Collaborative Development for Online Assessment

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ABSTRACT
In this paper, a multi-stakeholder case study is described in which an online examination for a second year undergraduate computing paper at a New Zealand tertiary institution was developed collaboratively with diverse stakeholders. Stakeholders included: the lecturer, learning centre advisors for both the learning management system (Moodle) and literacy, the undergraduate programme committee members, the examinations officer, examination supervisors, pre- and post- moderators, IT support staff members, IT engineers, and finally the students. Issues arising during the process have been analysed using Soft Systems Methodology.

Categories and Subject Descriptors
K.3.1 [**Computers and Education]**: Computer Uses in Education

General Terms
Human Factors

Keywords
Case study, collaborative development, online assessment

1. INTRODUCTION
This online examination was developed for a second year compulsory undergraduate paper (Information Gathering) in the Bachelor of Computing Systems at Institution X. The author felt that because students were studying computing, moving the examination online would align better with both the content and style of what they were learning. Students gain knowledge of information gathering, information analysis and content management in studying for this paper. Learning outcomes are: to demonstrate an understanding of the life cycle of information; to analyse and apply different techniques for effectively gathering information; to analyse documentation requirements for information and communication technology (ICT) projects; and to design, develop and present appropriate information and content management solutions for different types of businesses and research situations.

Online assessment provides learning opportunities to students that are not available in traditional paper-based assessment methods, especially end-of-semester examinations. One of the findings from this study is that the regulatory systems for governing the conduct of end-of-semester examinations constrained possible learning benefits for students.

The structure of this paper is as follows: firstly, a literature review is presented in which the pedagogy of online assessment is explored as a multi-stakeholder activity. Next the study scope is described. This is followed by a description of soft systems methodology [2] and how it was used to in the present study. The paper concludes with discussion, reflection and directions for future research.

2. LITERATURE REVIEW
In this literature review, online assessment in its complexity, the additional benefits offered to students, preferences of computing students, barriers to the uptake of online assessment and advantages for a range of stakeholders are discussed.

2.1 Online Assessment
Buchan[1] reflects on snapshots in time that have led to a personal understanding of the complex integrated network of responsibility in online assessment that involves academics, ICT support services, educational designers and other divisions. This understanding has led to the formation of new frameworks for managing online assessment and, more broadly, online learning. These frameworks are contributing to on-going development of tools, processes, procedures and policy as her particular university absorbs the impact of increased access to online learning as the result of the introduction of a new, open source, learning management system. Whilst Buchan has identified the need for institutional frameworks for on-going development of online assessment, this paper concentrates on the involvement of multiple stakeholders in the development of online assessment, rather than policy and procedure formation.

Campbell [3] suggests that high stakes assessment can be successfully digitized from the capturing of authentic student performance, to high stakes comparative pairs marking. Campbell also claims that with current technology reliability, validity, manageability and scalability are as good as or better than current (non-digitized) practices. By high stakes assessment it is assumed that Campbell is discussing activities such as end-of-semester examinations. Campbell also suggests that the digitization of the assessment process offers the possibilities to drive learning and education in positive directions through the capture of authentic student work in both standard and non-standard forms, and to assess students more efficiently, reliably and in different ways. Traditional marking methods of assessment and specifically those of non-standard forms have been time-consuming and costly. Non-standard forms of assessment cover a verity of formats from PDF to videos that can capture authentic student work (performance). This recording and capturing in real-time of authentic student work introduces the possibility to view and assess the process and not just the product of the student work, and this can be over an extended time-period or a fixed time as in an exam situation.

Fluck, Pullen and Harper [4] discovered that the Bachelor's degree students in their e-examination case study in Australia had no initial clear-cut preference for computer- or paper- based examinations. They suggest that further research could be undertaken to validate this finding for similar cohorts. They also discovered that the preference for an examination medium appeared to be strongly related to successful prior student experience of online assessment. This finding suggests that if the

first experience of online assessment is positive, students are more likely to accept further online assessment. Fluck et al. [4] were preoccupied with security and collusion issues in exploring alternate means to gather examination scripts using non-networked solutions such as collecting scripts on CDs or USB drives.

2.2 Barriers to the Uptake of Online Assessment

Hannon [5] states that technological, organisational and discursive issues will all increase the likelihood of breakdowns in the acceptance of online assessment. Hannon's analysis was based on a relational perspective drawn from actor network theory and discourse analysis. Adopting this view suggested that an innovation would be successful if all the actors (entities that performed actions) were able to form associations based on strong ties, and were brought to alignment and mobilised into a socio-technical assemblage. One question that arose from the two cases considered was how innovation, that is, transformative change, could occur in the context of mass teaching and learning, in light of the tension between innovation and standardised approaches to online teaching. At issue was the tendency of black boxes, such as a learning management system, to be totalising both as technologies and as discourses, and to set an institutional "standard" approach to online teaching which may be the antithesis of innovation. Hannon [5] also suggests that technologies and discourses need to be recognised as part of the assemblage of online teaching, but not *stand for* online teaching.

2.3 Advantages of Online Assessment

In summarising their study, Milne, Heinrich and Morrison [6] stated that there are strong advantages for student learning and staff workloads in using e-learning tools in support of assignment assessment. Milne et al. suggest that only a minority of academics exploits these advantages, and that a huge potential exists for further application of e-learning tools and approaches. McNeil, Gosper and Hedberg [7] also suggest that there is untapped potential for ICT-supported learning – including learning from online assessment. McNeil et al. claim that the potential of technologies to support assessment of higher-order learning outcomes such as evaluation, creation and meta-cognition, is still largely untapped. For many of the technologies, the results suggest that rather than being transformative tools, their uses are predominantly limited to perpetuating traditional practices.

3. METHOD

Input from multiple stakeholders all contributed to the final outcome for this project. These inputs included considerations from the lecturer in charge of the second year undergraduate paper in which the study was conducted, learning centre advisors for both the learning management system used and for literacy, undergraduate programme committee members, the examinations officer, pre- and post- moderators, IT support staff members, IT engineers, and finally, students. All views and requirements were considered using Checkland and Scholes' [2] 7-stage Soft Systems Methodology (SSM). An iterative process of development was utilized as changes were introduced.

SSM is a way of analysing a multi-stakeholder situation that considers the entirety of the system being considered as a single whole with emergent properties [2]. Central to SSM is the notion that a set of constructed abstractions can be compared to the perceived real world in order to learn more about the situation being studied (Figure 1).

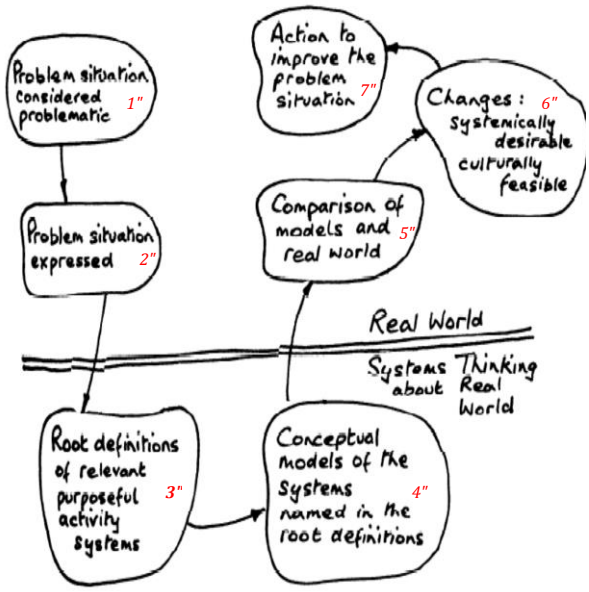

Figure 1. Soft Systems Methodology

The perceived real world is considered in stage 1, and expressed as a rich picture in stage 2 (Figure 2). These activities take place as perceptions of the real world as viewed by the actor. Stages 3 and 4 are conducted as systems thinking activities about the real world. In stage 3 root definitions are defined (see below), and in stage 4 conceptual models are derived from the root definitions. Comparisons of these conceptual models to the real world situation are conducted in stage 5. In stage 6 suggestions for change are made that are both systemically desirable and culturally feasible. The final stage (7) is where action to improve the situation is taken.

3.1 Problem situation considered

The problem situation considered problematic was the use of traditional paper-based examinations, with the considerable overhead entailed in tracking, monitoring and collecting marking. Other reasons for the conversion included alignment with the way in which computing students interact with IT, and that paperless systems are kinder on the environment. Moodle, the learning management system (LMS) being utilized by the institution, provided the capability for conducting online examinations. The decision was made therefore by the lecturer (actor in the case considered) to convert the paper-based examination to an online examination.

3.2 Problem situation expressed

Figure 2 shows that there are many stakeholders. These stakeholders each have defined roles within the system considered. The lecturer initiated the transformation from paper-based to online examination. Learning advisors (Moodle and literacy), acting as facilitators, provided necessary technical and literacy advice for the transformation to take place. The programme leader, programme committee and paper moderator provided the appropriate regulatory functions. The examinations officer facilitated the implementation changes required for the

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online examination to take place and provided a changed set of instructions to the examination supervisors. The IT support staff and engineers made it possible for the online examination to run without IT system failure.

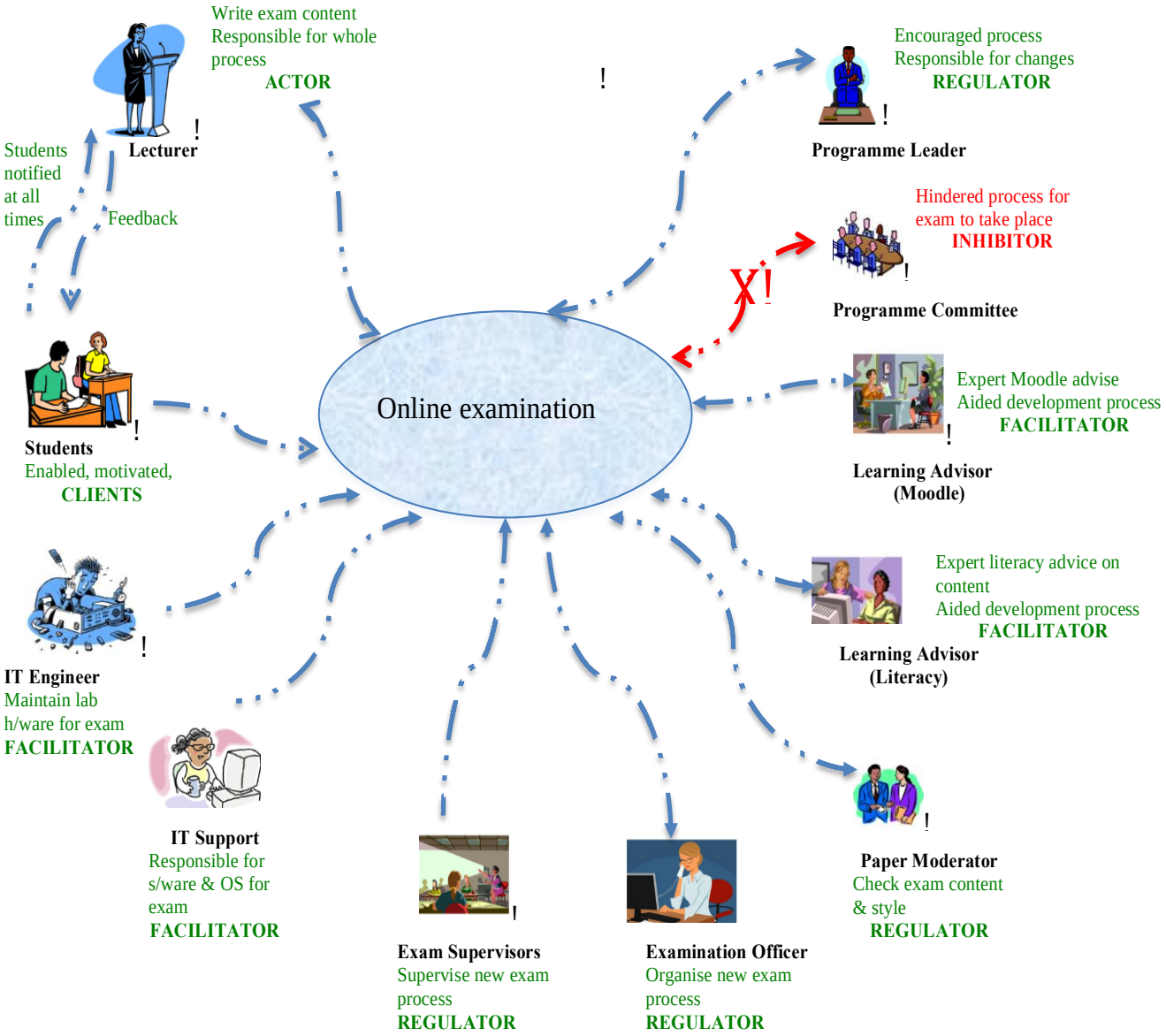

Figure 2 Rich picture of the problem expressed

3.3 Root definitions of relevant activity systems

The system analysed is the process of developing part of the assessment for a compulsory paper in the undergraduate computing degree at institution X in New Zealand.

Table 1. CATWOE definitions

(Based on Checkland & Scholes, 1999)

	Category	Definition
C	Customers	The beneficiaries of T (students)
A	Actor	Those who would do the T (lecturer)
T	Transformation process	Conversion of input to output (traditional paper exam to online exam)
W	Worldview	The worldview that makes this T meaningful in context (updating the exam format to align with students' worldview)
O	Owner	Those who would stop the T (regulatory bodies – NZQA, Academic Board, Programme committee, Programme leader
E	Environment	Elements outside the system taken as given (Students will enroll in the degree and therefore the paper)

3.4 Conceptual models of the systems named in the root definitions

Each stakeholder identified in stage 2 (problem situation expressed) has a different role to play, and therefore is represented by a separate conceptual model.

3.4.1 Customers (students)

As the beneficiaries of the system being considered, students had the most to gain (or lose) by the transformation to an online examination, as final grades were dependent on successful implementation of the online examination.

3.4.2 Actor (lecturer)

Preparation and successful implementation of the online examination is the lecturer's responsibility. In order to do this the lecturer was required to interact with all other stakeholders who acted in different roles (Figure 2).

3.4.3 Transformation process

Conversion of the traditional paper examination to an online examination was aided by learning advisors, facilitated by IT support and engineers, and regulated by programme leader and programme committee and paper moderator.

3.4.4 Worldviews

Each stakeholder involved in this study held different worldviews. It is interesting to note that all stakeholders (except students) were there to serve the students. Stakeholder roles as initiator, regulator or facilitator were instrumental in shaping worldviews held. For computing students, an online examination was more closely aligned to their technically enhanced worldview.

3.4.5 Owner

For this project, the owners of the system most directly affected were those with delegated regulatory power, programme leader and programme committee.

3.4.6 Environmental constraints

An assumed environmental constraint was that there would be sufficient students enrolled in this particular paper so that the transformation could go ahead.

3.5 Comparison of models and real world

In order to make this comparison, root definitions of the relevant activity systems need to be defined. Each root definition provides a particular perspective of the system under investigation. In general, a root definition should include the following information: what the purposeful activity carried out by the system is; who the 'owner' of the system is; who the beneficiaries/victims of the purposeful activity are; who will implement the activity; and what the constraints in its environment are that surround the system [1].

3.5.1 Actor (lecturer)

The initiator for this project was the lecturer, who could see that there were possible multiple benefits for students in creating and using an online examination.

3.5.2 Learning advisor (Moodle)

The Moodle learning advisor provided technical knowledge on structure, layout and correct implementation within the Moodle environment. The Moodle learning advisor also provided the lecturer with feedback on pedagogical style in using the online tools provided in Moodle. Advice was also given to the lecturer by the Moodle learning advisor about the most appropriate Windows environment to reduce access during the examination.

3.5.3 Learning advisor (literacy)

The literacy-learning advisor provided the lecturer with feedback on how students from multiple ethnic backgrounds could interpret the content of the online examination and changes were made to examination wording in a number of iterations.

3.5.4 Programme leader

The programme leader was responsible for the way in which the whole undergraduate programme in computing operated. The programme leader was the chairperson for the programme committee. The programme leader was in favour of this project taking place.

3.5.5 Programme committee

The programme committee provided debate on any modifications proposed within the undergraduate programme in computing and provided feedback and modification requests before any changes could be implemented. The programme committee proved to be an inhibitor for this project, with many objections to examination content, possible technical problems, fitting in with the existing examination system, which was paper-based, pre- and post- moderation process, supervision process, technical support required, extra cost, and laboratory availability.

3.5.6 Paper moderator

The paper moderator was responsible for checking that the assessment item satisfied programme requirements. In this case

the paper moderator could only check examination content and the extra technical requirements for a Moodle examination.

3.5.7 Examinations officer

The examinations officer was responsible for the conduct of all examinations for the department including the undergraduate degree in computing. The examinations officer could see no problems with the process and was reassured that the process would work smoothly. The only extra requirement was that the students have access to electronic copies of their own examination script during the post-exam viewing period. Creating pdf files that were placed on a central drive in the post-examination period accommodated this.

3.5.8 Examination supervisors

The examinations supervisors were responsible for the conduct of particular examinations. The examination supervisors were happy that their workload was reduced when the online examination was conducted as they did not have script books to collect, check and deliver.

3.5.9 IT support staff

The IT support staff members were responsible for all the required software and operating systems environments operating correctly during the online examination. The IT support staff provided the lecturer with support prior to the online examination by taking part in planning and contingency. IT support staff were also present or on call during the online examination.

3.5.10 IT engineers

The IT engineers were responsible for all computers in the laboratories being used for the online examination to be operating correctly. This required the IT engineers to reconfigure one laboratory in the 24-hour period prior to the online examination, as there was a network fault.

3.6 Changes: systemically desirable, culturally feasible

Checkland and Scholes [1] suggest that in considering a system holistically, technical, social and political issues need to be considered. In practice, such issues can be intermingled. For instance, the progamme committee used political influence to insist on documentation for all aspects of the development. In some cases, members of the programme committee did not have the required technical knowledge and skills to judge the merits of implementing the online examination.

For the students, who were clients of the system, technical changes brought about by the safe browser not working required compliance from them in agreeing to stay within the online examination window during the exam period. This was made possible by engaging the students early in the development process and by the alignment of student attitudes to online engagement as opposed to traditional paper-based examinations.

From a technical perspective, the lecturer discovered that support was required from multiple stakeholders that would not have been required for a paper-based examination; and extra development time was required to learn how to set up an online examination. From a social perspective, extra interaction time was required because there were so many stakeholders involved in the process. From a political perspective, more time was required to satisfy the programme committee's requests for extra documentation to support the changes requested in setting up an online examination.

From the examination officer's point of view, the online examination was a desirable change because it reduced work both for her and for the examination supervisors.

From the programme committee point of view, there was reluctance to engage in the change process, and extra documentation and process steps were required to satisfy their regulatory requirements. Systemic changes are still required here to address the attitudinal barriers put in place.

From the IT support staff and IT engineers point of view, the online examination involved extra work to ensure that all IT hardware, networking and software were operational at the time of the online examination because laboratories that are operational are not required during paper-based examinations.

3.6.1 Benefits

A major benefit and an unexpected outcome for this project was the way in which the students became engaged with the project, and they appreciated their involvement and the opportunity to provide feedback during development. Rather than viewing the examination negatively, most students enjoyed the whole process and there was early 'buy-in' and little resistance to change.

Another benefit was that because the LMS was linked to the student management system used at this institution, students could not take part in the online examination if their enrolment status was not current. This required greater emphasis to be placed on correct enrolment status prior to the examination period.

The examination officer and supervisors were pleased that their tasks during the examination period were simplified because there were no paper examination scripts to collect, check and store.

Paperless examinations also contribute to environmental sustainability, and to reducing costs within the institution.

3.6.2 Outcomes

The commitment and 'buy-in' demonstrated by most stakeholders contributed to a successful outcome for this project, despite the barriers that were imposed in the guise of regulatory requirements. The computing students involved were keen to take part in this project. It is interesting to note that none of this particular group of students accessed paper materials in the library for any part of their studies during the semester.

4. DISCUSSION AND FINDINGS

Findings from this study suggest that having cooperation from all stakeholders is important. However, some stakeholders are more 'important' than others. If the 'important' stakeholders provide any sort of barrier to development, like, for instance programme committee objections, then the development process will take longer. Technical support from the IT team (both engineers and support staff) is vital for the online assessment to 'run on the day'. Use of online assessment, especially examinations, requires commitment, dedication and 'buy in' from all stakeholders. Students can be prepared in advance about what to expect. Power relationships between and amongst stakeholders both contributed to and detracted from the collaborative process.

5. CONCLUSIONS

Experience from this project suggests that early and continuous consultation with facilitating stakeholders is required. There is a

time and skill commitment required to do this. There are also benefits for the lecturer in obtaining immediate results online during the examination. Unfortunately this benefit could not be shared with the students involved because this would have contravened current examination procedures.

Minimising the use of paper was both a benefit (from a sustainability and examination process point of view) and a risk in this project. The risk is that when all examination scripts are online with no paper backup there is no contingency plan in the event of technical failure.

'Buy-in' from the students was obtained early in the process by informing them of progress with online examination development, providing a trial examination as a tutorial exercise, and giving the students the opportunity to provide feedback.

On reflection, the author believes that developing and using online examinations is an evolving process, with one cycle feeding off the next. Doing more negotiation with the 'powerful' stakeholders on incorporating immediate feedback in releasing online examination results would enhance the learning experience for students.

The findings from this paper contribute to what is known about developing online assessment. Early and continuous consultation with facilitating stakeholders is required for such development work. Immediacy of online results is of value when time is critical, especially at the end of semester.

6. ACKNOWLEDGMENTS

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