exams assist students with their learning), "validity" (whether e-exams are appropriate for specific disciplines), "reliability" (how e-exams accurately assesses student performance), "practicality" (how e-exams are undertaken), and "security" (security of e-exams compared to paper based exams). We also included "production" items identified by Hillier & Fluck (2013) that looked at how students feel about typing instead of

handwriting during an exam and a final “adoption” item asked if students would want e-exams to replace traditional paper based examinations. These items as shown in table 1 were constructed using a 5 point Likert scale with 1 being “strongly disagree”, 3 “neutral”, and 5 being “strongly agree”. We also included two open response items that asked students for 'the concerns they held about e-exams at this time' and for general comments regarding e-exams.

Table 1: 20 items included in the survey along with overall agreement

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

Data Analysis

The Likert scale data gathered as part of the survey were considered to be non-parametric (Jamieson, 2004) and this informed the choice of suitable statistical techniques applied using SPSS v22 such Mann & Whitney’s (1947) U test on the variance of two groups and Kruskal & Wallace’s (1952) test where more than two groups were analysed. Further, Levene’s test for non-parametric data (Nordstokke & Zumbo, 2010) was used to check the homogeneity of variance between the groups. The study by Dermo (2009) supports the choice of using Mann & Whitney’s test in analysing students’ perceptions of e-assessment systems. However, like Demo we do not consider the data to represent an objective truth but rather are indicative of the strength of opinion across the student body regarding various issues. As such we apply statistical techniques to Likert scales as one means of 'sense making' the body of opinion in conjunction with content analysis of open comment responses.

Results

The results are presented in this section in the form of statistics for demographics and Likert scale items. The two qualitative items provided emergent themes and representative comments. A discussion of the results will appear in the last section of this paper.

We reiterate that we sought and received in these results, the preconceived perspectives and concerns of students rather then feedback based on prior experience.

However, we did find a small minority that had experienced some minor use of computerised exams in their courses and we will touch on the nature of this exposure later in the paper. Overall the data gathered represented a body of opinion that would be valuable for institutions contemplating the implementation of e-exams. Such fore warning will allow a range of potential concerns held by students to be considered and addressed in the formulation of a roll out strategy for computerised examinations.

Response Rate

A total of 488 students (37% males, 63% females) responded out of a total student population of just over 48,000. While this makes for a return rate of only 1%, Krejcie & Morgan (1970) state that for a population of 50,000 a sample size of 381 would be sufficient to provide a representative sample in relation to opinions expressed by respondents to a 95% confidence level. However, in this case the sample was not randomly drawn

from this population. Students voluntarily responded to the online survey based on notices posted on the LMS login page and to university specific student social media groups. The survey was open for two months. Further, an internal survey reported in McManus (2012) showed that around 80% of students were accessing the LMS at least weekly. As such it was thought that the risk of response bias with respect to an over representation on the part of students who are frequent users of the institutional LMS and social media groups was reduced, but perhaps not eliminated.

Demographics

Most respondents were undergraduate students between 15 and 19 years of age (38%) and 20 to 24 year of age (52%) with the remainder aged above 25 years. Respondents comprised 27% first-year undergraduate students, 26% second-years and 39% were enrolled in third-year or above. Only 9% of respondents were enrolled as post-graduate students. The students who responded came from a variety of disciplines across the university, which would serve to reduced any skew towards any specific discipline. There were a total of 45 programs represented in the survey however to ensure we reflect the diversity of views of the real world student body in each program (akin to the idea of 'ecological validity' Cicourel, 1982) only programs that had at least 10 students completing each item were included when analysing against this factor (See table 2). An analysis by program is presented later in this paper. It should be noted that students could exit the survey or skip items so the numbers varied slightly with individual questions.

Table 2: Programs with at least 10 respondents

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

Scales

The strength of agreement assigned to each survey item was compared by experience (of e-exams), gender, and program (major) using Mann-Whitney tests. The Levene's test for non-parametric data validated the homogeneity of variance between the two groups for each pair-wise comparison. Items found to have significant differences but that did not pass the homogeneity test have been marked with three asterisks ***.

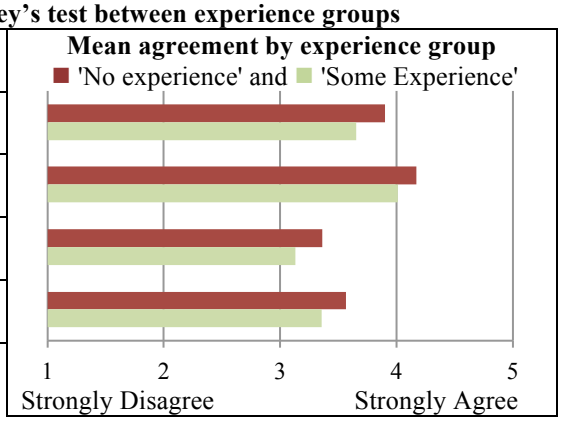
By experience of computerised exams

Students were asked on a 5 point scale to nominate the proportion of supervised exams that they had undertaken at university which were computerised. 294 reported that 'none' were computerised (54.4%), 170 reported 'a few' (34.8%), 13 reported 'half' (2.7%), 5 reported most (1%) and 6 reported all of their exams were computerised (1.2%). Due to the very low numbers for anything above 'a few', students were grouped by those that had 'no experience' (54.5%) and those that had 'some experience' (45.5%) of computerised exams. Students with 'some experience' reported lower levels of agreement that were found to be statistically significant for four questions. The Mann-Whitney's test results for items that showed significant results are presented in table 3.

Table 3: Significant results for Mann-Whitney's test between experience groups

Nn	Ns	U	Sig	Question
285	190	24072	<.05	I prefer typing rather than handwriting essay answers
285	192	24576	<.05	I work more efficiently when I type on a familiar keyboard
262	190	21749	<.05	Doing exams in the campus computer labs is impractical
272	191	23298	<.05	Computerised exams favour some students more than others

Notes: Asymp. Sig. (2-tailed). Only significant results are shown. Nn(no experience) and Ns(some experience) shown.



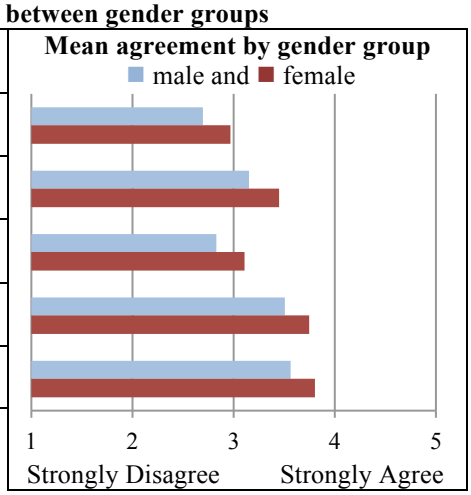
By gender

Results show that females gave stronger agreement ratings than males across the five items where Mann-Whitney's test results showed significant differences (See table 4).

Table 4: Significant results for Mann-Whitney's test between gender groups

N(m)	N(f)	U	Sig	Question
166	278	20778.5	<.05	Using a computer for an exam is more stressful than handwriting
174	290	21460	<.01	Technical problems make doing exams via computer impractical
158	259	17509.5	=.01	The technology used in computerised exams in unreliable
170	291	21653	<.05	I would prefer to use my own laptop to undertake a computerised exam…
177	299	23586	<.05	I get hand cramps when handwriting exams 1.5 hours or more

Notes: Asymp. Sig. (2-tailed). Only significant results are shown. N(male) and N(female) shown.



By major

To measure whether the nature of the discipline in which students were enrolled influenced how students responded we used the Krusal-Wallace test to obtain the mean ranks of each program for each question. Given that a five point Likert scale was used, the differences between each program and its adjacent neighbours in the rank order were small. Given the tight ranking of programs, testing between adjacent programs would not yield meaningful results. Instead we used the top-ranked program (strongest agreement) and bottom-ranked program (weakest agreement) where there were at least 10 respondents in that program. If a top or bottom ranked program had less than 10 respondents then the next available program was used. Mann-Whitney's tests revealed significant differences between the selected programs on most the items (see Table 5). Mean agreement scores for each program are shown for clarity.

Table 5: Significance by selected highest and lowest ranked program

Theme	Question	Strongest agreement	Weakest agreement	U	Sig
Affective factors	Using a computer for an exam is more stressful than a handwritten paper exam.	Biomedical 3.5 (N=24)	Education 2.3 (N=11)	55	<.01
	I am at a disadvantage when undertaking computerised exams.	Applied sci. 2.3 (N=25)	Math 2.6 (N=13)	59	n.s.
Teaching and learning	Computerised examinations are consistent with contemporary learning approaches …	Education 4.3 (N=11)	Mechanical eng. 3.3 (N=23)	59	<.05
	Computerised exams allow me to demonstrate my knowledge in more ways than paper-based exams.	IT 3.6 (N=15)	Civil eng. 2.4 (N=15)	55	<.05
	The potential for immediate feedback with computerised exams could help improve my learning.	Education 4.6 (N=11)	Electrical eng. 3.5 (N=13)	35.5	<.05
Validity	Computerised exams are appropriate for my discipline/subject area. ***	Software eng. 4.4 (N=10)	Math 2.2 (N=13)	11	<.001
	Computerised exams need to include a variety of question types test my knowledge fully.	Math 4.4 (N=13)	Applied sci. 3.3 (N=24)	44	<.001
Reliability	The technology used in computerised exams is unreliable.	Electrical eng. 3.7 (N=12)	Math 2.6 (N=13)	36	<.05
	Computerised exams favour some students more than others.	Civil eng. 3.8 (N=15)	Education 2.9 (N=11)	42.5	<.05
	Paper-based exams are fairer than computerised exams.	Pharmacy 3.8 (N=16)	Education 2.4 (N=11)	23	.001
Security	Computerised exams are just as secure as paper-based exams.	Education 3.6 (N=11)	Social sci. 2.9 (N=10)	28.5	<.1
	It is easier to cheat in computerised exams than with paper-based exams.	Mechanic eng. 3.7 (N=23)	Business 3.0 (N=23)	157.5	<.05
Practicality	Technical problems make doing exams via computer impractical.	Civil eng. 3.6 (N=17)	Business 2.9 (N=22)	120	.05
	Doing exams in the campus computer labs is	Electrical eng.	Chemical eng.	33	<.05

Theme	Question	Strongest agreement	Weakest agreement	U	Sig
	impractical.	4.0 (N=13)	2.9 (N=11)		
Production	I prefer typing rather than handwriting essay answers.	Education 4.5 (N=11)	Chemical eng. 3.5 (N=11)	30	<.05
	I work more efficiently when I type on a familiar keyboard.	IT 4.5 (N=15)	Math 3.4 (N=13)	50.5	<.05
	I would prefer to use my own laptop for exams rather than use equipment supplied …	Applied sci. 3.7 (N=24)	Civil eng. 3.6 (N=15)	174.5	n.s.
	I get hand cramps when handwriting exams 1.5 hours or more. ***	Electrical eng. 4.4 (N=10)	Software eng. 2.8 (N=13)	24.5	.01
	I would like to be able to type answers in an exam.	Education 4.4 (N=11)	Civil eng. 3.9 (N=18)	23	<.001
Adoption	I want computerised exams to replace paper-based examinations at university.	Education 4.0 (N=11)	Civil eng. 2.1 (N=15)	23.5	.001

*Notes: Exact Sig used [2x(1-tailed Sig.)]. Sample means agreement shown for clarity. Programs where n was 10 or more. Items denoted by *** did not pass Levene's test.*

The questions with the most significant divergence of opinions are illustrated in Figure 1. We see that there is a reasonable spread of programs either side of the overall mean. Particular programs tend to appear in similar positions with regard to agreement about the virtues (or otherwise) of e-exams. Education, IT and software engineering tended to favour the idea of e-exams while disciplines were hand drawn diagrams or long hand formulae were more common such as Maths/Physics and various engineering majors tended to favour the pen-on-paper approach.

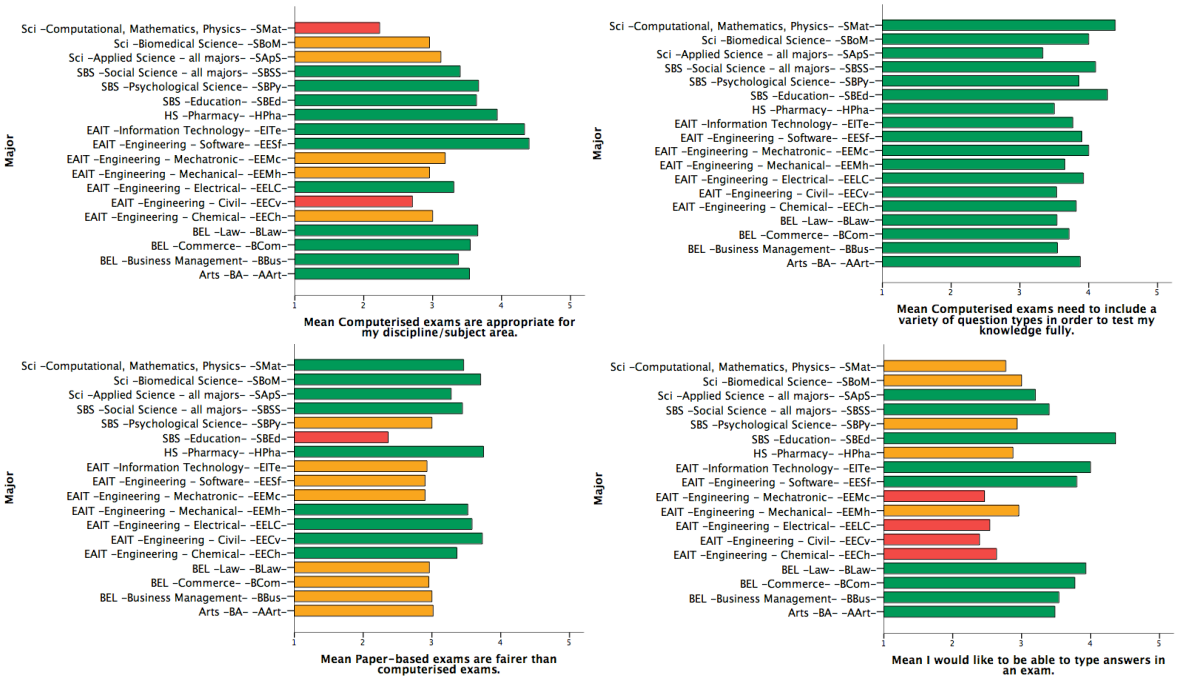


Figure 1: mean agreement by program for highly significant divergence of agreement.

By year of program

The responses to each item were grouped by program level (first-year, second-year, and third-year) and the level of agreement compared using the Kruskal-Wallis's test. It was found that there was no significant difference across any of the survey items.

Open comments

There were 285 students who offered additional typed comments about 'their concerns regarding computer-based examinations'. The comments were analysed and grouped into themes. The emergent themes and typical comments are shown in table 6. It should be noted that students frequently commented on multiple aspects. We found that technical reliability, cheating, system security, and computer literacy were often mentioned together.

Table 6: Emergent themes regarding concerns held about computer based exams

Theme	N	Example comments
Technical reliability	99	Technical reliability frequently revolved around software errors: "Trouble logging in, losing all progress (not being saved)" - *male, civil engineering, no e-exam experience* "Making a computer based mistake that may void the exam (like pressing submit accidentally)" - *female, nursing, no e-exam experience*.
Cheating	76	Cheating was perceived to occur through (1) ability to look at the answers on the screens of other students and (2) insecurity of a computer-based examination platform: "There also is a greater risk for technical problems as well as unfortunately people figuring out ways to get around the system" - *female, software engineering, some e-exam experience*. "How would plagiarism be prevented? Easier to look over someone's shoulder at a laptop screen that is raised up than it is to look at a paper flat on the desk - specific desks or dividers would be needed." - *male, arts, no e-exam experience*
Match with discipline	49	Many students commented that computerised examination were not always appropriate to aspects of their discipline while others wanted it 'yesterday'. Rigidity of marking was also thought to be flaw of some computer marked questions: "It is too difficult in a biomedical science major to have fully computerised exams as too many questions rely on drawing diagrams within the answers. However for long essay questions where no diagrams need to be included or for multi choice, computer based would be preferable." - *female, biomedical science, some e-exam experience* "Coding based subjects in particular are in desperate need of computerised final exams. 60-70% of your overall grade in a subject teaching you how to program on a computer comes down to being able to hand write the general form of it on paper in an exam. It's stupid and proves absolutely nothing about your ability." - *female, mechanical engineering, no e-exam experience* "It is just plain stupid when a computer marks you 0% for an answer of 39.64 when it wanted 39.642. If a real person had marked that he would of just taken a small mark off for improper significant figures." - *male, computational, math, physics, no e-exam experience.*
Keyboarding prowess	42	Many students reported concerns around keyboarding prowess such as (1) differences in typing speed, (2) familiarity with keyboard, and (3) sound of keyboard processing: "My typing speed is poor. I only use two fingers and would struggle to complete an exam in the time available different keyboards- makes me slower if its [sic] a different key board"- *female, social science, some e-exam experience* "Computerised exams would be distracting - the sound of a hundred or so students typing and clicking would be incredibly frustrating!" - *female, arts, no e-exam experience*
Computer literacy	20	Several respondents made the connection between computer literacy and equity. "Some students may not be able to afford their own laptops or computer for their exams and may have to use those supplied by the university. Therefore, they may not be as proficient in computer skills, typing, MS word functions, etc because they may not use computers as often as someone who owns there [sic] own and may be disadvantaged simply because they cannot afford a computer" - *male, law, no e-exam experience* "...A Gen X/Baby Boomer can go to as many computers-for-dummies classes as they can fit in the rest of their life, but they will NEVER be at the same standard as a Millennial who has grown up with a computer" - *female, arts, no e-exam experience*

The final question sought general impressions on computerised examinations. Both advantages and disadvantages were discussed. Students perceived advantages to include the improved ability to edit their responses as they went, taking advantage of their typing ability, and improvements to the readability of their answers. Some illustrative responses from students include:

> "Most people can type a lot faster than they can write which would allow students to think about their answers more and worry less about physically having the time to write down the answer." - *female, law, no e-exam experience.*
>
> "It is much easier to edit answers when typing than writing. Answers will be a lot neater and easier for examiners to read using basic mathematic software tools, even as simple as excel, could dramatically decrease the amount of time spent correcting minor mistakes (such as forgetting to carry a negative sign down to the next line of working), and allow students to spend more time on demonstrating understanding and comprehension than focusing on minor details." - *male, mechanical engineering, no e-exam experience.*

The practice implications of the findings above are discussed in the following section.

Discussion

The most robust relationship observed was between the enrolled program (major) and rating. Students from computer-based disciplines such as software engineering or information technology and from the Education program provided the strongest endorsement for computerised examinations. Given that in IT programs the main the object for the program is ICT use this is not surprising. Indeed we received complaints about having to handwrite software code in current pen-on-paper exam situations. This highlights the deepening divide between current exam practices and the needs of the IT discipline in particular. In contrast, students from disciplines that utilised a lot of hand-drawn diagrams and long form equations such as biology, chemical engineering, civil engineering and mathematics were the least enthusiastic towards computerised examinations. The more text intensive disciplines in business and social sciences were somewhere in the middle in terms enthusiasm for the idea of e-exams. The open comments from students further re-enforced such specific needs among students from different disciplines. This would strongly suggest that the implementation of e-exams would need to be tailored to the nature of the assessment undertaken in various discipline areas. Further that certain discipline areas are more 'ready' than others for the introduction of e-exams. It would appear that from the student's point of view that tasks involving drawing and long form mathematical equations are least conducive to computerisation while text intensive tasks and those such a computer programming would benefit immediately from the introduction of computerised examinations.

These findings revealed only a tenuous relationship between prior experience and rating in that only a 4 of the 20 items showed any significant difference. These results are not surprising given the very low level of prior use of computerised exams. However, the few items that did show a significant divergence of opinion were items that related to typing preferences and reliability. In particular, students with no experience of e-exams agreed that they would prefer typing rather than handwriting answers and that they worked more efficiently on a familiar keyboard than students with some prior experience of e-exams. It appeared that students with no experience were more positive towards the idea of e-exams in the form of essay questions than students with ‘some experience’. However it is worth highlighting that 80% of the students who were classified as “students with experience” had taken only a small proportion of supervised examinations in a computerised format. Such little exposure as it was in this particular institutional context was characterised by the informal and ad-hoc use of ‘take home’ online quizzes for grades in their courses. The majority of academics who assign these computerised quizzes in their course utilise an institutional LMS that was not designed for the task of exams. These factors, outside of our control, may have led to negative experiences rather than facilitating a better testing experience for students. The examination of open comments revealed a relatively frequent occurrence of comments relating to ‘cheating’ in online quizzes. These findings re-enforce the notion that academics need to be mindful that tools that work in a formative self-evaluation context may not work in a summative context. The careful choice of technology tools, planning and management of high stakes e-assessments is just as important as it is for the operations of traditional paper-based examinations. Studies such as Ogilvie, Trusk, and Blue (1999), Walker et al (2008), Jimoh et al. (2012) and Mogey and Hartly (2012) that gathered data post-exam on the attitudes of students in thoughtfully implemented e-exam projects. All found positive feedback, which lends support to the idea that inadequately supported and inappropriate use of e-quizzing tools may cause more harm than good. Further those who are just starting out with e-exams are on the earliest part of the learning curve may report experience levels of stress and difficulty in these early stages. This supports the importance of providing additional support to students and academics in the introduction phase. As academics and students gain exposure, experience and learn to overcome the initial difficulties, they may well be more likely to adapt, adopt and realise the benefits of e-exams. This remains a working hypothesis, so future studies investigating the influence of differing levels of e-exam experience may shed light on the apparently contradictory results we obtained in comparison to these other studies.

The concept of 'fairness' was a concern expressed by students that manifest across multiple dimensions. This current study found that students with no experience of exams believed to a greater extent that computerised examinations favoured some students more than others. Those with ‘some’ experience of computer based testing thought it was less of an issue. Through comments, students voiced a range of concerns regarding cheating via pragmatic means (i.e. being able to see the screens of other students, or being able to communicate with each other) and technological means (i.e. the fear of students 'hacking' into the assessment platform). The ownership of computers, familiarity with computers, and typing speed were also listed as issues that students thought might lead to some students being more advantaged than others. As is the nature of preconceptions these issues do need to be addressed via justified argument and via concrete action. Students with concerns about their unfamiliarity with computers hindering their performance may be reassured by studies such as Leeson (2009) who found no difference in the test results of highly experienced users when compared to less experienced users of computers. However these comments are useful triggers to remind planners to address student concerns about fairness. The introduction of practice sessions so that students may become familiar with the technology and an equity or loans program for the provision of computer equipment may be required to ensure all students have

adequate preparation. Further, the design of the testing environment needs to take into consideration the impact of the use of computers verses that of pen-on-paper. For example, the vertical position of a computer screen when compared to horizontal orientation of paper on a table was a point recognised by students via their comments. Dermo (2012) found that the problem of the visibility of other screens can be addressed by altering the arrangement of tables and chairs. Other measures such as the placing of dividers or portable polarised overlays on computer screens may also need to be considered. Similarly the issue of the noise generated by typing may require the separation of typists from those still hand writing or the use of sound mitigation, such at felt on walls or portable sound absorption screens in exam venues.

The relationship between gender and agreement ratings was interesting in that the statistically significant differences in ratings between males and females all revolved around technical aspects (i.e. “technical problems make doing exams via computer impractical”). A previous survey by Haywood et al. (2004) on ICT use at university found females reported needing more assistance and having less confidence than males. This appears to support the findings in our study where females perceived greater stress than males in regard to the idea of computerised exams as well as the greater preference by females for the use of their own computers. Similarly Terzis and Economides’ (2011) study on the acceptance of computer based assessment also found differences due to gender that indicated usability and ‘support’ were more important factors when it came to females accepting the system. Such factors as improved usability and support are likely to serve as antidotes to technical complexity and e-exam system designers should consider these in developing their approach.

Conclusion

This study was conducted prior to any formal e-exams trials and was done so with the intention of uncovering pre-conceived ideas held on the part of students with regard to the idea of e-exams. To the best of our knowledge this is the first such study investigating the preconceptions of students on e-exams conducted on such a scale, across a broadly multidisciplinary population.

Overall the results showed that students were cautiously optimistic about the idea of e-exams and about being able to type their answers in an exam. However students were also attuned to the nature of the assessment tasks in their discipline and how the idea of an e-exam might fit within that context. This lead program clusters such as education and software engineering to come out more strongly in favour of e-exams while others such as chemistry, mathematics and biology were more reserved. Students expressed a variety of pre-conceived concerns the most prominent of these relating to the fear of the unknown manifest in the risk of technical failures and cheating. Such preconceptions will need to be addressed by planners and system designers.

These findings offer valuable points of reference for the future implementation of a comprehensive e-exams approach. The particular discipline areas in which e-exams would be more readily accepted by students are useful starting points. Given the overall diversity of concerns expressed in these findings it also highlights the complex nature of the e-exams problem. It is therefore suggested that a 'whole of system' approach covering process, policy, professional development, stakeholder involvement as well as careful technical design will be required in order to move towards a computerised examination environment.

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NOTE: This is a pre-press version.