A pedagogical end game for exams: a look 10 years into the future of high stakes assessment

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This short paper looks ahead 10 years to a possible future for high stakes assessment in Australian higher education. The authors discuss some of the drivers pushing towards this future along with desirable operational features and pedagogical capabilities of an e-exam system for the year 2025. This paper represents a vision or road map to which a newly established, half million-dollar, Australian Government Office for Learning and Teaching national project on e-exams will be contributing over the next three years.

Keywords: high-stakes assessment, forecasting, futures, e-exams

Teaser of the Future

The future of exams needs to be a fully open affair.

This is a controversial statement in the context of the capabilities, mind set and technology available today.

Imagine a future in which students are able to demonstrate their capabilities using a full range of twenty first century ‘tools of the trade’. They will be assessed in a manner that mimics, or is embedded in, the real world problem solving environments they will face in their work and social lives. Yet it provides for the strong integrity and assurance of contemporary high-stakes supervised examinations. Imagine that students will readily be able to gain access to the vast storehouse of information, tools and contacts available in the contemporary networked world.

But this is easier said than done. Such highly authentic assessments (Crisp 2009, Herrington, Reeves & Oliver 2010) would provide students an opportunity to demonstrate their twenty first century abilities (Binkley et. al. 2012) in a very realistic, contextualised environment, but questions of fairness may well persist if appropriate frameworks are not established.

Back to Today

The world of today is awash with information sources, some high quality, the majority less so. Never the less, people facing problems in their daily life and work are able to draw upon a wide range of information and social resources. The technology to allow students to access these resources instantly is available to us today, but for educational authorities such access currently represents a significant threat to the integrity and validity of the assessment process, particularly at the high stakes end of the spectrum. An 'open borders' examination system would provide no comfort and assurance to educational testing authorities. The problem of bringing real world authenticity to the domain of high stakes testing currently seems insurmountable and we persist with locked down, limited, paper based or selected response examinations that get further away from the reality of practice of the 21st century every day. Forays into the world of technology enhanced high stakes assessment currently available largely replicate paper-based exams in a digital format; either 'armoured word processors' or glorified multiple choice quiz tools with limited pedagogical flexibility that only slightly expand the landscape of possible assessment activity. Call it "paper 1.1".

Worse still, almost all solutions available today send institutions down a pedagogical and technological cul-de-sac with closed and 'black box' solutions that lock institutions out of the very data their own students produce. It is just this kind of data from which the most successful enterprises are increasingly mining insights to improve effectiveness, efficiency and spur innovation. Closed systems, while 'neat' and available today, are sacrificing opportunities for the future use of such data. In an increasingly data intensive future this could prove costly to institutions who choose ‘closed’ over that of open-standards based approaches.

Forward to the Future

Instead, imagine a future in which authentic, complex and even 'wicked' problems can be set for students to address. A future where the 21st century 'tools of the trade' are provided to students to utilize as they see fit in constructing their responses. Imagine that all touch points a student makes in the information galaxy during the

problem solving process can be known to the examiner. Where each student's progress in solving a problem is captured in detail; where all sources, contacts and decision points are logged, mapped and presented in an easy to comprehend display, allowing examiners to see into the analytic mind of the student in order to assess their ability in solving real-world, wicked problems. The teacher will be presented with a graphical representation of the interactions in summary format, with drill down capabilities. The temporal dimension of student decision making and problem solving during the course of the assessment will be mapped and displayed with gains in marks or decision points made explicit.

Varying degrees of automated or computer assisted marking will be available. Each problem set, question and fact presented to the student will be recorded, banked and tagged against a set of desired learning outcomes established by the institution. Program leaders and students will be able to see their progress towards personal and program learning goals as part of an overall educational analytics platform, of which e-exam performance data will be just one part.

Program designers, teachers and managers will be able to conduct skills audits of assessments. With wider curriculum mapping and performance modelling in place, changes to assessments or curriculum will be reflected in the models of likely impact on learning outcomes and student performance. Students will be able to gain insight into their progress across a range of learning themes and 21st century skills. Assessments can be adaptive, modifying successive challenges as students progress.

Teachers will gain insight into the performance of the very questions and problems set for students with the use of a range of statistical analysis approaches, all displayed in an easy to comprehend graphical display. Problematic questions will be highlighted for review and effective questions promoted to the top of the pile for sharing with other educators. The quality of questions developed will be reviewed prior to the exam via a secure online, integrated exam development, quality control and review process resulting in fewer errors and misunderstandings in the exam room.

Computerised administrative processes for exam management will be made usable by non-technical administrators and teachers. A thoughtfully designed, open-technology based exam platform will enable scalability from the smallest classroom to the largest institution, so all in the community are able to benefit from advances in assessment techniques and technologies.

Unknown futures will be catered for by storing data in 'open standards-based' secure store houses. This will ensure institutions will have future access to fine grained data that will facilitate the growth in learning about student performance, data and the evolution in analytics and presentation tools not yet known. As time goes on, deeper insights into student performance will be enabled by complete access to the response, action and click streams of each and every student's engagement with each and every question, fact and resource.

Institutional policy may well still direct the release of marks, but the technology will greatly improve the timeliness of feedback from high stakes assessments. Feedback cycles will be streamlined such that computer marked items could provide instant feedback, while non-computer assessable items will be streamed to suitable or available markers. These markers will not need to diagnose increasingly messy student handwriting, and will be able to provide customised-on-the fly feedback based on a library of shared comments from colleagues. Moderation via linked systems will improve the consistency by which marking schemes are applied.

Getting There

The future outlined in this short paper is driven by a range of factors in the contemporary higher education world (Hillier & Fluck 2013). Added to this, the 'massification' of higher education has meant that a bachelor degree is the new high school. In Australia 28% of the working age population have bachelor degrees or greater as of 2014 (ABS 2014). This is up from 21% in 2004. Similarly young adults aged 18-34 years are now much more engaged in higher education. For example in 1976 only 5% had a bachelor degree or greater, while in 2011 this had increased to 26% (ABS 2013). This vast increase in numbers has placed enormous pressure on higher education institutions to provide a quality education to larger class sizes at a time when per student funding is decreasing in real terms (Universities Australia, 2015, p. 7).

The contemporary internet makes knowledge easily available. Higher education institutions have long since lost their monopoly on information. Instead universities need to play to their strategic strengths and expertise in critiquing knowledge. We guide students to acquire a critical mind, to analyse problems and assess the capabilities of students to perform against the criteria and standards suited for the world of the 21st century.

Achieving this vision is indeed a truly 'wicked systems problem' (Rittel & Webber 1973, Ackoff 1999). A complex 'wicked' systems problem is an adequate metaphor for the 'problem' of e-exam implementation because there exists wide range of stakeholders and perspectives acting on the problem domain (Linstone 1999). These perspectives come from both within and external to institutions and include, university and government policy makers, institutional managers, students, teachers, finance, human resources, examinations officers, learning designers, parents, employers, technologists, campus facilitates, buildings and maintenance services. A national project (Transforming Exams 2015) has been convened in Australia to examine the problem in detail with plans to develop and pilot procedural and technical solutions in Universities. The project is located in most states and territories of Australia and will range from research intensive to teaching focused, from metropolitan to regional institutions over the period 2016 to 2018. The national project will continue work started at the University of Tasmania (Fluck, Pullen & Harper 2009) since 2007 and later at the University of Queensland via an OLT seed project in 2013-2014 (Hillier & Fluck 2014).

The strategy developed to enable implementation of this 10 year plan is one of evolution rather than revolution. Procedural, policy and technological change of this magnitude would face overwhelming resistance unless all stakeholders are brought on the journey together. A transition strategy is planned of a gradual introduction and iterative development from paper-replacement to post-paper supervised exams to eventually arrive at an open borders approach to high stakes assessment. The process aims to address embedded cultured attitudes. 'Hearts and minds' must be won, professional development offered and technology infrastructure developed that meets a range of pedagogical, stability, efficiency and validity needs. The road map to this possible future is outlined in Table 1, starting with where we currently are, and through a gentle ramping up of technological, process and cultural change.

Table 1: A possible road map to the future of high stakes assessment

	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

	About now	2015-2020	2020-2025	2025 and beyond
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.

It must be acknowledged that computerised and online exams already exist in the market but these are rarely used in higher education. They are generally limited in their pedagogical capabilities. What we are prosing is an e-exam 'platform', not just an application or web service. We argue that to provide the full set of 21st century tools a 'whole computer environment' needs to be made available to each student, initially with no or restricted connectivity, but with a view to fully open, internet connected exams with comprehensive logging and auditing.

However, this vision is not pie-in-the-sky. The Tasmania Qualifications Authority has already moved beyond paper-replacement and post-paper examinations to utilise open, Internet connected examinations leading to Australian tertiary assessment ranks for Year 11/12 candidates (TQA, 2013). Marking was conducted electronically via iPad. Internationally, Finland is implementing a national 'Digabi' project to make all matriculation examinations digital by 2019 (Von Zansen, 2014).

Conclusion

Australia stands on a cusp for high stakes assessment. Institutions cannot afford to invest in fleets of computers reserved solely for semi-annual testing. Bring your own device (BYOD) solutions are therefore critical to this cultural transformation, bringing challenges of validity and reliability. But the prize is worth striving for, making academic awards more credible, and carrying the opportunity to reform curricula with powerful software tools. Further information on the national 'Transforming Exams' (2015) project is available.

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