CAN TERTIARY E-ASSESSMENT CHANGE SECONDARY SCHOOL CULTURES?

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Abstract

Tertiary eAssessment has a crucial role to play in secondary schools. This paper reports on a pilot project which replaced written examination papers by CD-ROMs. Whilst the traditional supervised fixed-time assessment process was preserved, students were able to use modern digital technology to create text and graphical (drawing) responses, without collusion. The paper suggests that such innovations at the tertiary level of education may eliminate barriers to transformation of schooling through ICT at the secondary level.

Introduction

"If the exam is on paper, then that's how we'll teach!" Australian secondary schools are trapped between policy pressures to use computers in classroom practice, and the reality that students progress into universities where hand-written examinations are crucial. This paper addresses a barrier to change in schools by demonstrating how university examinations can be transferred onto computers. This transition makes sense for tertiary students, since much of their learning is conducted using online materials blended with face-to-face activities (Mogey, 2006). Winkley & Osborne (2006) have written about the distributed development of item banks and reticulated examination setting, but also note:

"In the UK, our experience is that first generation e-assessment projects generally start with replication of existing paper processes (this applies to both the test development and test delivery phases)."

Such an approach addresses misalignment between learning and assessment technologies (Ashton & Thomas, 2006) and is therefore more likely to gain acceptance. Thus it was adopted for the pilot project described below.

Literature

Tertiary assessment as a barrier to ICT in schools

"There is cautious ground for optimism [about ICT in schools]. 83% of teachers interviewed in schools said that they believed that ICT can raise standards. *Yet, we wonder, why is this a belief instead of a reality after the investment of so much in terms of both money, time, commitment and energy in ICT over the past twenty years?*" (Reynolds et al., 2003)

There is a clear problem in schools where policy drivers promote the use of ICTs but the reality of classrooms mitigates its impact. If Australian schools are to aspire to the transformative uses of computers, they need assurance this will not impede pupils as they pass into tertiary studies. The transformational role of ICT in schooling has been underlined by the four types of use identified for the Australian government (Downes *et al*., 2002, p.23):

- Type A: encouraging the acquisition of ICT skills as an end themselves
- Type B: using ICTs to enhance students' abilities within the existing curriculum;
- Type C: introducing ICTs as an integral component of broader curricular reforms that are changing not only how learning occurs but what is learned;
- Type D: introducing ICTs as an integral component of the reforms that alter the organisation and structure of schooling itself.

Pervasive high-stakes hand-written examinations in the tertiary sector are a major disincentive for changing current text production methods in schools.

If ICT use in schools is restricted to Types A or B, then the full benefit of high technology investment will be limited. However, for uses corresponding to Types C or D, school cultures will need to change markedly. This transformational view of ICT in schools requires a rethink about curriculum content, the applicability of previously established learning outcomes and criteria to the future lives of student, and even the structure of schooling itself (Fluck, 2003; Fluck, 2005; Tinker, 2000).

This project hypothesised that transformational thinking in schools is inhibited by a range of factors from teacher skill with ICT, infrastructural capacity, cultural inertia, perceived equity and curriculum constraints (Enerson, 1997). At other levels, such as awarding bodies, return on investment uncertainties and candidate authenticity are among the barriers to acceptance (Chapman, 2006). One critical inhibitor was considered to be school sector attitudes to formal assessment processes, particularly those associated with pre-tertiary qualifications and beyond to undergraduate examinations. This was given credence by the operations manager of the Tasmanian Qualifications Authority who related discussions with 'laptop' schools, in which all pupils have a personal computer. These schools have not lobbied for pre-tertiary

entrance examinations to be undertaken using computers, because they know students need experience in the hand-written testing they later encounter in University assessments. This can be seen as a crucial attitudinal obstruction for the adoption of ICT-dependent information handling in schools.

By providing tools to eliminate this inhibiting factor in a small range of cases, there will be an opportunity to study the potential of ICT in schools that are subsequently able to change their cultural approaches. This has been demonstrated by a recent trial in Victoria, Australia which allowed Year 12 (age 17-18) students to complete English examinations using computers (Maslen, 2004). The author's personal conversation with those involved suggests that students who were previously regarded as having illegible handwriting - a very large proportion of adolescent males - did exceedingly well in the keyboard environment.

Online or Offline?

As a lecturer in a pre-service teaching course, I have noted the displacement of supervised examinations by unsupervised home assignments, to the point where less than 10% of student grades in some degree courses derive from rigorously identity authenticated assessment. Students receive mixed messages from school and university assessment, where much is done in collaborative team settings, and these are not easily distinguished from work required to be completed individually. Students assigned a personal online quiz have been observed gathering a team of friends to assist in the completion of the assessment. The online nature of the process appears to blur the line between collaborative and individual assessment, since the examiner has little control of the context in which it is undertaken.

This emphasis on online learning is often accompanied by the requirement for students to submit assignments which have been printed rather than handwritten. Lecturing staff are gradually moving into a multi-media mode, and some are asking for the submission of assignments on CD-ROM or to a content management system. This digitalisation of tertiary learning has not been matched by internal examinations. Sometimes these examinations are considered 'high stakes', as they represent up to 70% of the total mark for a unit being studied. The University of Tasmania has a well orchestrated examinations system: exam halls are booked; papers are securely drafted, checked and printed; furniture is moved into place; exam periods are invigilated by employed supervisors; papers are securely distributed for marking; and results collated for posting. Very little technology is allowed into the examination hall. Mobile phones are banned, calculators are required to be identified on the exam paper, and a few dictionaries may be permitted. One of the consequences is that local physiotherapists do extremely good business during the examinations. It is quite evident that students are put under increased stress because of the nature of the handwriting process required, which is so very much removed from the rest of our teaching and learning practice.

Strategic importance of eAssessment

ICT and associated skills are seen as strategic, and nationally important for economic, pedagogical and social reasons (Hawkridge, 1989). The Australian Information and Communications Technology in Education Committee AICTEC (2006) has recognised the strategic importance of eAssessment in its detailed report on an identity management framework, noting "the effective management of e-Education including the areas of eLearning, eAssessment and eReporting between providers, learners and parents (in the case of learners in the compulsory school years). The importance of this issue at a national level has been increasingly recognised in the work undertaken by a range of national groupings and initiatives - e.g. AICTEC, the Education & Training Statistics Advisory Group and the Student Mobility Working Group." Similar sentiments have been expressed by the UK Department for Education and Skills [DfES] (McGill, 2006).

When it comes down to it, the value of a certificate from a learning institution is worthless if it can be obtained by an individual who has completed less than the entirety of the accredited programme. The pathway taken in this pilot project has been to suggest an intermediate solution for eAssessment enabling proctored examinations to be taken using CD-ROMs instead of printed examination papers.

Why go for an offline solution? There are two reasons. The first is that current proprietary web-based testing solutions such as Exambient (Blackboard, 2007) or Software Secure Securexam (SecureExam, 2007) require responses to be formed within the browser context or using producer-defined applications. Therefore the choice of software candidates can access is severely limited to those tools provided by the testing environment web-page. This is not acceptable if students are to really demonstrate their expertise using a wide range of popular software tools such as Audacity (audio editing), The GIMP (image manipulation), Mathematica (mathematical analysis), FreeMind (concept mapping) and other highly complex applications. The second reason for choosing a CD-ROM based solution was the flexibility it gives examiners for making the decision about connectivity. One paper may use a CD-ROM stripped of all internet connectivity software functions, forcing candidates to use the facilities of the isolated workstation. The afternoon paper on the same computer may allow access to a selection of five critical web-sites. By configuring these options when the master CD is created, the decision is left to the examiner.

This is not a solution to the difficult problem of online identity management in certification situations (Fluck, 2005b; Pescaru & Holotescu, 2002), but only a step towards it. The system described in this paper is for proctored or supervised examinations, where the identity of candidates is verified by reference to documentation upon entry into the examination room, and where inter-candidate communication is strictly monitored and generally forbidden. A more general solution for examinations outside this on-site context using may emerge from this proposal, and a combination of approaches involving biometrics (UK Passport Office, 2004), third-party proctoring and a controlled

IT environment might be subsequently developed for completely on-line testing.

Study

Most computers have at their core an operating system and applications stored on a non-volatile medium such as a hard disk drive. When the computer is switched on, this set of instructions is loaded into RAM and subsequently controls the machine's behaviour. An alternative is to provide a complete operating system on CD-ROM, a medium which cannot be altered during the examination. At least three such systems are available: Lindows, Knoppix (Knopper, 2004) and Ubuntu. They can be used on almost any modern computer (Mac or PC) just by inserting the appropriate disk and switching on the computer. When everyone is using identical copies of the same CD-ROM, the result should be equitable. These systems (others may be available or could be created) are open-source (Fluck, 2004a; Office of Government Commerce, 2004): therefore students can legally be given copies to take away and practice with, facilitating their familiarity.

Over the past two years a small pilot project at the University of Tasmania has provided proof-of-concept. In brief, we have been able to assess a cohort of 167 students using an on-computer examination system. Students were issued free copies of the examination system to boot their own or a Faculty computer from (without the paper!) a month beforehand to enable them to become familiar with the environment. This allowed the students to spend considerable time practicing with the examination environment since the CD-ROM was built from open-source components. This built personal confidence and ironed out some initial problems well before the examination day.

On the day of the test, computers in a conventional laboratory were started from copies of the same CD-ROM containing a 'live' operating system and the examination file. The 'live' operating system CD-ROM provided us with an environment which was pre-engineered to suit the circumstances of the examination. On such a CD-ROM we can prepare an operating system which has no network functionality, no tools for inspecting the local hard disk drive and no other software except that strictly required for the examination. The environment we selected included Open Office (which is similar to Microsoft Office), and a program called 'GIMPshop' which compares with Adobe PhotoShop for image manipulation. Since these applications use open file standards, the response files produced will be accessible over a longer time span than alternatives using proprietary formats, as required by the National Archives of Australia (Zymaris, 2004, p. 26). The preparation of this CD-ROM is analogous to the printing of an examination paper.

The questions were fairly unremarkable, being almost exactly the same as one would expect on a conventional examination paper at this level. The topic was classroom pedagogies using ICT. Figure 1 illustrates some typical questions. They were a mixture of short answer, image manipulation, and attitudinal types. Only a few were of the knowledge-based multiple choice

variety. This flexibility to provide an examination close to the paper-based original, but encouraging the use of sophisticated software tools was hoped to produce a test of high-level thinking whilst retaining the digital environment to which students were accustomed.

Question 7:
What are the dangers of a ‘Cut & Paste’ culture?

Question 10:
How do robots provide an example of ‘Problem solving’ with ICT?

Question 22:
Describe one way to create an animation, and one reason for using this technique in a teaching setting.

Question 26:
How do you suggest a student with no arm control take national literacy tests?

Question 33:
Concept-mapping software can be used to visually plan a unit using a theme-based approach. Provide a diagram which shows the start of such a plan.

Question 32:
If you had 4 classroom computers, show where they would best be situated in the room below:

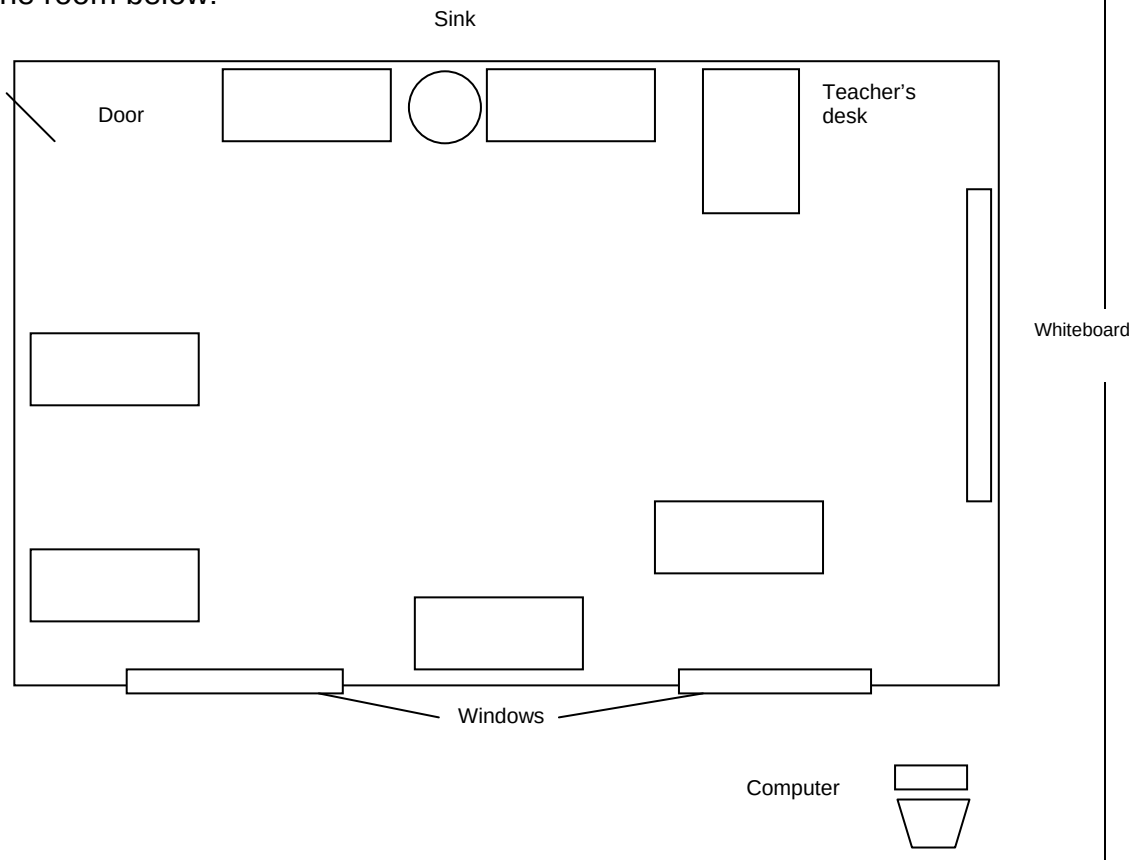

Figure 1: Sample questions from pilot examination

The inclusion of a unique artistic feature on the desktop background for each examination helped non-technical supervisors ensure the correct operating environment was present on each candidate's computer. In the pilot, the computer file of the examination question paper was loaded onto the desktop using a USB data-stick, but in future years we will pre-burn this onto the 'live' CD-ROM. In a similar way, we collected completed scripts using another USB data-stick. They were burned to CD-ROM for archival and for shipping to the external marker. We found the system extremely reliable, and resilient to operator error or equipment failure. The auto-saving aspects of OpenOffice allowed us to retrieve, virtually intact, the work of two students who had this kind of problem.

The results of the pilot were highly encouraging, with all candidates submitting completed scripts in digital format. These were marked externally, and the results returned as a spreadsheet. Anecdotal evidence from student remarks indicated they did not like the timed nature of the assessment (many carry-home assignments do not have this limitation), but did appreciate the opportunity to use a computer for a formal test "because it makes sense". Compared to a related assignment (on teaching through animation) in the unit, the computer-based examination was slightly harder, with fewer students getting higher grades (see Table 1).

Table 1: Numbers of students with each grade

	Reverse cumulative grades on computer-based examination	Reverse cumulative grades on related assignment
Fail	100%	100%
Pass	100%	96%
Credit	86%	84%
Distinction	34%	58%
High distinction	12%	23%

These figures are not in themselves evidence for the efficacy of the computer-based examination system, but assure us that it is sufficiently resilient to give results comparable with other assessment techniques. Since this was a new unit, comparison with previous years was not possible; nor was a split cohort using different testing regimes possible on equity grounds. A future use of the technique might be ethically approved if students self-selected between different modes of taking the same assessment.

Discussion

Text creation in examinations

This study illustrates the strategic problem posed by formal assessment methodologies; and hence the importance of providing a reliable and resilient system whereby undergraduate assessment can use the computer as a principal text-creation tool in examinations. To do so will allow other areas of

education to use similar methods. Conversely, so long as first degrees are awarded primarily on the basis of hand-written exams, this will remain the de-facto standard for all areas of schooling.

Whilst some US law schools administer examinations taken on tablet computers, they still distribute the questions on paper (Augustine-Adams et al 2001). This project eliminated paper completely from the assessment activity, yet provided potential opportunities for candidates to use their own laptops, university desktops or a suite of special-purpose computers.

This pilot study established the proof-of-concept for an open-source system to replace printed examination papers by live operating system CD-ROMs. In a non-networked environment, collusion was suppressed, but this did make the collation of completed scripts more difficult. In the future, the excision of networking drivers from the CD-ROM may be adjusted and allow internal submission to a local server. This could be controlled by physically unplugging from the local router any cable leading elsewhere.

Cultural Transformation

Figure 2 illustrates the anticipated effect of tertiary eAssessment on student writing behaviour over the course of an academic learning pathway. The solid line below represents anecdotal evidence and the literature. The anecdotal evidence suggests that pupils in schools are increasingly allowed to submit assignments and homework in printed format as they progress through the school system. Talks with teachers in the primary sector emphasise the need for pupils to concentrate on and develop good handwriting skills at an early age, hence the gradual increase in machine-mediated text production. Externally moderated examinations in Years 11 and 12 and undergraduate degrees are currently required to be completed using handwriting – hence the annual dips. Currently, choice of a computer as a writing tool is impeded by high stakes examinations from Year 12 (age 18) to completion of a Bachelor's degree. If we are successful in removing this barrier to innovation, students will be able to choose the appropriate writing tool for any given task more freely. This will facilitate curriculum transformation through ICT across the breadth of diverse subject areas taught in the period of compulsory schooling.

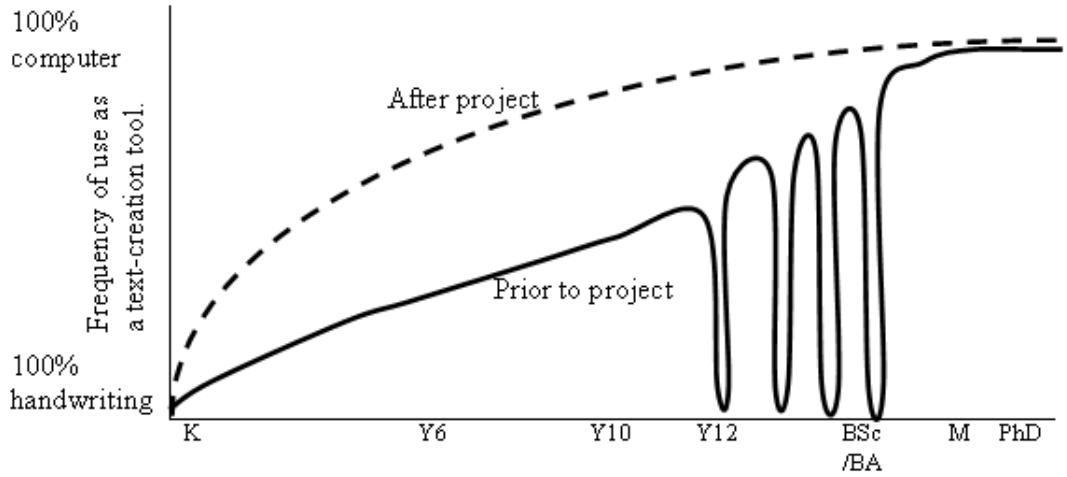

Figure 2: Anticipated student writing behaviour

Conclusion

Future activities could involve the comparison of schools which feed students into the same university. Laptop schools or those with a significant investment in ICT may be more likely to transform their curriculum delivery if the tertiary institution exhibits a receptive tendency to students versed in that medium.

Some supervised forms of written assessment can be undertaken in an ICT-based environment. This could be used for performance assessments, knowledge assessment, some professional skills assessments and to facilitate essay, short or long answer written tests. Where these tests are normally conducted in an examinations hall, the venue could be moved for the purposes of the trial to standard computer laboratory(ies) when student numbers are sufficiently small. Therefore some University examinations will be taken by students using computers instead of by handwriting.

The benefits for students include:

- An context for assessment similar to the context for learning for most students (who are IT-savvy and access many units through on-line materials)
- The capacity to perform changes and re-organise written replies at any time up until the end of the examination without crossing out or attempted erasure
- Fewer students with disabilities would need separate conditions, leading to inclusivity of practice.

For University staff, the benefits include:

- For examination supervisors, a simple way to verify the correct environment is in use (current requirements with respect to checking the technical capabilities of electronic calculators can cause concern);
- Easier marking for examiners: the digital scripts can be marked on-screen or from printouts – no more guessing what the student was attempting to hand-write;
- Opportunities to streamline administration when the scripts and marks are retained in a single digital environment, by eliminating transcription errors.

The characteristics of an ICT-based examination system will include:

- Portability – it should be possible to set it up using almost any available equipment
- Equity – it should be accessible to a wide range to students
- Familiarity – students should have every opportunity to practice essential skills in this environment

- Technical capacity – it should not limit students creativity or expression
- Archivability – the environment should produce material which will be accessible in future years
- Inviolate – students should not be able to alter the environment to gain an unfair advantage. (Fluck, 2004b)

By replacing formal tertiary examination papers by CD-ROMs, printing costs have been saved and marking expedited. It is expected that this cost saving and gain in efficiency will be matched by greater satisfaction from students who are rarely required to write by hand, except in high-stakes testing.

As tertiary institutions replace hand-written examinations by supervised computer-based activities, Australian schools will be empowered to use information and communication technology (ICT) in more challenging and transformational ways which reflect the realities of modern life.

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