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Welcome to the 23rd and Annual Conference of the National Advisory Committee on Computing Qualifications (NACCQ). This is an historic moment in NACCQ history as we herald the beginning of a new organisation – CITRENZ, which will take computing education into the future.

The National Advisory Committee on Computing Qualifications (NACCQ) was formed in 1988, and provides help and support to member institutions in the development, teaching and quality assurance of courses and programmes, from certificate through degree to postgraduate levels, in the field of Computing and Information Technology. The NACCQ also supports academic staff in several different ways, such as national workshops, research seminars, APL, moderation, the publishing of a journal, a research bulletin and also by organising this annual conference. NACCQ activities and a digital version of these proceedings are available from http://www.naccq.ac.nz

The philosophy of the conference is the encouragement and support of new, emerging and established researchers in a safe environment while encouraging excellence and academic discourse.

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Theme

The conference contains papers in the following areas:

- computing education
- computing practice
- computing research

Full papers: (Quality assured)

Full papers are double blind peer refereed on submission by a review panel and accepted/modified/rejected.
The editorial panel reviews final versions. They may be rejected or returned for modification at that point. 31/61 (51%) of submitted papers were accepted for publication.

In keeping with its supportive mission, the conference uses a system of paper proposals which are reviewed and guidance given to the content, tone and structure of papers before they are formally submitted.

Poster papers:

An A0 poster is displayed at the conference along with one page in the proceedings.

Online

This conference proceedings, along with those from recent years, can be found online at www.naccq.ac.nz

Design

The cover design is by Simon Horner (Otago Polytechnic NewSplash) using a panorama of Dunedin and Otago Peninsula taken from Mt Cargill by Samuel Mann.

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Quality Assured Papers

Student Retention: How to keep them?

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This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

Student retention is one of the more intricate issues of modern tertiary education. The purpose of this paper is to explore the reasons why first year Bachelor in Computing System students in one New Zealand institute of technology, continue their studies or leave after their first semester of study without completing their studies. This paper seeks to understand these reasons and to explore possible ways of retaining students who might consider withdrawing. It seeks to share with other institutes of technology these experiences and to find ways of improving retention rates at this institution. Some experiences from other institutes using existing published literature are explored. Students that withdrew in the first semester of study were telephonically interviewed. Their responses are discussed in the paper. Students that were retained were also interviewed and their responses are also analysed. Several interesting reasons were identified with both groups and are included in the discussion of the findings in the paper.

Keywords

Retention, Retention Rates, Completion.

Introduction

According to Tatham (2009) the Productivity Commission in Australia has estimated that for each year of additional education that a person undertakes – their earnings will increase by between 5.5% and 11.0%. There is therefore a huge economic benefit to countries and individuals if students can be encouraged to continue and complete their studies and be retained for the full duration of their programme of study.

Student retention refers to whether a student in a program of study continues their studies until they have successfully completed a tertiary qualification (Education Counts, 2010) – which for this paper is the Bachelor of Computing Systems at the Eastern Institute of Technology (EIT), Hawke's Bay, New Zealand. In order to monitor this it is necessary to study the withdrawal rate – that is those students who left without completing their qualification. According to Education Counts (2010) retention can be one of the indicators of the efficiency or quality of the tertiary qualification. Tertiary institutions are under increasing pressure to improve student outcomes such as retention and completion (Zepke & Leach, 2005). The New Zealand government has made some changes to the funding structures for tertiary institutions which includes basing funding on the retention rate, which will impact on the Eastern Institute of Technology as well as all Polytechnics in New Zealand.

It is therefore important to understand that a range of factors play a role in whether a student continues their studies until completion. The purpose of this paper is to understand the different reasons why students stay or withdraw and to explore possible ways of retaining students who might consider withdrawing. The focus of this study was on a group of first year students who enrolled in 2009 into the Bachelor of Computing Systems (BCS) at the Eastern Institute of Technology.

Methodology

Tertiary education institutions in New Zealand need to take the issue of student retention and successful completion of programmes by students very seriously (Grote, 2000; Zepke & Leach, 2005). A study conducted by the Ministry of Education showed that 19% of all students starting a bachelors' degree in 2007 did not complete the qualification and did not re-enroll in the following year (Education Counts, 2010).

In 2002, the New Zealand Ministry of Education commissioned a team from Massey University researchers to conduct a literature study to determine ways that tertiary institutions might improve their student outcomes and reduce withdrawals (Zepke & Leach, 2005). Figure 1, based on this research (Zepke & Leach, 2005), shows content criteria of how student environment support can impact on student satisfaction and results. It is apparent from this diagram that students need emotional and social support as well as academic support. A good induction seems to be suggested by a number of authors (Jefferson Community College, 2004; Zepke & Leach, 2005). Other suggestions from the literature includes setting up learning groups, setting up a mentoring system, engaging the students in class and meeting with them on an individual basis at regular time and treating all students fair (Jefferson Community College, 2004; Zepke & Leach, 2005). Tatham (2009) mentions that teacher engagement with the individual students are very important, that students need to have a clear understanding of the career they want to prepare for and that students should not fail or withdraw from any programme – and should be supported to help this happening. This last point mentioned by Tatham is the one that this paper is focusing on – what can we do to better retain our students?

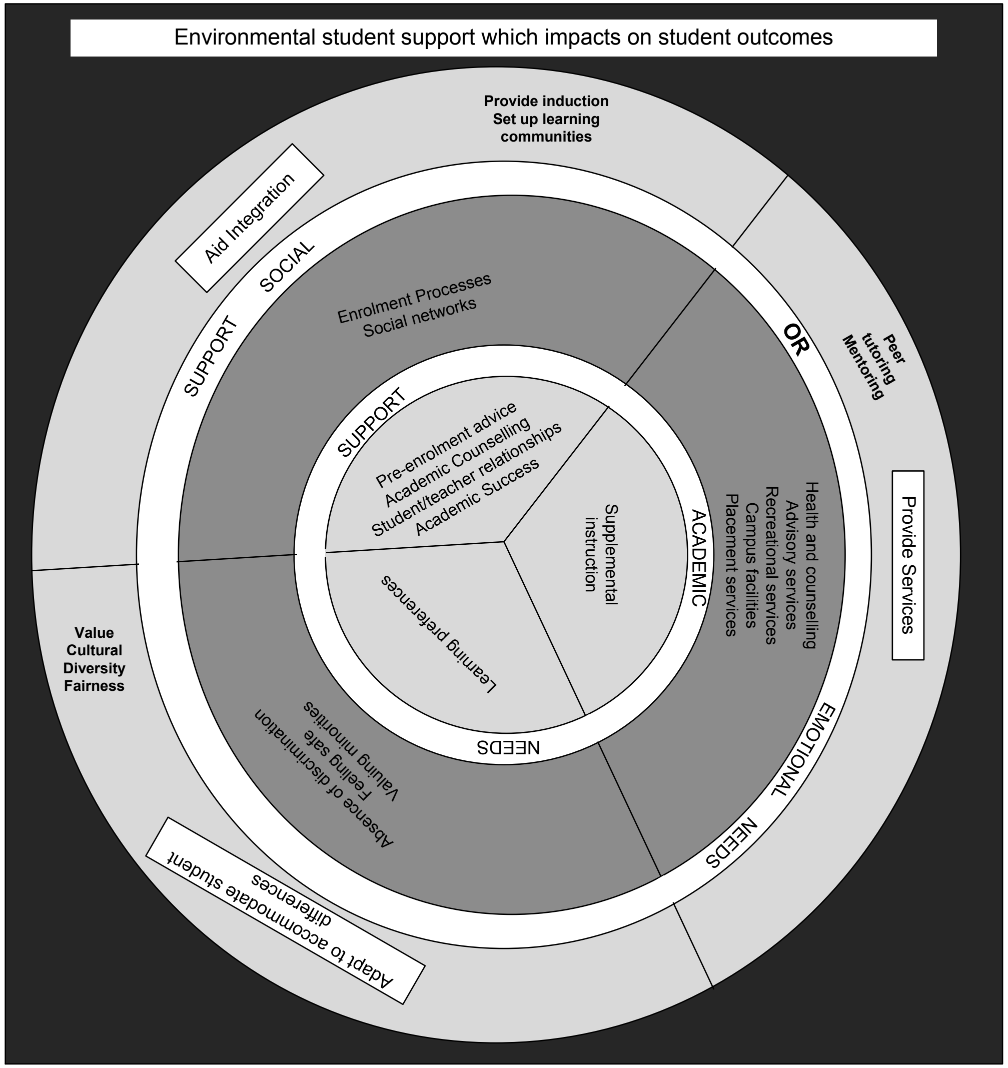

Figure 1. Content criteria (Based on Zepke & Leach, 2005)

It was decided that in order to obtain data on how to better retain our students and also because the lecturers in the computing school at EIT were worried about the withdrawal rate of a specific group of students, to conduct the research presented in this paper. The data used for this research was focused on a specific group, namely the first year 2009 Bachelor of Computing System students. It was decided to employ questionnaires to survey the respondents. A qualitative method was adopted with the use of open questions. Analysis was however executed on the results obtained to make it easier to draw conclusions.

It was determined that there are mainly 2 groups that had to be targeted in the research, namely:

- 2009 first year BCS students who withdrew in the first year of study (phase 1)
- 2010 second year BCS students who survived and were retained after their first year of study (phase 2)

It was decided that every student in the two above groups will be targeted in the research. It was also necessary to investigate other research that has been done in this area.

Once the research objectives were defined for the initial study, it was used as a basis for the development of the questions used in the questionnaire. The questions for the two phases had to be as similar as possible in order to allow analysis of the data. The number of questions also had to be limited as it had to be a questionnaire that could be completed in 5 minutes in an attempt to maximise the number of respondents that were willing to participate in the exercise. This study is introductory and not comprehensive. Further research will be required to understand the environment better. A full comparison with other institutes will also need to be done in the future.

In phase 1 the marketing department of the Eastern Institute of Technology was approached to conduct interviews with the first year Bachelor of Computing students that withdrew from the programme in their first year of study. This consisted of a telephonic conversation to determine the answers to a set number of questions. The questionnaire was made up of five questions. These were:

1. Why did you enroll into the BCS degree?
2. Why did you withdraw from the programme?
3. Could EIT have done anything differently to prevent you from withdrawing?
4. What have you done since withdrawing?
5. Will you return to tertiary study in the future? Where?

There were 12 students that withdrew in their first year of study. An attempt was made to contact all of these students. The marketing department managed to contact nine of these students and all of them agreed to answer the questions.

In phase 2 the students in one of the second year BCS classes completed the questionnaire early in 2010. The questionnaire was made up of four questions. These were:

1. Why did you study at EIT?
2. What did you do in the 2 years prior to enrolling at EIT?
3. Do you believe that you want a career in computing?
4. Are you glad that you chose EIT as your tertiary provider?

Sixteen students were retained and completed their first year of BCS study. All of these students were targeted – and 12 of these students completed the questionnaire.

In the next section the results obtained from this research will be discussed.

Results

Phase 1

As seen in the results of phase 1 in table 1, there are various reasons why students decided to discontinue their studies.

The analysis of question 1 shows that 5 out of the 9 (56%) students realized that they do not like computing as a possible career. These students should have been mentored to enroll into different programmes. Even the students that withdrew to go to a "real university" or the army could maybe have been prevented from enrolling into the BCS if they were better supported in their choice at enrolment.

Analysis of question 2 shows that there were a number of reasons why students decided to withdraw from the programme. All of the reasons supplied were valid with no clear indication of anything that could have been done to prevent them leaving.

In question 3 all the students were adamant that there was nothing that EIT could have done to prevent them withdrawing. Question 4 showed that 67% of the students are currently working which includes the one student that joined the army. 17% of the students immediately went into another programme.

Question 5 shows that 75% of the students are planning to enroll into another programme or have already enrolled into another programme. This means that even when students withdraw they still have dreams to improve themselves by further study.

It is important to incorporate some of the points mentioned in the methodology paragraph such as setting up learning groups; setting up a mentoring system, engaging the students in class and meeting with them on an individual basis at regular time and treating all students fair. Also mentioned are teacher engagement and ensuring that students have a clear understanding of the career they are preparing for.

From this study it is clear that the students believe that there is not much that could have been done differently to retain them.

Table 1: Research results from BCS students that withdrew in their first year of study

BCS students that withdrew in their first year of study
Why did you enroll into the BCS degree? "Studied somewhere else – then tried BCS – want a break". "BCS was too difficult – switched to DipICT". Five students said: "Tried BCS – did not like computing". "Wanted to join the army". "Health reasons". "Wanted to go to a real University". "Lost funding".
Why did you withdraw from the programme? Going to Australia". "Personal reasons". "Want something easier". ""Heart not in the right place". "Wanted to join airforce". "Not interested". "Health reasons". "Wanted to go to Uni". "Left family home – funding ran out".
Could EIT have done anything differently to prevent you from withdrawing? The consensus here was that there was nothing that EIT could have done different to convince them to stay.
What have you done since withdrawing? 7students said: "Working", 2 students said: "Changed to another programme", "Joined Airforce", "Sickness benefit".
Will you return to tertiary study in the future? Where? 5 students are either already studying another programme at EIT or planning to return to EIT in the future. Three students are planning to study or already enrolled at another institute. Rest will continue working.

Phase 2

In phase 2 – the students that were retained and continued to their second semester are emphatic in stating that they believe they made the right choice. This can be clearly seen in Table 2.

Question 1 showed overwhelmingly that students choose EIT predominantly because of its location.

Question 2 indicated that 50% of the students enrolled directly from school and 50% had been in the work environment in the 2 years prior to commencing their studies. This indicates that these factors do not seem to play a role in their withdrawal.

Question 3 indicated that 50% of the students would like to go directly into a career in computing and 25% indicated that they would like to combine their computing career with a career in business. 16% of the students want to continue their studies before deciding what to do next and 9% want to go into secondary school teaching.

All of the retained students indicated that they were pleased that they chose EIT as their tertiary provider. Some of these comments can be seen in Table 2 under question 5.

The aim should be to improve student satisfaction in order to improve the student retention rate.

Table 2: Research results from BCS students that where retained after their first year of study

Retained BCS Students
Why did you study at EIT? All but a few students said: "Wanted to stay in Hawkes Bay". "Wanted to go to Uni but wanted a gap year – decided to kill time and study at EIT with scholarship– loved it". "Programme appeared very practical",
What did you do in the 2 years prior to enrolling at EIT? Half of the students worked the two years before their study and the other half was still at school.
Do you believe that you want a career in computing? Six of the students want a career in computing, one want to go into teaching, two want to continue their studies – one overseas and one want to try aviation, the rest want to combine computing with a business type of job.
Are you glad that you chose EIT as your tertiary provider? All said "yes". Some of the comments include "campus, lecturers and diversity is great", "I know people doing the same sort of programme elsewhere and they think they should maybe have come here too", "environment and staff great".

As part of trying to improve student retention a mentoring system has since been introduced at EIT to mentor first year students. Each lecturer teaching on the degree is assigned between 5 and 10 students and meets with these students on a regular basis to build report and to identify any potential problems early. The number of students that have withdraw in the first semester of 2011 seems to have declined from the number that withdrew in 2010, but it is still a few weeks to the end of the first semester.

Conclusion

There are a number of challenges to retain students. At EIT it seems as though the lecturers are already doing their best to ensure that students get integrated into the group - academically and socially (Zepke & Leach, 2005). Some of the changes already implemented include a mentoring system, adapting teaching styles to accommodate different learning styles, strong emphasis on 21st century learning, ensuring strong online support, small classes with all lecturers engaging with students on a personal level.

The research into why students withdrew seems to indicate that the students believe that they would have made the decision to withdraw irrespective to anything that EIT would have done. It does however seem that by mentoring students better before the start of the programme it might be possible to prevent them wasting a semester on "a wrong career path". Literature also shows that there are a number of things that can still be done to improve retention rates.

Further research should be undertaken to compare the retention of students in different faculties and polytechnics to try and identify more problem areas that could be improved.

Acknowledgements

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Ethical permission was obtained through the Ethical Research Committee of the Eastern Institute of Technology.

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Industry View of ICT Roles and Skills Needs in Canterbury

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Abstract

This paper elaborates on the ICT skills needs within both Canterbury region and New Zealand. ICTs play a crucial role in today's knowledge-based economy. Organizations heavily rely on ICT solutions to develop and grow business. There is an increasing need for ICT skills within organizations – so as to benefit from the use of ICT tools and solutions. A focus group of industry representatives participated in this study – to identify the need for roles and skills within the ICT sector. It appears that there are consistencies in both the need for roles and the use of development platforms for the Canterbury region and all regions of New Zealand. That is to say, ICT qualifications designed to address national needs should address majority of ICT needs within the Canterbury region.

Keywords

ICT Skills, ICT Roles, Canterbury Region, Development Platforms

Introduction

Information and Communication Technologies (ICTs) play a crucial role in today's knowledge-based economy – often characterized by diffusion of information, communication and knowledge. The use of ICTs has accelerated economic transformation from industrial to knowledge-based economy. Within the last decade, rapid developments of ICTs have created many opportunities for developing innovative ICT and web based information management solutions to allow for innovative ways of business development and growth. As a consequence, investment on ICTs in most organizations has become the largest component of capital expenditure. In the United States alone, the annual capital expenditure on ICT equipment and infrastructure in the recent years exceeded $2 trillion. What's more, there has been a dramatic increase in the percentage of ICT capital expenditure (of the total business investments) in the last decade (in some cases as high as 40% of the total investment on business - source: US Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts).

Although there have been different views on the impact of investment in ICTs on economic growth and developments, a majority of economists and sociologists recognize the positive correlation between use of ICTs and economic growth. Productivity can be improved by organizations' capacity to develop and exploit knowledge and thus achieve economic success. E-technologies and ICT solutions have been increasingly contributing to the development of solutions to allow for increased productivity and improved service. ICTs have also contributed significantly towards GDP growth within most countries. A deep decline in ICT prices has motivated increasing investment in ICTs - which has in turn enabled organizations to establish technology platforms that allows for effective use of ICT solutions within both private and public sectors. A recent research initiated by the European Commission Enterprise and Industry Directorate General shows that from 1995 to 2004 the GDP growth as a consequence of ICTs was 3.4% in USA, 2.9% in the UK and 2.1% in European Union (EU15).

New Zealand is not exempt from being part of the broader global economic and technological developments. Within the past decade, ICT solutions have played a major role as business enablers within New Zealand organizations. Some researchers may argue that small countries being remote from major centers of global economic activities may be in greater need of ICT solutions to remain connected and competitive. New Zealand organizations increasingly depend on advanced ICT solutions and skilled ICT personnel to make progress and grow. What's more, to protect investment in ICT solutions, organizations have been increasingly relying on skilled ICT staff in order to maximize the benefits of ICTs across the organization. We have witnessed a growing demand for knowledgeable ICT workers.

In recent years there has been ongoing debate so as to what is being considered as valuable and/or effective ICT skill(s). Additionally, it is widely argued that a successful ICT worker needs to not only be highly skilled but also be able to respond effectively (and in a timely fashion) to the ever changing body of knowledge associated with the industry. In other words, ICT workers are required to be able to learn and upgrade skills on an ongoing basis.

In late 2009, in reviewing the effectiveness of the portfolio of ICT qualifications at CPIT, it was decided to look at industry needs of key ICT skills and attributes that contribute to success within the ICT sector. It was intended that the outcome of the study would assist in identifying the effectiveness of ICT qualifications within the institution and help to identify possible changes in revamping the portfolio of out qualifications.

A focus group of industry representatives that constitute the ICT qualifications local advisory committee participated in this study – which was completed in late January 2010.

This paper elaborates on the outcome of this study.

Research Design and Methodology

The research questions considered for this study are as follows:

- Which ICT occupations (roles) are in high demand in Canterbury and how does the demand in Canterbury compare with that of New Zealand wide demand?
- Which development platforms are currently in use and which are likely to be in demand within the next 2-3 years?
- What other ICT skills are seen as being critical for graduates to possess in order to be successful ICT workers within the sector?

It was decided to look at ICT roles (skills) frameworks and standards in order to develop our list of roles for this study. A number of frameworks (such as Skills Framework for Information Age SFIA and Australian and New Zealand Standard Classification of Occupations ANZSCO) were taken into consideration. We decided to adopt ANZSCO occupations reference – as it seemed more relevant to New Zealand market.

The methodology considered for the first Phase of this project was to survey a focus group of ICT professionals who have considerable experience in recruiting ICT personnel for their organizations. The members of the Local Advisory Committee who represent a wide range of organizations within the Canterbury region were chosen as a focus group for conducting this study.

A questionnaire made of three categories o questions was sent to potential participants. The first category listed ANZSCO ICT occupations. Participants were advised to rate these occupations as they perceive the need for the occupation. The rating was done for both Canterbury and nationally. For both categories the participants were asked to rate both current and future needs. The rating could range from zero (no need for those roles so no jobs related to the role) to three (there is a perceived need for the role and it is expected that many jobs will exist in relation to that particular role).

The second category consisted of a list of development tools and platforms. Participants were asked to tick to indicate if there is current or future use for the particular tool and platform.

Finally, participants were asked to list five key skills that are in need within their organizations.

Findings

The average ratings for various ICT roles are outlined in Table 1.

- The most highly rated skills over a 2-year horizon in Canterbury are Business Analyst,

Analyst Programmer, Software and Application Programmer, ICT Security Specialist, Network Administrator, ICT support Engineer and ICT project manager.

- In the long term (5-year horizon), the most highly rated skills are: Business analyst, systems analyst, network administrator and ICT support engineer. There seems to be a high degree of consistency in ratings for the short and long term needs for roles.
- For all regions of New Zealand, the most highly rated ICT roles over a 2-year timeline were considered to be Systems Analyst, Analyst Programmer, Database Administrator, ICT Support Engineer and ICT Project Manager.
- Over a 5-year timeline, the highly rated roles (most needed roles) are Multimedia Support, Analyst Programmer, Network Administrator, ICT Support Engineer, ICT Project Manager, Web Developer and Software Tester.

Overall, there is some consistency in perceived needs for roles within Canterbury and nationally. In other words, looking at the top 10 rated roles, short and long terms, within Canterbury and nationwide, we will observe consistency – even though the order of ratings may be slightly different. This is a significant outcome as it suggests that ICT qualifications that target the highly rated roles can prepare graduates to work in the sector both in Canterbury and nationwide.

Table 1. Summary of results

ANZSCO Occupation Reference	ICT Occupation	Canterbury region	
		Rating Short Term (2-year horizon)	Rating Long term (5 Year-horizon)
261111	ICT Business Analyst (BA or Business Consultant)	2	2.3
261112	Systems Analyst	1.8	2.3
261211	Multimedia specialist (Multimedia developer, multimedia programmer)	1.3	2
261212	Web Developer (Web programmer)	1.6	2
261311	Analyst Programmer (Programmer analyst)	2	2
261312	Developer Programmer (Application developer, ICT developer or ICT programmer)	1.8	2
261313	Software Engineer (Software architect or Software designer)	1.6	1.6
261314	Software Tester	1,8	1.8
261399	Software and Application Programmers (if not classified in other roles above)	2	2 **Only ONE response**
262111	Database Administrator	1.8	2
262112	ICT Security Specialist (Security administrator)	2	2
263112	Network Administrator	2	2.3
263113	Network Analyst	1.5	1.8
263211	ICT Quality Assurance Engineer (Quality analyst, Quality manager or Quality specialist)	1.5	1.3
ANZSCO Occupation	ICT Occupation	Canterbury region	
		Rating	Rating

Reference		Short Term (2-year horizon)	Long term (5 Year-horizon)
263212	ICT Support Engineer (Support analyst or Support architect)	2	2.3
263213	ICT Systems Test Engineer (Systems tester or Test Analyst)	1.2	1.7
263299	ICT Support and Test Engineers (if not classified elsewhere)	1	1
263311	Telecommunications Engineer	1.2	1.5
263312	Telecommunications Network Engineer (communications consultant, Communications specialist, Telecommunications consultant or Telecommunication specialist)	1.4	1.4
NA	IT Project Manager	2	2 **Only ONE response**
NA	Solutions Architect	1	2 **One response only**
NA	Enterprise Architect	1	2 **One response only**

Next the current and projected use of development platforms were assessed. The top 10 highly rated development platforms currently are: HTML, Java Script, Java, ASP.NET, Sql Server, XML&XSLT, Jade, C#&C#.NET, Oracle and MS Development Tools. The top 10 highly rated platforms of the future are: HTML, Java Script, Delphi, Java, Sql Server, XML&XSLT, SharePoint, Oracle, J2EE and C#&C#.NET. It can be seen that there is a high degree of consistency in perceived current and future needs for development tools. That is to say, ICT qualifications which train graduates for development tools in use currently can still be relevant for the future (2-3 years) use of development platforms.

Next participants were asked to list five highly desirable skills of an ICT graduate. The responses covered not only technical skills but broader soft skills and attributes. A summary of chosen desired skills (and attributes) is outlined below:

- Business understanding to give contact to requirements
- Communication and social skills (mentioned on 4 occasions)
- Capability to learn
- Basic programming skills (mentioned on 2 occasions)
- Work ethics
- Maturity in relationships
- Problem solving
- Technical skills
- Personality
- Business acumen
- Personal efficiency
- Basic financial skills
- Basic ICT knowledge
- Networking skills
- Web technologies
- Knowledge of server management
- Design and coding skills
- Software orientated architecture

- Management, bets practice and standards
- ITIL, secure managed and IT SME
- Critical thinking and analysis
- Understanding of business models and processes

There seems to be a significant emphasis on business understanding and communications skills. In other words, typical employer would like an ICT graduate to be not only technically competent but also possess personal attributes and skills that enable a graduate to link to business needs and be able to communicate with a wide range of clients.

Conclusions

This study involved establishing industry needs of key ICT skills and attributes - that contribute to success within the ICT sector. It is intended to take into consideration the outcome of the study in identifying possible changes in the process of revamping the portfolio of our qualifications. A focus group of industry representatives that constitute the ICT qualifications local advisory committee participated in this study – which was completed in late January 2010.

Three research questions were considered:

- Which ICT occupations (roles) are in high demand in Canterbury and New Zealand wide?
- Which development platforms are currently in use and which are likely to be in demand within the next 2-3 years?
- What other ICT skills are seen as being critical for graduates in order to be successful as ICT workers?

ANZSCO was adopted as reference for the list of ICT roles to be considered in this study – as it seemed more relevant to New Zealand market.

Some consistency existed in perceived needs for roles within Canterbury and nationally. This is a significant outcome as it suggests that ICT qualifications that target the highly rated roles can prepare graduates to work in the sector both in Canterbury and nationwide.

It was also evident that there is a high degree of consistency in perceived current and future needs for development tools. In other words, ICT qualifications which train graduates for development tools in use currently can still be relevant for the future (2-3 years) use of development platforms.

Further studies are recommended in order to:

- Involve bigger focus groups to verify the outcome of this study
- Compare the outcome with what is currently being delivered through ICT qualifications within the tertiary sector.

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IT Students' Orientation: A challenge accepted.

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Abstract

"Orientation Week" is a well established tradition in New Zealand tertiary education institutions and done well it is increasingly being recognised as important in both retaining students and contributing to their future success. Reflecting on previous years' orientations prompted the IT teaching staff to rethink the traditional form it had taken and as a result "IT Challenge Week' was organised. This was a series of fun but challenging tasks, involving all students, intended to encourage team work, problem solving, socializing and orientation to the services offered by the Institute and the wider community. Although not initially planned as a research project, the anecdotal and observable success of the Challenge Week has led the staff to consider the whole concept in more depth, not least how more traditional teaching activities may be enhanced by taking a similar approach. This paper details the rationale for the activities, based on observation and feedback and describes improvements that will be made for future years.

Keywords

Student retention, student orientation, student engagement, serious fun learning, IT education

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Introduction

The introduction of students to the basic information and networks necessary to survive the first few months of a new academic programme has long been established and enshrined in tertiary institutions' as 'orientation week' . With the current emphasis in New Zealand on the retention of students and the successful completion of courses, increasing attention is being paid to activities which would appear to encourage both. A synthesis of 146 international studies undertaken by two New Zealand researchers strongly suggests that successful orientation experiences which "facilitate both social and academic integration" will "improve academic outcomes." (Leach & Zepke, 2003 p 5). In addition they report strong evidence that orientation programmes can "provide anticipatory socialization, whereby individuals come to anticipate correctly the values, norms and behaviours they will encounter..." which sits alongside their observations that "...outcomes improve where institutions make personal contact outside classrooms....including facilitating social networks and promoting social integration..." (Leach & Zepke, 2003 p.4)

Although the IT faculty at NMIT were initially unaware of this research, common-sense, experience and personal observation, all of which were later supported by these suggestions, informed their discussions as they met to design the 2010 orientation programme for new and returning students. A lack of enthusiasm for, and an acknowledgement of the unengaging nature of previous orientation sessions, was tempered by the recognised importance to the students of much of the information. Alongside these somewhat negative feelings was a desire to impart to students the fun, the challenge and the rewards of studying IT. Staff members were already keen to see how "serious fun - serious learning" (Atkins & Caukill, 2009) could be translated into wider practice and how 'the fun theory' as epitomised by the serious but lighthearted Stairway Piano (Funtheory, 2009) could be utilised to design an engaging orientation experience which could be the starting point for re-thinking some of the more traditional educational activities. The concept of the orientation-activity focussed IT Challenge Week was born.

Rationale and Initial Design

The idea for the IT Challenge Week grew from a perceived level of dissatisfaction and apathy around orientation among both the IT staff and students at NMIT. While the Student Association organised fun and social activities across the campus, the sessions specific to academic orientation, for which staff had responsibility generally consisted of guided tours of the support areas, the library and a brief introduction to the most essential information from the Programme Leader. As a result, individual staff, particularly those teaching introductory courses, came under pressure in the first few weeks of the year 'shepherding' new, and sometimes returning, students.

One aspect of orientation that was a particular problem concerned the student laptop programme. Since 2007, each student in an IT programme at NMIT is issued with a laptop for the duration of their study. The laptops are imaged with the basic software required by all IT students over the summer break and (re-)issued to students at the beginning of the year. Each laptop user has to be registered with the NMIT network and configured appropriately. In previous years this activity had been plagued by delays caused by bureaucratic and technical hurdles, as well as bottlenecks at the issuing office. This in turn caused a great deal of distress and considerable strain for all concerned, the students, the academic staff (some students still didn't have working laptops some weeks into the semester) and the issuing and technical staff. All staff had agreed that a better way had to be found.

Two other important orientation activities concerned the use of NMIT's Learning Management System, NMIT Online and ensuring that the rules governing the student IT network were absorbed. Although NMIT Online is widely used within the IT programme, traditionally, very few students bothered to register a preferred email address on their NMIT Online account. This had always created problems for class-wide urgent notifications. In addition, students had to be constantly reminded to check NMIT Online for up to date information and very few would take advantage of RSS feeds. Likewise, ensuring that students had read and were cognisant of the network rules, is akin to the average user reading the EULA thoroughly before the installation of their software! Of course, providing every student with a copy of the rules and disciplining the rule breakers was valid under the 'ignorance is no defence' argument but the staff actively wanted the students to take a professional and ethical interest in the rules that governed their online behaviour.

Obviously, an introduction to the campus and to the wider community for students from outside the region, was also a required outcome of orientation. Various student support services, including the Students Association and the Library Learning Centre needed to be placed on new students' maps together with a number of businesses, retail, social and technical which they would be using during the course of their study. Staff also felt that it was important for all students to be able to recognise the academic and support staff connected to the IT programme.

The intention of the IT Challenge Week then, was to provide an enjoyable and stimulating orientation to both NMIT and to the IT programmes. The 'mission statement' for the week, while never specifically articulated as such, can be summed up as:

To provide fun, challenging, social and enjoyable activities that will:

- familiarise students with key NMIT facilities, e.g. the library, NMIT Online, Student Support Services, IT infrastructure and policies,

- ensure that all students have a working laptop in time for the start of formal classes

- create a sense of community between students of all levels and between students and staff,

- introduce students to some parts of the wider Nelson community

- provide opportunities for students to use IT for creative expression and fun.

Inspired by generally positive feedback from individual final year students, it was hoped that participation in the IT Challenge Week would appeal to students of all levels and and it was agreed that the first week of the teaching year would be devoted solely to these activities. In order to ensure that all the outcomes were adequately covered, activities that would address all of these areas were brainstormed by staff and developed over a number of planning sessions in late 2009. These sessions were in themselves very valuable in helping to strengthen the teaching team as they were engaging and created energy and momentum. In particular, the team became excited that they were breaking new ground for the Institute and both hope and confidence grew that staff enthusiasm would infect the student cohort and have beneficial effects that went beyond the actual orientation week itself.

Activities

It was clear that the activities needed to be both engaging and useful for all students and in order to encourage the returning students to assist the newcomers it was decided to organise the students into teams of 4 - 6 to complete the activities. Each activity would attract points for the team and a 'winning' team would be rewarded on the final day. Each team would consist of two year 1 students and at least one student from each year 2 and year 3. In this way, one of the key objectives of community building, had been addressed through the setup of the Challenge week participation itself.

Once the ideas were distilled to a set of 10 distinct activities, one staff member was assigned to each activity with the task of detailing and eventually setting it up. It was decided that a one page "Task Sheet" be created that would be handed out to each student team on the first day of the Challenge (See Appendix 1). The sheet also contained areas for scoring, and each team would return it by the week's end along with some self-assessed scores. It was envisaged that the scoring process was to be light-hearted and subjective and that, while special prizes would be awarded to outstanding work, all teams would receive a prize of some kind.

One of the first tasks for staff was writing a brief of their assigned activity. In addition, each task had to have a measurable outcome, the "Evidence", plus a possible score for (part) completion. The evidence had to be simple, fair and easy to assess, as the evidence had to be checked and assessed in a short time on the last day of the Challenge. It turned out that some tasks' outcomes included all team members' success (e.g. receiving and setting up each team member's laptop), while others had a single team-outcome, such as a short video production.

Implementation

All students had been advised that although the first week of the semester had no scheduled classes, their presence on campus was still expected. It did not seem in the spirit of the exercise to make attendance compulsory but by being deliberately a little vague as to the arrangements for the week, the team hoped to at least ensure a high level of attendance on the first day particularly as all students would be keen to uplift their laptops.

The first session took place on the Monday morning in a lecture theatre and was attended by 70+ students and all staff. The students were informed about the purpose and logistics of the Challenge Week, given the instruction sheet, organised themselves into 14 teams, adopted a team name and identified a team leader. One highlight of the session was the staff introductions - rather than spending too long talking about what they taught, each staff member was asked to speak 'two truths and a lie' about themselves - the audience (both students and staff) were then asked to identify by a show of hands which was the lie. This initial exercise, which served as our ice breaker, enabled those that did not know the staff to learn a little about them while the returning students interacted with the staff through teasing. The use of humour by staff here was critical in setting the scene as the light hearted but enthusiastic approach that we wanted students to emulate was modelled. Everybody learned something new!

After this session, the students were, to a large extent, left to their own devices, with just various deadlines or specific targets to meet. Each team was allocated a staff mentor who would help if necessary but in general students were expected to solve problems themselves and find any additional information that they needed on NMIT Online. Several rooms had been booked for them to use as a base and some activities ran throughout the week while others had to be completed within a certain time frame. All challenges had to completed by Thursday evening so that staff could meet on Friday morning and decide on the prize-winners. Staff and students then came together for a shared lunch before heading into the final 'awards' session.

The final session on Friday afternoon brought everyone back together and each staff member gave a quick de-brief on the outcomes of their challenges. The answers to some of the quizzes were shared, the T-shirt design was voted on, the YouTube videos were watched and the punishments were read out. The staff had ensured that although the 'winning' team was clearly acknowledged, all teams received recognition for something positive. A large number of 'prizes' from USB sticks to free coffee cards had been donated by local business and these were distributed across all participants. Much laughter, a high level of energy and a sense of wonder at what had been achieved in three and a half days was apparent. Everyone, staff and students alike, appeared to leave with a sense of achievement and enthusiastic anticipation for the start of classes.

Observations

The observations in this section are a mixture of those that were immediately apparent and others that occurred to us over the following months. Clearly, the observation is on-going and retrospective reflection is increasing the team's understanding of what happened. Some areas for improvement have been identified, such as choosing a more suitable room for our introductory session, ensuring that all standard NMIT induction information is included and ensuring that more international students are engaged with the week. However, the general opinion from IT staff, IT students and the NMIT community is that the week provided a successful experience on a number of levels. Some of the more obviously successful areas are described below.

Laptops

The resounding success for staff concerned the issuing of laptops, something which had proved very problematic in previous years. During the challenge week a tight timetable with bookable slots for issuing laptops has been set up, where the emphasis was on the students to get their paperwork in order and book a slot for getting a laptop as early as possible, as most, if not all, further challenges were computer-based. Despite Institute enrolment problems which negatively affected a number of students, the fact that the laptops were issued speedily helped to give students a positive experience and gave staff the time to sort out any problems. All but two of the students who registered for teams successfully completed the laptop challenge and for the first time, staff were able to begin formal classes with almost everyone having a functioning laptop.

Two things contributed to the success of this activity. One was the employment of a current third year student to build the laptop images for 2010, prepare the laptops and bags for issue and to be on hand throughout the week to troubleshoot any problems for individual students. The second was the incentive, inherent in the team environment, to help each other - it was in the team's interest to have all their members' laptops up and running and consequently second and third year students who were already familiar with the technical environment could often assist the others. This in turn relieved some of the pressure on both staff and the employed student who could thus focus on 'real' problems rather than on straightforward queries.

Treasure Hunt

There were a number of objectives underlying the Treasure Hunt. These included getting the students to

- work together to follow instructions and solve problems,
- discover relevant student services on campus,
- find useful businesses in the CBD and,
- use relevant technologies such as Google maps, NMIT Online, encryption, and binary maths to do so

A simple three wheel paper form of Enigma encoding was used to encrypt endpoint names. The students had to follow the operating instructions to decipher the information, which would lead them to the appropriate business where they had to find a clue. In retrospect the use of the Enigma encoding for all questions did become a little tedious and next year this may be restricted to just one or two clues. Picture proof was encouraged and lead some fun and interaction with business staff. It was suggested that photos should be posted on the team blog and points were also given for full group participation which encouraged the group to involve all members.

The companies that chose to be involved with the treasure hunt were enthusiastic about the groups coming into their businesses. They were cognisant of the benefits of having IT students knowing about the business, and for the local ones, knowing where the business was located and actually coming onto the premises. The buy-in was such that all the companies that participated, also donated prizes for the challenges. Student Services and the student union (SANITI) were the two campus endpoints of the hunt. Anecdotal evidence from Student Services has the visits by our students up on previous years while SANITI was sufficiently impressed that they brought the Week to the attention of both NMIT Senior Management and to the NMIT Council.

Use of NMIT Online

Requiring students to access NMIT Online to gather information about the activities and to post some of the answers, was an excellent introduction to the use of the Institute's Learning Management System (LMS). It encouraged them to consider the LMS as the first port of call for information which appears to have improved their use of the system in formal courses.

Students were also challenged to set up a realistic profile, including a picture and an email contact. This had a pragmatic purpose as well. In previous years, contacting students for various course purposes has not been a straightforward process as there are two systems for communicating with them: email via the standard campus Exchange and via NMIT Online. These two systems are never perfectly synchronised as many students prefer to use their personal email address and NMIT by default issues standard institute addresses. By encouraging the students to update their NMIT Online profile, staff then had an accurate method of communication.

Law and Order

This exercise was an attempt to introduce students to the rules governing the use of the campus computer networks and to consider why they are in place. Obviously, the staff were not seriously interested in the proposed punishments but by treating the rules in a somewhat light-hearted fashion, it was hoped that the students would actually read and digest the rules of network participation. It was clear from some of the suggestions that the implications of breaking some of the rules had been understood as many of the punishments made a humorous attempt to make the punishment match the crime.

Other Activities·

'Matching the mugshot' provided a great amount of fun and some interesting insights into personality as students attempted to match current staff to their younger and their virtual selves. The primary purpose was to enable the new students to associate a face to a name through help from the returning students. The original intention of including staff's avatars (from Second Life, World or Warcraft and others) was designed to merely make the challenge greater and more fun but in fact it had the unforeseen effect of highlighting that most staff had a virtual life, to some degree!

This emphasis on virtual existence was carried through to the Second Life challenge. More than half the students, 46 in all, managed to download Second Life, create an account and find their way around 'in-world'. Primarily designed as a fun activity, this did have several serious objectives. It is generally considered that Second Life has a large learning curve and as it is used in at least one of the IT courses, this self introduction was intended to assist with this. It also provided an opportunity for those who were already familiar with the virtual environment to pass some of their skills along. It also provided a number of opportunities for unintended problem solving (e.g. a new graphics driver needed to be installed) but it also gave students a glimpse into a new and exciting IT environment. Learning how to behave, create a network and generally navigate through immersive 3D spaces, are skills that IT professionals are very likely to require in the near future.

A number of the IT courses now use wordpress blogs as an integral part of their delivery and assessment mechanisms and while learning to create and update a blog is not particularly challenging, remembering to use it to record team activity - normalising it as an adjunct to classroom study - does tend to prove difficult for some students! It was hoped that by encouraging the use of a blog as a team diary, some of the barriers would be overcome. As it turned out the blogs were fun to create and to read and made demonstrating each team's work very easy. All teams created a blog and most fulfilled the minimum requirements laid out in the challenge.

It was not intended that all teams would complete all activities and we had believed that most would only attempt one of the 'creative' challenges - creating a TALOS logo, a T-shirt design or making a video for YouTube. In practice several of the teams attempted at least two of these and three teams did all three. All these activities tapped into the creative nature of IT and the videos particularly added significantly to the feel of the final awards sesison. They were fun, well implemented given the time available to create them and inspiring to staff and students alike.

General

The Challenge Week certainly created a 'buzz' on campus and generated significant interest in what was was inspiring such purposeful activity! The Student Association in particular was both supportive and encouraging and brought it to the attention of the CE. As a result, a presentation was made about the week to senior management who are now thinking of including some aspects of it into a broader set of orientation activities for all students in 2011.

For the students, it helped to create social networks with their peers and to develop or strengthen good relationships with staff. Those new to the campus were very quickly absorbed into the community through growing friendships with other team members and found that they had a core group of people to whom they could turn for help. This helped to promote both self-confidence and self reliance and in several instances brought out unexpected leadership traits. Both staff and students gained a new appreciation of the skills and knowledge that individuals possessed.

The Student Perspective

Anecdotal evidence from those involved was that it was fun, stimulating and useful but no specific evidence was collected in the period immediately following the Challenge Week. However, when students returned after the Easter Break, they were invited to anonymously complete a short survey. The survey asked students to identify whether or not they had found the week's activities useful and more tellingly whether they would do it again. The survey only managed to capture around 66% of the students who had taken part and no claim is made for any statistical significance in the following figures. However, they do provide some interesting insights into the student view of Challenge Week.

From a possible total of 70, 46 students responded. Of these 22 were Year 1 students, 15 from Year 2 and 9 from Year 3. Interestingly while 77% and 87% of first and second year students said they would do it again, this rose to 100% for the final year students. Additionally, 90% of those who agreed they would do it again, reported that they had found it useful. Even among those who reported that is wasn't useful, there were still those who would do it again - presumably because it was fun! An interesting observation from a final year student suggested the main reason that the first years students were the least impressed was that they had nothing against which to compare it. Those students who had experienced the orientation activities of previous years were significantly more enthusiastic.

A good number of students described the week as "fun", "entertaining", "entertaining and useful", "a good introduction" and "awesome" although two negative comments were that it was a "waste of the first week" and "too easy mentally". Perhaps the most telling comment though came from the student who said that it was "good to become familiar with NMIT infrastructure and build relations with mates, but that is all". Clearly for this student, the Challenge Week had achieved what had been intended without the students realising!

Although some did participate, the largest cohort of students missing from the Challenge Week was the international one and this was a cause for some concern for staff. On talking with our international student support staff it has become clear that our Chinese students, in particular, need to know exactly why something is being carried out and what the outcomes of not attending the event will be before they will make the decision to participate. This may also be true for some domestic students and one area that we intend to improve on for next year is being clearer to students about the benefits and purpose of the Challenge.

Future Plans

Planning for 2011 is already underway and a number of new ideas are being considered as well as refinements to the original concept. The fundamental principal of providing fun activities to help our students socialise, foster a sense of self-reliance and self-help within the student community, orient them to the important parts of NMIT and model the kind of problem-solving and sense of enthusiastic enquiry that we hope they will bring to their studies, remains unchanged. How these outcomes are achieved is still under discussion and review. Several aspects that have already been identified are briefly described below.

One current initiative at NMIT is the creation of a Learner Journey profile and the mentoring of students at all stages of that journey. One suggestion put forward is to challenge students to use software like Mahara (http://mahara.org) to create an extended profile of themselves and their interests that would create a foundation for their Learner Journey. In subsequent years, returning students could be encouraged to update their e-portfolio with reflections on the past year and goals for the new one.

Another suggestion is to build a challenge around some aspect of our Library Learning Centre : something that involves discovery and will increase their understanding of the LLC facilities and services. Alongside this it might be useful to include an activity centred around how to carry out searches on the internet and how to decide whether the information found is valid or not. This would support our international students in moving to a different educational model and would also benefit those who are returning to study after some time. Part of this challenge could also be to search for information that is not easily found via Google, e.g. identifying an image or an audio clip.

Rather than focusing only on design based challenges, such as the T-Shirt and logo, a speed programming or programming bake-off competition, using some very simple facilities that students are likely to be already familiar with, or which they can quickly gain from other more experienced students in the same group, could offer an interesting alternative. Additionally, a physical group-building activity, as might be carried out as an introductory game at an outdoor adventure centre, could be included. Another aspect that wasn't explored in 2010 but that could be integrated into a variety of activities was the use of social media technology such as Facebook or Twitter. Of course this could be as much as a challenge to staff as to students!

The team for 2011 had considered inviting senior students to assist and advise in the planning and running of activities for next time. However informal conversations with current final year students suggests that this may be counter-productive. Part of the attraction for these students was seen to be the element of surprise and the real challenge for them in seeing themselves as the 'experts'. Clearly, this was an important confidence-building exercise for many of the final year students and one which it may be best to preserve.

Conclusion

The IT Challenge Week had been envisaged as providing a fun way of ensuring that students gained vital orientation information while also encouraging the creation of social networks across the complete body of IT students. Observations from staff and students would suggest that these objectives were very well met and that the week was a great success. The staff experienced the motivational power of tasks and activities that were not only closely matched to student interests but were presented in an engaging and largely self-directed manner. The students gained useful information with little pain, achieved some personal growth and increased their social networks. Together staff and students established a framework for useful and acceptable interaction which could be translated into the learning environment for the coming year.

A number of improvements and new initiatives have been identified for next year. There is a clear need to encourage participation from an even larger number of students, in particular the international student cohort, not only to improve the induction experience but so that all students can reap the on-going benefits that IT Challenge Week has been demonstrated to bring.

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Appendix 1 - IT Challenge Week Activities

Laptops By week's end each team member will have a working SBCT laptop. Get your paperwork in order, pick up a laptop, set up your login account, ensure printing, wireless Internet access etc. works, then help other members.
NMIT Online Learn how to use NMIT Online. Locate the IT-Challenge page. Find instructions for the IT-Challenge activities. Each team member needs to update their Profile by entering the preferred mail address and a picture!
Treasure Hunt Put your thinking caps and running shoes on! In this challenge you must solve clues, to direct you in the various tasks, to finish the hunt of NMIT and Nelson CBD with the best score.
Blog You will create a wordpress blog to record the progress of your team. Further details on NMIT-Online.
Get a 2nd Life By week's end each member of your team will have a Second Life account, will have accessed Second Life with their avatar and offered friendship to Arwenna Stardust. Further details on NMIT Online. Bonus awarded to team for completing the SL Treasure Hunt (instructions available in Second Life)
IT School T-Shirt Design Create a t-shirt design for the NMIT IT student group. It can be anything but must be based on the theme of IT.
Law and Order (well sort of) We have the rules, now we need you to decide on the punishment... Find the 'Rules governing student use of the NMIT computer network' on the NMIT website. Have a look at the listed examples of misuse and suggest a suitable consequence for each example. Points awarded for the most original and entertaining consequences, so get creative!
TALOS Logo Design Create a logo that represents our TALOS network, in three sizes: full size on single A4 page in Microsoft Word docx format, as a 128x128 pixel png file, and as a 32x32 pixel png file.
Get Yourself on YouTube Your task is to make a video of approx. 90 seconds describing the five hottest things about IT professionals. Choose your own angle, try humour, a suit look, a geek look, or whatever works.
Match the Mugshot In this challenge you will need to match the staff member's name with their current picture, baby picture, and their avatar. The more accurate you are, the better your group will do. Complete the online quiz to submit your answers.

From Computing Conference Paper to Journal Submission

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Abstract

It is accepted that academic conferences are one of the major forms of transmission of research findings within the computing disciplines. However in the various ranking systems for academic research, for disciplines other than computing, publication in academic archival journals is often more highly valued. A submission to a computing conference may sometimes be a self contained piece, but the conference format is of necessity brief and means that many aspects of the research must be glossed over. The lengthier journal article format can provide more scope for presenting your work in depth. Thus a conference submission can also be viewed as but one step in a journey to a more considered piece of research and a higher quality publication. This paper discusses the issues that need to be taken into account and presents some guidelines for upgrading a conference paper to a journal submission.

Keywords

Computing publications, Conference Paper, Academic Journal, self-plagiarism, Research Performance Assessment

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Introduction

A recent European study conducted in response to increasing pressures from Governmental research productivity and quality measurement initiatives, has noted the tendency to apply inappropriate bibliometrics such as the ISI journal citation databases for the computing disciplines (Meyer et al., 2009). Clear & Young, (2007) have similarly noted, in the New Zealand context, that computing publications are poorly represented in that collection. As Meyer et al have observed, "*In the computer science publication culture, prestigious conferences are a favorite tool for presenting original research—unlike disciplines where the prestige goes to journals and conferences are for raw initial results. Acceptance rates at selective CS conferences hover between 10% and 20%*" (2009).

Echoing this perspective from Europe, the recent conference and journal ranking process undertaken by the Computing Research and Education Association of Australasia (CoRE) has seen the Australian government accept a parity of esteem for selected conferences and journals within the computing and engineering disciplines (CoRE, 2009).

To emphasise the point Meyer et al. (2009) further note: "*Journals have their role, often to publish deeper versions of papers already presented at conferences. While many researchers use this opportunity, others have a successful career based largely on conference papers. It is important not to use journals as the only yardsticks for computer scientists*".

Yet there may be additional reasons to extend and revise a conference paper for a subsequent journal submission. McCartney & Tenenberg note that journals can offer more cycles of review and improvement than conferences can support, and thus can result in a higher quality publication. The feedback received after conference presentation can be incorporated into a later journal submission. Journals often have a stronger review and editorial team which may mean your work will get a better and fairer reception. The author gets another publication from the research, and more tellingly that is:

"…in a journal rather than a conference. Not unreasonably given the points discussed above, many people place greater value on journal publications" (McCartney & Tenenberg, 2008).

Reasons to Publish

For a striking expression of this distinction see the appendix attached which draws on the work of New Zealand social scientists Davidson and Lunt (2000), but adapted for the computing disciplines, and indicates the prestige associated with differing forms of academic publication. In the original version "*publishing in academic conferences*" did not "*contribute towards building an academic career*", but did "*provide an opportunity to test ideas*". The other reasons to publish of: *communicate ideas*; *enhance academic reputation* and *feel good about ourselves* were all satisfied by most forms of publication. The Performance Based Research Fund (PBRF) process critiqued in (Ashcroft, 2005) applies similar judgements to those outlined in Appendix A below in assessing the quality of academics' work and their publications. Therefore having a judicious balance of publications across categories (including journals) is a sensible strategy for weathering research ranking exercises.

It is also important to decide where to publish. The higher ranked journals (cf. CoRE, 2009) carry more weight and prestige, but are highly competitive and selective venues, with lengthy publication lead times. Some authors deliberately aim high and then work down the journal status hierarchy after rejection and feedback. Others select a journal they believe will be more likely to understand and accept their work. Nonetheless rejection is a not uncommon outcome, so be prepared for it – it happens to the best. As Moti Ben Ari acknowledges:*"(I follow my own advice scrupulously, yet I have had my share of rejections)*" (2000). Another sound strategy often involves submitting to a special issue in your own topic area. These come out from time to time and can often be identified by keeping actively linked within your research community.

This paper therefore outlines a few steps that should be considered by computing academics when seeking to promote a conference paper to a journal submission.

Guidelines for Journal Publications

Academic journal editors desire to publish high quality original work, or as noted by McCartney & Tenenberg (2008) "*work of archival quality worthy of the ACM moniker*". Thus your work needs to meet several tests, more simply stated "*the five R's of academic publication*", derived at a research colloquium session on academic reviewing (McNaught & Clear, 2004):

- Relevance
- Rigour
- 'Riginality
- Requirements of Editor
- Readability

Demonstrating Originality

Given that your work has already been published in a conference setting, the onus is on you to show that your journal submission is substantively different from the original. You will need to check the policy of the journal on previously presented work. As noted in Collberg & Kobourov (2005) both ACM and IEEE have policies on prior publication and simultaneous submission, including strictures against self-plagiarism:

> *"Both policies emphasize novelty of the new result as an important criterion, and ACM puts a number to it: 'at least 25% of the paper is material not previously published'".*

However policies differ between journals, for instance ACM's Transactions on Computing Education, which has formerly solicited prior conference papers (McCartney & Teneneberg, 2008) note:

> *"A paper that is based on previously-published work (a conference or workshop paper, e.g.) is expected to contain at least 30% new material, and the original paper should be cited as a footnote to the paper title" [http://toce.acm.org/authors.html]*

To achieve an original twist in your journal paper away from the original conference submission, you could consider adopting a different focus. McGraths' (1985) three domains as outlined following can be useful:

- Substantive

  (Phenomena of interest, e.g. practices, processes, industry, IT, system etc.)
- Conceptual

  (theories of relevance to the study)
- Methodological

  (ways of studying the phenomena)

For instance if your original conference paper had a focus on the substantive phenomenon, the journal paper could choose to adopt a more methodological focus.

Demonstrating Rigour

Journal editors expect high quality work that demonstrates rigour in both the research process and its reporting. Therefore ensure that your expression, formatting and referencing do not let you down by making your work appear sloppy and unprofessional. Adhere carefully to the editorial and submission guidelines, and write in a clearly phrased and logically structured fashion, so that it appeals to the audience and is in the style of the publication. Read a few prior editions and see what typically gets published, so that you know your work is likely to fit the publication. In particular if the journal has prior work especially relevant to your own submission make sure that you are familiar with it, and where appropriate have cited it.

In extending from a conference paper, there are a few approaches which can enhance the substantive rigour of a shorter piece of work. Frequently a journal article has scope to further develop the literature review and thereby build upon and cite prior work. This may help motivate the study reported in your paper. Alternatively you could choose to make a full literature review the sole focus of your journal article. A journal format may also offer scope to explain in greater depth the methodology applied in the research. More in depth analysis of data may be possible, with more illustrative examples, cases or tabulations of intermediate and final results. There may also be scope for expansion of the discussion, such as outlining particular frameworks applied within or resulting from the research and further exploring the implications of your work for research and practice.

Some Do's and Don'ts

As an author it is a good idea to put yourself in the shoes of the reviewers and editors of your paper. I highly recommend the brief set of guidelines on "how to get a good review" by Moti Ben Ari (2000), which include some excellent suggestions on choosing a suitable title and abstract for your work. Then from the reviewers' perspective Allen Lee (1995) offers an informative set of guidelines for reviewing a manuscript, which should enable you to act as reviewer for your own work prior to submission. Some key questions to pose yourself are:

- Can you easily summarize your paper and its message?
- Can you clearly state the objectives, contributions and limitations of the study?
- Is your argument consistent with your stated position and well developed throughout?
- Can you forecast how reviewers might react to the paper?
- Have you positioned the work well in its context and with respect to the future possibilities it may present?

There are also common pitfalls to avoid as noted by Murthy and Wiggins (2002), when analysing the reasons for rejections of papers submitted to the Journal of information Systems. Some critical questions you should ask of your paper before submission are:

- Is the rationale clear and is the paper likely to appeal to the readers of the journal?
- Is there a solid alignment between the motivation, literature review, and theory or resulting hypotheses of the study?
- Is the research design suited to the research question or hypotheses?
- Has the research been well conducted methodologically (e.g. appropriate statistical tests or analysis techniques have been used)?
- Are the conclusions well supported by the research design and findings?
- Is the work sufficiently developed for a journal paper and does it make a meaningful contribution?
- Is the work well organized and written?

Conclusion

This paper has posed a set of issues for consideration, and suggested some guidelines for computing researchers who wish to extend a prior conference publication for acceptance by an academic journal. Revising your conference submissions and taking them to the next step, offers the potential to gain satisfaction from doing more in-depth and better work. Moreover in this era of research performance measurement, it gives you another piece of published evidence to demonstrate the quality and value of your research.

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Assessing Academic Purpose and Merit of Differing Forms of Publication (Revised and Extended from Davidson & Lunt 2000, p.38*)

Publication Forum	Ranking Significance	Scope	Quality	Esteem	communicate ideas	test ideas	enhance reputation	build career	feel good
		N=national	FR = fully refereed	Top Ranking = T					
		I=international	ER = editorially reviewed	Intermediate = I					
			U =unrefereed						
Journal Article	1	I	FR	T	√	√	√	√	√
	2	I	FR	I	√	√	√	√	√
	3	N	FR		√	√	√	√	√
	4	I	ER	T/I	√	√	√	√	√
	5	N	ER		√	√	√	√	√
	6	N	U		√	√	√		√
Conference Full Paper	1	I	FR	T	√	√	√	√	√
	2	I	FR	I	√	√	√	√	√
	3	N	FR		√	√	√	√	√
	4	I	ER	T/I	√	√	√		√
	5	N	ER		√	√	√		√
	6	I/N	U		√	√	√		√
Conference Concise Paper	1	I	FR	T	√	√	√	√	√
	2	I	FR	I	√	√	√	√	√
	3	N	FR		√	√	√	√	√
	4	I	ER	T/I	√	√	√		√
	5	N	ER		√	√	√		√
	6	I/N	U		√	√	√		√
Conference Poster	1	I	ER	T/I	√	√	√		√
	2	N	ER		√	√	√		√
	3	I/N	U		√	√			√

* Davidson C., & Lunt N., (2000), *The Art of Getting Published*, Dunmore Press, Palmerston North

The Changing Shape of NACCQ

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Abstract

Recent years have seen significant changes occur in the tertiary education sector. A change of government and a new Tertiary Education Strategy, together with a major restructuring of the body representing Institutes of Technology and Polytechnics (ITP), has forced NACCQ to reevaluate its role in the sector.

This paper examines how these changes have impacted on computing education within the tertiary education sector and, in particular, within the ITPs. The role of the National Advisory Committee on Computing Qualifications (NACCQ), based on 23 years of consecutive activity, is described.

The paper explains the plans to form a new organization, Computing and Information Technology Education and Research New Zealand (CITRENZ). CITRENZ will continue NACCQ's strong advocacy role in promoting computing and Information Technology (IT) in the tertiary education sector.

The paper will be of interest to educational institutes delivering computing and IT qualifications, to students enrolled in the qualifications and to all stakeholders who have an interest in the programmes.

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Keywords

IT educators, history of computing, tertiary education, NACCQ, CITRENZ.

Introduction

The tertiary education sector is subject to rapid and continuous change, as is the computing and IT industry. NACCQ has earned a valuable reputation, both within the ITP sector and with the industry, as an organization that provides leadership in responding to these changes.

In recent years the pace of change appears to have increased and, as a result, the ITP sector faces a number of challenges. The changes are the result of a number of external events, including the introduction of the second and third Tertiary Education Strategies, both of which promote a much stronger focus on quality and relevance of education and research outcomes. The change in government has resulted in a new funding model for the ITP sector that emphasises educational outcomes. The resulting budgetary changes will place considerable economic pressure on the ITPs for 2011 and beyond. In addition to the government directed changes, the announcement of the withdrawal of the six “metro” institutes (Unitec, MIT, Wintec, Weltec, CPIT and Otago) from ITP New Zealand brought about the disestablishment of ITP New Zealand. This announcement meant that the NACCQ qualifications, as contained in the colloquially named Blue Book, no longer met the NZQA ownership requirements and needed to find a new home.

This paper briefly examines the 23 year history of NACCQ and identifies how the organization has evolved during this period in order to meet the needs of computing and IT education in NZ. The paper also considers the impact of some of the changes in the tertiary sector over the last few years and discusses options for NACCQ/CITRENZ to keep abreast of the changes, so that it can continue to offer a valuable service to its members.

The paper describes the consultancy process that was adopted to develop a blueprint for the future direction of NACCQ. This process included; an initial meeting involving the NACCQ fellows, meetings with representatives of the former ITP New Zealand organization, presentations to the NACCQ executive and working groups, and a presentation to the Heads of Schools of the member organizations.

The paper concludes by describing the plan developed on behalf of the NACCQ membership, which will lead to the establishment of CITRENZ.

The paper is narrative in nature, providing a reflection on the history and possible future role of NACCQ. It should be noted that the authors of the paper are the immediate past chair and present chair of NACCCQ and, as such, includes their personal views.

History of NACCQ

“In 1986 a committee, consisting of industry and polytechnic computing representatives, was formed to design a new qualification in computing that would replace the outdated New Zealand Certificate in Data Processing (NZCDP). As a result the Certificate in Business Computing (CBC) programme, a radical new approach to computing education incorporating competency-based assessment, was offered nationally in polytechnics for the first time in 1988.

The National Advisory Committee on Computing Qualifications (NACCQ), formed to replace the NZCDP review committee, continued with the development of the Advanced Certificate in Business Computing (ACBC), introduced in 1989, and the National Diploma in Business Computing (NDBC), introduced the following year.” (Roberton & Ross, 2003).

The formation of NACCQ to take ongoing responsibility for the new competency-based family of business computing qualifications was unique in the New Zealand tertiary sector. It preceded the establishment of the New Zealand Qualifications Authority (NZQA) in the early 1990s and resulted from a collaborative effort by a few far sighted tertiary educators and ICT industry representatives. NACCQ’s primary focus was and is still best described using its vision statement “Fostering Computing Education in New Zealand”.

With the establishment of NZQA considerable pressure was eventually mounted on NACCQ, via the ITPs, to adopt the so called national qualifications, based on unit standards. In 1994, at the annual conference in Christchurch, NACCQ persuaded NZQA to form a writing party to develop computing unit standards for levels 5 to 8. This was in response to an identified need to bridge the gap in student computing and IT knowledge between post secondary school and pre-industry. Three years later these computing unit standards, based on the modules contained in the then current version of the Blue Book, formed the basis of level 5 to level 7 qualifications registered on the national Qualifications Framework (NQF). *"With the infrastructure and the standards of the NACCQ programmes already well established, polytechnics could not see any added value in the NZQA levels 5 to 7 unit standards, so there was no uptake of the NZQA qualifications within the polytechnic sector."* (Roberton & Ross, 2003).

In 1990 NACCQ introduced a level 3 Introductory Certificate in Computing (ICC), with threads of literacy and numeracy woven into the whole programme. The Introductory Certificate in Information Technology (ICIT) was subsequently developed for the secondary school sector, thus encouraging strong links with the ICT teachers and defining clear pathways for their computing and IT students. Unfortunately, these programmes were forced to be discontinued with the introduction of NZQA's levels 1 to 3 national certificates in computing (NCC).

It is worth noting that NACCQ's acknowledgment of the need for literacy and numeracy to be integrated into the ICC Level 3 programme preceded the Tertiary Education Commission (TEC) Literacy, language and Numeracy Action Plan 2008 – 2012 by almost 20 years.

In the late 1990s a Graduate Diploma in Computing Education (GDICE) for ICT teachers was developed by Wintec School of IT staff. This was in response to the growing demand for computer technology and IT education in the secondary school classroom. NACCQ acquired GDICE in order to provide all polytechnics with the opportunity to offer the programme throughout New Zealand.

In 1994, the then government of the day, decided to introduce competition into the tertiary market by opening up the opportunity for polytechnics to offer degrees. The Wintec School of IT, under Alison Young's leadership as Head of School, responded to the challenge by becoming the first to offer a computing degree, the Bachelor of Information Technology. Other polytechnics quickly followed suit, until a majority of the NACCQ community were offering either the Wintec degree, variations of it, or their own newly developed degrees.

The result of introducing degrees into the ITP sector saw a gradual decline in the number of ITPs offering the Blue Book qualifications, confirmed in a survey of 20 institutions conducted in late 2002, early 2003. Note that the 2010 figures, known or estimated, have been added to the original results (Fig 1).

This same survey identified/raised a number of issues for NACCQ to investigate and as a result several new initiatives were instigated including;

- Incorporating internationally recognized industry certifications; e.g. Cisco, into the Blue book qualifications

- Aligning the moderation process with NZQA procedures, incorporating Accreditation & Moderation Action Plans
- The creation and implementation of a degree moderation scheme
- The development of Graduate Diplomas

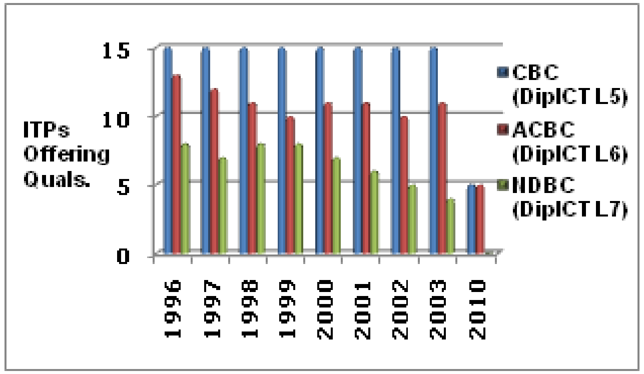

Fig 1 ITPs Offering NACCQ Blue Book Qualifications

The following statement, included in the 2003 paper, is as relevant now as it was then;
"None of us can predict with any certainty where the industry will have moved in the next ten years, but it seems that the NACCQ is sufficiently adaptable to cope and continue to offer and invaluable service to the (ICT) industry and educational sectors that it services" (Young and Joyce, 1998).

2008 and Beyond
Since the end of 2007 a number of events have occurred that potentially threaten the future viability of NACCQ, necessitating a focused proactive response. These events include the introduction of the second and third Tertiary Education Strategies (TES) and the 2008 election, which brought about a change in government. This led to changes in policy and changes to the funding models under which the ITP sector operates. These policy and funding changes were compounded in 2009 by an announcement that six of the largest ITPs intended to resign from ITP New Zealand and form a separate organization (NewsWire, 2009).

The second TES, released in 2007, covered the period 2007 to 2012 and set out where the government expected to see shifts in the provision of education and research for the tertiary sector. A number of priority outcomes were identified:

- increasing educational success for young New Zealanders; more achieving qualifications at level four and above by age 25
- increasing literacy and numeracy levels for the workforce
- increasing the achievement of advanced trade, technical and professional qualifications to meet regional and industry needs
- improving research connections and linkages to create economic opportunities

In essence the strategy encouraged institutes to concentrate on the under 25 demographic and improve completion and retention rates, while ensuring that qualifications met regional and industry needs. The strategy also introduced a new funding model for the sector, based on a negotiated number of equivalent full-time student (EFTS) places and a negotiated mix of provision. It encouraged a more applied focus to the research area. While the priority outcomes and new funding model did not impact directly the survivability of NACCQ the changes did encourage individual institutes examine closely what they do and how they allocate funds within their budgets.

The election in November 2008 led to a change in government and almost immediately an announcement was made that government spending would be curtailed to help the country cope with the worldwide recession. By 2010 a new Tertiary Education Strategy for the period 2010 to 2015 was released. The revised strategy added further priority outcomes, as follows:

- increasing the number of Mäori and Pacifica students enjoying success at higher levels
- increasing the number of young people moving successfully from school into tertiary education
- improving the educational and financial performance of providers
- strengthening research outcomes

The revised strategy saw the removal of some of the existing funding streams and indications that institutes would face some difficult budgeting decisions for 2011 and beyond. While the impact of the change in financial position is unclear at the current time institutes are increasingly questioning the value obtained from the voluntary levy paid by NACCQ members to allow the organization to operate.

In July 2009, the six largest polytechnics announced their intention to leave ITP New Zealand, the representative body for the ITP sector. When asked about the reason for the split Don Barnes (2009), the CEO of CPIT, stated that *"The six metros have issues that are common to institutions in the larger cities and are a little bit different from the other institutions"*. In December 2009 the two groups parted, ITP New Zealand was disestablished and the 14 remaining institutes formed a new organization known as NZITP. The disestablishment of ITP New Zealand meant that a new home had to be found for the NACCQ Blue Book qualifications.

During the 2008 to 2009 period there were a number of personnel changes to the Computing Heads of School (HoS). Some of these HoS were individuals who had had no active involvement in NACCQ matters and they questioned what benefits were to be gained from membership. They were appointed to organizations that did not offer Bluebook qualifications and they believed that the research opportunities created by NACCQ were insufficient to rate in terms of PBRF outputs.

Impact on NACCQ

The news that the "metros" had decided to split from ITP New Zealand was made just prior to the 22nd Annual NACCQ Conference held in Napier. The news of the split, combined with the other changes mentioned above, led to a lively discussion concerning the future direction of the organization. Delegates at the annual general meeting agreed that a working party should be formed. It would review the goals and activities of NACCQ and would draft a plan to reposition the organization in the new political environment.

A working party, consisting of the chair, the immediate past chair and NACCQ fellows, met in Auckland in August 2009. A proposal was developed illustrating how NACCQ could reorganize and refocus to maintain value to its ITP membership. Starting with a blank piece of paper the participants set about identifying the key activities that it should be involved in. The working party reaffirmed that a collaborative body, such as NACCQ, was vital, albeit with a shift in focus, to help ensure the continued provision of quality services to its members.

A mission statement and the organization's goals were drafted and an implementation plan, stating how the organisation would meet its goals, established. An organizational structure was developed, based on a regional model (very similar to the original concept of regional representation suggested when NACCQ was formed) with an executive consisting of ITP and industry representatives elected from each of the newly identified regions. Finally, the issue of an appropriate name for the revised organization was discussed and, although there was general agreement that a name change was necessary, no conclusion was reached.

The draft proposal was presented to a combined meeting of the two NACCQ working groups in October 2009 and, as a result, the model was refined. At the executive meeting the next day, following lengthy discussions and further refinements to the model, the name for the new organization, Computing and Information Technology Education and Research New Zealand (CITRENZ), was adopted. It was agreed that the model should be shared at a meeting of the Heads of Schools of the membership organizations and their agreement to the proposal be sought.

In December 2009, a meeting of the Heads of School was convened in Wellington. With the exception of Unitec and Waiariki (an apology from Waiariki indicating support for the concept was recieved), all the institutes that offer computing qualifications were represented. Participants voted unanimously in support of the CITRENZ proposal.

The CITRENZ Proposal

CITRENZ will represent the interests of those offering computing qualifications in the tertiary educational sector, focusing on, but not limited to institutes within the ITP sector. The agreed vision for the organization is to *"Promote excellence in computing education".* Its proposed mission statement is; *"to work with industry and stakeholders to provide collaborative opportunities in teaching and research to promote excellence in computing education".*

The organization will concentrate on four main activity areas:

- Encouraging communities of practice (CoP), such as the;
    - Research community
    - IT Teaching community
    - Heads of Schools
- Research
- Consultancy & Linkages
- Curriculum Development and Quality Assurance

The research community would be involved in producing the journal (JCIT) and the online bulletin (BACIT), hosting and organizing conferences, mentoring and encouraging emerging and established researchers, organizing collaborative research opportunities, forming alliances with national and international research bodies, and fostering research potential.

Those participating in consultancy and in developing linkages area would provide advice on matters related to teaching computing & IT in tertiary sector. It is envisaged that the linkages would be with industry (e.g. employers, NZCS, NZSA) ; educational institutes (e.g. high schools, universities and PTEs); and government departments (e.g. TEC, NZITP, Metros, MOE, and Ako Aotearoa).

Curriculum development and quality assurance would involve; professionalization and certification (linking in with the NZCS initiatives and SFIA), policy formulation, moderation, monitoring, consultancy on quality assurance matters, and qualification compliance.
The organizational structure would be leaner than the current structure and regionally based with five regions each nominating one academic and one industry representative to the executive committee. The executive would be responsible for the governance and management of the organization. Working groups would be tasked with facilitating the operational activities of the organization.

CITRENZ will need to have legal status as an organization so that the Bluebook qualifications can be transferred from the disestablished ITP New Zealand. Options that were considered included the formation of a consortium, which would require a lead institute, an incorporated society, which requires a minimum membership and offers little flexibility, and a charitable trust. The charitable trust option was chosen as it provides a very flexible structure that should meet the needs of the organization for the foreseeable future.

Where to next?

Once the CITRENZ proposal is fully agreed to, a charitable trust needs to be established, together with the rules and regulations governing its operation. The CITRENZ executive members, tasked with implementing the vision and mission statements, then have to be elected.

A number of activities have been identified that would need the immediate attention of the newly elected executive committee, including; transfer of the Blue Book qualifications to the charitable trust, initiation of a project to redevelop the qualifications (adopting a zero-based review), and reviewing all the current NACCQ activities to ensure that they focus on the four main activity areas identified in the CITRENZ proposal.

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Attempting to Establish a Business Incubator in Hawke's Bay

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Abstract

All but one of the business incubators in New Zealand are located in a metropolitan areas and all of them are closely associated with one of the New Zealand's major universities. This paper describes an attempt to establish a business incubator, with a focus on using IT, in a regional centre which does not have a University presence.

The paper describes how a group of Hawke's Bay business leaders working alongside Eastern Institute of Technology (EIT) set about trying to establish a business incubator in the Hawke's Bay region. The decision to consider developing a business incubator with an Information Technology (IT) focus arose from an offer by FX Networks, New Zealand to provide accommodation, and IT and networking support to local entrepreneurs who might need assistance in establishing a new business venture.

The paper briefly describes the processes adopted by a steering group consisting of educational and business leaders as they went about attempting to establish an incubator. The paper also describes how local businesses were surveyed in an attempt to establish the level of support that existed. The findings from the survey, which showed mixed level of business support, are also presented. The paper concludes with a summary of progress to date.

The paper will be of interest to educational institutes and businesses in regional centers of New Zealand who are thinking of establishing a business incubator and are looking for advice on the processes to follow.

Keywords

IT incubator, business collaboration, regional focus, Industry, fiber optic networks.

Introduction

Currently there are no business incubators in New Zealand that are associated with an institute of technology or polytechnic. The only non-metropolitan business incubator is in Palmerston North and that has a close association with Massey University. At the current time there are no business incubators that have

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been established with the primary purpose of making use of IT infrastructure to enable businesses to develop and grow.

The installation of a fiber optic networking service by FX Networks in Hawke's Bay in 2008 provided an opportunity for local businesses to investigate how access to very high speed data and voice services could provide opportunities to expand their operations.

This paper explores what happened when FX Networks offered to host a business incubator to enable local entrepreneurs and businesses to establish start up business ventures in a supportive environment. The FX Networks offer was aimed at business ventures that would leverage the newly introduced high speed data and voice services to create new business opportunities.

The paper commences by defining what is meant by the term "business incubator" and looks at examples of business incubators that have already been established in New Zealand. The paper then describes how a working group was established to investigate the potential for a regional business incubator and reports on the activities of the group as it set about identifying the level of regional support for the concept and structures necessary to establish and support an operating incubator.

The paper then describes the development of a questionnaire that was distributed to local businesses in an attempt to identify attitudes towards the establishment of business incubator with a focus on the use of IT within the Hawke's Bay region. The responses to the survey are summarized and the consequential actions that occurred after the survey was analysed are detailed.

The paper concludes describing how the working group failed to maintain momentum with the project and FX Networks support was withdrawn. Resulting in a situation where an incubator is still likely to be established but based on a special relationship between FX Networks and the Eastern Institute of Technology (EIT) and only available to highly performing EIT graduates.

The methodology adopted for this study combines both qualitative and quantitative methods. The paper describes a case study based on the steps taken to establish the need for an incubator in Hawke's Bay and uses a survey instrument to establish industry reaction to the establishment of a regional incubator. The survey provides qualitative data relating the attitudes of local industries and business organisations towards the establishment of a locally based incubator.

Business Incubators

The concept of developing a business incubator is not new, there are several successful incubators operating in New Zealand. With the exception of the Bio Commerce Centre, an incubator based in Palmerston North, all the New Zealand incubators are based in major metropolitan centers. The Bio Commerce Centre, which focuses on biotechnology is located in the Fitzherbert Science Centre, amongst New Zealand's largest cluster of researchers in the fields of food, environmental technologies, and human and animal health. Establishing an incubator in Hawke's Bay would be the first instance of an incubator in a regional center which does not have a very specialized focus. The aim of establishing a business incubator with a focus on the use of leveraging IT to nurture business growth would also make the incubator unique within New Zealand.

The Business Dictionary (2010) defines a business incubator as

> *"Facility established to nurture young (startup) firms during their early months or years. It usually provides affordable space, shared offices and services, hand-on management training, marketing support and, often, access to some form of financing."*

This definition is similar to the description given on the New Zealand Trade and Enterprise (2010) website that describes a business incubator as a facility designed to assist businesses to become established and sustainable during their start-up phase. The New Zealand Trade and Enterprise (NZTE) websites suggests that typically this is achieved by providing potential start-up businesses with access to:

- shared premises,
- business advice,
- business services,
- access to investor, market and international networks,
- mentoring, and
- a full-time, hands-on management team.

They also suggest that the incubation period for an individual business is normally two to three years.

NZTE is a major funder of the New Zealand business incubators and supports incubators in Auckland, Palmerston North, Wellington, Christchurch and Dunedin. In support of the funding provided through NZTE, Trevor Mallard (2006) stated that "incubators had graduated 107 companies since the Incubator Support Programme run by New Zealand Trade and Enterprise's began five years ago."

There are a number of incubators not funded by NZTE and they include Soda Inc and WaikatoLink Incorporated, both of which are located in Hamilton. Like most of the existing incubators in New Zealand, both Soda Inc and WaikatoLink Incorporated have strong links with universities.

Incubator New Zealand, formed in 2003 as the incubation industry's national association, indicates that there are 16 incubators in New Zealand. The Incubator New Zealand Newsletter (2006) reported that "Performance data from 68 of the 107 companies graduating from incubators since 2001 show they generated $50.3 million in revenue in the past financial year, of which 23 percent was from exports. The 68 firms also raised $19.6 million of capital to fund future growth and directly employed 544 people."

FX Networks

Towards the end of 2008 FX Networks New Zealand, a company that provides long haul very high speed data and voice communications established an office in Napier. At the same time that the office was established, FX Networks installed a high speed fiber optic data and voice service linking Hawke's Bay with the rest of the country and the world. The installation of fiber optic cabling provided an opportunity for

Hawke's Bay businesses and educational institutes to make use of the Gigabyte data services and grow their existing business and look for opportunities to explore new business ventures.

Early in 2009, FX Networks announced that it intended to offer some of its Napier office space to establish an incubator aimed at encouraging local entrepreneurs and business interests to make use of the newly installed high speed data communications infrastructure to grow new business ventures. At the time FX Networks indicated that they had a vision which would see Hawke's Bay emerge as a region recognized for its innovative use of digital technologies. The offer was publicised through several business networks including the Hawke's Bay Chamber of Commerce, Te Puni Kokiri, Venture Hawke's Bay and a selected number of local IT and general businesses.

Incubator Working Party

A working party with representatives from FX Networks, the Hawke's Bay Chamber of Commerce, Te Puni Kokiri, Venture Hawke's Bay, EIT, a software development company, a human resource management company, and a local business consultant was established to investigate the possibility of establishing a Hawke's Bay based business incubator.

The working party arranged a number of meetings and there was general agreement between participants on what was seen as the role of the business incubator and time was spent looking at how the existing New Zealand incubators operated. The working party identified a need to survey local industry to see if there was support for the incubator concept. As a way of ensuring that local business understood the concepts of business incubators a number of meetings were arranged to share ideas and representatives from some of the existing New Zealand incubators were invited to speak about their experiences.

While the original offer from FX Networks was aimed at business opportunities that would leverage the new high speed fiber networking infrastructure and establishing the Hawke's Bay as region recognized for its innovative use of digital technologies, the emphasis on IT and digital technologies gave way to a more general business incubator approach.

The Survey Instrument

Using information shared by a group of Australian consultants tasked at looking at establishing a business incubator in Australia, a survey was developed to attempt to judge local industry support. The survey was based on a similar survey used in Australia and was distributed by email to more than 100 local businesses. While the sample cannot be said to be a random sample it did reflect the organisations that are likely to be using or supporting an incubator should it be established.

The EIT representative agreed to collate the responses and report back the findings to the working party.

The survey instrument provided some background information about the incubator concept and the types of activities which an incubator might support. The survey instrument was designed with four sections, with businesses being asked to supply information related to:

1. The existing business, including, the type of business, the size of business, the location and type of premises from which the business operates.
2. Plans to develop new business ventures that could be supported by an incubator.
3. The level of support and the type of support that the existing business would be prepared to offer.
4. The services that one would expect from an incubator should it be established.

Survey Results

The survey instrument was distributed to around 100 businesses and the response rate was 36%. While this may appear low, it should be noted that several of the businesses that received the survey suggested that it did not really cater for businesses that wanted to use the incubation services to grow an existing business or an aspect of an existing business. Several businesses did not complete the survey but indicated by email, conversation or phone message that they were supportive of the incubator concept.

The responses were received from a wide variety of businesses, representing most of the business activities being conducted in Hawke's Bay, as shown in Table 1.

It should be noted that 4 of the respondents (22%) indicated that their business activity spanned several of the listed categories, perhaps an indication of the less specialised nature of Hawke's Bay business. When a business indicated multiple areas, their responses were not included in each of the individual categories.

Table 1: Types of Business

Type of business activity	**Number of respondents**
Accommodation Cafes & Restaurants	2
Agriculture	2
Communication Services	2
Construction	2
Cultural & Recreational Services	2
Education	2
Electricity Gas & Water	0
Finance & Insurance	0
Government Admin	0
Health & Community Services	2
Manufacturing	2
Personal & Other Services	2
Property & Business Services	2
Retail	0
Transport & Storage	1
Wholesale Trade	0
Software Development	4
Multiple Areas	8
Unclassified	2

The respondents to the survey reflect the wide range of business activities and dearth of Government focused businesses within the region. The sample does not reflect all of the local economy because some sectors are not suited to incubation, and the focus of the incubator is on innovation and commercialisation rather than generic small business support.

Of the 36 respondents, 36 indicated that they were existing businesses, suggesting that the sample failed to include intended or planned businesses. The result clearly indicated a need to develop a mechanism that provides a way of contacting individuals or groups who have an idea or concept that has the development potential. Discussion with business leaders would suggest that Hawke's Bay has been a good breeding ground for entrepreneurs who have ideas the merit support.

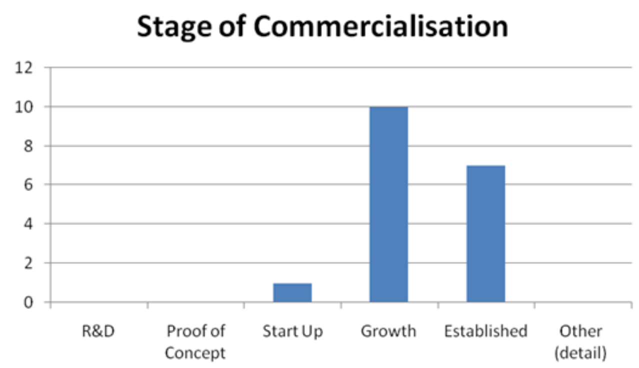
The average age of the business tended to fall into three broad categories (Table 2). 22% had been in business 2 years of less, 39% had been in business between 2 and 10 years and 39% had been in business more than 10 years. The average length of time that a business had existed was slightly more than 26 years. The age ranges tend to support the findings relating to stages of commercialization.

Table 2: Age of Business

Percentage of sample	Age of business enterprise
22%	2 years of less
39%	great than 2 but less than or equal to 10
39%	greater than 10

Prospects were at different stages of commercialisation with 5% of respondents at the start-up stage, 55% at the growth stage and 39% indicating that they were an established business. This is shown in Figure 1.

Figure 1: Stages of Commercialisation

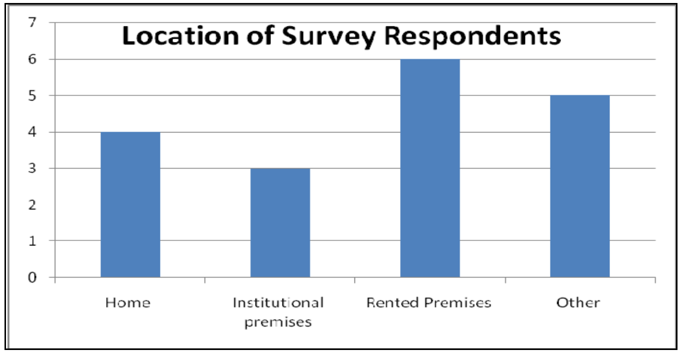


This tends to reinforce the previous statement that the survey sample did not include prospects who have a concept worthy of development or those business who are in research and development phase.

Respondents had varied business locations, as shown in Figure 2 based on the 18 responses for this question.

For all respondents who indicated other, the respondent indicated that the business were located in premises owned by the business.

Figure 2: Location of Survey respondents



The number of employees involved in the business (Table 3) varied with almost 60% of respondents indicating that they were small to medium sized businesses with less than 20 employees. The average number of employees was approximately 51, indicating that the sample included a small number of larger businesses that employed more than 100 employees.

Table 3: Number of Employees

Percentage of sample	Number of employees
27%	1 or 2 employees
5%	between 2 and 10 employees
27%	between 11 and 20 employees
16 %	between 21 and 100 employees
16%	more than 100 employees

39 of the 38 respondents indicated that they had at various stages sought business advice. The majority had sought both market research advice and coaching and mentoring support (see Table 4).

Table 4: Number of Employees

Advice Sought	Number of respondents
Assistance in preparing a business plan	8
Market research, to identify potential markets	20
Coaching and mentoring	16
Developing the firm's financial and managerial competencies	14
Assistance developing the firm's management team	14
Intellectual property advice	8
Provision of physical facilities and office services; and accommodation	10
Help securing private finance: Venture Capital, Angel Investment etc	8
Professional advice	
Accounting & Finance	18
Legal	18
Marketing	14
HR	12
Insurance	14
Assistance obtaining government funding	10
Export and Developing links to global markets	14
Developing links to national markets	6

Respondents were asked a number of questions relating to their interest in making use of an incubator and these were used to estimate the likely deal flow. The survey sought indications as to how many prospects would enquire about making use of an incubator's services, so this could be compared and analysed with actual incubator data on the number of enquiries that convert to being incubatees.

Out of 36 respondents, 20 (55%) said they would consider making use of an incubator. Six out of 20 (30%) who expressed interest in making use of an incubator said they would consider locating on site and 14 (70%) out of the 20 said they would consider using the services without locating in the incubator's premises. While the figures do not appear high it should be noted that the sample consisted mainly of business that were established or in a growth phase and no businesses were described as being in the research and development or proof of concept stage.

When asked if they were currently undertaking projects that have the potential to be commercialised through spin-off form a new small business 24 (67%) indicated that they did not have any projects. Fourteen respondents indicated that they had projects that they could identify and of the 14, eight identified specific projects. Considering that most of those surveyed identified as being businesses that were established or in growth phase this result is very encouraging.

All of the 36 respondents indicated that they would support the concept of developing an incubator (Table 5), this is perhaps the most encouraging result obtained from the survey. When asked to rate their level of support for the concept of developing an incubator no one indicated very low or low level support.

Table 5: Level of Interest in Incubator

Level of interest	Number of respondents	%
Medium	12	33%
High	12	33%
Very High	12	33%

Compared to other similar studies this is a very high rating of interest, reflecting the positive attitude of Hawke's Bay businesses towards developing an incubation service in the region. The response would seem to indicate that businesses within the region are looking for ways to help others to grow local business opportunities.

When asked about the type of support that they would be prepared to offer, 6 (17%) indicated that they would be prepared to offer financial support, 14 (39%) indicated that they would be prepared to offer moral support and 22 (61%) indicated that they would be prepared to offer mentoring services. Other services such as process improvement, operational performance and general advice were identified by 12 (33%) of respondents.

In terms of an ideal location for an incubator should it be established, 6 specifically identified EIT as the preferred location, 12 suggested Napier, 6 suggested Hastings and 4 suggested somewhere between Napier and Hastings. When asked if a location close to EIT would be beneficial, 22 suggested that it would be and no one that it would not.

When asked about the services required (Table 6) only eight respondents indicated the need for office space and no one indicated a need for industrial or storage space. When asked about Internet bandwidth it was suggested that the bandwidth should be as high as possible.

Table 6: Services Expected in Incubator

Fax	6	Typing/Word-processing	6
Photocopying	12	Book-keeping	4
Phone Answering	6	Secretarial support	2
Reception	4	Meeting Room	10
Conference Room	4	Water in unit(Not tea & coffee)	4
Showers	2	Access to a computers	6
Internet (see 20)	8	Web Page	4

Discussion

The survey results provide a picture of businesses in Hawke's Bay and indicate a wide variety of business activities with little government activity. 80% of businesses have been inexistence for more than two years and only 5% describe themselves as start-up businesses. Almost 60% of businesses have less than 20 employees and more than 80% of the businesses that responded suggested that they had sought business advice and mentoring support.

When asked about the level of support for an incubator in Hawke's Bay all respondents indicated some level of support with a third indicating a high level of support. The type of support offered ranged from financial support to the provision of mentoring services.

The survey results were shared at a meeting of the incubator steering committee and a summary of the results were sent to all participating businesses that had indicated an interest in receiving feedback. Since the survey indicated generally positive support for the incubator concept, the steering committee decided that a business case should be prepared and plans made to further the development of an incubator in Hawke's Bay.

While the steering committee expressed a desire to further the incubator concept the people who volunteered to build the business case failed to deliver and three months passed without any progress. Concerned about the delay and apparent lack of progress, FX Networks announced that they were withdrawing their offer support for the regional incubator concept. They also expressed a desire to work alongside the computing school at EIT to investigate opportunities for supporting high performing students once they graduate. As a result of the withdrawal of FX Networks support the incubator steering committee agreed to drop the plans for establishing a regional incubator in Hawke's Bay.

Conclusions

The enthusiasm of the steering committee and the positive response to the business survey would suggest that there was a good level of support for developing a business incubator in the region. However the Hawke's Bay experience would suggest that developing a regional incubator is not a straight forward task. When the steering group was unable to deliver the business case document in a reasonable timeframe the project lost momentum and the principal sponsor withdrew support. FX Networks also indicated that they were disappointed that the steering group had opted for a general business approach to the incubator concept in preference to the original concept that aimed to leverage the high speed fiber networking infrastructure to high speed fiber networking infrastructure and establishing the Hawke's Bay as region recognized for its innovative use of digital technologies.

While the attempt to establish a business incubator in Hawke's Bay was unsuccessful, the experience should provide some useful insights to anybody thinking of developing a regional incubator elsewhere. The two things that appear to have been instrumental in the Hawke's Bay case were the failure to maintain momentum when developing the business case and the early decision to drop the concept of attempting to use the incubator establish the region as a place recognized for its innovative use of digital technologies.

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The digital divide: real or imaginary?

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Abstract

There has been much written about the existence of a gap between generations when it comes to technology use and knowhow. This gap has been called the "digital divide." Since the early 1990s the prevalence of home computer use and ownership has increased to become the norm. Along with this, children are being exposed to computers at all levels of the education system from pre-school to tertiary study. This exposure has, in part, lead to the premise that this current generation are "good" at using computers. This paper examines the concept of the digital divide from the perspective of a class of students enrolling in an introductory computing class in a New Zealand University in 2009. The mean age of this class was 20 with the most represented age group being those who are younger than twenty. This study found little evidence of the traditional digital divide.

Keywords

Digital divide, first-year students, computing knowledge, computer literate, skills perception, end-user computing

Introduction

It is generally accepted that not only will the generation leaving high school and entering tertiary study be computer literate but it is also accepted that they will be more technology adept than class members from older generations. Tertiary classes have changed over the years to include not only those coming directly from high school but now commonly include people who are older, having already spent time in the paid workforce (McClelland, 2006). While members of the generation born since 1980 who have been given such labels as the "net generation", (Prensky, 2001), may be more proficient at using online resources for communication, this does not necessarily equate to them having have good skills in basic calculations or the management and manipulation of data (Kennedy, Judd, Churchward, Gray & Krause, 2008; Kline & Strickland, 2004; Bartholomew, 2004; Hoffman & Vance, 2005, Gibbs, 2008).

Lincoln University is a small rural New Zealand university just outside Christchurch. The introductory computing subject, Comp101, has been taught in some form or another for about twenty years. It is available to all students in the University. Up until the end of 2008 Comp101 was a compulsory course for all Commerce students. The compulsion was removed as there was a consensus within the Commerce faculty that new students had sufficient knowledge without needing to study computing formally (Eves & Dalziel, personal communication, 23 July 2007). Phelps, Hase and Ellis (2005) say that although computers have become commonplace there are still many school leavers as well as mature-aged people who are insecure in their computer use. They say there is a need for specific end-user computing to be taught within tertiary institutions as this is an area which has been neglected. This view, in a USA context, was recently reinforced by a personal communication from Meg Murray (2010) stating

> *"There exists a gap between the perception of the skill set under-graduates require in their educational experience and their actual functional ability … Major initiatives in the area are under way in the US … It has been mandated that technological literacy become a part of the national assessment of pre-college level students beginning in 2012. "*

A similar view, in an Australian context, has been expressed by Miliszewska, Venables and Tan (2009).

While it is acknowledged that the younger generation appears to be more confident when using and trying new technology it was decided to compare the skills and usage of the different age groups which make up the Comp101 cohort. Did the younger students really have a higher perception of confidence in their ability than their older classmates, and if so, did this translate into actual knowledge? In other words was there a digital divide, based on age, in this cohort of students?

Method

At the beginning of the first semester in 2009 the students in Comp101 were asked to complete a small questionnaire. As well as collecting demographic data, the questionnaire also asked the respondents to complete a small number of competency based questions.

The demographic data collected included the respondent's age, gender, their access to computers and asked if they had studied computing formally at high school. Respondents were also asked to outline the time spent using a computer for different online and offline computing type activities. They were also asked to give a self-rating of both their computing knowledge and their computing confidence.

To gain some insight into a respondent's computing ability three problem-solving type questions were incorporated (see Appendix 1). For each respondent the number of correct answers for these questions was calculated. Similar questionnaires have been undertaken at the start of Comp101 classes over a number of years. The specific end-user computing questions asked have been included for at least ten years and are still considered to be a relevant measure. Computer knowledge, ability and literacy have been defined in a number of ways (Yoon &Lee, 2007; Gibbs, 2009). In this study the authors use the term knowledge to mean having the knowledge and ability to complete specified spreadsheet and database tasks.

Results

In semester one 2009 there were 128 questionnaires returned which represents a response rate of 70% from a class of 183 students. The number of students in the class was the lowest it had been for many years. This downturn was due not only to the drop in the number of commerce students at Lincoln (McLennan & Gibbs, 2008), but also reflects the fact that in 2009 Comp101 was no longer compulsory for commerce students. However, having fewer students means that not as much confidence can be placed in the conclusions as when the class was larger.

The mean age for this class was 20 with a range of 17 – 51. For the purposes of this study the class has been divided into three age groups: 20 years or younger; between 21 and 24; and 25 years or older. The rationale for this grouping of ages was that those in the younger group could be typically described as "recent school leavers" often with no experience in the workplace aside from the odd after school job. The next group is those who have been out of formal education for a short period, it is likely they have been in paid employment. This group is, along with their younger colleagues, likely to be labelled as digital natives by virtue of having been born since 1980. The last group, those 25 or older, are those who have been described traditionally in New Zealand as "mature-aged" students (McLennan, 2003). These people have been in paid work and are returning to study or studying for the first time in order to make a career change or to update their skill-set. This breakdown is shown in Table 1.

Fifty four percent of the respondents had studied computing formally at high school. The group, with the highest number having studied computing formally, was the youngest group but curiously the mid-aged group had the highest percentage (Figure 1).

Table 1: Breakdown of age groups within the class

Age Group	Number	% of class
20 or younger	89	71%
21 to 24	23	18%
25 or older	13	10% *
*Note: one respondent did not give his or her age.		

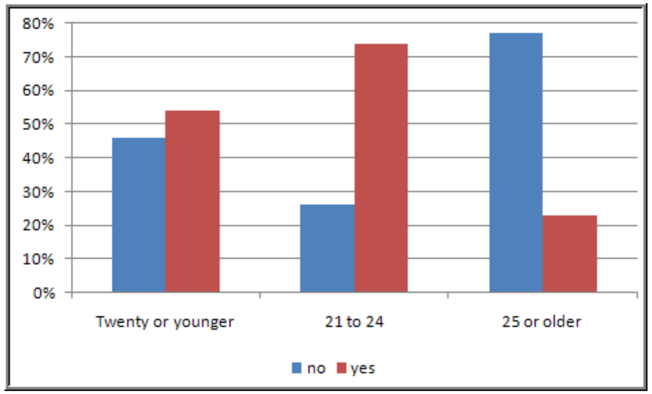

Figure 1: Percentage of each age-group who had studied computing at high school

Some of the expectation that those entering tertiary study will have good computing skills comes from the notion that they all study computing at school. This is not necessarily true. What is true is that, certainly in New Zealand, all schools, both primary and secondary, provide some level of computing technology for their pupils to use. Unfortunately sometimes this use has not come with appropriate tuition.

Self rating of computing knowledge

One of the most common ways of gaining insight into a person's perception of their ability is to ask them to rate themselves using a Likert type scale. Although commonly used there are flaws associated with 'ask and rate' type assessments. One of the most common flaws is the propensity for people to overestimate their ability. Often over-estimation is associated with those who have lower skills. Windschilt, Rose, Stalkfleet and Smith (2008), report that it is likely for people to overestimate their ability with tasks they perceived to be easy, likewise make more conservative estimations when a task is considered to be difficult. Gibbs (2008) made similar observations when interviewing students regarding their computer use.

The questionnaire asked each respondent to rate their knowledge of computing on a five point Likert type scale. The knowledge scale ranged from one for absolute beginner to five for expert. Results (Table 2) show that the majority of respondents rated themselves as having some or average knowledge with an overall mean of 2.7 (sd = 0.9).

Table 2: Breakdown of Knowledge Categories for whole class

Knowledge Category	Number	Percentage
Absolute Beginner	13	10%
Some Knowledge	37	29%
Average Knowledge	55	43%
Pretty Knowledgeable	22	17%
Expert	1	<1%

When these results are scrutinized by age group it is interesting to note that the younger group have a higher perception of their own knowledge than the older groups. This can be seen in Table 3 and Figure 2 where younger students appear to have higher scores. Regression analysis between age and knowledge perception returned a non-significant correlation.

Table 3: Mean results of perceived knowledge by age group

Age Group	Mean response
twenty or younger	2.8 (0.9)
21-24	2.7 (0.8)
25 or older	2.5 (1.0)

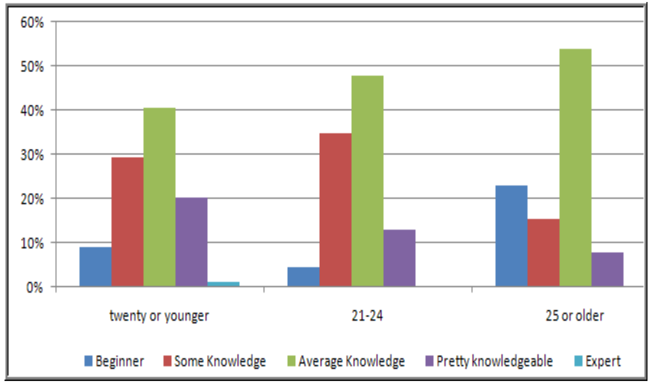

Figure 2: Knowledge broken-down within age group

Self reported confidence

Often, when talking about an individual's computing skills, confidence and knowledge are confused. Anecdotally the authors have had the experience, when asking someone to rate their computing ability, of the answer including the words "I am quite confident using computers". With this in mind it is considered important to discuss the results of the student's self-rating of their confidence level.

The mean scores, computed using a Likert type score similar to the previous section returned a mean value of 3.07 (SD = 0.9). The actual numbers in each of the categories are shown in Table 4 with the mean results in Table 5.

Table 4: Breakdown of Confidence categories for whole class

Confidence Category	Number	Percentage
Not confident	7	5%
A little confidence	23	18%
Average confidence	61	48%
Confident	28	22%
Very confident	9	7%

Table 5: Mean results of perceived confidence by age group

Age Group	Mean response
Twenty or younger	3.2 (1.0)
21-24	3.0 (0.8)
25 or older	2.7 (0.8)

The results reported in table 5, while not significantly different, might suggest that the younger students believe themselves as being more confident in their computing ability than the older students do.

It is interesting to consider this result by age group by examining the graph in Figure 3. What this shows us that for each group the most common category is, not surprisingly, Average Confidence. However, it is again not surprising, to see that the younger age group is the one where there is a larger proportion who rate themselves as being more confident, than in the other age groups.

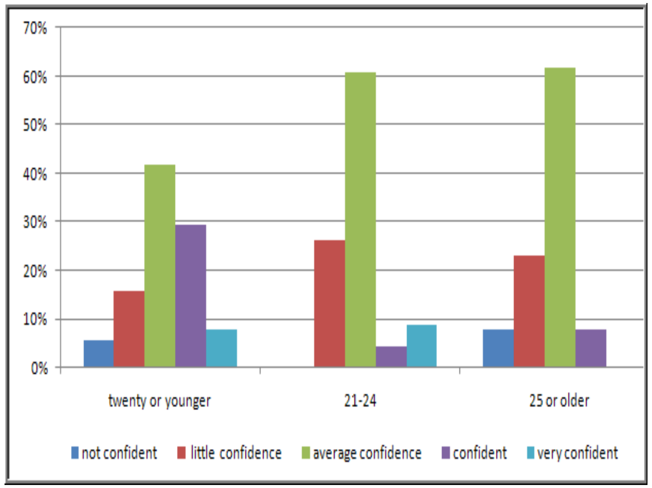

Figure 3: Confidence by age group

Ubiquitous computing
In part, the higher levels of confidence with the young group can be explained by the greater access they have had to computer technology. They were born when ownership of computers increased to high levels. They have also had the benefit of having access to computers at all levels of their education. The NZ 2006 Household census reports that at that time 71.6% of New Zealand households owned at least one computer and 64.5% of households had access to the Internet (http://www.stats.govt.nz/~/media/Statistics/Browse%20for%20stats/HouseholdUseofICT/HOTP06/householduseofict2006hotp.ashx). In contrast access to computers is much higher for the 2009 Comp101 students with 97% having a computer at home and 92% having an Internet connection. This statistic suggests it would to safe to assume that the most students are used to using computers. Much of the younger generation's computer use has been reported as being online activities such as social networking, online gaming and buying and selling via online auctions (Kennedy, et al., 2008). With this in mind, and having collected information about the types of activities the students used computers for, it was decided to take the three activities mentioned and compare the frequency of use between our three age-groups. This is displayed in Figure 4.

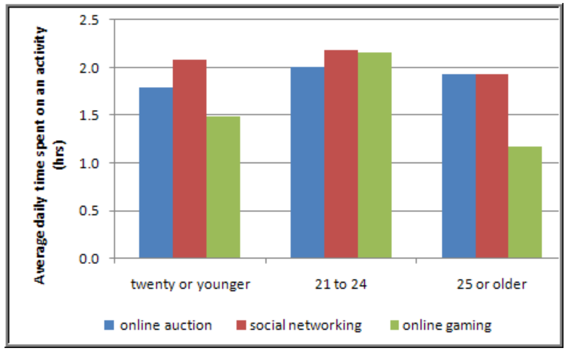

Figure 4: Mean time spent on online activities by age-group

An interesting result is that the mid-aged group, the older digital natives, appeared to have the highest use of online activities overall. This is a little surprising, given that all most young people are rumoured, by popular media, to spend a lot of time social networking, etc. However, Kennedy, et al. (2008) had a similar finding where they report that in a class of first-year students only 24% used social networking regularly and 64% had never communicated this way. These data, collected more recently than Kennedy's, showed 25% of the students did a lot of social networking and only 20% did little or none. What was especially surprising was how little difference there was between all three groups in their online use in all three categories.

Knowledge based questions
Three knowledge based problem solving questions were included in the questionnaire given to the students. These questions, 12 to 14 in the questionnaire (see Appendix 1), were designed to test students' basic knowledge of spreadsheet techniques and database query logic. Possibly competence in solving these problems indicates a sufficient level of knowledge of end user computing for tertiary study and later employment. Summarised results by age group are given in Table 6 with the full results shown graphically in Figure 5.

Table 6: Mean number of correct answers, out of 3, by age group

Age group	
twenty and younger	0.5
21-24	0.3
25 or older	0.4
Overall Average	0.4

The results show us that no one group stood out above the rest as having more knowledge. In fact all groups performed equally as poorly as the others with only one class member getting all three questions correct and the majority getting one or none correct.

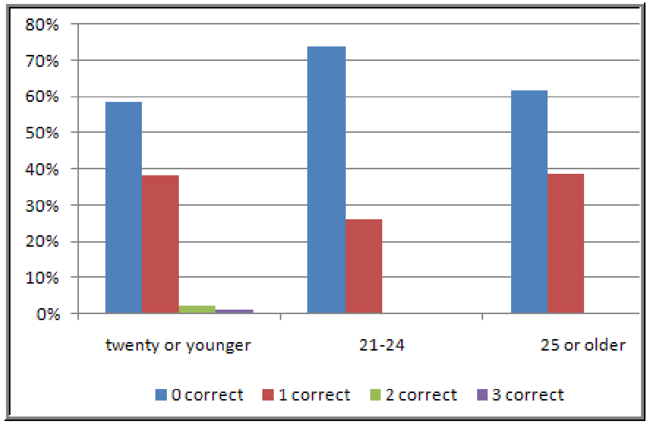

Figure 5: Results of knowledge based questions by age-group

What is interesting is that the mid-aged group (21-25) appears to have performed the worst. This is the group that had the most members who completed high school computing (74% compared with 54% for the younger group and 23% for the older group) and also the group that had the highest daily online usage. They might have been expected to have been the most computer literate of the three groups. This is not apparent from our results.

Findings

Given that the survey took place with one medium sized class at one small university it would be wrong to generalise too much. However it would seem fair to say that within this cohort, there is discrepancy between the computing knowledge students need and the knowledge they actually have on arrival for tertiary study. This applies to all students in this study regardless of age. There was little evidence of what is traditionally called the "digital divide". The results suggest that those who say that the young people do not need to take an introductory computing course when embarking on a tertiary degree are mistaken. As noted by Kennedy, et al., there is a diverse range of technology available and therefore a diverse range of skills. So while the younger students may be more confident they have computing knowledge than their older colleagues, this confidence does not appear to translate into actual knowledge.

Conclusion

Colleagues in the USA and Australia have already realised the need for introductory computing courses for incoming tertiary students is no less important now than it was a decade ago. Unfortunately, it is harder to encourage students into computer literacy courses than previously and harder to convince colleagues from other faculties of their value. It is our responsibility, as IT educators, to continue to pressure for the retention of these tertiary courses. If we don't, students may struggle to efficiently complete their coursework and may enter the workforce under-prepared.

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Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon*, 9(5), 1 – 6.

Appendix 1: End user computing questions included in the survey

1. The formula =IF(J2+5<10,10-J2,J2/2) is in cell I2 of a spreadsheet. If the value in J2 is 7, the value in I2 will be: (Choices were a: 3.5, b: 3, c: 12, d: 1.5, e: 6.5 or f: don't know.)

2. The cell reference =$D4 is entered into a spreadsheet in cell A1 and copied to cell B2. How would it appear in cell B2? (Choices were a: =$D4, b: =$D5, c: =$E5,d: =$E4, e: error or f: don't know.)

3. A database keeps information about students which includes information about their age and whether they are living "at home" (residence = "at home"). Which of the following expressions would select all students who are under 18 as well as all students living "at home"? (Choices were a: Age <19 AND residence = "at home", b: Age <18 OR residence = "at home", c: Age <18 AND NOT (residence = "at home") or d: don't know.)

Implementing a UUID Primary Key in a Distributed Email Client Application

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Abstract

This paper describes the incorporation of Universal Unique Identifiers (UUIDs) into the database design for a children's email application. Implementation of the new design is described including the mechanism for sharing data between installations using an IMAP based email server. Testing of the software has demonstrated that the design results in a functional distributed application although there remains scope for improving the synchronization algorithm. The Mifrenz application is available from http://mifrenz.com for download.

Keywords

Mifrenz, Email, Children, UUID, Database, Design, Primary Key, Synchronization.

Introduction

A critical part of database design is the choice of data for a table's primary key (PK). The traditional academic view is to look at the available natural data and select an appropriate attribute or group of attributes. The alternative view is to use an artificial key, typically implemented as an automatically incrementing value. In previous work, Hunt (2010) observed that a significant gap exists between what is normally taught to students (use the natural data) and

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

what actually happens in practice (use an artificial value). It was noted that although this topic has been discussed at length in the online community, there seems to be a lack of coverage in the academic literature.

Hunt (2010) described the situation where data needed to be synchronized between two or more computers via an email server. A PK was required that would allow a new record to be added to a table, before the data was fully synchronized with remote data. This ruled out the use of an automatically incrementing value, as the next value in the sequence could not be reliably determined. However, the use of natural data was possible, as each user did have a unique email address and so this was chosen as the PK. A major drawback of this design was the issue of dealing with a user wishing to change their email address, as allowing the PK to change is seen as poor database design and should be avoided if possible.

Universal Unique IDentifiers (UUIDs) (Leach, Mealling & Salz, 2005) are a particular type of artificial data that can also be used as a PK. Their use is of particular significance when data needs to be synchronized between data repositories when the connection between them is not always available e.g. mobile devices may have intermittent access to the internet. Hunt (2010) discussed the possibility of using UUIDs in a children's email application and this paper describes that process of implementation.

Mifrenz email application

Mifrenz is an email application designed specifically for children to be able to send emails in a safe environment. Unlike most other solutions for children, Mifrenz is not a server based application, but instead is installed on the user's own computer. This design means that a high availability server does not have to be provided and so costs can be lower. The design does introduce the problem of how a parent can easily update the status of a child's contacts and how a child can access his or her email from multiple locations. Mifrenz solves these problems in a similar way to Microsoft Outlook in that email and contact information is stored on a server and the application synchronizes with the server. For Mifrenz the server is a third party email server, normally Gmail (Welcome to Gmail, n.d.), and the IMAP protocol (Crispin, 2003) is used to communicate with the server. Unlike an email application used by adults, an email application for children needs to filter the emails that a child sees based on the child's contacts list. Therefore, Mifrenz needs to intercept the emails that arrive at the child's IMAP account and determine what should be done with each email. The IMAP protocol does not provide for a standard way to store contact information and so Mifrenz uses a standard email to store the contact information.

What are UUIDs?

According to Leach, Mealling & Salz (2005):
"...a Uniform Resource Name namespace for UUIDs (Universally Unique IDentifier), also known as GUIDs (Globally Unique IDentifier). A UUID is 128 bits long, and can guarantee uniqueness across space and time. UUIDs were originally used in the Apollo Network Computing System and later in the Open Software Foundation's (OSF) Distributed Computing Environment (DCE), and then in Microsoft Windows platforms."

The ability to create a unique key "across space and time" makes the UUID ideally suited for use as an artificial PK in situations where remote applications cannot communicate to determine the next value in an automatically incrementing sequence.

UUID's can be considered a mature technology as they are now a critical part of various networking technologies, e.g. the Bluetooth wireless protocol (Bluetooth Special Interest Group, p83) and the Remote Procedure Call protocol (The Open Group, 1997).

The Java programming language (Java Platform Standard Ed. 6, n.d.) has incorporated the generation of UUIDs through the provision of the UUID class and so the use of UUIDs is provided for by a robust programming environment. Using Java a UUID can easily be created using the following code, myUUID = UUID.randomUUID(), where myUUID has already been declared as variable of type UUID. From then on, myUUID can be compared to other UUIDs using the UUID compareTo method and can be converted to a text representation using the UUIDs toString method. The text representation enables straightforward storage of UUIDs in a local database or in an email stored on an email server.

Original database design using natural data

Original database design using natural data

Figure 1 shows the original Entity-Relationship Diagram (ERD) for the database. The email address was used as the PK for the User entity as this could be guaranteed to be unique for each user. This immediately constrained the application, making email address changes problematic, and also restricting each user to only one email address (although it was never intended to allow a user to have multiple email addresses). User data is not actually shared between separate installations of Mifrenz, and so using the email address as a PK for the User data was not in itself necessary. However, the Email, Contact and Joke entities can now use the email address as a foreign key relating back to the correct user. The PK of the email entity is a composite of the user email address and the time that the email was entered into the database. The software logic assures that for location no two emails are inserted at exactly the same time. It is assumed that a user is not using the software at two locations concurrently, because if they were, it is possible that two records could have the same values of email address and creation time. The Email entity also requires a foreign key (contact email address) from the Contact entity so that an email can be related to the contact that an email was either sent to or received from.

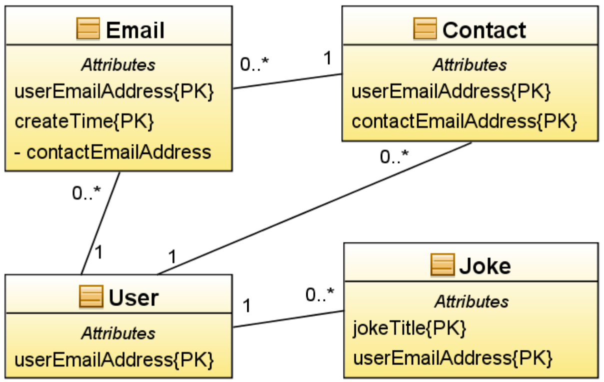

Figure 1. ERD of the original Mifrenz database design. It can be seen that each table uses an email address as either the PK, or as part of a composite PK. Only the attributes that form part of the relationships between entities are shown.

The Contact entity uses a composite PK consisting of the user email address and the contact email address. This allows contacts for all the users to be stored in the same table, yet a simple SQL query can retrieve just the contacts for the current user. Here the use of the natural data, i.e. the contact email address, again puts a restriction on the application: this time according to good design principles the email address of a contact should not change. Initially it was thought that this was not a significant restriction as the purpose of the software is to control emails based on the email address rather than a person's name. A contact is approved by a parent based on the email address and so a change in email address was initially thought of as just a new contact being created. This concept was later changed to the idea that a contact could change their email address with parental approval. As the software does not display email addresses to the user, but rather displays the contact name, there would have to be a rather complicated process of showing that emails from two different email addresses were really from the same contact.

A feature of the Mifrenz application is the creation and sharing of jokes. Each joke needs to be uniquely identified and associated with a particular user. It was decided that for a user, each of their jokes should have a unique title and therefore a composite PK of joke title and user email address was chosen. Again, it can be seen that a users email address should never change, and not so obviously, a joke cannot be received (or at least inserted into the database) with an identical title to one already present in the database.

In summary, the use of the email address was chosen as the whole or part of a PK after following the standard database design 'rules' that are taught to students. It has been shown that there are major drawbacks with this approach for this particular application. Yet, the alternative approach of using auto numbers (auto number) as the PK is not a solution when the data is distributed and offers no guarantee that the sequence of numbers can be synchronized before the need to know the next number of the sequence. This is obvious when you consider the following example.

Two siblings share their time between two households. Mifrenz is installed on PCs at both locations and there is currently a child at each location using the application. Each child creates a new email – what should the next automatically incremented number be? The database can only be synchronized between locations via the child's IMAP server (typically their Gmail account), and this only happens once they use the software at the other location. In fact in an extended family situation, they may never use the software at the other location.

A place for auto numbers

The use of UUIDs for PKs for the entities that share data between locations is discussed in the next section, but first it is worth considering the situation where data is not shared, that is the User entity. In the previous design, the user email address was used as the PK, but this has been shown to have drawbacks. The use of a UUID seemed unnecessary, as there was no need to share this data with other locations. When a child uses the application, the application knows who is logged on, and so any data that is downloaded from the users IMAP account, is obviously for that user. It was decided that it was probably straight forward to use the correct user identification number (userId) when a row of data, that has just been retrieved from the IMAP account, is inserted into the database for that user. This userId will not be stored with any data, for any of the entities, on the IMAP account as each user's data is stored in their own IMAP account and so belongs to them. This means that there is no attempt to synchronize userIds between installations of the application, which results in the possibility that a user has a different userId at each location. The userId is never shown to the user (as good database design suggests) and so the user is not going to be confused by this situation.

Referring back to Figure 1, the userId can now just replace the user email address attribute in each of the entities.

Distributed database design using UUID's

The case has been made for using UUID's for the entities that are shared and therefore it was decided to reengineer the Mifrenz application to use a UUID as the PK for the Email, Contact and Joke entities. Figure 2 shows the new ERD with UUIDs being used for the PK for the Email, Contact and Joke entities. As discussed above, the User entity now uses an auto number, the userId, for its PK. It was also decided that it would be useful to keep track of who created a particular joke, and so the Joke entity also uses the contactUUID as a foreign key. If the Joke was created by the user, the contactUUID can be left blank, hence the 0..1 multiplicity at the Contact end of the Contact-Joke relationship.

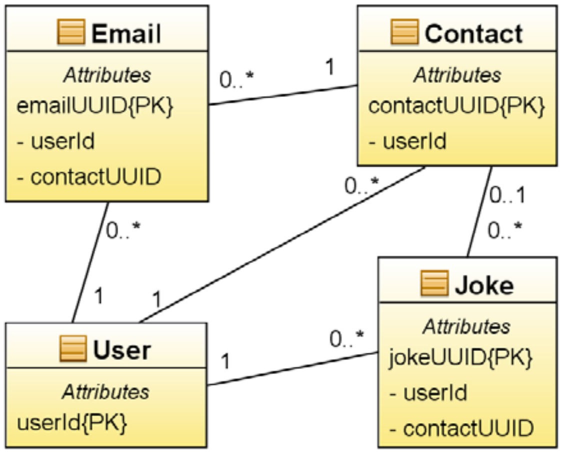

Figure 2. The reengineered database design that uses UUID's for the PKs of the Email, Contact and Joke entities. The User entity uses an automatically incrementing value, userId for the PK.

As the original design (Figure 1) used the user email address for the PK of the User entity, the user email address was unique. This uniqueness is still required (each user should have a different email address) and so a unique constraint is placed on the email address attribute in the User entity. Also, each contact should only occur once for each user, and so the Contact entity has a unique constraint consisting jointly of the contact email address and the userId attributes.

Implementation

Mifrenz is written in the Java programming language and uses the HyperSQL database (Hsqldb – 100% java database, n.d.) for data storage on the local computer and connects to an IMAP email store (currently only Gmail). IMAP does not provide a standard for access to contact information or for that matter jokes. In any case, Mifrenz requires additional attributes for contacts such as the status of a contact's approval. These limitations were circumvented by using a normal email for the storage of contact and joke data. The data was stored in plain text in the body of an email, one email being used for each contact or joke. Figure 3 shows the contents of an email being used to store contact data. The main points of significance from this paper's perspective are the first line that holds the contactUUID and the deliberate absence of user identification as described above.

```
contactUUID cbb08fad-9225-4042-ab73-486988ce50ac
contactEmailAddress tim.hunt@wintec.ac.nz
firstName Dad
lastName Work
createTime 1260827498618
lastModifiedTime 1265927852824
parentApprovalStatus APPROVEDCHECKATTACHMENT
childApprovalStatus APPROVED
strangerApprovalStatus NOTSET
childInformedOfDeclinedDecision false
deleted false
contactType CHILD
createdBy CHILD
```

Figure 3. The text contents of an email stored on an IMAP account. This email is being used to hold the data of a single contact.

When a user logs on to Mifrenz, the contents of the local database are immediately displayed for the logged on user. This is significant, as a previous design did not store any data locally, but the time it took to retrieve and display the user's data was found to be unacceptable. Mifrenz then connects to the user's IMAP store and synchronizes the contacts there with the contacts stored locally. It is important that this is performed before any new emails are downloaded, as an email will only be displayed to the user if it has come from an approved contact. If an email is from someone who is not yet a contact, a challenge email is sent back to that person as the first step of an authentication procedure. To avoid a challenge email being sent multiple times, it is important that synchronization of contact information occurs first. Once contact synchronization has occurred, new email can be downloaded, processed and displayed if appropriate. Finally synchronization of the already processed emails and jokes can occur e.g. deleting emails that were deleted at another location. Figure 4 shows a screen shot of the user interface as seen by a child. Information such as when an email was sent or received is deliberately missing in order to create a simpler interface.

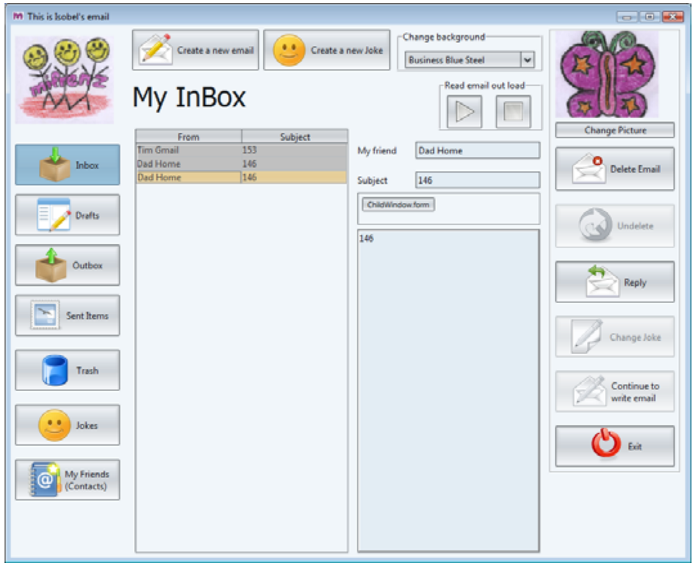

Figure 4. The child user interface of the Mifrenz application. The interface deliberately displays less information than a normal email application intended for adults.

Testing and future work

The use of UUIDs in this application has proven to be a robust and successful technique for synchronizing data across multiple installations. The software has been installed in two locations and functional testing has shown that the data can be successfully replicated. To aid with ongoing testing, a log file of which functions are used and errors that occur is created and emailed to the developer each time the software is used (by the developer's children). Mifrenz is also available to download from http://mifrenz.com and can be used for a trial (with data collection) or can be purchased for actual use, in which case logging of data ceases.

Testing has highlighted the current poor performance of the synchronization process. This normally is not an issue as it occurs as a background process of which the user is unaware. However, when the user closes the application, a final synchronization occurs which the user has to wait for before shutting down the computer. A similar situation seems to happen with Microsoft Outlook which manifests (at least with the Vista operating system) when it is shut down immediately after sending an email. However, it is believed that the current algorithm used for synchronizing can be improved and this is expected to be the subject of future work.

Future work includes the plan to produce a multi-lingual version of Mifrenz utilizing the inbuilt Java capabilities for internationalization support.

Discussion

This work was undertaken in the context of teaching and indeed learning database design. It has taken the author on a journey from repeating the mantra of using natural data for PKs, to considering auto numbers, and finally to UUIDs. It is difficult to envisage this journey happening if it was not for the author working on an application that he wishes to share with a wider community: working through text book examples would unlikely have had a similar result. The author believes this experience will greatly enrich the 'real world' practitioner expectations of teaching and learning at his institution.

Summary and Conclusions

Previous work had highlighted the design issues of choosing a database table's PK for a distributed email application called Mifrenz and concluded with the suggestion of using a UUID. This work has used a combination of UUIDs for shared data, and auto numbers for non shared data. Initial testing has demonstrated the new design to be robust and it has been incorporated in the latest version of the software.

Acknowledgements

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Methods for rubric inclusion into Moodle

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This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

The purpose of this paper is twofold. The first part discusses a method of embedding a rubric in Moodle using various methods – existing facilities, SCORM and a Moodle Module. The second part introduces a Moodle specific module suitable for including multi dimensional rubrics. The paper briefly revisits the pedagogy behind the rubric and how it was applied to the Moodle module.

Keywords

Moodle, Rubric, SCORM, Online course design

Introduction

Since as early as 1995 ("History of Virtual Learning," 2009; Freed, 1999) Learning Management Systems (LMS) have become a common feature in tertiary institutions. Moodle LMS has proven to be a great success as an internationally recognised LMS and as at June 2010 has 50741 installations across the globe. (www.moodle.org/sites). This figure only includes the registered installations with potentially more ad-hoc and private installations that are not recorded.

The LMS enabled the delivery of the online component of classroom-based or blended learning courses. However, to ensure a quality educational experience, care needed to be taken to ensure that learning activities and resources are appropriate for the online or blended environment. The materials used in a typical classroom were not always suitable or needed significant adaptation for use in an online delivery environment.

Many educators in institutes of higher learning could be considered subject matter experts first. They may have minimal to no course design, little experience working, teaching and learning in an online environment. An assessment instrument was selected for determining the completeness of an educator's online course offering to help alleviate the above problem. This instrument was a modified version of the Rubric for Online Instruction by the Centre for Excellence in Learning and Teaching rubric (CELT) (Rubric for online instruction, 2009). The goal of this rubric was to provide a mechanism to;

a. aid teachers in the design of these courses,

b. assess and evaluate the courses' level of completeness, and

c. to help reviewing the course content.

The modified CELT rubric (Seitzinger, Jamieson & Forlong-Ford, 2009) was created and sent out to various teachers within the author's organisation for testing and evaluation. Rather than the hoped for comments on the rubric content, the teachers were more concerned with the form of the rubric. A comment like, "Do you have an electronic version?" was frequently ask whereby an electronic version of the rubric document was offered to them. Subsequently the teachers came back with some questions like "…I mean is it part of Moodle?" and "Does Moodle have it as an activity?" The resulting answer to all these questions was "No". Hence an investigation was started in an attempt to identify a method of offering the rubric in a form suitable for use in an LMS other than the use of a simple electronic word processed document. The rest of the paper carries on with a brief look at the structure of the rubric followed by an investigation in methods of embedding the rubric, finishing off with an analysis of the proposed methods.

The CELT rubric revisited

The modified CELT rubric, just called the rubric for the rest of the document, takes a holistic approach to evaluating online course content though some aspects of the rubric include an analytical approach (Stevens & Levi, 2005). Some of the scoring criteria contain a range of specific items for measuring or evaluating the online course against.

It was important to understand the structure and composition the rubric so that the best method of implementation could be applied. The rubric had to be facilitated in such a way as to not destroy the ease of use and simplicity a rubric offers. A teacher should not have to find an excuse to not use technology owing to it being in the "too hard to use" category.

The literature described various technologies encouraging and facilitating interaction such as web-based resources (Hughes & Hewson, 1998) and the importance of taking full advantage of these technologies (Kimeldorf, 1995). The literature (Auvinen, 2009; Daniels, et al, 2004; Heinrich, 2009; Monpara, 2008) interestingly enough did not cover many aspects regarding electronic versions or implementations of rubrics other than the electronic document versions.

The rubric can be considered 3 dimensional matrix with one dimension set for the categories and the other two for the elements and scoring criteria. The rubric consists of 5 broad categories that covering the online learning domain. The categories can be considered as groupings of similar elements and are as follows;

a. Learner Support & Resources

b. Online Organisation & Design.

c. Instructional design & delivery.

d. Assessment and Evaluation of Learning.

e. Innovative Teaching with Technology.

For each of these broad categories there are one or more elements forming the vertical dimension. There was a case where elements, containing the analytical components, were to be separated depending on how the rubric was implemented. This becomes apparent later on in the paper. The horizontal dimension covered the three scoring levels in the horizontal dimension that offered a score ranging from 1-6 depending on the degree of completeness.

The complete rubric is available from the author or on http://moourl.com/designbynumbers

Rubric implementation approaches

Using Moodle as the preferred LMS an investigation was conducted into the Moodle technology identifying suitable strategies for the implementation of the rubric. The implementation had to provide a minimal impact on the Moodle installation and provide an interface that was easy and comprehensive enough for the teacher to use. Three features of Moodle suggested a method in which the rubric could be implemented;

a. Use of existing Moodle features or functionality,

b. As a SCORM package added to the respective course, and

c. As a module or plug-in installed onto of the base/core Moodle installation.

There was a consideration for Adobe PDF document form as a potential technology candidate. A major drawback for this solution was the cost of purchasing the expensive proprietary tools in order to edit and create the Adobe PDF form. Once a form was created the results of the rubric were not readily usable. Each form was self contained with the rubric results embedded. This meant the results were not readily available to the teacher for inclusion in a spreadsheet or other means. It would have required additional expense and tools to extract the data into a suitable medium. Although there may be software available for editing and converting PDF documents the Moodle LMS does not have interactive support for PDF other than simple course content. The scope of this research did not include the PDF form was not considered further.

Moodle Quiz activity
Using the Moodle Quiz activity and the *Multiple Choice* question option it is possible to embed a rubric. Five question categories are created to reflect the 5 rubric categories. Within each question category the rubric elements become the "quiz questions" with the scoring criteria as the "multi choice answers". To use the rubric, all of the questions from the categories are assigned to the quiz. Figure 1 shows a sample out of the attempted implementation

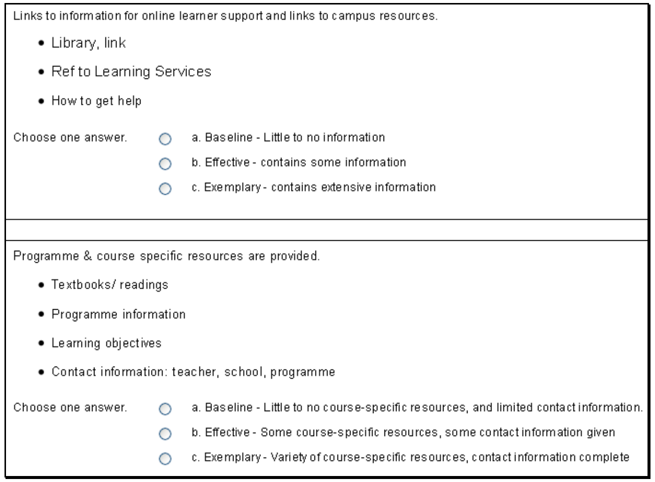

Figure 1 Moodle Quiz as a rubric

The limitations of this method of implementing the rubric are as follows:

- The matrix or table view of a rubric is lost and there is no option for groupings/categories.

- Quiz requires specific setup process whenever it is used for the rubric. i.e. with regards to the score and weightings. A new quiz needs to be created each time for each course.

- A "correct" answer is always expected and since it's an assessment it is handled as such by Moodle. Questions are assigned a % rather than allowing custom scoring.

- The quiz is very student centric and requires Moodle Gradebook access which would skew overall assessment results if the Gradebook was in use. This is fine if the Quiz was intended for the students or if students were requested to evaluation the course.

Moodle Workshop activity
The workshop module has a rubric grading strategy option for grading progress during the workshop activity. Figure 2 demonstrates a sample of the rubric as part of the workshop.

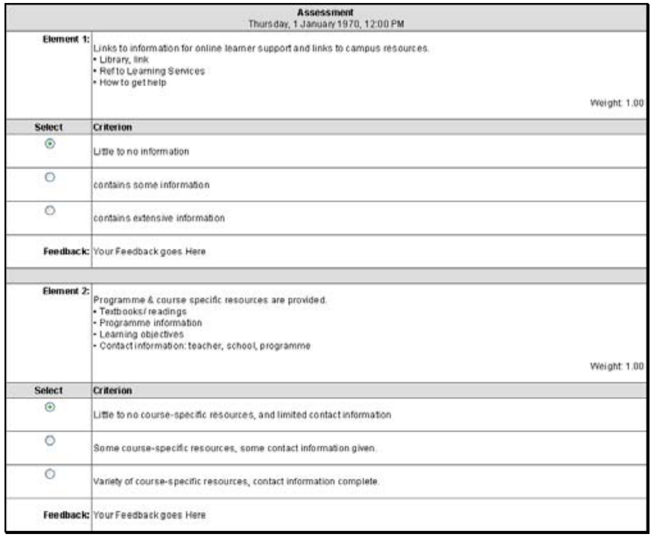

Figure 2 Moodle Workshop as a rubric

The limitations observed in this implementation are as follows:

- The matrix view of a rubric is lost but a single dimension table is retained. There is no provision for groupings/categories.
- Scoring is done per element not criterion with a -4 to 4 weighting range.
- Limited to 20 Elements.
- Workshop activity is student centric.

Online course evaluation as a course

Workarounds to the above included creating a Moodle course with the online teachers enrolled as students. Hereby creating an "assignment" for each course that was needed to be reviewed or checked. This only leads to confusion when the course ends up with multitudes of "assignments" and only a fraction belong to the "student".

SCORM

"Sharable Content Object Reference Model" indicates that SCORM (SCORM 2004 4th Edition Version 1.1 Documentation 2009) is all about creating units of online course content that can be shared across systems. Specifically, SCORM governs how online course content and LMSs are able to communicate with each other. Essentially it is a set of technical standards used by programmers to write software products for e-learning software. One of the more important aspects of SCORM is that it does *not* involve or determine instructional design or any pedagogical concern. It did however provide a potential framework for implementing the rubric.

Moodle versions 1.9.5+ are certified SCORM 1.2 compliant with partial support for SCORM 2004. This means in order to use the SCORM method the rubric had to conform to the SCORM 1.1 or SCORM 1.2 set of standards in-order to produce a compatible package. The open source tool eXe, a New Zealand project funded by the New Zealand Government Tertiary Education Commission's eCollaboration Fund (eXe 2008), exports content in IMS Content Package, SCORM 1.2, or IMS Common Cartridge formats or as simple self-contained web pages. This tool and many commercial tools such as THESIS and Trident IDE can produce the required SCORM content but none of them produce rubrics.

As it happens current literature did not provide much or any in way of examples of rubrics used or created in a SCORM package. This strongly indicated the possibility that SCORM did not yet have the functionality to support a rubric. Producing the much needed functionality into SCORM requires a basic understanding of the SCORM structure and standards.

The SCORM Content is made up of assets, sharable content objects (SCOs) and activities. Assets are the electronic media, such as text, images, sound, assessment objects or any other Web related content. Multiple assets can be collected together to build other assets. This indicates that the rubric can be constructed from various assets. The tools mentioned earlier did not readily support this yet.

Having to learn a new tool to build a one tool that is required to function in another tool could not be a considered a desirable learning experience by teachers not confident with technology.

Moodle rubric module

The default or core installation of Moodle does not provide immediate facilities for using rubrics in any form other than as part of course content in the form of an electronic document or part of an existing assessment. Moodle however, did provide a mechanism whereby developers are able to write modules or plug-ins to add functionality to the LMS.

The Moodle module repository only offered two modules that could be utilized for the rubric creation. The first option is based on a commercial product from Waypoint Outcomes and details a proprietary implementation. The module was not available for general use which discounted this solution from testing.

The second option is a rubric module that showed development activity halted towards the end of 2008. Figure 3 shows a sample of the output produced by the rubric.

Given the lack of suitable rubric integration tools for Moodle this appeared the only and most suitable offering. Owing to the halted development there was no guaranteed this module would function in any of the later Moodle versions. Upon inspection of the module source files it was noted the module was embedded into the Moodle core assignment module which severely limits is use in later versions should the core files change.

Name	Notes	Points
Learner Support & Resources		
Links to information for online learner support and links to campus resources.	**• Library, link • Ref to Learning Services • How to get help**	
▪ Little to no information		6
▪ contains some information		4
▪ contains extensive information		2
Programme & course specific resources are provided.	**• Textbooks/ readings • Programme information • Learning objectives • Contact information: teacher, school, programme**	
▪ Little to no course-specific resources, and limited contact information.		6
▪ Some course-specific resources, some contact information given.		4
▪ Variety of course-specific resources, contact information complete		2
Online Course Design		**24 pts**

Figure 3 Sample view of the Moodle rubric module with part of the Online Course Design Rubric implemented.

The module was installed tested on sandboxed versions of Moodle 1.9.8+ and Moodle 2.0 preview on a Microsoft Windows Platform. Both installations accepted the module with no errors.

Figure 3 clearly shows it was possible to insert the Online Course Rubric into the rubric module. Once again the view is a 1 dimensional table with an outline structure. From a visual perspective it is not hard to understand. Upon further testing of the module with the rubric some limitations became apparent making the module in its current state unsuitable for implementing the rubric. The more noticeable limitations were:

- Scores for the criterion did not accept ranges only a mark-out-of value as reflected in Figure 4. This meant the original rubric would have to change. The rubric was not intended to work with the out-of type scoring.

- The rubric module is very much integrated into the Moodle assessment and gradebook hence making it student centric.

- The rubric cannot be updated once an "assessment" has been assigned of completed against the rubric. This makes further updating of the rubric problematic. The teacher would have to export a copy of the rubric and create a new assessment to be able to use the rubric again.

Using the rubric module in *the Online course evaluation as a course* option was a stronger candidate for implementing the rubric if a teacher was content with the results. It may have required some extra interpretation of the scores to make it meaningful. There was the possibility of teachers using different scoring methods owing to how they would apply the scoring to the Moodle rubric module which in-turn could be counter-intuitive towards establishing a standard online course content evaluation process within an institute of higher learning.

Name	Notes	Points	Grade Comments
Learner Support & Resources			
Links to information for online learner support and links to campus resources.	• Library, link • Ref to Learning Services • How to get help		
▪ Little to no information		4 / 6	
▪ contains some information		3 / 4	
▪ contains extensive information		1 / 2	
Programme & course specific resources are provided.	• Textbooks/ readings • Programme information • Learning objectives • Contact information: teacher, school, programme		
▪ Little to no course-specific resources, and limited contact information.		6 / 6	
▪ Some course-specific resources, some contact information given.		1 / 4	
▪ Variety of course-specific resources, contact information complete		2 / 2	
Online Course Design		Score 17 / 24 (70.8%)	

Figure 4 Rubric module showing grading in action

Based on the analysis of the Moodle rubric module it has been determined a revision of the module would have to take place to accommodate a more teacher centric approach.

Towards a New Moodle Rubric module

The new or updated rubric module had to be created with a number of features in mind as well as overcoming the various limitations. In saying that, the rubric module was to not totally remove the functionality of the existing rubric.

The new rubric module had to retain existing functionality but include the following changes:

- Able to switch rubrics from student centric to teacher centric as required. The centricity is dependent on the rubric in use and is not as a either/or scenario.

- Accept variable scoring methods such as fixed value, range and out-of scores.

- Provide cleaner embedding with minimal or no modifications to the Moodle core source files.

The existing rubric module was dissemination into functional components to determine what had to be replaced and what could stay. Analysis of the module's code showed it had to be part of the assignment module if it was to retain its existing functionality. This implied the creation of a new module which was left for further research.

The rubric module remained student centric but the following changes were applied:

- changes were made to allow variation in the scoring methods,

- amendments could be made to "closed" rubrics under certain circumstances,

- addition of non score bearing "bands" were able to be included into a rubric - in the case of providing categories of questions, and

- visual changes to offer a more matrix appearance.

The updated module has been undergoing testing.

Conclusion

There are a number of ways to implement a rubric into Moodle, some shown to be possible but inaccurate in presentation. Other implementations demonstrated possibilities in implementing a rubric as it was intended but with limitations.

Despite its simplicity rubrics are assessment instruments that are scoring criteria which are summative, formative, evaluative and educative (Stevens, 2005). They will become an important tool when it comes to assessing 21st Century skills based assessments especially those submitted through Moodle.

This research will continue with the complete development of the Moodle rubric module to offer interoperability with ongoing projects such as *Lightwork* (Heinrich, 2009) from Massey University.

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Developing Research and Presentation Skills in Post Graduate Students

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Abstract

In this paper, techniques used with postgraduate computing students to develop research, analysis and presentation skills are explained and their success is evaluated. Several different techniques are used with students entering post graduate study at different levels. The courses at each level and the research forums are described and analysed.

Keywords

Postgraduate, presentation, research, skills

Introduction

Students new to postgraduate study in computing or returning to postgraduate study after a significant gap often need help in acquiring research, analysis and presentation skills. In some institutions, students must complete a course or series of workshops that cover such topics before they can commence their formal postgraduate studies. In other institutions, the opportunities to develop these skills are built into the course work and/or offered in parallel. This paper begins by reviewing some of the relevant literature and then describes and evaluates the approaches taken in two postgraduate computing programmes offered by Unitec Institute of Technology, the Master of Computing (MComp) and Doctor of Computing (DComp).

Literature

Whittle (1994) discusses a faculty-based research skills workshop program for masters students and their supervisors "which was trialed in the University of South Australia as a strategy to improve the teaching and learning environment for research masters students" and concludes that "providing students with structured research skills training at the commencement of their degree programs, can … improve the teaching and learning environment at the postgraduate level and help students to get off to a good start."

Webb and Sillitoe (1998) evaluated "a weekly discussion group, additional to the normal supervisory arrangements, [in which] a range of issues, including research philosophies, project conceptualisation, methodology selection, personal challenges and administrative procedures, were discussed … A 'twilight' midweek meeting time was chosen to maximise the opportunity for both full- and part-time students to attend …The findings indicate that the opportunity for students to speak in a diverse group to resolve project dilemmas as well as to showcase their own work, made a significant contribution to the development of broader understandings of the research process as well as stimulating deeper learning about specific aspects of research design, methodology and analysis."

Juniper and Cooper (2002) described a Postgraduate Research Training Programme which "adopted a workshop format which uses active learning exercises to stimulate thinking and discussion … in order to arrive at an understanding of the fundamental principles and processes of research, as well as to provide practical skills and strategies … Students undertake the programme voluntarily and are drawn from a wide variety of disciplines and cultural backgrounds." Student evaluations rated the programme very highly (4.47 out of 5).

Ingleby (2008) described a series of workshops at Deakin University which combine generic skills support of research students and supervision training for "early career researchers" who have recently completed their doctorates. The first set of workshops focused on the "development of a critical approach and the creation of a specific line of inquiry to encourage the formulation of a properly formulated research question".

Masters degree coursework

The first course that Master of Computing students undertake is called "The Impact of Information Technology on Society" with the course aim being "To enable participants to analyse the impact of information technology on society from social and ethical perspectives". The content of this course includes lectures and workshops on topics such as; what is research, research terminology, what is expected of students undertaking research, and this is taught within the framework of the impact of IT on Society. This content was deliberately included in this first course as the majority of students entering this masters degree have come from industry and have had a break in their study. Also many students who have completed undergraduate degree in other countries may not have gained these skills. The philosophy was to ensure that students as they continued with their post graduate studies were equipped with the knowledge and skills to conduct research, analyse data or present their findings.

In the first session of the semester 2 2009 course, students worked in pairs and interviewed each other about their opinions of the impacts (two positive and two negative) that information technology has had on them personally and the impacts (two positive and two negative) that information technology is likely to have on the world in the future. The whole class then analysed the responses into categories such as communication, education, health, information, leisure and work. Among the issues that came up were the challenges of categorising answers to open questions and what to do if the respondent mentioned more or fewer impacts than requested.

In earlier years (Joyce 2002) students in the same course had each interviewed seven people outside the class (ranging in age from less than 10 to 60 or more, with one per "decade", and including either three or four females). The 2009 students were shown the earlier results and asked to identify differences and similarities and suggest possible reasons for them. This led to discussion of sampling issues (including age ranges and gender bias), interpretation of results and changes in the (perceived) impacts over time.

Later in semester 2, 2009, students worked in pairs to analyse the content of professional codes of ethics (one code per pair) into categories (such as competence, confidentiality, conflict of interest, criticism and crediting others) that had been identified by students in the first DComp intake (Joyce et al 2003). The whole class then critiqued the analyses, which in some cases led to changes in the categorisation of particular elements. Finally the class produced a table analysing the content of the codes which was compared to the 2003 table. There was a lively discussion about the categorisation process, the differences between the codes and changes over time.

The first formal assessment item for this class includes assessed presentations and a report on the historical impact of an aspect of information technology on society and the potential future impact of a new or emerging information technology. The students present the historical impacts they have researched. These presentations lead into the assessed report on the future impact of an aspect of emerging information technology on society. During the historical presentations the students are urged to look at common themes and build a framework for assessing impact of technology. This assessment helps students to understand what evaluation frameworks are and how to use them when doing research.

The second assessment looks at ethical decision making. The students are asked to write an ethical case study about an ethical dilemma in an information technology project or a dilemma resulting from the use of information technology. The students are asked to use an ethical decision making framework to come to a decision resolving the dilemma that the students are able to defend or live with. The students present their case study to the class and then lead a 30 minute discussion about the ethical issues and principles in the case study. This discussion often shows the great impact culture has on ethical decision making.

During the presentations for both assessment items, the student peers asked questions about the content of the presentation and the instructor provided feedback about the presentation. The standard of the first set of presentations varied considerably and the instructor highlighted good and bad aspects. The standard of the second set of presentations had improved significantly (both overall and individually) which suggested that students had learned from seeing the earlier examples and hearing the instructor's feedback (compare Joyce et al 2004).

Another outcome from the Impact of Technology on Society course has been the number of students who have been able to look at a wide range of potential thesis topics and in many cases the Masters topics that are ultimately selected by the students come from the work done in looking at the various emerging technologies and their impact on society.

In the end of course evaluation and in informal feedback, several students commented positively on the way in which the course had helped them develop research, analysis and presentation skills. Before they undertake their thesis research, MComp students continue to improve their research, analysis and presentation skills in other courses (particularly the Research Methods course).

In other semesters since 2000, other appropriate techniques have been employed to assist these students.

Doctoral coursework

The first course that DComp students take is called Critical Issues in Professional Practice and includes a topic on ethics. The first time the course was offered, there were six students and 18 professional codes of ethics were chosen for analysis. Each student independently analysed the content of three codes and then the whole class agreed on the categories and produced tables using the agreed categories to compare the contents of the codes. The next three times the course was offered, the categories were given in advance. All four times the course was offered there were lively discussions about the categorisation process and about the differences between the codes.

DComp students have to complete three assessed courses, each involving research and analysis of large volumes of published material. During each course they make multiple in-class presentations on their chosen research topic and receive feedback on content and delivery from their classmates and instructors. At the end of each course their final presentations are assessed by a panel of four academics, who provide detailed oral and written feedback. As with the MComp students, there is significant improvement in the quality of presentations.

Postgraduate research forums

Most of the post graduate students in the two programme undertake paid work during the week and all their classes are held at weekends. Accordingly the postgraduate research forums are held at 5pm mid-week (compare Webb and Sillitoe, 1998). The standard pattern for a forum is that two or three academic staff talk about their own research interests and topics they would like to supervise and answer questions (mainly from students), two or three students talk about their research proposals and receive feedback (mainly from academic staff). The programme director of postgraduate programmes then talks about some aspect of the research process (such as ethics approval or thesis examination). Attendance varies during the semester but averages around six staff and ten students. Feedback from MComp and DComp students indicates that the forums help them to identify possible supervisors and refine their research ideas.

Workshops

Te Puna Ako (Unitec learning support centre) provides workshops on topics like Academic Writing, APA Referencing, Literature Reviews and Managing the Personal Challenges of Postgraduate Study. Postgraduate students are encouraged to attend, especially the new students, but most find that as the workshops are held during the working day their participation is limited.

Analysis

Table 1 shows how the concepts, skills and strategies identified in the literature review are initially addressed at Unitec in coursework, research forums and workshops. These concepts, skills and strategies are explored in greater depth in the MComp Research Methods course and in the DComp courses Advanced Scholarly Enquiry and Research Development.

	Webb & Sillitoe	Juniper & Cooper	Ingleby	MComp Impact Course	DComp Issues Course	Research Forums	Work shops
Philosophies and Principles	Y	Y		Y	Y		
Developing Critical Approach			Y	Y	Y	Y	
Project Conceptualisation	Y					Y	
Formulating Research Question			Y			Y	
Methodology Selection	Y					Y	
Practical Skills and Strategies		Y		Y	Y		Y
Research Processes		Y		Y	Y		Y
Administrative Processes	Y					Y	
Personal Challenges	Y						Y

Table 1 Concepts, Skills and Strategies

Conclusions

Most new postgraduate students especially at the masters level have limited research, analysis and presentation skills, so analysing data in pairs and as a whole class and presenting to the class help them build confidence and prepare them for later courses, their thesis research and subsequent employment. Including in the content of the first course opportunities for students to acquire research, analysis and presentation skills has proved invaluable in their later study and ability to pass and gain high grades.

Most new DComp students have acquired some research, analysis and presentation skills during previous studies and employment, but need to have these enhanced during the coursework before presenting their research proposal to an invited audience of academics from a wide range of departments. It has been our experience that only a minority of MComp and DComp students attend forums and workshops, but those who do so have indicated how much benefit they have received by attending them.

From the student experience and feedback, and the analysis done it would be advantageous for the students to make these forums compulsory.

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The Feedback Loop: Encouraging Student Submissions

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Abstract

The use of a network of tablet PCs to teach a first year computing degree mathematics class has shown that students value the learning involved in seeing other student's submissions and the teacher comments on these as well as comments on their own submissions. The lecturers value receiving responses from many of the students and not just the few who always answer.

This paper discusses the use of an active learning pedagogy, student submissions, and feedback in a database class based in a standard PC computer laboratory. Instructor perceptions and student reactions to this pedagogy are discussed. Student reactions were collated from a questionnaire. In spite of many technical problems both lecturers and students reported benefits for teaching and learning.

Keywords

Student submissions, Active Learning, Educational Technology

Introduction

It is recognised that interactive learning has many advantages over the standard lecture format both for students and for the lecturer (Crouch & Mazur, 2001; Draper, 2004; Guthrie & Carlin, 2004; Knight & Wood, 2005; Su, 2002). Classroom Presenter (CP) has been used at Christchurch Polytechnic Institute of

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Technology (CPIT) since semester 1, 2008 on a trial basis. It has been used only to teach a first year degree discrete mathematics class using a classroom set of wireless networked tablet PCs. The responses, from teachers and students involved, suggest that the main benefits are the active learning and immediate feedback enabled by this approach. CP enables active learning, concept testing, immediate lecturer feedback, and student involvement by all of the students.

Student submissions provide valuable feedback to the lecturer on the level of understanding of the class as a whole (Robson & Kennedy, 2010). Other researchers have noted similar findings (Anderson, Anderson, VanDeGrift, Wolfman, & Yasuhara, 2003; Huettel, et al., 2007; Koile & Shrobe, 2007). The major advantage the tablet PC has over a standard PC is the 'natural' writing capability which is useful for instructor inking (Anderson, et al., 2004; Price & Simon, 2007), and it enables a range of questions that are just not possible with text only input e.g. equations, diagrams, colouring and shading (Denning, Griswold, Simon, & Wilkerson, 2006). CP can be used on a network of standard PCs but it uses multi-cast networking and although student text input is possible it is quite basic and not easy to use (Wilkerson, Griswold, & Simon, 2005).

Ubiquitous Presenter (UP) was developed by University California, San Diego to specifically address these issues and allow students to interact via a web browser from tablet or non tablet PCs. The students can choose to overlay question slides with text or ink depending on the capabilities of their PC. The teacher can use a standard PC but there is no text box for comments – it is assumed that the teacher will be using a tablet PC. UP allows a teacher to add ink to lecture slides. These slides (plus ink) are available to students via the website both during the lecture and after the lecture. The student PCs need only to have a browser installed (Denning, et al., 2006; Wilkerson, et al., 2005).

An increasing number of lecturers are now using tablet PCs to enable lecturer inking of slides and for active learning via questions and student submissions (Guthrie & Carlin, 2004; Knight & Wood, 2005; Loch & Donovan, 2006). They report advantages for student learning and immediate instructor feedback on student understanding. This paper seeks to see if some of these advantages can be realised on a standard PC network.

Methodology

UP was used with a second year degree database management course. Classes were taught in a standard PC laboratory for all sessions and consisted of a combination of lecture and laboratory exercises. Questions for each session were developed in Power Point and, using the UP add-in, uploaded to the UP server. During a teaching session the students log in to the UP server and select the slides for that session. The lecturer can control the question sequence. A series of questions were developed as formative assessments for each lab session and these were delivered to the students via UP. The students entered their answers via a textbox and submitted an anonymous response. The instructor selected "interesting" submissions to display and discuss. UP was used only to deliver questions and receive submissions from students and not for lecturer inking of lecture slides.

UP was typically used for one of the two weekly sessions. After eight weeks the students were asked to complete a questionnaire to determine their attitudes to this style of teaching.

Results

The majority of the database class had experienced the use of CP in a previous year so they were familiar with the idea of answering questions and submitting responses. However the use of UP with this class was very much in the nature of a trial. The lecturers, and the students, learnt a lot about the pitfalls of using technology for teaching. There were times when the network went down and times when the system did not work as intended. This was time-consuming and frustrating for all concerned and is reflected in the questionnaire responses.

Of the 29 students in the class, 21 completed the questionnaire.

The questionnaire comprised 10 questions that were answered using a 5 point Likert scale (1 Disagree, 2 Disagree Somewhat, 3 Undecided, 4 Agree Somewhat, 5 Agree Strongly) as shown in Table 1, and three open questions that asked for advantages, disadvantages and any other comments.

Given the technical problems encountered it is not surprising that usability questions did not rate highly.

The main motivation for using this pedagogy was to engage the students in an active learning process and to receive responses that could be used to discuss the concept involved. It is pleasing to note that questions related to this such as "Discussion of other students' submissions helped my learning" and "The questions made me think" rated quite highly.

Table 1: Average of responses for the 10 Likert scale questions

Question	Average Response	Standard Deviation
UP was easy to use	3.1	1.1
UP was enjoyable to use	2.9	1.2
UP helped my learning	2.9	1.3
Getting comments on submissions helped my learning	3.3	1.4
Discussion of other students' submissions helped my learning	3.9	1.0
The questions kept me interested	3.1	1.2
The questions made me think	3.9	1.0
The questions helped reinforce the teaching	3.3	1.2
The discussion of submissions showed me other ways of doing things – which helped my learning	3.9	0.9
The discussion of submissions showed me wrong ways of doing things – which helped my learning	3.7	1.0

Student comments

14 students made at least one comment. There were 15 comments for advantages and 17 comments for disadvantages. The comments are summarised below.

Students listed advantages that reinforced the positive aspects of active learning with comments such as "more participate in answering questions" , "instant feedback is handy", "discussions helpful, "able to know other peoples answers", and "anonymous".

Given the technical problems we continued to experience it is not surprising that all the comments listed as disadvantages related to this aspect of the use of UP and not to the active learning pedagogy. Typical comments were "does not work well", "fails a lot", "a very slow method", and " would need to have it running well before implementing".

Discussion

Our experience with Classroom Presenter was that although there were initial technical problems we learned how to avoid them and they are no longer an issue. With UP we encountered a number of on-going technical problems which made it a frustrating experience for the lecturers and the students. These problems were mostly not a problem with UP as such but more network and browser problems. For the first two weeks the CPIT campus network was very unreliable (the students would log in and connect to the UP server, and then the network would go down) and at that stage when UP didn't work we didn't know if it was a network problem or a problem with the way we were using UP. The student documentation for UP notes that: "UP is supported on Mozilla's Firefox browser. You may encounter difficulties using other browsers". The installed CPIT campus browser is Internet Explorer (IE). Using IE the students were able to register, log in to the UP server, and connect to the question slides. It was only the student submission function that did not work properly when using IE.

Firefox was available to the students but the network settings had to be changed to enable access to the Internet. Because students have limited rights to the C: drive of networked PCs and temp directories are deleted at intervals these changes were not always permanent. The UP server response times were often slow when sending and receiving submissions. The lecturer needs to be aware of this and make allowances for the delay in receiving submissions. There are some operational steps for the lecturer to become familiar with such as clicking the icon to allow student submissions. Also UP assumes that the lecturer, at least, is using a tablet PC so there is no textbox input available to the lecturer. To annotate student submissions the best a lecturer can do when using a standard PC is use the mouse for "writing" a tick, a cross, or to highlight.

Also, because students using a standard PC can really only answer using text input the range of question types is limited.

Conclusion and Recommendations

Formative assessment is an important aspect of learning. The challenge is to involve all students and to provide immediate feedback on student answers. Technology, from clickers to tablet PCs, has been used to enable this interaction. In spite of all the difficulties the lecturers involved considered that the use of UP on a suite of standard PCs did have benefits for teaching and learning. As one lecturer commented “I’m not worried whether they get it right or wrong, I just want some feedback on their understanding”. It is certainly a way of getting most, if not all, students involved. The range of student submissions provides a platform for discussion of correct and incorrect understanding of concepts, and because submissions are anonymous students are not embarrassed if their response is discussed. The best questions to use seem to be single word responses, fill in the gap, short answer type questions or multiple-choice questions as most students are prepared to answer these types of question. It does take time to complete the cycle of question displayed, students think about and submit an answer, lecturer displays and discusses selected submissions so initially aim for two or three simple questions per session. Try one for revision at the beginning and one for review towards the end. Using UP on a suite of standard PCs is worth a trial. There is a set of lecturer instructions available at http://physics.csusm.edu/eprice/research/UP/UPsupport/UPsupport.html

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Assessing with a unit test framework: variations of approach

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Abstract

This work describes two different uses of a Unit Testing Framework for automated marking of programming assignments. Usually unit testing focuses on verifying the correctness of individual methods. Here we firstly show how to use unit tests to give novice programmers feedback as they learn how to code simple data-centric Creation, Retrieval, Updating and Deletion (CRUD) tasks. Following this there is an explanation of how advancing novice programmers can be guided to create robust methods in a complex system through the feedback from automated acceptance tests. These are novel variations of the standard use of unit tests for automatic assessment of programming assignments and showcase the possibilities for vocational focused programming courses.

Keywords

automated marking, unit testing framework, testing, education, programming assessment

Introduction

Many people have developed software to automatically mark programming assignments (Doulce et al., 2006). The now well-established advantages of such automatic marking (Higgins et al., 2005) is a reduced workload for teachers and an improved learning experience for

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students due to rapid feedback about their coding. Most programming assignment marking schemes are based on language specific code (eg QuizPACK as reported by Brusilovsky & Sosnovsky, 2005) which cannot be readily used with other than the target programming language. Such systems are also typically closed-source and proprietary. If teaching a programming language which differs from the tool's target language the intellectual investment in test authoring cannot be reused.

All published schemes focus on computer science course programming assessments. Very different types of assessments are used in computing courses in vocational and applied education. Such courses are industry focused and aim to ensure that students are work ready when they graduate. Assessments appropriate to vocational course are not well covered by any existing 'testware'. The goal of this paper is to show how automatic assessment of business focused programming assignments can be implemented. Two different teaching situations are described in which unit tests have been used to automatically mark programming assessments.

1. Automatically Assessing CRUD

The usual use of a unit testing framework for assessing programming (Edwards, 2003; Edwards, 2004; Helmick, 2007; Lance, 2005) is to have students program to a set interface and require them to write tests which establish the correctness of their code. In contrast business computing courses often have an early emphasis of getting student to "…write scaled-down versions of standard programs" (PR50n course prescription) which involves an emphasis programs as both structures and algorithms (Content can include: Data structures including arrays, simple file handling, interactive dialogue, commercial report programs, data validation, simple exception handling, simple file updates, all standard syntax options, efficiency considerations). The standard description (Wikipedia) of such programming is C.R.U.D. as it involves Creating, Reading, Updating and Deleting tasks. Assessments of business specific programming contrast strongly with the existing work on automatic marking. Work to date has emphasized "… programming-in-the-small….implement specific modules (viz., classes), for which the instructor provides the appropriate specification (viz., interfaces), not large-scale programs." (Tremblay et all 2006). Existing testware is suited to situations where "almost all the programming assignments that students construct are command-line based…" (Douce et al., 2006). The following demonstrates that automated marking of CRUD assessments is possible.

Writing code which correctly creates, reads, updates and deletes data with simple data structures typically follow the Whole-Part Pattern (Buschmann et al., 1996). Figure 1 below illustrates such a situation: a Company has many SalesPersons and many Products.

Figure 1

Students can be exposed to a range of different variations of the pattern (e.g. chains of data, hubs with surrounding data) and over a series of practical exercises learn (by repetition and generalization) how to code typical CRUD operations. Figure 2 shows assignment instructions for such a task.

4. Write a Jadescript loadTestData()method that
- Calls the deleteAll() method you wrote for question 3.
- Creates an instance of the Company class
- Creates the following 4 SalesPersons, using the addSalesPerson() method that exists in the Company class

ID	Name	Salary	Commenced
14	Jim Peters	39,000	1998
11	Helen Brash	47,000	1999
12	Don Clarke	37,000	2003
13	Winston Anderton	42,000	2002

(3 marks)

Figure 2

While coding these tasks students can get formative feedback from a suite of unit tests. The students do not need to understand the internals of the unit testing framework but can be expected to respond to assorted tips and warnings and error messages until they have produced correct code. The scope of test coverage includes: checking if data structures exist, making sure nothing which was initially provided has been broken, making sure published interfaces (eg set, add and get methods) being followed, checking that expected data is correctly populating the database, ensuring correct data types are used, and that all references and collections being used correctly. Figure 3 shows a typical unit test which establishes that a data structure has been created with appropriate properties.

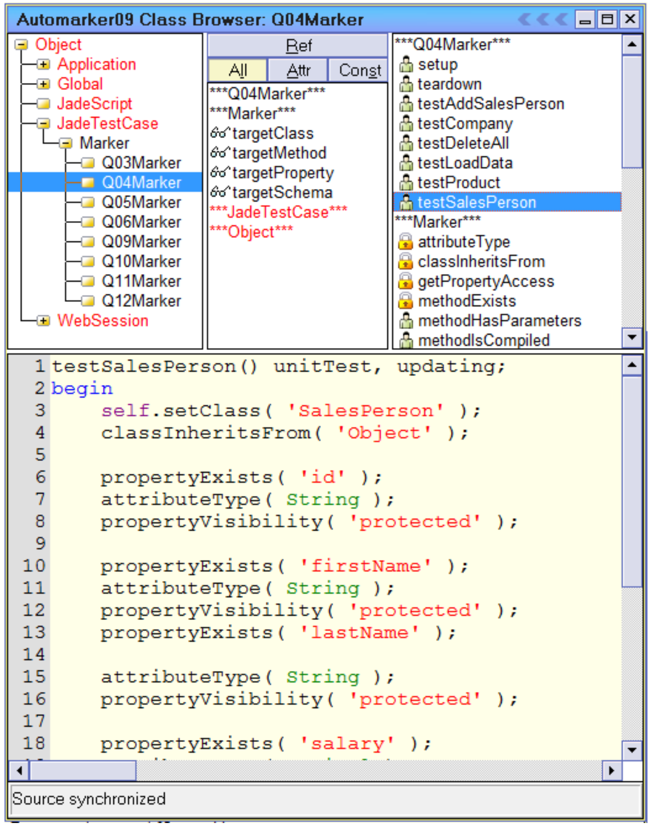

Figure 3

If a student has succeeded in the required task the tests confirm this (See figure 4 below). Students come to like the green progress bar and the 'passed' message.

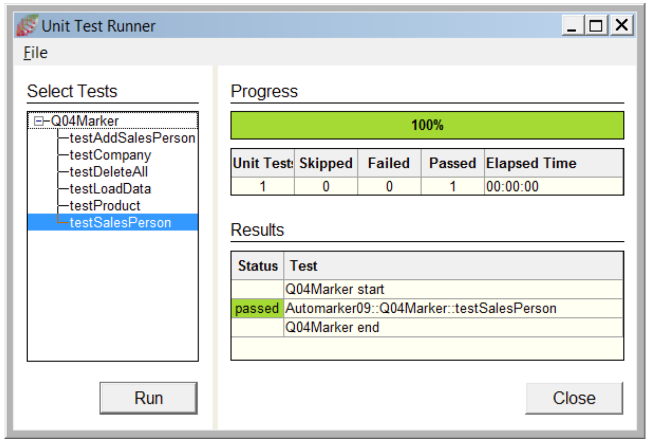

Figure 4

The advantage of using unit tests in this basic data construction task is that students get a lot of feedback as to what aspects of the program are to important. It is very time consuming for a teacher to check the 75 items covered by assertions in the unit test for question 4. The feedback provided can be either a very generic warning (i.e. 'Encapsulation has been broken') or a very specific instruction of what needs to be done next (i.e. 'make sure the set method of the Product class assigns the newDescription parameter to the classes description property). Figure 5 shows a typical problem report. The attribute of the SalesPerson class have been changed to public visibility to avoid having to write a set method

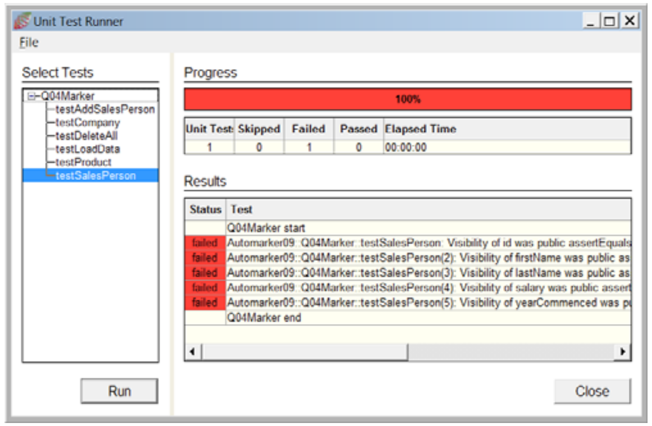

Figure 5

In this introduction to testing, students are not required to be aware of the internals of the unit tests, but do have to use unit tests to get immediate feedback of the quality and functionality of their code. The immediacy of the feedback starts their 'test addiction'.

2. Automatically Assessing Complex Algorithm Creation

Once students are aware that automated tests can mark their work and provide a substitute for inspection of code by a teacher a next step is to expose students to the internals of how tests are written and get students writing their own tests.

One way to do this is to require students to develop a complex algorithm with many different possible 'correct' implementations. Provide a complex system and direct students to one place where a crucial extension of code is required. For example in a vending machine (see Figure 6) the task is to add a single method to dispense the change for a transaction. This is a relatively complex system with many collaborating objects needing to be taken into account. Careful testing is needed to avoid unexpected consequences.

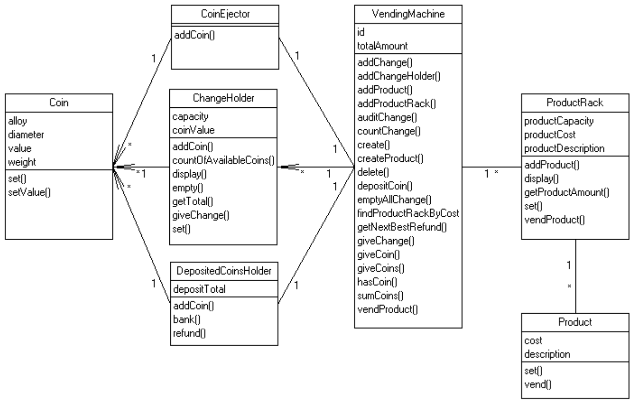

Figure 6.

There are many possible correct ways of coding the required change giving algorithm. A good solution requires the calcChange method to check for possible error conditions such as the unavailability of required coins. For example what if 50 cents of change is required and there are no 50 cent coins left in the machine. Two 20 cent coins are available but no 10 cent coins. Robust code will detect that it is impossible to give the correct change, and void the transaction returning the initial deposit and activating the out-of-change sign.

The unit tests are assessing the range of situations which the student's algorithm can deal with eg what happens when the system runs out of a particular denomination of coin? What happens if there is no correct change which can be given?

The unit tests for such a system are non-trivial. The vending machine system has 591 lines of code and the associated unit tests have 2824 lines of code. The unit testing framework provides a before and after dump of the state of every object in the system and a suite of 30 different acceptance test scenarios of varying complexity.

An extension task requires the student to inspect and extend the unit tests to cope with altered requirements. Is their change giving algorithm sufficiently robust that it can cope with US rather than NZ currency? To do this students need to modify existing tests creating new test setup methods which load a different currency into the system and change assertions to reflect different expected change. Testing is being learnt by modifying existing examples.

Conclusions

This work has documented how a unit testing framework can be used to automatically mark two different types of business computing programming assignments. It establishes that it is possible.

Observing students using these tests it is evident that novice programmers are unaware of testing strategies and heavily reliant on rote learning of rules. Using and reading the unit tests showcases different testing techniques and helps novices to analyze what testing is relevant in the context in which they are working. The next step in extending this research is to investigate what feedback is most effective in promoting this learning.

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Computing student views on sustainability: a snapshot

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Abstract

UNESCO launched the Decade of Education for Sustainable Development for 2005 – 2014 with the aim of integrating Education for Sustainable Development (ESD) into all aspects of education and learning. The motivation for this study was to inform our decisions on embedding ESD into our teaching.

Incoming computing students (n=116) were surveyed to capture their views on sustainability before they engaged in formal learning and these views were compared to those of computing students at another institution. The study explored views on the relevance of sustainability to their study, sustainability priorities and knowledge, possible actions they could take, their capacity to take these actions and make a difference, and how they would deal with a challenging scenario.

Students were pro-ecological but did not believe they had the capability to make a difference. Significant variation was found in attitudes and values across the various ethnicities in our sample, suggesting that careful consideration should be given to this aspect.

This study adds to the emerging body of knowledge around sustainability perceptions and values of incoming students and informs curriculum for the embedding of ESD into education and learning.

Keywords
ESD, Sustainability, Practitioner, Teaching philosophy, Education.

Introduction

Sustainable development is meeting the needs of the present without compromising those of future generations. Education for Sustainable Development (ESD) aims to help people to develop the attitudes, skills and knowledge to make informed decisions for the benefit of themselves and others, now and in the future, and to act on those decisions. UNESCO launched the Decade of Education for Sustainable Development (DESD) for the decade 2005 – 2014 with the aim of integrating ESD into all aspects of education and learning. (UNESCO, 2004, 2005a, 2005b).

A working group at the Innovation and Technology in Computer Science Education (ITiCSE) conference in Madrid acknowledged the need for computing professionals to act in order to support sustainable living (Mann, Muller & Smith, 2008). In New Zealand, the National Advisory Committee on Computing Qualifications (NACCQ) has adopted a policy that promotes the concept of social, environmental and economic sustainability for students and academics. (NACCQ, personal communication, 4th July, 2008).

The same objective has been addressed by a proposed policy (Mann, Muller, Davis, Roda & Young, 2009) for the Association of Computing Machinery (ACM) which defines a framework for Computing Education for Sustainability (CE4S). The proposed framework informs educators how to integrate the principles and practices in the curriculum, encourages "distributed" integration of sustainability and development of ad-hoc resources.

In the New Zealand tertiary sector, Otago Polytechnic has committed to embed sustainability education in all their programmes. Other institutions, including ours, have been investigating how we can integrate education for sustainability into our programmes. Mann and Smith from Otago Polytechnic have articulated a vision of a collaborative approach to ESD for tertiary institutions in New Zealand and have provided leadership in this initiative.

As part of this initiative, they have published findings that contribute to the understanding of student attitudes towards sustainability and to the understanding of the requirements of curriculum development for computing graduates (Mann, Smith, Shephard, Smith & Deaker, 2009). Their research instrument combined the New Ecological Paradigm Scale (NEP) from Dunlap, van Liere, Mertig, & Jones (2000) with questions from a study into young people and the environment (Fien, Yenken, & Sykes, 2002) and a variation of the Personal Meaning Map (Storksdieck, Ellenbogen, & Heimlich, 2005). Within their study they compared the sustainability worldviews of incoming computing students to the wider institute intake. Our study complements this by comparing the worldviews of incoming computing students across institutions. We had two main aims for our study:

- To replicate the study carried out by Mann et al. (2009), comparing and contrasting our respective findings and thereby, hopefully, both supporting the generalisation of their study and contributing to the emerging body of knowledge around sustainability perceptions and values of incoming students.
- To investigate the variation of attitudes across the demographic profile associated with our institution's students.

The Sample

The target population was students enrolling in computing and information technology qualifications. Our institution organises "orientation" days for new students to welcome them to the institution and to help familiarise them with our staff, resources and processes. We chose to carry out the research at orientation sessions so that we could capture student attitudes before they had been exposed to formal instruction.

Students attending two orientation sessions (for semester 2, 2009 and semester 1, 2010) were invited to participate in this research. Participation was voluntary and involved completing an anonymous questionnaire. Approximately 92% of those attending the orientation sessions chose to participate. The characteristics of the sample (n=116) are summarised in table 1.

The Instrument

Our questionnaire was based on that used by Mann, *et al.* (2009). We made some minor changes to comply with our local ethical approval requirements, particularly relating to ethnicity.

The first section of this questionnaire comprised the New Ecological Paradigm instrument (Dunlap *et al.*, 2000) which identifies a participant's location on an anti-ecological to pro-ecological continuum.

The second section (priorities) set out a number of possible goals for New Zealand today and asked participants to identify and rank which they considered the top four.

Table 1: Sample characteristics

		Count	Valid	%
Gender	Male	76		68%
	Female	35		32%
			111	
	Missing		5	
			116	
Age	Under 20	61		55%
	20-29	34		31%
	30-39	7		6%
	40-49	6		5%
	50 or more	3		3%
			111	
	Missing		5	
			116	
Semester	S2, 2009	39		34%
	S1, 2010	77		66%
			116	
Ethnicity	NZ/Euro	29		29%
	Maori	13		13%
	Pasifika	31		31%
	Asian	17		17%
	Other	9		9%
			99	
	Missing		17	
			116	
Programme	Certificate	39		39%
	Diploma	34		34%
	Degree	27		27%
			100	
	Missing		16	
			116	

The third section (knowledge) asked how familiar participants were with a number of sustainability concepts.

The fourth section (making a difference) asked participants to rate their desire to be involved in improving the environment and their belief in their capability of making a difference.

The fifth section (actions) set out a list of possible actions that could be taken to improve the environment and asked them to indicate which they had done, which they would consider doing, and which they would not consider doing.

The sixth section (scenario) asked participants what they would do if asked by their manager to carry out a task that they believed was unsustainable practice. There is no right answer to this scenario.

The seventh section (relevance) asked participants how often they discussed sustainability issues and how relevant they believed sustainability was to their study.

The final section (meaning) asked participants to write down any words, ideas, thoughts, or images that came to mind from two captions and for any comments or suggestions they had on Education for Sustainability.

Ordinal scales were used for all sections except for the sixth (scenario) and the final section (meaning) which solicited open ended responses.

Method

We used a polytomous Rasch measurement model (Rasch, 1960; Andrich, 1978) to create interval level variables from the ordinal categories; this is a stochastic model that identifies the maximum likelihood estimates of participant and item scale locations by simultaneous modelling of the location estimates and the uncertainty in their location. For consistency of interpretation, we standardised all of our scales to a range of 0 to 10, centred at 5, with positive measures indicating more of the named construct.

To enable direct comparison of the findings, we also calculated summated scales using the same methodology as Mann *et al.* (2009).

We chose a parametric approach for our analysis using the general linear model. We also carried out equivalent non-parametric tests for confirmation, but we do not report them here because the data met all the assumptions of the more familiar parametric tests.

We had no specific hypotheses to guide the analysis. Accordingly, to minimise spurious effects, we chose a confidence level of $p<.01$ rather than $p<.05$ for all measures. At this significance level, the minimum effect size that we could detect is approximately 6%.

Results

In this section we begin by commenting on the data screening we carried out and then present the results for each of the sections of the questionnaire.

For the Rasch model to extract the maximum information from a dataset, the scales should be uni-dimensional. We carried out a principal components analysis to verify this and show the results in table 2. All scales were multidimensional under Kaiser’s criterion (Kaiser, 1960), suggesting that there is more information in the dataset than will be extracted by the use of a Rasch measurement model. Although the last three scales have a smaller principal component than we would like, the remaining components are much smaller and the alpha measure is adequate, so there is no reason to doubt the model. The NEP is more problematic; we found five components with contributions ranging from 8 to 19% and marginal internal reliability (alpha = 0.68), There is clearly a lot more going on here than is captured by our analysis.

Table 2: Dimensionality of scales

Scale	Cronbach's Alpha	Variance explained by Principal Component
NEP	0.6800	19%
Priorities	0.8177	40%
Knowledge	0.8474	35%
Actions	0.8673	43%

A key benefit of the Rasch model is that it is readily falsifiable. Standard fit statistics measure the fit between the model and the observed data, enabling identification of poorly fitting items. We present the main fit statistics in table 3.

Linacre (2002) gives some standard interpretations of these fit statistics as "productive" for measurement, "non productive (but not degrading)", "degrading", "over fitting". With this terminology, all items in all scales were classified "productive for measurement". We conclude that there is an acceptable fit between the model and the data.

Table 3: Rasch model fit statistics

Scale	Infit Min	Infit Max	Outfit Min	Outfit Max
NEP	0.842	1.209	0.837	1.222
Priorities	0.795	1.110	0.738	1.109
Knowledge	0.795	1.349	0.799	1.354
Actions	0.695	1.267	0.706	1.244
Acquiescence	0.724	1.175	0.779	1.189

Acquiescence bias is a tendency to agree with a statement rather than to disagree. The NEP aims to control for this by balancing the direction of endorsement across the instrument. Endorsement of odd numbered statements represents a pro-ecological stance and endorsement of even numbered statements an anti-ecological position. There are 8 pro-ecological statements and 7 anti-ecological statements offered for endorsement.

To test the level of acquiescence bias, we formed a scale in which the first 14 questions were all coded in the direction of agreement. We designed this scale to have a range of 0 to 10, centred at 5 with values above 5 representing an acquiescence bias and those below 5 a tendency to disagree with statements. A one sample t-test suggested ($t_{(115)}$=12.7304; p<.0001) that the mean value of acquiescence *bias* was significantly greater than 5; the confidence interval of the estimate was $CI_{.99}$ = (5.6980 ≤ bias ≤ 6.0577). We conclude that there was significant acquiescence bias in our sample.

No significant correlation was found ($r_{(114)}$=0.0138; p=0.8554) between this acquiescence bias and the overall NEP scale. This suggests that the scale balancing was working as designed and gives us no reason to question the validity of the overall NEP scale itself.

This level of bias does, however, raise doubts about the validity of the five sub-scales of the instrument for our sample since each sub-scale consists of 3 questions and is inherently unbalanced. For example, we found a significant ($r_{(114)}$=-0.2962; p=0.0014) correlation between acquiescence bias and the *rejection of exemptionalism* subscale. Moreover, the internal consistency of these sub-scales seems quite low (see table 4).

Table 4: Dimensionality of scales

Variable	Cronbach's Alpha
NEP	0.6800
Factor 1: limits to growth	0.2947
Factor 2: Antianthropocentrism	0.3413
Factor 3: nature's balance	0.4171
Factor 4: non exemptionalism	0.3225
Factor 5: Possibility of ecocrisis	0.3523
Acquiescence bias	0.4793

We note that the authors of the NEP caution that the dimensionality of the instrument will depend on the extent to which individual beliefs and values are organised into a coherent belief system and they predict that the factors will be variable and sample dependent. We also note that Hurd (1999) suggests that acquiescence bias may be associated with uncertainty. One interpretation of the level of bias is that there might have been an overall lack of familiarity with many of the concepts presented, suggesting the lack of a coherent belief system, and hence doubt about the stability of the factors.

In consequence, we have chosen for the rest of the paper to use the overall NEP scale to illustrate some of the results, but not to pursue the subscales further. We found no significant association between any of the study variables and the orientation session. We have therefore chosen to combine the two sessions into a single dataset for the rest of the analysis.

NEP rating

A one sample t-test suggests ($t_{(115)}$=8.0614; p<.0001) that the mean value of *new ecological paradigm scale* (NEP) is significantly greater than 5; the confidence interval of the estimate is $CI_{.99}$ = (5.4846 ≤ NEP ≤ 5.9483). We conclude that participants in our sample were pro-ecological. The mean NEP score, calculated with the same methodology as Mann *et a.l* (2009), was 2.634. There is no significant difference between this score and their score of 2.627 for Otago Polytechnic students.

We found no significant association between the NEP score and gender or ethnicity but there was a significant association with age. A Pearson correlation analysis suggests ($r_{(114)}$=0.2913; p=0.0017) that higher values of NEP are associated with higher values of age. We conclude that older students are more pro-environment.

Priorities

The second section of the questionnaire presented participants with a list of possible goals for NZ and asked them to *number the four most important issues* 1 to 4. We found analysis of this section of the questionnaire to be problematic. Although many participants completed the question as intended, others chose to give multiple issues the same ranking, sometimes ranking all items.

We felt that the only aspect we could analyse with confidence was to assume that participants believed that 1 was more important than 2 etc. Accordingly, we treated the ratings as an ordinal scale (1, 2, 3, 4 and unrated) and coded all responses above 4 as unrated. The resulting priorities are shown in figure 1. Lower numbers represent higher priorities, and the vertical bars an estimate of uncertainty.

Given the different interpretations of the question by participants, we are unable to present a direct comparison between these results and those of Mann *et al.* (2009). We note that the overall pattern is broadly similar. For example strong defence forces is the least preferred in both and protecting the environment is the most preferred. One action is noticeably different between the two. Reducing unemployment is in second place for our students, but in eighth place for the Otago Polytechnic students. This might represent a shift in overall perceptions as the employment consequences of the global recession continue to worsen or might just represent a regional difference, since unemployment is relatively high in our region.

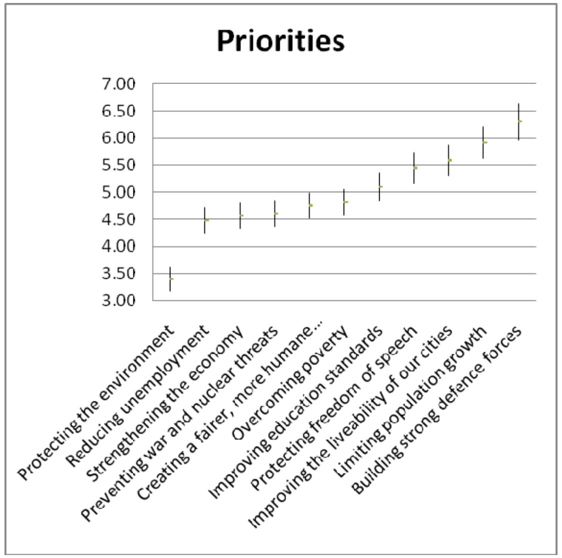

Figure 1: Priorities

Knowledge

The next section of the questionnaire asked participants how familiar they were with a number of sustainability concepts. Table 5 sets out the percentage of our students (MIT) who had never heard of it, compared with the equivalent figures from Otago Polytechnic (OP).

Overall, computing students at MIT were slightly less familiar with the concepts than those at Otago Polytechnic (40% unfamiliarity compared with 35% unfamiliarity). However, this may be partly due to the different timing of data collection. MIT students were surveyed prior to any class contact time, and OP students were surveyed slightly later, after some exposure to course material that embeds sustainability concepts. The overall pattern of unfamiliarity was very similar with a correlation of 0.982.

Table 5: unfamiliarity with concepts

Description	MIT	OP
The ozone layer	4%	2%
Renewable resources	6%	0%
The greenhouse effect	9%	2%
The carbon cycle	21%	11%
Ecology	26%	10%
Sustainable development	27%	5%
Interdependence	30%	25%
Biodiversity	32%	26%
Carrying capacity	40%	41%
Intergenerational equity	61%	58%
The precautionary principle	66%	71%
The Aotūroa worldview	73%	78%
The Papatūānuku worldview	77%	78%
The Pūtaiao worldview	82%	86%
Average	40%	35%
Correlation	0.982	

Making a difference
Students were asked to rate their desire to be involved in improving the environment/community (D01) and to self-assess whether they had the skills and knowledge to bring about change (D02). We also created a variable which we termed ***empowerment.*** We defined this as capability (D02) less desire (D01). Negative values are thus associated with disempowerment – a desire to be involved in positive change without the necessary skills and knowledge to achieve it.

For comparison with the Otago Polytechnic dataset, we created a simple summated scale for questions D01 and D02, ranging from 0 to 10 and centred at 5. We found a significant difference in desire between the datasets ($t_{(112)}$=3.7399; p=0.0004) with students in our dataset expressing stronger desire to be involved, but no significant difference in capability ($t_{(111)}$=-0.5062; p=0.6197)

For our own dataset, a one sample t-test suggests ($t_{(115)}$=4.5310; p<.0001) that the mean value of *desire to be involved in improving the environment/community* (D01) is significantly greater than 5; the confidence interval of the estimate is $CI_{.99}$ = (5.5338 ≤ D01 ≤ 6.9827). We conclude that participants endorsed a desire to be involved.

The mean of the capability variable (D02) was 5.0585 which is not significantly different from 5 ($t_{(115)}$=0.2165; p=0.8122).

A one sample t-test suggests ($t_{(115)}$=-4.7802; p<.0001) that the mean value of empowerment is significantly less than 0; the confidence interval of the estimate is $CI_{.99}$ = (-1.8545 ≤ Empowerment ≤ -0.5450). We conclude that the participants had an overall perception of disempowerment; their desire for change was not matched by a belief that they had the necessary skills and knowledge to bring about change, even in a small way.

We found no significant difference in desire between the genders, but female participants reported a significantly ($F_{(1, 109)}$=7.73; η^2=6.62 %; ω^2=5.71 %; p=0.0064) higher belief in their capability to effect change.

We found no significant differences in desire or capability across the age groups. However, we did find some differences across ethnicities. There was no significant difference in perceived capability, but we found significant differences in desire for change ($F_{(1, 97)}$=7.99; η^2=7.61 %; ω^2=6.59 %; p=0.0057) and in empowerment ($F_{(1, 109)}$=7.73; η^2=6.62 %; ω^2=5.71 %; p=0.0064) between NZ/European/Other ethnicities and Pasifika/Maori/Asian ethnicities.

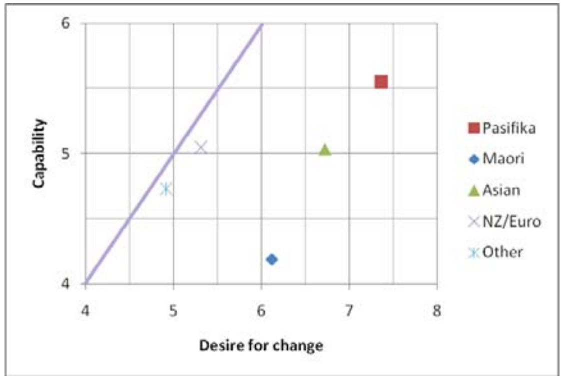

Figure 2: Empowerment by ethnicity

Figure 2 shows the relationship between desire for change and perceived capability for each of the major ethnic groups. In this figure, the solid line represents a balance between desire and capability. The overall mean and the mean of each ethnic group all fall to the right and below this line, representing a degree of disempowerment. The extent of this disempowerment is represented by the distance from this line and is greater for the Maori, Pasifika and Asian groups than for NZ/European and other groups.

Actions

Participants were given a number of possible actions and asked to state for each whether they *had done* this, *would consider* doing, or *would not consider* doing. Our measurement placed the possible actions on a scale ranging from the easiest to consider doing to the most difficult. We also coded these on a points scale to enable comparison with the Mann *et al.* (2009) findings. We present these actions in table 6.

In this table *Beta* represents the difficulty of endorsing the action and *See* the standard error of this estimate. The MIT and OP columns represent scores for our institution and Otago Polytechnic calculated on a scale where 0 represents "would not consider" and 10 represents "have done".

Actions are presented in order of increasing difficulty of endorsement. The order of these actions is very similar for the two institutions with a correlation of 0.966 between the scores.

We found no significant association with age or gender. No significant association was found with ethnicity apart from *making a gift or donation to an environmental or conservation group.* We found that Pasifika students were significantly more likely to endorse this as a possible action ($F_{(1, 94)}$=14.93; η^2=13.71 %; ω^2=12.68 %; p=0.0003).

Table 6: Endorsement of possible actions

	Beta	See	MIT	OP
Deciding for environmental reasons to re-use or recycle something instead of throwing it away	2.42	0.22	7.65	8.15
Growing food in your own garden	3.98	0.20	6.52	6.65
Choosing household products that are better for the environment	4.27	0.20	6.13	6.40
Trying to encourage someone else to change an activity or practice that you thought was harmful to the environment.	4.53	0.19	5.95	5.70
Making an effort, for environmental reasons, to reduce water consumption	4.69	0.19	5.79	4.95
Trying to get information for your own interest on some topic that you thought was relevant to protecting the environment	5.37	0.20	5.18	4.90
Making a report or complaint about something that you thought was bad for the environment	5.76	0.20	4.70	3.80
Taking part in a clean-up campaign or anti-litter scheme of some kind	5.85	0.20	4.66	4.20
Taking part in a tree-planting scheme	5.85	0.20	4.61	4.85
Making a gift or donation to an environmental or conservation group	6.01	0.19	4.20	3.60
Writing a letter, or signed a petition, or attended a meeting etc, with the aim of protecting or improving the environment	6.09	0.19	4.05	3.65

Scenario

Participants were asked what they would do if asked by their manager to carry out a task that they believed was unsustainable practice. There is no right answer to this scenario. We analysed responses using the same categories used in the Mann *et al.* (2009) study. We found the classification task challenging and felt a tension between bringing out the richness of our participants' responses and maintaining compatibility with that study.

For example, we coded the responses "Research on why use unsustainable, come out with findings and proceed to apply corrective measures." and "Build a website that unsustainable practice is about etc." as "no idea" because these responses did not address the inherent power balance issue and the conflict between personal ethics and the need for employment..

If we were devising our own classification, we would have coded these responses as “Compensatory action”. However we felt that, for this study, it was more important to maintain compatibility. We would caution that some of the variation between the two institutions may be attributable to our coding of the responses.

We present in table 7 the respective proportions of responses, excluding those coded as “no idea”. This table also shows, for the MIT students, the mean NEP score for each response category and the mean location on the *desire to be involved in improving the environment* scale*.*

Table 7: Scenario responses

Response	OP	MIT	NEP	Desire
Do it, say nothing	33%	14%	2.82	2.80
First talk alternatives	46%	26%	2.33	6.49
Talk and do it	8%	44%	2.43	7.35
Don't do it	12%	16%	2.48	5.35
No Idea			2.76	6.32

Across the response categories, we found a significant ($F_{(4,\ 111)}$=4.33; η^2=13.5%; ω^2=10.31%; p=0.0028) difference of NEP scores and a significant ($F_{(4,\ 111)}$=3.58; η^2=11.42%; ω^2=8.17 %; p=0.0089) difference in desire to be involved. The “do it, say nothing” category was associated with a low desire to be involved (2.8) and the least pro-environmental NEP score (2.82). The highest desire and most pro-environmental (low NEP score) ratings were associated with discussion rather than refusal to carry out the task.

Relevance

Participants were asked to rate the relevance of sustainability to their programme of study. The overall rating was medium (4.84 on a scale of 0 to 10) and not significantly different from the mid-point of 5. The summated scale equivalent was 2.83, very similar to the 2.77 that Mann *et al*. (2009) found for the Otago Polytechnic students.

We found no significant, variation by gender or age. However, there was significant ($F_{(4,\ 94)}$=6.74; η^2=22.29%; ω^2=18.83%; p=0.0001) variation across categories of ethnicity. The mean endorsement by ethnicity is set out in table 8.

Table 8: Relevance by ethnicity

Category	Mean	N	Variance
Asian	5.8862	17	8.0058
Maori	6.2695	13	10.4009
NZ/European	3.0710	29	10.7837
Other	2.5254	9	8.5727
Pasifika	6.3336	31	8.5228

In this table, means above 5 indicate positive endorsement of relevance and higher values denote greater relevance. Pasifika participants saw the most relevance, followed by Maori and Asian students. There was a substantial gap between these students and those of NZ/European and other ethnicities. We conclude that the Pasifika, Maori and Asian students in our sample regarded sustainability as relevant to their studies, but students of NZ/European and other ethnicities saw little relevance.

Discussion

Our study had two main aims: to replicate the study by Mann *et al.* (2009) and to investigate variation across our institution's demographic profile. We begin our discussion by identifying some threats to validity; then we compare our findings to those of Mann *et al.* (2009); finally we discuss the demographic variation.

We found a substantial level of acquiescence bias in our sample. As mentioned earlier in this paper, this might suggest a lack of familiarity with many of the concepts presented (Hurd, 1999). Endorsement of some items might therefore represent an element of "that seems plausible" rather than agreement with the statements.

Overall, there was a great deal of similarity between our results and those of Mann *et al.*(2009). Direct comparison was possible on five measures: NEP, Relevance, Knowledge, Actions and Making a difference

- The mean NEP score in our sample was 2.634. This was not significantly different from the score of 2.627 found for Otago Polytechnic IT students. Both groups were equivalently pro-ecological.
- The mean relevance score in our sample was 2.83. This was not significantly different from the score of 2.77 in the comparative sample. Neither group endorsed strong relevance.
- The mean unfamiliarity with concepts in our sample was 40%, compared to 35% at Otago Polytechnic. Correlation between familiarity with the various concepts across the two datasets was very high (r=0.982).
- A similar pattern was found in the endorsement of the various possible actions presented with a high correlation (r=0.966)
- Within "making a difference", we found a significant difference between the two datasets in *desire to be involved in improving the environment/community* with students at MIT expressing a stronger desire. This may be partly understood by the demographic variations discussed below. We found no significant differences in participants' perceived ability to bring about change.

We were less able to make a direct comparison on two measures:

- Not all participants in our study interpreted the question on priorities in the manner intended so we were unable to make a direct comparison. However, the overall pattern of responses was broadly similar.
- We found the analysis of scenario responses to be problematic. Differences found might be due to our coding of the responses.

Overall, we believe our findings support those of Mann *et al.* (2009) and lend weight to the proposition that the findings could apply to the computing student intakes of other tertiary institutions.

There are differences however, and we believe these can be best understood by exploring the variability across our institution's demographic profile.

We did not find females to be more pro-ecological than males in our sample. This contrasts with the Mann *et al.* (2009) study which found females to be significantly more pro-ecological. To understand this discrepancy we would point out that our study was within a single discipline and their study was across multiple disciplines, which in turn exhibited different ecological worldviews. We could reconcile these findings by the proposition that *after controlling for differences in worldviews associated with a student's chosen discipline*, there is no significant difference between the genders. This proposition is consistent with a recent national representative household survey carried out by Research New Zealand on behalf of the Ministry for the Environment (2008) which found no significant gender differences in pro-ecological stance.

We found a significant association between age and pro-ecological views, as measured by the NEP, with older students more pro-ecological. This is also consistent with the Ministry for the Environment (2008) survey mentioned above which found that older participants were significantly more pre-ecological.

We found considerable variability associated with ethnicity and there seems to be a difference between the worldviews of Pasifika, Maori and Asian ethnicities, and NZ/European and other ethnicities. The Pasifika, Maori and Asian students:

- See sustainability as more relevant to their studies.
- Perceive greater disempowerment: a desire for change not matched by their perceived capacity to bring about change.

For statistical reasons, we have grouped together many individual ethnicities. However, we would caution against treating these groups as homogeneous. For example, there are many Pasifika ethnicities, each of which may have unique worldviews. Our study suggests that these groups share a level of perceived disempowerment, not that the worldviews are the same.

A key goal of education is to reduce disempowerment by helping students gain the necessary skills and knowledge to achieve what they desire in life. From this perspective, our findings give support to embedding ESD into our teaching. The variation of worldviews and empowerment across ethnicities is a key finding that needs further investigation.

Finally, we note that although we asked participants about the relevance of sustainability (which was strongly endorsed across world views) to their study, we could look at this question the other way round and ask how relevant their study is to their worldview.

Conclusion

Our first aim was to replicate the study carried out by Mann *et al.* (2009), comparing and contrasting our respective findings and thereby, hopefully, both supporting the generalisation of their study and contributing to the emerging body of knowledge around sustainability perceptions and values of incoming students. We believe that our findings are consistent with those of Mann *et al*. (2009) which suggests that the worldviews presented may apply to other students starting their educational journey in computing qualifications. We hope that our findings will provide a useful point of comparison for others researching this area.

We also wanted to investigate the variation of attitudes across the demographic profile associated with our institution's students. We believe that our major finding here is the level of disempowerment, especially that perceived by Pasifika, Maori and Asian ethnicities. We cannot say from this sample whether this disempowerment is specific to sustainability issues or is symptomatic of a more general feeling of disempowerment. In either case, embedding Education for Sustainability into our teaching may have a part to play in reducing this disempowerment.

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Wilber's Quadrant Theory in an Interdisciplinary Approach to Teaching Sustainability in IT

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Abstract

This paper describes the use of Ken Wilber's Integral Theory as applied to first-year BIT professional practice students' oral presentations. The paper introduces Wilber's theory and his use of quadrants as a theoretical framework for of approaching technology and sustainability via popular media.

Keywords:

Sustainability, Integral Ecology, Framework, professional practice

Introduction

Marcel Proust's statement that "The real voyage of discovery consists not in seeking new landscapes, but in having new eyes" provides a useful starting point for teaching sustainability in an IT context because it means looking at what we, as human beings, do—and have always done—from a new perspective: their effect on our environment. Further, Paolo Friere (1970, 1993, 1994: 26) tells us, as teachers and as human beings, to be involved in the "vocation of becoming more fully human." I believe, in order to "become human," it is essential that students be empowered to take control of their own lives and minds—and in order to continue to thrive on this planet—to apprehend the reality of our human tool-maker behaviours with new eyes. A vital aspect of this process is their learning to take control of the of the media products they encounter—to learn to understand and interpret the "imaginary." Nichols (1981: 3) defines this term, "imaginary," to mean not the "unreal" but the "views, images, fictions, or representations that contribute to our sense of who we are and to our everyday engagement with the world around us."

These images are "the signs of social representation, the markers or bearers of ideology..." (Nichols, 1981). In this view, Nichols echoes Taine's critical theories that define the artist in terms of "race, milieu, and moment": that the creator/artist is the product of his/her nation, generally, his/her own cultural climate and circumstances, specifically, and his/her own location in time, i.e. the Zeitgeist—of the age. Art—including film art and literature—then, is a social, historical, and cultural product. Nichols also reminds us that "language, if considered semiotically, includes all forms of communication based upon signs . . . words, clothes, gestures [and is a] necessary element of all material social practice." (1981: 2) In our Western cultural narratives, we can identify a repeating pattern—a motif—of cultural anxiety concerning what our creations can do to us. From Icarus' fatal flight to the earth's revenge against humanity in the Biblical Flood, from the Trojan Horse to the Terminator, from Shakespeare's Prospero to Mary Shelley's *Frankenstein*, from the novels of Thomas Hardy to *The Matrix,* from Ovid's Pygmalion who falls in love with his own creation to Rusnak's Katie Fuller who falls in love with her own computer simulation—our stories betray us: we *know* that we can destroy ourselves through what we make and what we do. Further, our recent stories—books and films—have been warning us, specifically, about the worsening environmental crisis for over 50 years. As early as1962**,** Rachel Carson's *Silent Spring* predicted dire consequences for our behaviours towards the environment; in 1970, the British film *No Blade of Grass* (based on the 1956 novel, *Death of Grass* by Samuel Youd*)* depicted world-wide famine and a resultant global plunge into chaos due to environmental pollution; in 1982, Godfrey Reggio's *Koyannisqatsi* (*Life out of Balance*) bombarded the viewer with visual images of what technology is doing to us and to our world. In 2008, Al Gore's *An Inconvenient Truth* reprises images and warnings from half a century ago, and challenges us to do something now, because we have no more tomorrows.

In order to effect change in ourselves and in our world, we must be able to comprehend the meanings of the signs—the images and language—with which we are confronted. Cultures, however, change; their paradigms shifted by the intersection of Taine's "race, milieu, et moment": the right person, the right surroundings, and the right time. In order to incorporate images and changing cultural values, and a sustainability perspective, it was necessary to use a theoretical framework which effectively incorporates all three. Ken Wilber's Integral Theory of Sustainability (Brown, 2005) allows the flexibility of approach needed and allows to reflect a) our propensity for using technology first and recognizing its impact on our world in retrospect; and b) our current and critical need to identify solutions to the problems we have created in ways that can be acted upon by each of us, immediately.

Briefly, Wilber's quadrant approach places our relationship to the environment and sustainability in four spheres. The first sphere, Interior/Individual/ Psychology, is the sphere of what *I* experience, my subjective realities of self and self-consciousness. The second sphere, the Exterior/ Individual/Behaviour sphere reflects what *I* am and what *I* do—my objective realities, primarily bodily functions and physical interactions with my surroundings. The third sphere, the Interior/Collective/Culture sphere is what *we* experience—the inter-subjective realities of shared values, norms, communication, and customs. And finally, the fourth sphere, Exterior/Collective; Systems: is sphere of what *we* do—our inter-objective realities of social systems and environment. Figure 1 illustrates Wilber's integral theory and its quadrants regarding water.

For example, the first quadrant—the interior/individual, is how we experience water as individuals: we get wet, it goes up our noses and in our eyes, it can cool us or warm us, float us or drown us. The second quadrant—the Exterior/Individual reflects what we do with water or learn about it as individuals. We analyze it chemically and structurally, and understand its properties. It is H2O, and can exist in three states: ice, liquid, and steam. The third quadrant, the Interior/Collective, is how we experience water culturally and as a means of communication. This image in the third quadrant reflects water as representing not only an historical perspective, but also power, wealth, and privilege. Finally, the fourth quadrant, the Exterior/Collective, represents how we utilize water in terms of social systems. Economically, for example, the image in the fourth quadrant reflects how we use water for trading opportunities, for fishing, for pearl-diving, etc. Thus, in terms of sustainability, we can use integral theory to re-interpret the element of water from four specific perspectives.

Figure. 1. Wilber's quadrant model re: Water

The Oral Presentation assessment in the first-year BIT Professional Practice 1 paper intends to engage the students by examining new contexts—or as Wilber puts it, new perspectives or "lenses"—through which they could gain information and insights about human beings, their attitudes, behaviours, and interactions vis-à-vis their environment and technology (especially, information technology). Within the parameters of these assignments, "sustainability" was defined as preserving and maintaining for future generations, a planet which can continue to provide the abundance and diversity of resources necessary for life—human and non-human—to thrive. Wilber's four quadrants, then, become important when we attempt to re-frame our relationship vis-à-vis IT technology —and our other technologies and behaviours—by re-viewing it through a different lens—a lens which focuses on sustainability.

A vital aspect of this process is their learning to take control of the media products they encounter—to learn to understand and interpret the "imaginary." Nichols (1981: 3) defines this term, "imaginary," to mean not the "unreal" but the "views, images, fictions, or representations that contribute to our sense of who we are and to our everyday engagement with the world around us."

These images are "the signs of social representation, the markers or bearers of ideology…" (Nichols, 1981). In this view, Nichols echoes Taine's critical theories that define the artist in terms of "race, milieu, and moment": that the creator/artist is the product of his/her nation, generally, his/her own cultural climate and circumstances, specifically, and his/her own location in time, i.e. the Zeitgeist—of the age. Art—including film art and literature—then, is a social, historical, and cultural product. Nichols also reminds us that "language, if considered semiotically, includes all forms of communication based upon signs . . . words, clothes, gestures [and is a] necessary element of all material social practice." (1981: 2) Thus, in order to effect change in ourselves and in our world, we must be able to comprehend the meanings of the signs—the images and language—with which we are confronted. Finally, cultures—their images and ideologies—change, their paradigms shifted by the intersection of Taine's "race, milieu, et moment": the right person, the right surroundings, and the right time.

The students' assignment required them to view a film or read a novel from selected lists, and to interpret it in order to identify issues deriving from the interrelationship between human beings and each other, our technology (esp. IT), and our environment. Their interpretation should identify the underlying problems caused by technology, any benefits to be derived from technology, the relationship of human beings to each other and to their societies, vis-à-vis technology, and any solutions proposed by the film/novel. Finally, they were asked to identify the consequences of inaction. To finalize the assignment, they were required to consider both the solutions and the consequences of inaction, and recommend actions that an individual in the real world of "here and now" could take to contribute to the sustainability both of humans as a species and of our environment. Their interpretations and recommendations would be submitted as an oral presentation supported by written documentation and visual examples. Their journey through the assignment would, therefore, involve them in moving within and between Wilber's four quadrants, using the media product as the terrain, to emerge with a conclusion/recommendation for their audience.

The student presentations raised significant questions and presented challenging new perspectives on technology, the sustainability of human life and culture, as well as the sustainability of our planet home. Two are described following with transcripts included in Appendix A and Appendix B. The student presentations during the panel session reflect challenging new perspectives on technology and sustainability derived from contemporary media. Jane Sutcliffe's examination of Jean Auel's novel, Shelters of Stone, considers the environmental realities of our ingrained technological behaviours and the ethical issues that plague us when the question is "If we can do it—should we do it?" Jane examines the positive and negative sides of a simple but powerful Paleolithic technology—the spear-thrower—in terms of the same ethical questions that plague our contemporary uses of our own technologies. Ultimately, Jane's research and analysis focus on the role of leadership within any community and the effect that the leaders have on how a community receives, values and uses new technologies. Jonathan Ford provides a different view as he considers the sustainability and value of knowledge relative to the wider environment presented in the post-apocalyptic film, The Book of Eli. His presentation challenges us to think about the worth of what we have when what we have is no longer worth anything. How much is money worth—if the value system in place is based on what can be eaten? How valuable are programming skills when the most pressing issue is how to find food and shelter? How do we use information that we need to survive if we can no access the places where we've stored it? Jonno asks us to consider several questions, in light of the film, but the most haunting is his question: "What will our qualifications mean if we not living in the future we're preparing for?"

Conclusion

This paper has described the use of a theoretical framework for approaching technology and sustainability via popular media. This has been successful in taking students beyond simple actions, instead they have been empowered to examine much deeper issues. The students were able to challenge societal perspectives and begin to frame their own role as sustainable practitioners.

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Appendices

Appendix A: Presentation by Jonathan Ford, *The Book of Eli* and the Sustainability of Knowledge

Overview

I will be giving a presentation on survivability and sustainability, and to demonstrate various points I will be using examples from the science fiction movie *The Book of Eli* written by Gary Whitta and directed by Albert and Allen Hughes.

I will give you an outline of the movies setting, and its storyline. I will also go over some ideas and messages introduced by the movie, and how I interpreted them.

I will show you a small clip from the movie, and talk about the symbolism

in the movie – what I feel the creators of the movie are trying to say to its audience.

I will conclude and leave you with some important questions to ask yourself.

In this film, the world as we know it is barren and mostly devoid of life.

The film is set in a post-apocalyptic era, perhaps the not too distant future—possibly 2050 judging by the ages of people in the film – due, perhaps, to a nuclear war?

Craters the size of small towns mark the landscape, and the desert has claimed back the cities, suburban, and rural areas. It's a wasteland. The population left over after the war is very small – they live in a broken society; they are just trying to survive.

People fend for themselves with any weapon at their disposal. It is survival of the fittest and no one knows how to read/translate information that was stored away in the pre-apocalyptic, computer-driven world.

Story outline

The drifter Eli has been wandering to west across North America. He carries a Bible that he reads from everyday; he survives hunting animals and scavenging destroyed houses/vehicles to trade for water and supplies . When he reaches the village ruled by the powerful mobster Carnegie, the man offers a job to Eli to join his gang, but Eli refuses. When it is revealed to the mobster that Eli has the Bible, he, Carnegie, sends his gang to take the book, and Eli spends a large part of the movie protecting it with his life.

What I want you to ask yourself and remember throughout this presentation is this : how much of what I know is sustainable—and can I survive in a world I am not prepared for?

So if it's the year 2050 and there has been a nuclear war how far back does this set us really? Pretty far back from what I can tell – No infrastructure or utilities like water/gas/electricity. No vehicles / housing /certainly no computers

The symbolism in the film speaks clear enough to me: people find the most effective weapons for hunting and self-defense are bows and knives— the bigger the better. They protect themselves with biker leathers and chain mail made from scrap.

The Bible that Eli protects with his life could easily represent how precious information is and maybe how it is taken for granted. It's because of his skills and knowledge that he is the most effective fighter, traveller and protector

He has learned his ability to survive and his knowledge of martial arts by working at Kmart.

"What is Valuable now?"

Eli is about to do some trading in this part of the movie. Pay attention to what the store-person wants from him as payment – even though he refers to the currency as “coin” anything but cash is about to change hands.

Did you notice what he used as currency? (KFC moist towelettes)

Part of a Cree Indian Prophecy I remember from classes in high-school helped me illustrate this next point. It says “Only after the last tree has been cut down; only after the last fish has been caught; only after the last river has been poisoned; only then will you realise that money cannot be eaten.” In the film, Eli says “People had too much; they didn’t know what was precious or valuable; they threw away things that people are killing each other for now.”

What caught my attention in the movie pertaining to the topic of survivability and sustainability were the following examples:

The obvious shift from what people’s needs and wants were before the war, and what they are now.

Technology took knowledge away when it (the technology) was destroyed. For example, water is the most expensive thing in the bar, and the wife richest man in towns wife get the shampoo.

How much will we lose if we can’t use computers? What happens if we lose the ability to read and write? For example, in the movie, *The American Army Survival Manual* picked up by bikers who can’t read.

Have we written everything down and then forgotten it? I’ve forgotten a lot of information because it is so easy to store it electronically stored and recall it at the touch of a button. Do you have basic hunting and foraging skills? Do you know how to make a fire? Without looking it up on the Internet?

Remember my quote from the beginning about whether money can be eaten?

Consider the following questions:

- How much is your currency/information worth?
- Is our current style of learning/storing knowledge sustainable?
- Have you taken steps to secure the future you are preparing for?

We are learning programming/web design and how to survive in a technological commercial environment. If there’s a nuclear war tomorrow, my exceptional programming skills won’t help me catch cats to feed the tribe. So just be aware—take care of the earth and the knowledge we’ve stored within it . . . and make sure you can live in the future you’re preparing for.

Appendix B: Presentation by Jane Sutcliffe, *Shelters of Stone: Innovation and Ethics*

Today, I am speaking about technological sustainability, what it means to me, and the relative meaning I found within the novel *The Shelters of Stone* by Jean Auel. I'll give an example from the novel of how a new innovation is introduced in an ethical manner and touch on how this may relate to modern humankind.

The *Shelters of Stone* is set at the end of the last Ice Age. Cro-Magnon humans are developing new technologies and the culture is flourishing. There are numerous examples of innovations in this novel. In reality, we know of at least 20 technological innovations from this era, ranging from using small, everyday bone tools, to crafting boats, to developing musical instruments. When I considered this topic and what innovation and ethics mean to me, I did a little thinking and I asked myself; what really are innovations and what is ethics? In "The Truth About Innovation," Max Mc Keown (2008) states that "Innovation is, literally, 'new stuff that is made useful.'" It can be a new thing, or a change to something already in existence, or a new way of doing something that results in a gain— be it financial or social gain. This return can be for the few or for the many. For example the new kinect hands free console is an innovation on the Xbox 360. But the gain of financial return is for Microsoft, not society.

I also considered this: what makes *us* such amazing innovators?

We've been innovators since we fell out of the trees. Early humankind picked up a stick, stone or bone and used to their advantage. Imagine picking up a stick and thinking 'this is an innovation! Life's going to be so much better with this!'

Of course we didn't stop there: we sharpened the stick, we shaped it, we cut and carved it, we burnt it to cook food and to keep us warm. That, ladies and gentlemen, is innovation, and it is technology at its grass roots level. The *Shelters of Stone* is reflects many examples of innovative ideas that enabled our ancestors to evolve. They developed more efficient ways to hunt –I'll give an example of this soon, and interestingly, it's a technique that is still in use today.

More efficient hunting methods meant more leisure time. More leisure time and abundant food, paved the way to a more developed brain. A more developed brain meant more innovations. But innovation does raise some questions.

Why change? Why use this new tool or adopt this new idea? Will it be to my advantage or detriment? How will it affect society, the planet, the future? And who will have the gain, the power? This is where ethics comes in.

We already have a good idea of what "ethics" can mean, personally: our inner sense of right and wrong, our own code of conduct that enables us to, hopefully, make good decisions when faced with a choice or dilemma. When a choice has to be made for humankind we look to elected leaders, who we hope will make ethical decisions to everyone's advantage.

When developing and introducing new technologies and innovations I believe we must employ ethical practices. In *The Shelters of Stone,* a spear thrower, an innovation for spear hunting, is introduced to the tribe. I'd like to invite you to consider, while hearing about this innovation, how it may relate to us today.

Spear throwers came into use from around 40,000 to 10,000 years B.C.E. Here we see a spear thrower from France dating from around 15,000 B.C.E. It's been made from reindeer horn, and we can see that the handle has been ornately carved with a horse, perhaps it was used primarily, to hunt horses? There is a hole in the end that a spear would notch against, offering stability when raised and ready for use. A spear thrower uses leverage to launch a spear many times the distance of a conventionally thrown spear, well over 100 metres, although; loss of accuracy does occur after about 20 metres. The spear thrower, an innovation from the upper Paleolithic era, is still used in Australia today. It's a boat shaped, shallow object measuring about 80-100cm in length. On the spear end, instead of a hole, a sharp barb or notch is attached with chewed cat gut and more tree gum. The spear sits snug against the notch before being thrown in exactly the same manner as its pre-historic counterpart.

In *The Shelters Of Stone*, the introduction of the spear thrower is set to revolutionize hunting. The obvious advantages are apparent: the need to get dangerously close to the target is eliminated, and the resulting, more forceful throw would dispatch prey with deadly accuracy. It is a powerful innovation; however, it is met with mixed reactions. Many of the hunters are skeptical, they don't see a need to change when their way has worked for generations, until they see a demonstration.—until they witness their leaders adopting it.

When influential tribal leaders and respected hunters take up the new way of spear hunting, others soon follow suit. The device is then taken to an inter-tribal gathering and introduced to more hunters by the leaders. The greater populace then sees the advantage of the spear thrower, and the use of it becomes the norm rather than exception. We aren't so different today, we like our technology to look familiar and to operate in a familiar way. And we look to influential members of our society for direction; when they adopt new ways, we follow suit. In *The Shelters of Stone,* the tribes listen to the leaders because they are ethical and knowledgeable, and knowledge is power; the leaders know this and use it for the good of the tribe, they make changes for the people, the gain is shared.

In our age money is power. The modern gain is financial and that return is for the few rather than the many. Now, I'm not suggesting we try to return to egalitarianism here, I can't imagine that working in our conservative, capitalist society. But I don't believe our way is encouraging sustainability. We live in a throwaway society built on consumerism, constantly looking to make personal gain. It doesn't have to be this way though. Perhaps while we are developing new technologies, we can employ our ethics a little more and ask "What can I give?" rather than "What can I get?" and "What will we contribute, what are the negative impacts" or, in I.T; "How long will this be useful to society, and when and how will it be disposed of?" I believe that however we choose to interpret sustainability in technology, innovation and ethics are at the very core of it.

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StudySieve: supporting student-generated free-response questions

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Abstract

Asking students to reflect on course content and ask questions about that content has been shown to improve comprehension in numerous domains. More recently, tools have been developed to store multiple-choice questions created by students in an online repository where they can be shared, evaluated and discussed with their peers. Although benefits are reported from the use of such systems, multiple-choice questions are not suitable for all teaching contexts: many instructors prefer to use free-response questions to assess learning.

We report here on a tool specifically designed to expand the contexts in which student-generated questions can be used. StudySieve supports student-generated questions with free-response answers. We investigate the way that students use StudySieve in an introductory computing course. We categorise their questions according to the cognitive dimension of the Revised Bloom's Taxonomy, and compare them with the questions used by instructors in coursework. We find that most student-generated questions belong to the lower cognitive levels, consistent with the type of questions they must answer in laboratories and tests.

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Keywords
StudySieve, contributing student, constructive evaluation, student-generated content, peer review

Introduction

Contributing student pedagogies are ones in which students contribute to the learning of others, and value the contributions of others (Hamer et al., 2008). Technology is required to support many of these pedagogies, particularly when they are implemented in large classes where the administrative overheads may be overly burdensome (Bhalerao and Ward, 2001)

One such pedagogy is that of *constructive evaluation* (Luxton-Reilly and Denny, 2010), in which students create assessment-style questions about course content, and solutions to those questions. The questions are shared with their peers, typically using an online repository. The questions in the repository are evaluated in a peer review process, and students may use the questions as a learning resource.

Although numerous systems have been developed to support peer review (Luxton-Reilly, 2009), these more general tools lack the features required by constructive evaluation. A number of previous tools have been developed in order to support constructive evaluation in the domain of multiple choice questions (Yu, Liu and Chan, 2002; Horgen, 2007; Denny, Luxton-Reilly & Hamer, 2008). The authors of such systems report many benefits for students including increased motivation (Horgen, 2007); improved confidence (Yu et al., 2002); and improvement of content knowledge, as measured by examinations (Denny, Hanks and Simon, 2010).

Multiple choice questions can be an effective assessment and learning tool, however, it is difficult to write multiple choice questions that assess higher-order cognitive skills (Palmer and Devitt, 2006). As an example, introductory programming courses usually assess code construction tasks. Typically, this is a task such as writing a fragment of code that fulfills a given specification. This would be extraordinarily difficult (if not impossible) to assess in the framework of multiple choice questions.

To extend the domain in which constructive evaluation can be used, we have implemented a tool (entitled StudySieve) that supports the creation, evaluation and sharing of free-response questions and their answers.

StudySieve

Figure 1 shows the default view of the StudySieve system. Students are able to view existing questions, create a new question, look at their contribution statistics or find out more about the way the tool is used.

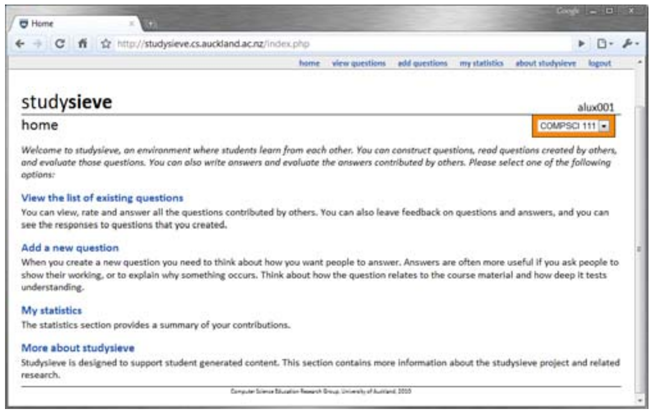

Figure 1: The StudySieve system as it appears to students when they first log in.

The list of questions may be filtered and ordered, which makes the question repository more manageable for students. Questions may be rated on a 1-5 scale, and both the user's rating and the average rating is displayed. Figure 2 shows the appearance of the question list, with the user's rating indicted by stars, and the average rating indicated by a horizontal bar directly below the stars. The third question has been rated by the user as 4 out of 5 stars, and has an average rating of about 4.5.

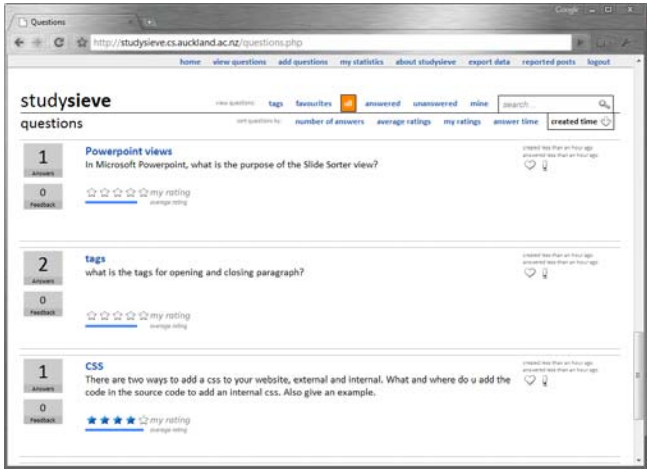

Figure 2: The questions view showing three of the student-generated questions.

The answers to a question remain hidden until a student submits an answer of their own. After the answer is submitted, the answers of other students are displayed in a list below the question. Students may rate the answers submitted by others, and can see their own ratings, and the overall average rating of the answer. Figure 3 shows a question that has been answered, and two of the answers submitted by other students.

In this study, we investigate how students in a general computing course use StudySieve, and the nature of the questions they create. We report on the logs of use, and analyse the cognitive level of the questions created by students, compared with the level of the questions used by instructors in laboratories and archived tests.

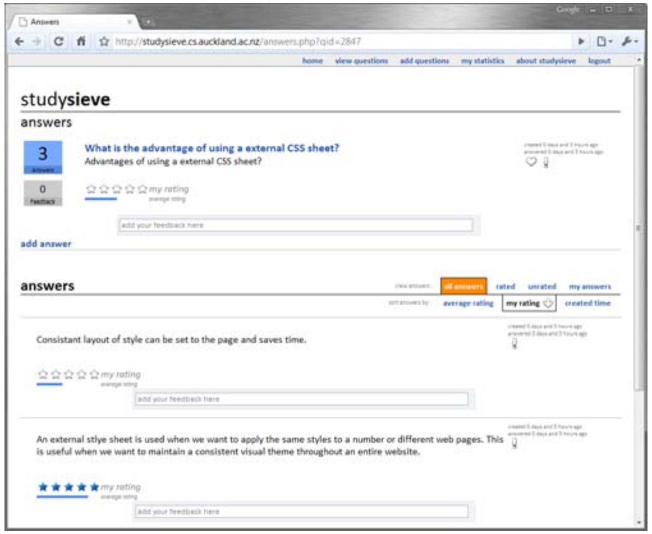

Figure 3: A question that has been answered by the user, and two answers contributed by other students.

Methodology

The StudySieve system was trialed in a first-year computing course – CS111 – entitled "An introduction to practical computing". This course is designed to provide a general overview of computing for non-CS majors. In addition to lectures, students are expected to participate in one laboratory session per week.

Students were required to submit one question to Studysieve and to answer one other question each week as part of their laboratory requirements. We report here on the data collected between 7th March 2010 and 1st April 2010, the period between the introduction of StudySieve in the first laboratory and the date of the mid-semester test.

In order to analyse the cognitive level of the questions produced by students, two of the authors coded the questions according to the Revised Bloom's Taxonomy (Anderson et al. 2001). We used only the cognitive levels dimension and coded questions as belonging to one of the categories: Remember, Understand, Apply, Analyse, Evaluate or Create. We interpret each of these categories as follows:

Remember – questions that require students to recall or remember something. This includes questions asking students to describe something, or state a definition of something.

Understand – questions that require students to explain a concept or idea using their own words. Typically this differs from simple memorization by asking students to interpret or translate ideas

Apply – questions that require the application of a process, such as performing a calculation.

Analyse – questions that require students consider how parts relate to a whole.

Evaluate – questions that require a judgment about quality based on standards and criteria.

Create – questions that require students to develop something new

Initially, a sample of 30 questions were coded by the first two authors. Once agreement was obtained, the set of questions was divided in half and questions were coded individually. Questions for which the category was ambiguous were flagged for discussion and were assigned a category after agreement was reached between the coders. After the completion of the coding a sample of 50 questions was coded independently by one of the other authors. The codes agreed in 85% of cases. The remaining questions were borderline cases falling into the categories of either Remember or Understand.

We hypothesize that the type of questions that students submit are likely to be influenced by the type of questions that instructors provide in laboratories and archived tests from previous years. We therefore categorized instructor questions present in the first three laboratories, and the three most recent archived tests, which are available to students.

Results

We report here on the usage of the StudySieve system and the cognitive level of the questions contributed by students.

Use of the system

At the time of the data collection, students had attended three laboratory sessions, one per week. The assessment requires that a laboratory report is submitted one week after a session is attended. Therefore, all students should have completed the requirements for two laboratories. Some students will have completed the requirements for the third laboratory, while others will not yet have finished the tasks specified for their third laboratory.

QUESTIONS CONTRIBUTED

Students were required to submit at least two questions. Some students would have submitted a third question to fulfill the requirements of their third laboratory. Students who submitted four or more questions did more than required for no additional credit. The maximum number of questions by a student was 13.

Table 1: The number of students who contribute less than, equal to and greater than the number of questions required by the assessment.

Number of questions	Number of students
0	100
1	71
2 - 3	321
>= 4	48

ANSWERS CONTRIBUTED

Students were required to submit at least four answers (two for their own questions and two for questions written by others). Students who were working on their third laboratory may have submitted five or six answers. Students who submitted seven or more answers did more than required for no additional credit. The maximum number of answers by a student was 35.

Table 2: The number of students who contribute less than, equal to and greater than the number of answers required.

Number of answers	Number of students
<= 3	196
4 - 6	230
>= 7	115

RATINGS CONTRIBUTED

StudySieve is structured so that a user must self-assess their questions and answers by assigning a rating to them when they are submitted. This means that every question and answer is rated at least once, by the student who created it. Students who have fulfilled the assessment requirements will have submitted at least three ratings for each lab (i.e. six ratings at the time of data collection). The maximum number of ratings by a single student was 196.

Table 3: The number of students who contribute less than, equal to and greater than the number of ratings required assessment.

Number of ratings	Number of students
<= 5	184
6 - 9	195
>= 10	162

FEEDBACK CONTRIBUTED

Feedback may be provided on any question and on any answer. The contribution of feedback is not assessed in any way. The maximum number of comments contributed by a single student was 8.

Table 4: The number of students who contribute one or more comments as feedback.

Number of comments	Number of students
1	82
2	16
>= 3	9

SUMMARY OF USE

Overall, only 83.4% of the students enrolled in the course logged into the StudySieve system and made a contribution (i.e. submitted a question, answer, rating or feedback). Relatively few students contributed a comment as feedback to a question or answer. Table 5 shows the number of students enrolled, the number of students who logged into the system (active users), and the total amount of contribution in each category.

Table 5: Overall use of the system by students.

Category	N	Users
Students Enrolled		541
Active users		451
Questions contributed	1151	439
Answer contributed	2422	449
Ratings contributed	4078	451
Comments contributed	172	108

Cognitive level of the questions

Table 6 summarizes the number of questions authored by students in each category, and the number of instructor questions (as they appear in laboratories and archived tests) in each category. Some questions were incomprehensible or were clearly not related to course content, and as such were placed in the category of Irrelevant. The vast majority of questions contributed by students fall into the lower cognitive categories: Remember and Understand. Examples of student-generated questions in each of the categories are shown in figure 4.

Table 6: Number of questions from students and instructors that fall into each cognitive category

Cognitive level	Student questions	Instructor questions
Remember	693	54
Understand	316	21
Apply	22	14
Analyse	0	0
Evaluate	1	1
Create	0	0
Irrelevant	60	0

We identified numerous duplicate questions during the coding process. In some cases, the same student submitted the same question (or a minor variation) multiple times, in other cases multiple students submitted the same question (or a minor variation) at different times. For example, the question "What does CPU stand for?" appeared 12 times. Some questions are simple variations of the questions used in the laboratories. For example, the question "What is the difference between Cc and Bcc?" appeared in the laboratory, and 34 variations were discovered in the repository.

Discussion

We observed that a substantial portion of the class (16.4%) did not contribute anything to StudySieve. The COMPSCI 111 course is a general education course designed for students who are not majoring in CS. It is typically viewed as a low priority course by students, which may explain the lack of involvement in a straightforward assessment task.

We also note that some students used StudySieve more than the minimum required. This provides evidence that students see intrinsic value in the system. We did not observe heavy use of StudySieve in the period immediately prior to the test, as has been reported with the PeerWise tool (Denny, Luxton-Reilly & Hamer, 2008). We speculate that perhaps the large number of questions and few answers per question limited the value of the repository for revision. At the time of data collection, no facility to search the questions was available, although we have since implemented searching and tagging to assist students who are revising specific topics.

StudySieve does not require students to evaluate the questions or answers of others. Few of the questions or answers submitted by other students were rated. This is consistent with findings by Barak and Rafaeli (2004) who reported that few students were willing to assess or criticize their classmates work.

Studies conducted with peer review report that students often do not feel comfortable evaluating their peers, particularly when the criteria are imprecise (Dochy, Sergers & Sluijsmans, 1999). The rating of 1—5 stars used in StudySieve is perhaps too vague for students to confidently assess an answer. Further investigation into the evaluation of questions and answers is warranted.

The repetition of previous questions suggests that the system would be improved if there was a mechanism to either prevent or aggregate similar questions. It may be possible to extend the current interface for creating a new question so it shows similar questions that already exist in the repository before submission is confirmed. Alternatively, allowing students to identify similar questions in the repository might allow those questions (and their answers) to be combined.

REMEMBER:

- What does XHTML stand for?

UNDERSTAND:

- How can grouping shapes in Microsoft Word make it easier to manage the content in a document?

APPLY:

- Convert the binary number 010111 into a decimal number.

EVALUATE:

- Browsing "Computer", or "My Computer" in Windows XP. One will notice there may be different hard drive formats -NTFS and FAT32. What is the main difference between them and why would one user select one over the other, and what do the abbreviations stand for?

IRRELEVANT:

- QWERTY: the layout of keyboard
- It's 3:08am and you're buying a pie at the service station. What must you always do?

Figure 4: Examples of student-generated questions categorized as Remember, Understand, Apply, Evaluate and Irrelevant.

The majority of questions created by students fell into the lower levels of the Revised Bloom's Taxonomy. This is appropriate for an introductory computing course, and is consistent with the instructor questions in the laboratories and archived tests for the early topics in the course. Topics that occur later in the COMPSCI 111 course tend to involve tasks that cognitively more challenging, such as: programming in python, generating spreadsheet formulae, and constructing LaTeX for mathematical formulae. If students generate questions that have a similar cognitive level to those generated by instructors, we would expect to see a greater number of questions belonging to higher levels in the later weeks of the course.

Many of the questions that fall into the *Remember* category require a definitive answer. For example, "What does X stand for?" where X is an acronym. Questions of this type leave little opportunity to learn through the variation in answers provided by peers (since there is little or no variation in answers). For questions that require recall, a multiple choice system may be a more appropriate tool.

Conclusion and future work

StudySieve successfully supports constructive evaluation for questions with free-response answers. The questions created by students are consistent with those created by instructors for the material studied in the early part of the course. Further study is required to determine if students continue to generate similar questions to instructors when the course content is more complex and instructor questions are at a higher cognitive level.

The large number of similar questions may have occurred as a consequence of a large number of students writing questions about content that is largely factual. However, it is likely that the quality of the repository could be improved by introducing features that helped students to identify and manage repetitive questions.

Although students appear to value the repository of questions created by their peers, the majority are not engaged with the evaluation of questions. Further work is needed to improve the design of the system so students are encouraged to participate in the evaluation process.

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Attitudes of educators to the introduction of mobile technology

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Abstract

Mobile technology offers a wide range of possible opportunities in the educational context. The portability and low cost of mobile devices, compared to computers, have enabled interaction and learning to take place anywhere and anytime. Mobile learning is a relatively new area of interest and many early researchers report a range of advantages and possibilities of using mobile devices in schools and tertiary institutes. However, as with the inclusion of all new technology into a new context, it is important to consider the possible barriers and resistance that may result from the introduction of new technology. This paper discusses the results of a survey conducted at one of the largest polytechnic in New Zealand. The survey was aimed at collecting educators' attitudes to mobile learning, to determine what factors influence their potential adoption of mobile technology into the educational setting. The survey adopted the Technology Adoption Model (TAM) which was used to assess the perceived usefulness and usability of mobile technology used to support teaching and learning.

Keywords

Mobile technology, adoption, mobile learning, educators' technology use

Introduction

The term mobile learning (m-learning) refers to the use of mobile and handheld devices, such as Personal Digital Assistants (PDAs), mobile telephones and MP3 players, in supporting teaching and enabling learning. As computers and the Internet become essential educational tools and the technology becomes more portable, affordable, effective, and easy to use, so too have they become the focus on how they can be incorporated to support learning. These technologies provide many opportunities for widening participation and enable easier access to learning. Mobile devices such as phones and PDAs are more reasonably priced than desktop computers, and therefore, present a less expensive method of accessing a myriad of tools all in one small device. Features such as the facility to make phone calls, take pictures, record audio and video, store data, music, and movies, and interact with the Internet all provide opportunities that could be harnessed in the educational context. As new devices continue to enter the market, new features and capabilities are appearing at an accelerated pace. Mobile learning offers a fundamental change in the way learning can be regarded and opens the door to countless uses for educational purposes.

The decision of educators to integrate mobile learning into their teaching is a complex process with a wide number of influencing factors. A key question in trying to determine future adoption with the technology environment is determining why an individual would adopt one technology while resisting another. According to Straub (2009, p.626) "technology adoption is (a) a complex, inherently social, developmental process; (b) individuals construct unique (but malleable) perceptions of technology that influence the adoption process; and (c) successfully facilitating a technology adoption needs to address cognitive, emotional, and contextual concerns". The aim of this paper is to provide an initial insight into some of these factors that may affect the adoption of mobile technology into education. In addition this paper will assess the attitudes these educators have concerning the introduction of mobile technology into the educational context.

Technology adoption in education

User acceptance can be defined as "the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support" (Dillon & Morris, 1996, p.5). Therefore, in terms of this paper, user acceptance is the willingness of educators to use their mobile devices to support their teaching. Interest is focused on identifying the factors that influence the adoption of technologies by users who have some degree of choice. A high number of models and theories have arisen which aim to uncover the factors that will influence the adoption of technology. These factors range from focus on the technology itself through to the psychological characteristics of the individual (see Dillon and Morris, 1996 for a detailed review of various theories and models of user acceptance). Due to the wide ranging issue of why an individual would accept or reject a technology it is unlikely that a single-variable explanation could account for this decision. However, a number of theories and models have been developed to help understand adoption and have been used to explain adoption in the educational context.

One of the most popular models which have been used extensively in IS literature is the Technology Acceptance Model (TAM). The TAM has been used to explain the adoption of a wide range of technologies and has been used in the educational contexts to explain a wide range of educational tools (Ma, Andersson & Streith, 2005; Hu, Clark, Ma, 2003; Ngai, Poon & Chan, 2007). The TAM focuses on two main constructs, namely the perceived ease of use (PEOU) and usefulness (PU) of the technology as perceived by the intended user. Research has shown that the TAM model can be used to explain approximately 50% of the variance in acceptance levels (Davis, Bagozzi, & Warshaw, 1992). A number of studies have used the TAM model as a basis to describe the adoption of mobile technology by educators and students (Huang, Lin & Chuang; 2007, Carlsson et al., 2006). Huang, Lin & Chuang (2007) adopted the TAM to explain the adoption of mobile learning by students. Their study shows that that perceived usefulness (PU) and perceived ease of use (PEOU) are key determinants of user perception of m-learning, however the usefulness of mobile technology was a vital characteristic of adoption. Liu (2008) adapted the TAM model by including four additional variables that, he felt, better helped determine mobile learning adoption, namely: performance expectancy, effort expectancy, social influence and facilitating conditions. These additional variables stemmed from Carlsson et al. (2006) who stated that "mobile technology adoption is more individual, more personalized and focused on the services made available by the technology". Other authors have used a number of other variables in addition to PEOU and PU to help explain mobile learning adoption these include: the measurement of enjoyment (Phuangthong & Malisawan, 2005), self-efficacy (Lee, Kim, & Chung, 2002; Pedersen, 2003; MacCallum & Jeffrey, 2009) access to resources (Pedersen, 2003), image (Teo & Pok, 2003), and motivation (Kwon & Chidambaram, 2000; MacCallum & Jeffrey, 2009).

The addition of a wide variety of other variables used to support the TAM model has resulted in a rather complex list of possible variables that can be used to explain adoption. In addition, to the modifications made to the TAM model, other models and theories have also been adopted to help explain the adoption of technology, such as the Diffusion of Innovation Theory (Rogers, 2003), Theory of Reasoned Action (Fishbein & Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991). The wide varieties of possible models and subsequent modifications to these models have made it difficult to select an appropriate and verifiable model that can be relied on to truly help interpret the adoption process. Therefore, recently Venkatesh et al. (2003) set out to develop a unified theoretical model that captures the essential elements of all these theories and models. The resulting Unified Theory of Acceptance and Usage Theory (UTAUT) has brought eight adoption models and theories, namely, Diffusion of Innovation, Theory of Reasoned Action, Theory of Planned Action, Technology Acceptance Model, Combined TAM and TPB, Motivational Model, Social Cognitive Theory, Model of PC Utilization, with the aim of creating one robust model.

The original version of the UTAUT contained seven constructs (effort expectancy, performance expectancy, social influence, facilitating conditions, attitude, self efficacy and anxiety) however only four constructs were found to have a significant relationship with adoption. These constructs are performance expectancy, effort expectancy, social influence and facilitating conditions. In addition, to the above, constructs age, gender, experience and voluntariness of use were also considered to be of significance when assessing adoption. In Venkatesh et. al., (2003) in a longitudinal study they found that the UTAUT accounted for 70% of the variance in usage intention.

This study utilizes the Technology Acceptance Model to help interpret the attitudes of educators' to the introduction of mobile technology into the tertiary environment. The following outlines the methodology adopted and the results of the survey.

Methodology

An online survey was developed based on the instrument developed by Venkatesh, et. al. (2003). The participants of this study were instructors teaching at one of the larger polytechnics in New Zealand. Data was collected at the end of 2009. A total of 52 surveys were received however a number of these were later rejected due to missing sections, resulting in total of 38 responses. Due to the small number of responses received the results in this study are only meant to be exploratory rather than determine a significant relationship between the constructs measured in this survey.

The respondents in this survey comprised of 44.7% were male and 55.3% were female. The majority of the participants fell into the over 50 age category (n= 25), with 8 participants between the ages of 40 and 49. Only 5 participants were below the age of 40. The participants taught in a wide range of faculties, however most came from the Business and Computing, Art and Social Science and the Science and Technology faculties. These results were consistent with the institute's demographics. Table 1 provides a summary of the participants' reported faculty.

Of these participants all, except two, had a mobile phone and most (74%) carried the phone with them at all times. The majority of the mobile devices were considered by the respondents to be at the low-end of the scale where text and making calls the only feature of these phones. Only 11% of these participants considered their phones to be high-end phones. Table 2 gives a breakdown of the number of participants and the self reported mobile phone types. In addition, when comparing how likely the participant was to have the mobile device with them and the type of mobile device, those that stated that they had a lower end mobile device were more likely not to have a mobile device or regularly left it at home.

Table 1: Faculty Composition

Faculties	Frequency	Percent
Business and Computing	12	31.6%
Arts and Social Science	9	23.7%
Science and Technology	9	23.7%
Health and Sport Science	5	13.2%
Te Manga Maori	1	3%
Other	2	5%

Table 2: Mobile phone type

Mobile	Frequency	Percent
Low End: I can only text and make calls	11	28.9
	8	21.1
	9	23.7
	4	10.5
High End: Fully functional smart device with all the latest features	4	10.5

The survey was based on UTAUT model. Typically the UTAUT and similar models are used after a user has used the tool or technology in question. The participants in this survey have not been involved in any mobile learning initiative, however all have used a mobile device, therefore the wording of the survey was change to represent this slight shift in concept. The adoption of this model was still considered as suitable as many of the concepts with which the UTAUT covers can still be assessed. The concept behind using the UTAUT was to determine what factors would possibly impact the future adoption of mobile learning by educators. The results of the UTAUT would be assessed in conjunction with other variables (such as age, gender, computing experience, motivation, etc) to determine the impact these variables have on the UTAUT constructs. Due to the length constrains of this paper the wider context of the adoption will not be discussed however this paper will focus on the overall results of the five measured constructs and discuss the insights that this provides. These results gave significant insight to the possible future adoption of mobile learning as a whole however these results could not guarantee the same results when implementing select mobile learning facilities. Figure 1 outlines the five constructs which are measured in this study. The appendix contains the actual questions used in this study.

One construct that was left off the UTAUT was the scale of social influence. Social influence is defined as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh, et. al., 2003, p451). The reason for not including this construct in this survey, relates the fundamental shift of this survey. Since mobile learning is still an emerging tool and significant barriers (such as cost) impact on the probable introduction of mobile learning in any significant way in the immediate future therefore the likely social influence may not be as relevant here compared to other technologies.

Most people are not using mobile technology in there teaching therefore the pressure of others to adopt would be significantly less. In addition, the construct relating to attitude was left in this survey, as mentioned previously, Venkatesh, et. al. (2003) found that attitude had no significant influence on future use of technology and was therefore dropped from the final version of the UTUAT. In this study it was decided that this construct should be included as attitudes seem to play a big role in the likeliness of people wanting to adopt mobile technology in their teaching. Anecdotally, when discussing mobile learning with instructors the researcher has found that instructors typically have either have a strong favourable or negative attitude to mobile learning. These attitudes seldom change and would possibly be a big factor in the future adoption of mobile learning by instructors.

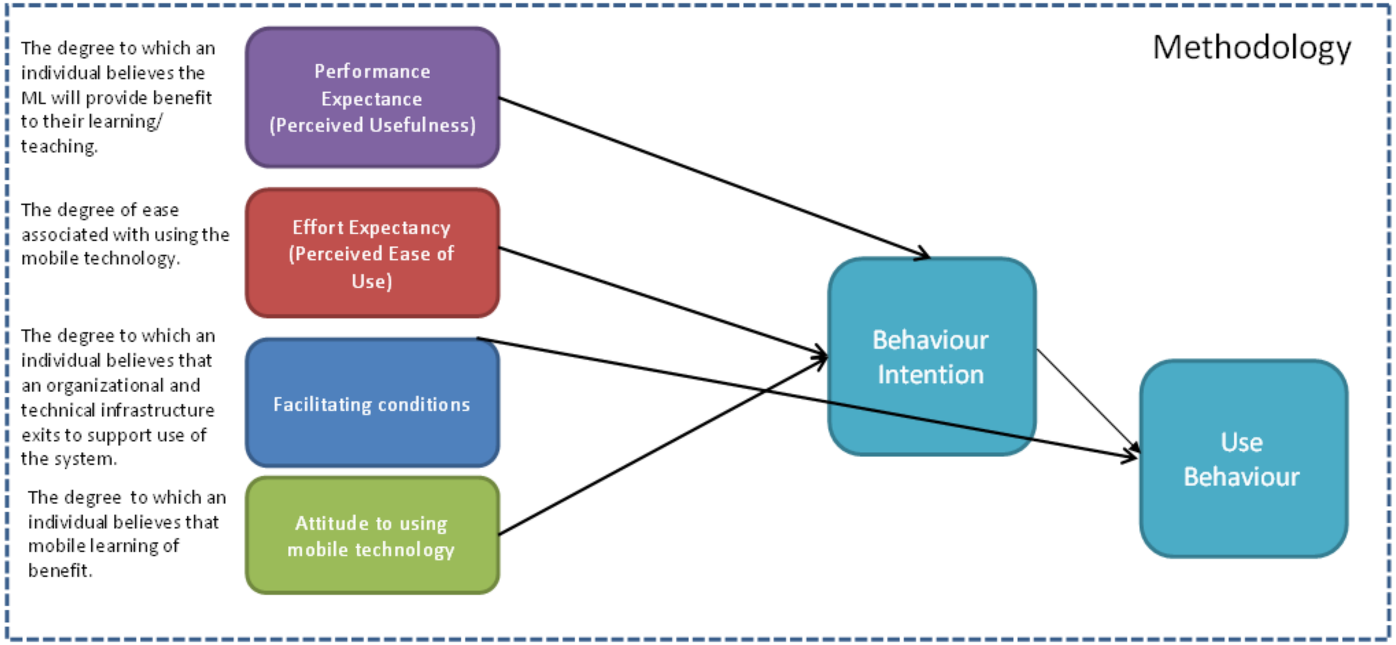

Figure 1. UTUAT Model used in this study

To help provide an insight to the reliability of the questions used to measure the five outlined construct a reliability analysis was conducted for the scales using Cronbach's Alpha. As summarized in Table 3, all except one of the scales that represent the UTAUT constructs appear to have a good degree of reliability since each computed statistic is above .70 (Nunnally 1978). The Facilitating Conditions construct falls slightly below this value with an alpha of .620, however since this is not very far below the .70 level recommended by Nunnally (1978), the construct will still be considered

Results

The results of the survey were analysed to determine whether the identified constructs (performance expectancy, effort expectancy, facilitating conditions, attitude, and behavioural intention) had any significant relationship to age, gender, faculty, how often they carry their mobile and the type of mobile.

The table in the appendix provides a summary of a Spearman correlation analysis to test the relationships among the UTAUT constructs. The significance of this correlation statistic needs to be considered as only an indicator of a possible relation between variables, due to the relative small size of this sample.

Table 3: Reliability Analysis (n=39)

UTAUT Construct	Cronbach's Alpha	Number of Items
Performance Expectancy	.922	7
Effort Expectancy	.758	5
Facilitating Conditions	.620	3
Attitude Towards Using Technology	.863	4
Behavioral Intention	.743	4

Overall, the results show us there is an overall strong relationship between the UTAUT constructs, where all these constructs relate and influence each other. On the other hand, there seems to be little evidence that the external variables seem to influence the results of the UTAUT, except when we consider age and effort expectancy. The initial results show that typically older respondents are more likely to worry about the level of effort needed to be expended to learn how to use mobile technology to support their teaching. This is consistent with the findings in Venkatesh and Morris (2000) where effort expectancy was most prominent for older workers. The interpretation of this result, in our study, needs to considered with some reservations since most of the respondents in this study fell in the above 50 age group. Table 4 provides a crosstab of the relationship between age and effort expectance.

Table 4: Effort Expectance (EE) and Age (n=39)

EE	Age			
	20 – 29	30 – 39	40 – 49	over 50
1	.0% (n=0)	.0% (n=0)	100.0% (n=1)	.0% (n=0)
2	.0% (n=0)	.0% (n=0)	.0% (n=0)	100.0% (n=6)
3	.0% (n=0)	11.1% (n=1)	.0% (n=0)	88.9% (n=8)
4	8.3% (n=1)	16.7% (n=2)	25.0% (n=3)	50.0% (n=6)
5	.0% (n=0)	.0% (n=0)	66.7% (n=4)	33.3% (n=2)
6	.0% (n=0)	8.3% (n=1)	.0% (n=0)	66.7% (n=2)
7	.0% (n=0)	.0% (n=0)	.0% (n=0)	.0% (n=0)

Table 5 outlines the means and standard deviations of the educator's perceptions of adoption mobile learning. Overall the results show that the instructors are relatively positive towards the idea of the introduction of mobile learning.

Table 5: Summary of results of UTAUT constructs (n=39)

UTAUT Construct	N	Min	Max	Mean	Std Dev
Performance Expectancy	38	2	7	5.13	1.234
Effort Expectancy	37	1	6	3.68	1.248
Facilitating Conditions	36	1	7	4.28	1.466
Attitude Towards Using Technology	36	2	7	5.31	1.117
Behavioral Intention	37	2	7	4.51	1.193

When considering the performance expectancy, participants overall slightly agreed with the seven statements that made up this measure. As can be seen the instructors tend to believe that mobile technology is a useful and productive tool; however, they tend to be a bit more neutral in terms of their perception that this technology would help them achieve tasks more quickly. Table 6 summarizes the mean and standard deviation of the instructors' perceptions with respect to performance expectancy.

Table 7 provides a descriptive analysis of the instructors' perceptions regarding effort expectancy. It appears that the instructors tend to agree that mobile learning would be easier to use and that they would probably find it comfortable to use in front of others, however participants felt that using mobile technology may require a significant amount of time to set up and support.

Table 6: Performance Expectancy

Performance Expectancy	N	Min	Max	Mean	Std Dev
I see ML as a way to enhance/encourage my students self-directed learning	36	2	7	5.36	1.199
I believe MT offers increase accessed to leaning material by my students	36	1	7	5.22	1.396
I see Mobile Learning (ML) as a way to offer more flexibility to my students compare to e-learning	37	1	7	5.16	1.344
I see ML as a way to improve student learning as it allows students to access learning content anywhere and anytime	37	1	7	5.16	1.405
I see ML as a way of encouraging more interaction by students and educators	36	2	7	5	1.454
I would find mobile technology (MT) useful in my teaching	37	1	7	4.92	1.552
I believe that using MT would enable me to accomplish tasks more quickly	36	1	7	4.39	1.712

Table 7: Effort Expectancy

Effort Expectancy	N	Min	Max	Mean	Std Dev
I believe I would find it easy to use a mobile device to support my teaching	38	2	7	5.13	1.234
I would feel uncomfortable about using MT in front of others in case I am unable to work it correctly*	38	2	7	5.13	1.234
I think it might take me a while to get comfortable with using a mobile device for teaching*	35	1	7	4.4	1.735
I would be anxious about having to use my mobile device to help support my learning*	32	1	6	3.53	1.524
ML requires too much time to support and setup*	36	1	7	2.89	1.508

* Items have been recoded

When assessing the possible relationships between variables the Spearman correlation analysis hinted towards a possible relationship between the age and attitude towards the facilitating conditions of mobile technology. In table 8 it can be seen that overall the instructors believe that mobile learning would be compatible to teaching however they feel that they do not necessarily have the knowledge to implement this into their teaching.

Table 8: Facilitating Conditions

Facilitating Conditions	N	Min	Max	Mean	Std Dev
ML would not be compatible with how I teach	34	1	7	4.94	1.757
I believe that I would need a strong level of support from the IT staff to help me with setting and using the technology	36	1	7	4.28	1.466
I feel that I would have the knowledge necessary to implement and use MT in my teaching*	35	1	6	3.46	1.482

* Items have been recoded

Table 9 presents a summary of the overall attitudes of the instructors' in regard to their view of mobile learning. Overall on average there seemed to be an overall positive response to mobile learning. Figure 2 gives a more detailed summary of the frequency of the individual responses on the 7 point Likert scale.

Table 9: Attitude Towards Using Technology

Attitude Towards Using Technology	N	Min	Max	Mean	Std Dev
Working with the MT will be fun.	36	2	7	5.31	1.117
Using MT for learning/teaching is a good idea.	35	1	7	5.26	1.245
MT will make learning and teaching more interesting.	35	1	7	5.23	1.190
MT will increase student's interest	36	1	7	4.92	1.610

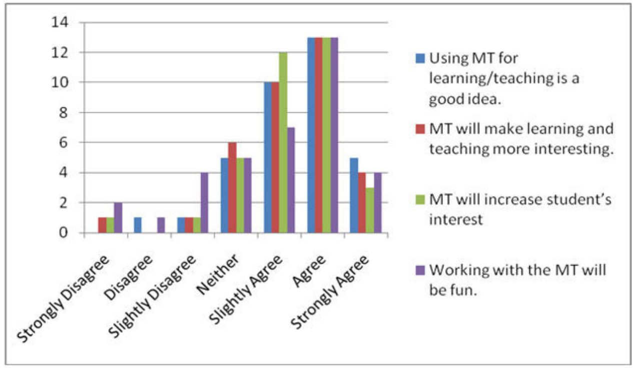

Figure 2. Attitudes towards using mobile learning

The last construct helped interpret the intention of the instructors on possibly adopting mobile technology to support their teaching sometime in the future. Table 10 shows that overall instructor were interested in using mobile technology however they felt that they needed to see others adopt and see the benefits before this would happen.

Table 10: Behavioural intention

Behavioural intention	N	Min	Max	Mean	Std Dev
Overall I would be interested in including ML if I had the opportunity in the future	36	1	7	4.86	1.533
I do not think I will implement ML until I have see other educators using it successfully *	37	2	7	4.51	1.193
ML is too expensive in terms of the cost of the devices, services, maintenance repair and upgrades, and support from an IT etc *	34	1	7	3.74	1.831
I can see how I could incorporate ML it into my teaching	29	1	6	3.45	1.478

* Items have been recoded

Conclusions

This study describes the results of small scale initial study into a group of educators and their perceptions of using mobile technology to support their teaching. The foundation of this study was based on the UTAUT model. This model helped identify constructs such as performance expectancy, effort expectancy, facilitating conditions, attitude, and behavioural intention as possible indicators to the future adoption of mobile learning.

Since this is a small scale study, no real relation was shown on these constructs based on gender, faculty and mobile use. However, some support was shown that indicated that age may be a factor in regards to the perceived effort which would need to be placed into setting up any mobile facility. This result was only perceived as an indicator of a possible relationship since the sample size was very small.

Overall the participants' attitude to mobile learning was largely positive however issues such as the time to set up this tool and the knowhow were major issues that may affect the overall future adoption of mobile learning by educators. Educators will need support and help with determining the best way to use mobile technology before they are willing to adopt. In addition mobile learning needs it champions to show how mobile technology can be used and the benefits it brings to students and teachers alike. The concept of observability, as discussed by Rogers (2003), seems to be a key issue to the future adoption of mobile learning. Rogers (2003) define observability being where the innovation uses and effects being visible to other. The introduction of mobile learning must be visible and the effects that it has on learning must also be visible or enthusiasm for the tool would wane. Wide research and long term studies are need to truly represent the true value of mobile learning. Currently most studies focusing on mobile learning are short term and limited in focus, therefore, failing to provide concrete and ongoing benefit.

Overall, this study has help give an initial insight to the attitudes and possible future adoption of mobile technology by educators. The next step of this study will be to broaden the scope of the survey to incorporate a wider audience of tertiary educatory therefore help provide more generalisable results.

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Appendix: Spearman correlation results

	Gender	Age	Faculty	Often phone carried	Type of phone	PE	EE	FC	A	BI
Gender	1.00									
Age	.112 .503	1.00								
Faculty	-.176 .296	.174 .304	1.00							
Often phone carried	-.044 .795	.063 .708	-.143 .398	1.00						
Type of phone	-.030 .860	-.092 .593	.075 .670		1.00					
Performance Expectancy (PE)	.139 .405	.073 .665	-.033 .847	.017 .921	.126 .465	1.00				
Effort Expectancy (EE)	.058 .734	.329* .047	.199 .245	-.062 .714	-.281 .101	-.446** .006	1.00			
Facilitating Conditions (FC)	.135 .432	.272 .109	.229 .180	-.245 .150	-.298 .087	-.375* .024	-.375* .024	1.00		
Attitude Towards Using Technology (A)	.124 .471	.015 .933	-.007 .967	-.039 .820	.160 .366	.796** .000	-.398* .016	-.240 .159	1.00	
Behavioural intention (BI)	.190 .260	-.214 .204	-.127 .461	.169 .318	.173 .320	.623** .000	-.669** .000	-.701** .000	.549** .001	1.00

** 2-tailed Significance at .001; * 2 tailed significance at .05.

Students as New Settlers: the policy implementation gap

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Abstract

Given that New Zealand is experiencing a lack of skilled labour in Information Technology (IT), and that this lack is increasing in direct proportion to ongoing technological development, the government is looking to immigrants to meet this shortfall. The purpose of this paper is to explore the issues surrounding the New Zealand Government's stated preference for meeting this shortfall in skilled labour by having highly qualified international students as new settlers/new immigrants. What actually happens to these international IT students once they are here in New Zealand and how does the New Zealand IT job market match their needs with the needs of these potential new settlers?

Keywords

International IT students, immigration, pastoral care

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Introduction

Many countries currently experience labour shortages in some fields as well as the excess of labour in other fields. To resolve these issues, these countries are trying to attract skilled people to come and fulfill the lack of labour in various particular fields by changing their immigration policies. Thus, the international exchange of labour has become an important global issue – especially to those people looking to better their lives.

One such immigration policy change arises out of the realization that international students are a potential source of qualified migrants. They have already experienced the local culture and lifestyle while studying and they have gained the required skills by graduation. According to Beerkens (as cited in Teshnar, 2009), the international exchange of students is used as a political instrument in European integration to link economic and cultural collaboration between countries. Swain (2004) claimed that international students, who had studied in New Zealand, are potential quality migrants as they have qualifications that are recognised by New Zealand employers and are already partly settled here.

A variety of skills, but especially IT skills, are required in many countries – for example, Canada, Australia, the United Kingdom, the United States of America, and

New Zealand. "*Highly qualified IT professionals, a microbiologist, a psychiatrist, other scientists, doctors, nurses, secondary school teachers, and trades people such as mechanics and electricians are among those being invited to apply for residence*," according to Swain (2004, para. 14). New Zealand is offering a job search visa for graduates who completed NZQA level 5 or higher level courses. Until three years ago, the job search visa was valid for six months. But it was changed in 2006 to a longer term of one year. The New Zealand Government appreciated the difficulties international graduates had in gaining employment in NZ. It did not want them to leave as soon as they became qualified as they were considered skilled potential labour.

Methodology

International students face certain difficulties when they graduate and are looking for employment in New Zealand. This also applies in other countries. Maasen & Uppstrøm (as cited in Teshnar, 2009), explain the difficulty of recruiting international students as a result of the "language issue". This language issue relates to gaining employment, but also for non-English speaking background (NESB) students studying. There can also be issues such as discrimination on the grounds of race, creed, language and other reasons.

A literature review explored the current global responses to international students, their motivation, any discrimination that may be experienced, and the New Zealand Government policies to support international students. As the scope of this topic is IT students and graduates as new settlers, this review is mostly limited to recent international students' immigration literature/research.

Then, on the basis of the literature review findings, a survey was conducted with international students in IT programmes of study using a range of closed and open questions. The survey addressed some of the issues raised by Malhotra and Clear (2010) and seeks to provide research into the perceptions and experiences of the students themselves.

Literature Review

Prior to the recent 2009 recession, international students were offered more and more favourable opportunities to seek employment after upskilling through post graduate study. Coleman (2009, para. 4) said *"Immigration is a major contributor to New Zealand's economy … as is export education. Export education is one of New Zealand's top five export industries, generating over $2 billion annually in foreign exchange for New Zealand's economy. In addition, there are an estimated 32,000 jobs associated with the export education industry. Export education is big business for New Zealand, but of course, it could be much, much bigger."*

From an economic point of view, *"High-skilled immigrants are… a self-selected pool of individuals, who move to countries where there is demand for their skills and … they raise global productivity"* (Kaushal & Fix, 2006, p.14). While some countries are unable to provide enough jobs to employ skilled people, other countries have insufficient skilled labour to fulfill the needs of their market. From a global point of view, immigration increases global productivity by fulfilling the supply and demand for skilled labour around the world (Teshnar, 2009).

The fundamental rationale underpinning immigration rules in many countries is to attract high-skilled workers. This policy created positive sentiment and attracted international students and graduates who then wanted to stay to find a job in their new countries. As the next step from the job search visa, New Zealand offers the opportunity for the graduates to apply for residency under SMC (Skilled Migrant Category). Although this applies to certain skills shortages, students recognised that New Zealand considered students and graduates as potential qualified migrants. Students who have studied in New Zealand were seen as potential quality migrants as they have qualifications that are recognised by New Zealand employers and they are already partly settled here (Swain, 2004).

The practice of securing qualified labour force through the recruitment of international students has became common in various developed countries (Kapur & McHale, 2005; Green, 2007; Hawthorne, 2002; & Chellaraj, Maskus & Mattoo, 2005 as cited in Teshnar, 2009). Countries consider their foreign students as potential qualified migrants as they were highly educated, experienced, and proficient English speakers. Chellaraj, Maskus and Mattoo (2005, p.12) emphasized the benefits of an *"open-door immigration policy"* to boost the rates of economic growth of the country (the United States). For example, besides attracting highly skilled workers, US Immigration Policy has changed to enable international students to stay on to work after graduation and contribute to the economy with their various backgrounds and skills (Anderson, n.d.).

Similarly, Australia's immigration policies have changed in recent years. From September, 1, 2007, changes were made to the Skilled Migration Requirements to ease the process of gaining employment for graduates with higher levels of English and relevant work experience. These changes ensured that international graduates who desired to work in Australia after completing their studies had a better chance of competing for jobs in their chosen vocations (Teshnar, 2009).

In addition, UK changed its immigration policies to broadly recognize international students as potential migrants. All international students and graduates were accepted for the international graduates scheme, rather than restricting it to science and engineering graduates. Thus, all international students who graduated from UK universities had the possibility of employment for a year after graduation – similar to the job search visa in NZ. Former British Higher Education Minister, Bill Rammell (as cited in Teshnar, 2009, p.17) said the measures were taken to *"allow UK employers to benefit from skilled people who have gained UK qualifications and have experience of living in the UK."*

What motivates international students and graduates to consider applying for residency? Migration is influenced by push and pull factors. Push factors force a person to move. These include drought, famine, lack of jobs, over population and civil war. Pull factors encourage a person to move – such as a chance for a better job, better education, a better standard of living. (Teshnar, 2009) Being an international student is expensive and takes considerable time and effort, so it is unlikely to be an easy decision for most students to make. Therefore, it is important to explore the ways countries appeal to international students to motivate them to study abroad.

Teshnar's 2009 study of International Students in Norway examined the concept of "Migration Motivation". According to the interviews in the study, the main pull was the absence of tuition fees, and in some cases, the availability of a scholarship (Teshnar, 2009). Commonly, financial problems could be a barrier for international students as it is expensive to live and study in Europe. The study found that another motivation for international students was their investment in their future career. This finding applies to almost all international students around the world. The study program content is highly rated by students. They seek programs that are relevant to their previous education or job experience, and consider a degree taken in Norway to be highly valuable for their future career plans (Teshnar, 2009, p.85). In conclusion, it appears that while the strongest reason to go abroad to study is their investment in their professional development for better future, they still need to carefully consider financial issues when choosing a country in which to study.

Another recent study from the United States examined perceived obstacles for international students. The *Study of International Students and U.S. Policy Choices* discussed recent obstacles for increasing international student enrolments. International student enrolments at U.S. universities have recently declined. Firstly, the U.S. Visa Policy was an obstacle. Many applications are declined because the applicants did not prove that they did not intend to stay permanently in the United States, under section 214(b). Thus, at a time when the nation's success was based on its laws and institutions and the skills of its workforce, U.S. policy specifically blocked the entry of bright foreign nationals who planned to study and later work in the United States. (Anderson, n.d.).

Another obstacle was being in competition with other countries to attract international students. The study said when other countries changed their policies to attract more international students, recent U.S. policies lagged behind. Another disincentive was the unattractive exchange rate for the US dollar and the high cost of living and education. Finally, their low potential ability to work in the United States while studying was an obstacle. The less realistic that opportunity becomes, the less likely it is for students to choose a U.S. university. They are more likely to choose postgraduate education in another nation state, including in their own country (Anderson, n.d.).

Other disincentives from choosing the United States have been identified by the *Discrimination and Harassment Among International Students: a Focus Group Study* (Sutton, 2002) at North Carolina State University. Discrimination has been described as something that involves different treatment based on a characteristic such as colour or gender or being "foreign". This study examined international students' experiences through several themes including discrimination, harassment, national origin, race, religion, disability, sexual harassment, gender roles in American society and other societies, Post-September 11th experiences, student and American faculty perceptions of international students, and forms of harassment or discrimination an international student may face (Sutton, 2002).

Having a 'foreign-sounding name' can cause disadvantage by receiving different treatment from a roommate. The study found that international students could benefit from education that gave a clear definition of discrimination and how American laws and policies manage discrimination. Participants referred to race as their "ethnic origin" or "ethnic background" whereas others referred to race as "colour." Some of the participants also noted that race was a much bigger problem in America than it was in their own country (Sutton, 2002). Some Americans also have strong stereotypes and prejudices about different religions which they associate with different countries or national origins; especially as an effect of post September 11 experiences (Sutton, 2002).

In summary, it was clear that harassment and discrimination are handled in different ways in other countries; therefore, more education for international students is needed to inform them of their rights and responsibilities as outlined by federal and state laws and university policies. In addition, international students may not have a clear understanding of "race" as defined by law or of what constitutes harassment (Sutton, 2002).

Some New Zealand based research has been conducted among Pacific Island students at Auckland University, sponsored by the Ministry of Education. The Pacific Island Students Academic Achievement Collective (1993) explained why Pacific Island students achieved low marks in their study and suggested ways in which lecturers could understand their background to improve achievement. Language is one of biggest issues for international students. It could cause discrimination and also be an obstacle to fully understanding their studies.

In New Zealand, there is a Code of Practice for the Pastoral Care of International Students. All educational institutions must honour this to enable them to have international students in their institutions. The Code provides a framework for service delivery by educational providers and their agents to international students. It sets out the minimum standards of advice and care that is expected from educational providers for international students. The Code applies to pastoral care and provision of information only, and not to academic standards (New Zealand Ministry of Education, 2003). Thus, international students are legally protected by schools and they have a right to ask for help from their schools.

In summary, developed countries vary in their policies and practices towards international students depending on skills shortages, and the degree of competition for their fees within the global tertiary education systems. In buoyant economic times of with high skills shortage, international students are exposed to a variety of incentives, including nil or relatively low tuition fees, and a variety of incentives to stay on as job seekers for a period of time after their post graduate qualifications are completed. The effect of these pull factors on international students in ITPs in New Zealand is further explored in research conducted in 2010.

The Survey

The survey questions were designed based on findings from the literature review. There were four parts. Part A dealt with New Zealand's Immigration Law, Part B looked at current students, Part C examined the motivation of the students to come abroad to study and live, and Part D looked at those who had graduated and were now successful immigrants.

In Part A of the Survey (New Zealand Immigration Laws) six questions defined how the respondents thought of themselves fitting into New Zealand society and their attitudes and knowledge of the current immigration laws. In Part B, they were asked, as a student now, nine questions to find out whether they had experienced any discrimination and also how hard they believed it was going to be for IT international students to find employment. Seven questions in Part B also related to more detail on the question about discrimination. As already mentioned, Part C dealt with the Students' motivation to come to New Zealand to study and live, and two questions looked specifically at why they actually chose New Zealand. Part D asked about life after a successful immigration, and this included two specific questions to investigate how many participants would stay in NZ forever after successful immigration.

The survey was carried out amongst the international students who study Bachelor and Graduate IT programmes of study at one of the South Island metropolitan tertiary institutions in New Zealand. While it was mostly completed through face to face interaction, some of questionnaires were completed by emails. (Acknowledgement is given to several staff for allowing the survey to be carried out at the beginning of their respective courses.) Participation in the survey was completely voluntary and in all 32 completed questionnaires were used to analyse the results. This represented approximately 80% of all international students in these programmes of study.

Results

Most participants (about 84%) classified themselves as students and also as potential immigrants (see Table 1). A similar number of participants said they would fit into the NZ immigration scheme in the near future.

Q1. How do you see yourself fitting in to NZ society?				
As a student	As a potential immigrant	As someone who will return home	Other	
15	12	2	2	
Q2. How soon do you see yourself being fully familiar with the NZ immigration laws..				
Now	Soon	Later	Much Later	Other
2	14	11	3	1
Q3. What more do you see yourself having to do to fit into NZ society?				
Complete your Study	Apply residency	Apply citizenship	I feel I already fit in	Other
15	14	3	0	0
Q4. Do you see the process of fitting in...				
Easy	Too Easy	Hard	Too Hard	Other
5	1	18	4	2
Q5. How long do you see that it will take you to fit into NZ society?				
1 year	2 years	3 years	More	Other
7	12	6	6	0
Q6. Do you think that the current NZ immigration laws encourage international students to consider immigration?				
Yes	No	Don't know	Others	
17	4	10	0	

Table 1: Results of Part A: Fitting in and the New Zealand Immigration Laws

However, 90% said that completing their study and then applying for residency was the most important thing to do to fit into New Zealand society. About 69% of the participants said that the process of fitting into New Zealand society is hard or too hard and a similar number of participants believed that it would take them from 1 to 2 years to achieve this; 19% believed it could take as much as 3 years or more. Only 53% of them said that the New Zealand immigration laws encourage international students to consider immigration and another 31% of them said that they did not know.

About 72% of participants responded that they had never experienced any discrimination in NZ. But 25% of the participants said they had experienced some form of discrimination (see Table 2). In the questions

Q7As an international student in NZ, have you ever experienced any discrimination?				
Yes	No	Other		
8	23	0		
Q7.1. If yes, do you mind saying what the discrimination was				
6 answers				
Q7.2. If yes, how many times have you been discriminated against?				
1 time	2 times	3 times	More	
2	2	2	2	
Q7.3. If yes, do you think you were discriminated against because of your..				
Race	Creed	Colour	Language	Other
4	0	3	3	2
Q7.4. If yes, how did you resolve the discrimination?				
1 Ignored it	Asked for help	Others		
8	0	1		
Q7.5. If yes, did you need to go to hospital?				
Yes	No	Other		
1	7	0		
Q7.6. If yes, did you report it to the police?				
Yes	No	Other		
1	5	1		
Q7.7. If yes and you reported it to the police, what was their reaction?				
None	Not interested	Helpful	Other	
2	0	1	0	
Q8. How easy do you think it will be to get a job in ICT here in NZ?				
Easy	Too Easy	Hard	Too Hard	Other
1	0	19	9	1

Table 2: Results of Part B: As a student now- Discrimination and getting work in New Zealand

relating to the details of the discrimination, 50% of those who said they had experienced some form of discrimination, admitted it had been two or more times. They said it was mostly relating to race (50%), colour (38%) or language issues (38%). Being given the opportunity to choose more than one form of discrimination, gives rise to the overlap of percentage responses.

Almost all of those who responded that they had experienced some form of discrimination admitted that they ignored the discrimination rather than trying to resolve it. Most of the participants did not need to go to hospital because of the discrimination but one participant did answer that he/she reported the discrimination to the police. Responses to the question as to whether the Police were helpful have to be taken as null and void due to the inaccurate answers. Finally, in this section, most participants (about 88%) believe that it will be hard or too hard to get employment the IT sector in New Zealand upon graduation.

Q9. What is your main reason to come to study in NZ?				
Investment for future career	Better value for money than other countries	For living permanently in NZ	Other	
18	7	3	2	
Q10. What would be your main reason to stay in NZ after graduation?				
NZ nature	NZ culture	NZ economy	NZ immigration laws	Other
17	8	2	6	1

Table 3: Results for Part C: Motivation of Students to come abroad to study/live

About 78%of participants (see Table 3) answered that they came to New Zealand to study for either an investment in their future career or because of better value for money than other countries, but not for living permanently in NZ. Now that they are here, 50% of participants responded that the reason to stay after graduation would be New Zealand's natural environment and only 25% said they would stay because of the New Zealand culture.

About 6% of participants answered that they would only stay in New Zealand for a few years after having processed their immigration (see Table 4). Only 9% said they would stay in New Zealand forever. When asked what they planned to do back home, if they went there, 47% were not sure what they would do. 16% said they only wanted residency and another 10% said they wanted to go back home to their family.

Q11. How long do you think you will live in NZ?				
Forever	Few years	Few Months		Other
3	21	2		4
Q11.1. If you didn't choose 'Forever', why do you plan to go back home or go to other countries?				
For Business	For living with other family	Did not plan it from the starting point – just wanted residency	Not sure	Other
2	5	5	15	1

Table 4: Results for Part D: After Successful Immigration

Analysis of Results

As previously mentioned, the New Zealand Government recognises the lack of highly skilled labours, especially in the IT sector. Therefore they launched the skilled migrant scheme for immigration and they extended the term of the job search visa from six months to one year. According to the result of part A, most participants have answered that they are fitting into the NZ society as a student or as a potential immigrant. They answered that the process was hard but they would be qualified to apply for residency in the near future. They mostly acknowledge that the immigration laws encourage international students to consider permanent immigration.

This shows that the New Zealand Government's policy for international students has been implemented mostly in a positive way but still it is recognised that the students are finding it hard to fit in. Also, it appears the government needs to constantly keep informing potential new immigrants of their policies to attract more potential qualified immigrants as many participants answered that they did not know these policies.

The literature review identified that discrimination occurred to international students all over the world. According to the results of part B of the local survey, most participants responded that they had never experienced any discrimination in New Zealand. However, some did experience a degree of discrimination. Their experiences are varied but the common points were that they ignored it rather than trying hard to resolve it. The types of discrimination were mostly on the grounds of race, then colour, and then language. This highlights that the protection of international students is not properly working. Certainly there are government systems and policies in place to protect international students and one of the policies has been introduced in the literature review, namely the code of Practice for the Pastoral Care of International Students. So once again, the Government needs to inform the international students more effectively and, perhaps ensure that ITPs are more stringently following these guidelines.

Despite the fact that the New Zealand Government is aware of the lack of skilled IT professionals, and is heavily promoting internationally in that sector, the survey shows that students do still believe that it will be hard or too hard to get a job here New Zealand in IT. Again this is an indicator of the gap between what the Government see the situation to be and what international students experience or believe it to be.

There are a variety of different motivations for students to go abroad from their homeland to study or live. According to the survey results, most participants came to New Zealand to study because of the better value of the currency than other countries or for investment in their future career. As mentioned in the literature review, the quality of education would be one of the major reasons for international students to choose a country to go to. Results in this part of the survey differ from that found in the literature review and are not as expected.

Another concern of this survey was whether people would stay for some time or forever after successful immigration. Most participants responded that they would stay in New Zealand, after immigration, for only a few years. And most of them answered that they were not sure at that stage whether to stay for a longer or a short term. This possibly highlights the need for the New Zealand Government to encourage them, to provide incentives for them to stay on longer and provide their newly-acquired qualified skills to the job market.

Conclusion

There is no doubt that immigration is an important issue to New Zealand to improve the local economy and the government has tried to encourage international students especially those who are majoring in IT. But according to the results of the survey, there is a gap between what the Government has assumed and what actually happens to the international students. This, in turn, could result in a decreasing level of skilled labour in New Zealand unless the Government resolves these issues effectively.

Finally, it is important that the significance of these findings are enhanced by further study and research, perhaps extending the research into the qualitative detail of personal case studies and a broader spectrum of quantitative results.

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Learning from JamSessions

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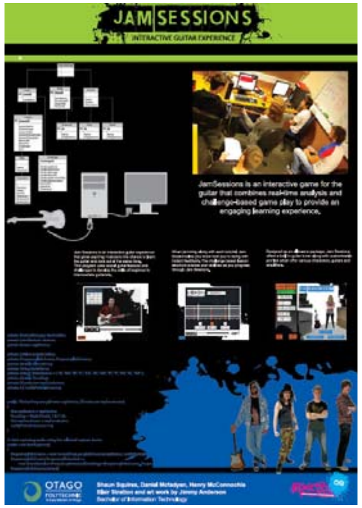

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Abstract

This paper describes the development of JamSessions: an interactive game for the real guitar that combines real-time analysis and challenge-based game play to provide an engaging learning experience. JamSessions was developed as a capstone project within an information technology degree. This paper explores the factors that made the project successful, with a view to enhancing future projects. These success factors include a strong group with a shared vision, a test-driven development approach, collaboration with design students, high skill and problem solving levels, and a project that maintained the students' passions.

Keywords:

Capstone, technical complexity, agile, project

Introduction

The capstone project is a feature of many computing degrees (Fincher 2001, Clear *et al.* 2001). Mann and Smith (2005,;2006; 2007; 2009) have worked to better understand the process of undertaking a capstone project in computing. Following this pathway, this paper explores the features of a highly successful group project, with a view to further enhance the capstone experience.

At Otago Polytechnic the projects are taught with an emphasis on a "real project for a real client". Students undertake the project in groups, following an Agile Development Framework (Mann & Smith 2006). The group project is assessed by an independent industry panel, largely on the basis of successful deployment. In 2009, two projects received 98% and 100% from the industry assessment panel. JamSessions is one of those projects (the other is described in Farquharson *et al* 2010).

The success of JamSessions can be seen in different ways - in this paper the focus is on the technical complexity and the student experience.

Paper methodology

The primary source for this paper is the evidence portfolio compiled by the student group. This portfolio contains evidence of the process of development along with critical reviews from each of the team. (http://bitweb.ict.op.ac.nz/wiki/_Final_Assessment). An overview of the components of JamSessions is shown in Figure 1.

The opportunity that led to the project will be described first, along with the two iterations. The final iteration: "Robust Delivery" is described according to the major areas of development:

- Gameplay
- Sound capture and analysis
- Learning structures
- Database

For areas of development of JamSessions, we present an overview of design decisions, the technical complexity, quality assurance and deployment (a more complete description is available in the online portfolio). The critical reviews from the individual students and the combined group also provide insights into the workings of the group.

By way of synthesis, the paper finally discuss some of the attributes of this group with a view to learning for future groups.

First iteration

This project came from one of the team's first year business proposal (Shaun Squires). In this he described the concept of 'guitar hero, but for the real guitar'. This idea was further explored when two of the team implemented a multimedia application to teach guitar in their second year of the BIT. The natural progression from this non-interactive system led to the foundation of the project. The group had a good vision of the problem to be solved - to take this static multimedia application to the next level and add some interactive elements to it. The success of the JamSessions would come from interaction that kept the user involved and enthusiastic.

The goal was to fill an identified gap in the market for an interactive teaching tool for guitar. The current hype of the Sony Play station game: "Guitar Hero", portrayed exactly the kind of interaction envisioned. The point of difference was to utilize an actual guitar, instead of a simple button controller in the shape of a guitar which provided no elements of learning anything about guitars.

All members of the group were musically inclined and were enthusiastic about the possibility of designing a system that both entertains and teaches the skills and techniques required to play guitar.

Initial research examined whether this idea of an interactive guitar lesson program was already established. While there was no similar product on the market, several companies had expressed their interest in the idea. However they provided only previews and no release dates.

A stake holder analysis identified key people who would directly influence some project decisions. This project was slightly different from other projects because the group acted as its own client with the project set up from the outset as a business venture. This gave the students more control over the implementation and functional requirements of the system. The outcome was a functioning deliverable that was built with the purpose of being presented to an industry panel as a pitch for obtaining investment for further development funding.

Second iteration: functional delivery

The second iteration release was a combination of the vigorous testing and proof of concept. The release included a very detailed paper based prototype that involved every section of the system (Figure 2).

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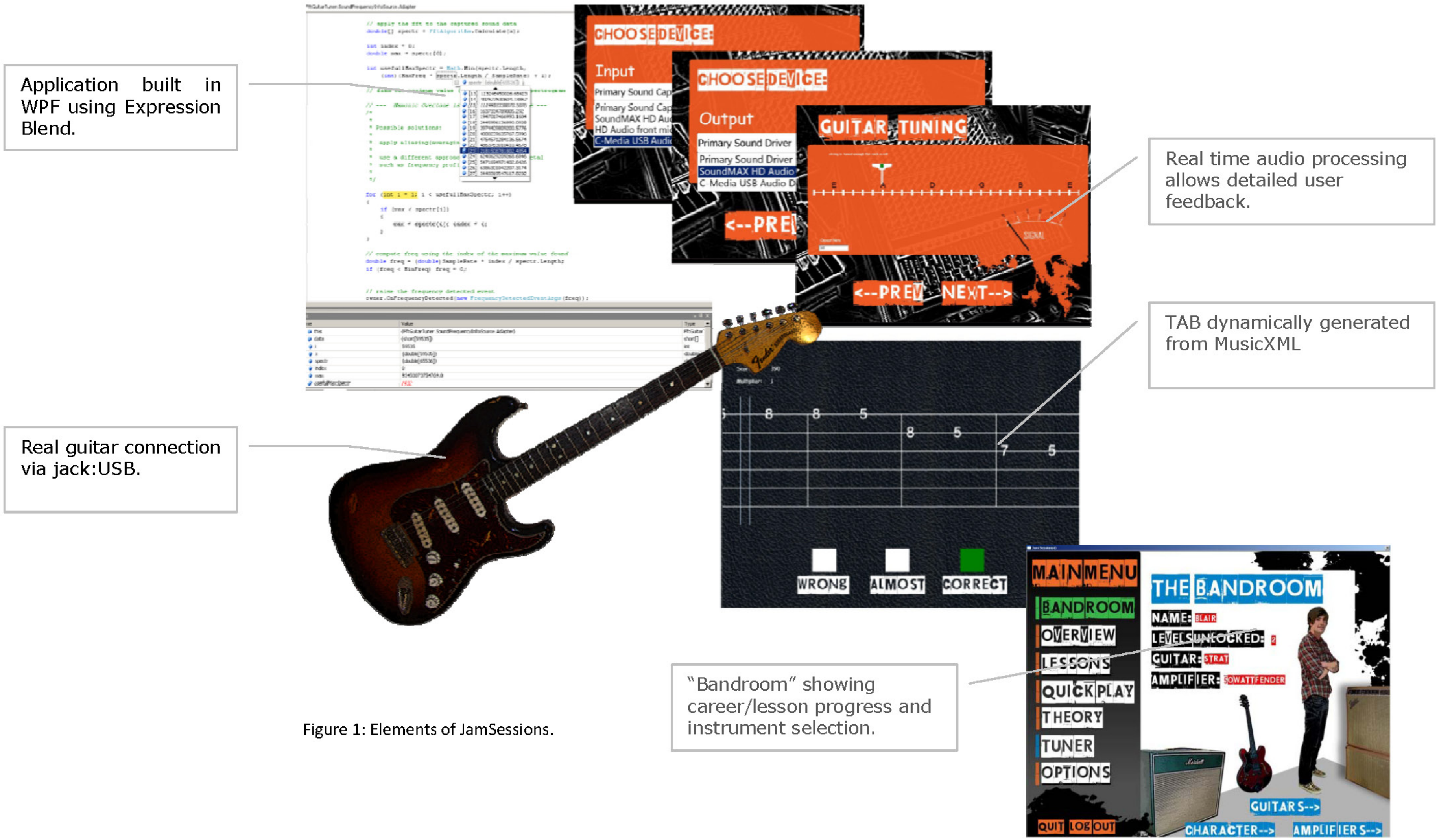

Figure 1: Elements of JamSessions.

The deliverable also included prototypes of the sound capture and frequency detection. It was vital that the group could demonstrate understanding and knowledge of how to implement these crucial requirements. Sound capture and frequency detection would be the pivotal part of the project to differentiate it from other methods of guitar teaching tools. Successful prototypes for both these requirements were created.

System 1: Game play

One of the main goals of the project was to create a challenge based game play environment that included real time feedback for the user utilizing the sound analysis functionality. This is the essential difference between this software and any other currently available teaching tool as it provides real time feedback to the user (note: educational aspects of gameplay considered in Lesson Structure).

Figure 2: Paper based prototype.

The functional requirements of the game-play section of the project can be broken up into several main sections:

- The ability of the user to play along with a song in a lesson and challenge based environment
- To generate tablature (TAB) dynamically to allow for a generic structure for each lesson and expandability purposes.
- To provide real time feedback and a scoring system

Technical aspects of gameplay

MUSICXML

A key functional requirement of the entire system and in particular the game-play element was to utilize a uniform data structure that allowed for the straightforward addition of new songs and expandability for future development. The use of MusicXML supported dynamic generation of the TAB and held song and note data which was compared with user input during a song/lesson.

INTERNAL DATA STRUCTURE

A robust data structure was created and implemented providing a generic base for storing note information that is used in both TAB generation and note comparisons in the real time feedback that is expandable to any piece of music loaded. On top of this it includes the functionality for utilizing all the features outlined on the functional requirements needed for our proposed system including dynamic tab generation, audio playback, sound capture and analysis, real time note comparison with feedback and a scoring system.

TABULATURE

The requirement for having TAB displayed scrolling across the screen when the user is playing was best satisfied by ’dynamically’ creating the image for each song/lesson. This is to achieve the most expandable structure. Not having this dynamic and expandable system would lead to huge overhead creating and loading in new songs which is unacceptable as are developing this with further development and additions to content in mind.

When a user chooses to play a song the information from the MusicXML is filtered out to and stored in our own data structure. From here before the lesson starts the song data is traversed in a way where every note and chord is drawn to a ’canvas’ and held in memory. When the lesson/game starts the image is drawn and scrolled across the screen synced up with the audio.

The complexity of dynamically drawing TAB was huge; there are many factors in drawing TAB that must be accounted for. Not only must it be done dynamically but in a way from a structure that allows any piece of music to be imported and produce its corresponding TAB.

SCORING

After struggling with deciding on a formula to determine the hits and misses ratio, the group decided to test with a hit value of 1 as: (the capture frequency rate happens at 16 times a bar with the tempo set to 120bpm. So this means a 16th note only has 1 capture during its note). So needing to achieve the hit value 1 means you have to get it right on the first attempt as you will only get 1 attempt.

Gameplay success

The requirements outlined for this functional set for the 'game play' have all successfully implemented. The dynamic generation has allowed for expandability options along with generic coding structures that need only the source file for the notes and audio to play the music, draw and scroll the music in time with the audio while providing real time feedback to the user.

The structure has met requirements for implementing the functionality into the Jam Sessions final version: to produce the tablature dynamically, play the backing track, holds the current song notes data for real time feedback comparisons with user input. Finally the ability to use the sound analysis functionality to determine the user input (what they played on the guitar) coupled with the real time feedback and scoring system provides the basis for our 'challenge based game-play'.

System 2: Sound capture and analysis

The sound capture facility of Jam Sessions is a vital point of difference between this project and other computerised tools for musical education. It allows us to combine the interactive game play of successful products such as Guitar Hero and the real guitar experience of traditional music training.

The goal of providing real time feedback are captured in the following functional requirements:

- Analyse the notes played by the user in real time. This will enable the system to analyze the timing and pitch of the user's input
- Provide real time feedback to the user. The system will provide adequate feedback, based on the user's accuracy

The sound capture and analysis is the framework that allows us to combine the interactive game play with the real guitar experience of traditional music training. The sound capture facility uses a Direct Sound to take the input from the guitar, detects the fundamental frequency using spectrum analysis and provides feedback in real time. This feedback forms the basis of the game play and the guitar tuner.

Technical aspects of sound capture

Primary Implementation issues:

- Connection hardware
- Direct Sound
- Fast Fourier Transform (spectral analysis)
- Multi-threading
- Event architecture
- Fundamental detection
- Harmonics and chord identification

- Playback of sound data

Algorithms for sound capture and analysis were researched throughout each of the iterations of the development process. In the final implementation, the frequency analysis was performed using a standard Fast Fourier Transform. The fundamental frequency, as identified by the FFT is compared to the user's input and feedback as to accuracy is generated in real time.

System 3: Learning structures and content

One of the first functional requirements the group settled upon was that at the core of the project was to educate the user to learn the guitar. The JamSessions system contains a structured lesson plan that aims to meet the needs of all types of guitarists - whether a beginner, or a well accomplished guitarist. Given its core status, throughout the three iterations, this functional requirement has remained as the number one functional requirement to accomplish.

Lessons technical complexity

The group worked with a music teacher, John Dodd and decided that best approach was to align with the Year 9 curriculum. Mr. Dodd demonstrated each of the key elements that had successfully helped his students learn the guitar. This collaboration resulted in a progressive learning structure (http://bitweb.ict.op.ac.nz/wiki/Lesson_Structure).

The lessons were written up into sections, identified for gameplay as levels. The levels were divided up into sections that contained similar elements. This took into account that people using our system might have never even picked up a guitar. In other situations, there will be users that may have played guitar for several years. This was crucial to our structure of learning. Starting from the very basics, lessons were developed to include more complex techniques throughout the system.

The lessons also utilised multiple means of teaching technical skills. A written form of lessons provided the foundation for the film and interactive categories. Finally the lessons would be incorporated into the interactive feature of our system. Some lessons were basic introduction elements about learning the guitar and not actually learning to play the guitar – for these modules a quiz section was developed.

The lesson content was slightly altered to incorporate the content into film scripts. The group had never developed any kind of filming production or scripting so this was certainly a challenge. Scripts were tested by repeated reading and low-fi videoing many times before the actual filming, as we only had limited time to work in the production studio (Figure 3). The group collaborated with an actor and a design student to help us produce and direct the filming of the lessons. The editing process took a lot longer than expected but the finished tutorials were easily incorporated into JamSessions.

System 4: Database

The database is a key part of Jam Sessions as it holds everything from the players name to path names for media content to the unlocking of levels.

A data structure was created and implemented that provides a generic base for storing note information that is used in both TAB generation and note comparisons in the real time feedback that is expandable to any piece of music we need to load during the lifetime of the application. On top of this it includes the functionality for utilizing all the features outlined on the functional requirements needed for the system including dynamic tab generation, audio playback, sound capture and analysis, real time note comparison with feedback and a scoring system.

The interface design was tested at each stage of development (Figure 4) with the goal of making the navigation flow was flawless. Testing was also carried out on data binding. This required testing that the users profile and contents could be saved and accessible throughout the whole system.

Figure 3: Project team in the studio; and the final lesson view.

Figure 4: Testing of nearly completed system.

Learning from the JamSessions.

In this section we allow the 'student voice' to tell the story of their experiences of the project. This is interspersed with insights for future capstone projects.

The group followed the Agile Development Framework taught in the prerequisite Software Engineering course. In this course students are introduced to the agile concepts of an iterative approach, deep commitment to communication with stakeholders and embracing change. This is clearly evidenced in the student reviews:

> *Software Engineering reinforced the critical processes and methods to follow and understand in the production of our system. …. We were able to embrace change at critical points in the system, without letting the focus of quality and time hinder our progress.*

They were able to stay focused on the end goal:

> *Our main objective and primary functional requirement was to educate the user of system. We strived to understand and incorporate the goals of the user into our project.*

While still embracing the many changes inevitable in a project development:

There were many times in the projects lifecycle that the concept of embracing change occurred.

Our major functional requirements never changed throughout the lifecycle of our system. We were always intending on deploying the system with the main requirements implemented. We had extra functional requirements and ideas that didn't get executed because of the time frame. However this did not deter the user experience of our system.

They utilized a defined agile framework (Mann & Smith 2006) as the basis for the development but were able to incorporate alternative methodologies when necessary:

The first two iterations were followed very closely to the agile framework. We held scrum meetings and group discussions and collaboration several times a week. The third iteration however took more of an extreme programming (XP) approach. We still adhered to the agile approach, but we intended to improve the software quality by rigorous testing and frequent release versions. This method of short development iterations lead to the improvement of productivity and allowed us to implement new ideas and changes to the system.

While the group had no external client, the agile practice of engagement with stakeholders was followed closely:

Our group had no client. We established our project as a business venture that could possibly be marketed and implemented for commercial release. To substitute the client figure, we sourced several major stakeholders to have an active role in the overseeing and decision making of our project. We valued the relationship with the stakeholders and always kept them informed on our major developments. We held regular meetings and informal discussions to further the quality of our project.

This situation led to considerable reflection within the group on the role of the client and the nature of client/stakeholder communications:

Considering the unique nature of the product of creating something where we ourselves are the client had an interesting effect on the project. Client- employee communication was not documented as we would just discuss topics as they arose. Also it lead to us looking to outside sources to act as stakeholders with high input into the project in terms of defining the functional requirements and advising us on the learning structure we implemented for example.

Prototyping was a key element of the methodology:

The first two iterations of our project were primarily focused on prototyping. We knew the complexity of the problem we were trying to solve was a highly complicated challenge.

Resulting in a focus on quality assurance:

The immense amount of time we spent on prototyping and testing before actually implementing the software was our indication that we would meet the essential functional requirements.

We tested each functional requirement for robustness and stability. All of the testing was performed in the prototyping stages which allowed for change and had good impact on the implementation in the third iteration. The testing was accomplished with having multiple users navigate through the prototype. We observed every test thoroughly and appropriately changed the necessary parts of our system accordingly.

Previous Otago Polytechnic BIT capstone projects have benefitted from working closely with design students (eg Goodsir *et al.* 2005, Nicholl *et al*. 2007). Sometimes, however, there have been tensions between the IT and communication design students, with neither side really sure of the others' skills. The partnership for JamSessions was very successful, with both sides clearly understanding the requirements of their colleagues:

This proved to be a massive success as we had already worked out our overall interface navigation and only required the actually screen designs allowing the designer to focus solely on the artwork.

The Agile Development Framework places high importance on communication within the development team rather than a document-centric approach (Noble et al. 2004, Mann and Smith 2006). The "barely sufficient documentation" to support that communication can be seen in the group's use of the wiki both as a collaboration tool and a self generating evidence trail, and the heavy use of the whiteboard as an extended planning game and central hub:

During the lifetime of our project the development process followed the same generic theme. On a regular basis (usually one to two times a week) we discussed the current project status identifying and allocating tasks for the coming days.

The allocation and discussion of potential solutions for each topic was done so in a informal scrum like manner in the way we did not always record the discussion for record purposes but rather keeping notes and goals written on whiteboards to give the group an overview of what is going on. This also allowed us to cross off completed tasks to show visual conformation of the work done.

Many authors of agile persuasion promote the use of sandbox development (Richardson & Gwaltney 2006) or always having a shippable version (Tate 2005). In discussing revolutionary versus evolutionary processes, Mann and Smith (2006) identified that student groups can struggle with these concepts. The JamSessions group got it right though and provide an exemplar for test-based sandboxed development:

Whenever we had made significant improvements in development we would thoroughly test the product with lecturers and other students, we would then make a new version of the Jam Sessions and develop form that, meaning we always had a working copy of the database that we could always go back to.

… we made an effort to attack each task in a separate 'mini' projects allowing continuous development towards the overall target without having to fight for time on the master version. This way we could test and develop each section and then have 'combine sessions' where we would update the latest/master version.

A capstone project is more than a big project at the end of the degree. It is supposed to pull together the learnings from across the degree, providing a platform for integration and application:

Another point of interest was the overall structure and implementation of the 'Game play' within our project where I was able to utilise techniques learnt throughout the year from 'Object Orientated Programming' and 'Advanced Algorithms and Data structures' classes. This structure caters for the entire game play system from generating the TAB, playing the Audio, utilising the Frequency analysis, scoring, feedback and syncing the lot together.

Overall it was a pleasure to see how our initial sketches of the system and ideas became reality. It was tremendous to be able to apply the skills we have learnt over the past three years of the B.I.T and create an amazing project.

Having completed the capstone, the group expressed value in areas outside traditional technical areas- here they describe educational content:

By adhering to the knowledge of musicians we consulted for our lesson structure, we managed to implement the lesson structure to a very high standard. With the knowledge we have gained over our time at polytechnic, we were able to create a structured method of applying the lessons into a multimedia platform. The code created to generate the features of our lessons was implemented elegantly.

It is interesting that the students saw the areas of educational structure, editing films and collaborating with a designer as "outside the IT curriculum". It is difficult to predict the areas their careers will take them but those areas are not unlikely. Perhaps as academics we need to do a better job of giving the message that the skills they have learnt are not just about specific technology but more generic and that few areas are outside the reach of IT.

Another feature of JamSessions, is that was a group project – like most of Otago Polytechnic BIT capstones. Critical to the success of group work is an aligned vision. This clear project vision must be both of the project itself and the context in which it is carried out (Augustine 2005). JamSessions demonstrated this coherence, both of the task and the process:

The cohesion of our group and our ability to take and give advice, work together in peer programming environments and work together to attain a product that is better than any *one of us could make on our own is something I am proud to a part of.*

…

The chance to work in a group with likeminded and talented students was a great pleasure. Everybody in the group was very reliable and we created a great atmosphere for learning and developing our system. Everyone was willing to help each other out, as we each brought different skill sets into the project.

This vision set high standards:

I think the need and willingness to embrace change relates to the fact we all realised the potential of our project not only for potential business opportunities but a certain 'cool factor' that many other projects can lack. Having realised this potential in every aspect of the project we did not want to do anything by half standards and were aiming for high marks right from the start.

Conclusions

JamSessions was a technically challenging capstone project. It required: the use of C#.NET audio processing engine using a Fast Fourier Transform algorithm for frequency detection; a WPF front end, user controls designed in Expression Blend; dynamically generated guitar tabulature from underlying musicXML files; high quality digital video for lessons and demonstrations; and an underlying SQL Server database stores user information and student progress.

Despite - and perhaps because of – these challenges, the student group performed extremely well.

Insights for future project groups include:

- The importance of always having a working deliverable
- Heavy use of peer programming.
- Working with designer
- Multilayered communication supported by as light as possible tools.
- Cohesive group, aiming high
- Integrating all degree
- The "real project for real client" can be simulated with a passionate group and a stakeholder structure to provide objective guidance
- Empowerment of project
- Excitement of computing

The Agile Development Framework is working for such high performing groups. Especially useful are the expectations of early deliveries and a focus on transparent communication. It is interesting that students thought they changed from ADF in last iteration – instead adopting Extreme Programming for the robust built (despite this being promoted in Software Engineering).

Perhaps the conclusion is best encapsulated in these final quotes from the student group:

It was one thing to dream up the ideas but to see them all implemented and working is just awesome.'

The most pleasing aspect of the project was that it always remained interesting. The chance to create an interactive guitar teaching tool was something that I never thought I would be doing when signing up for an IT degree.

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A Review of Computer Science Resources to Support NCEA

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Abstract
The Ministry of Education in New Zealand is in the process of making a major revision to the technology curriculum for NCEA. These changes include the addition of a body of knowledge with distinct knowledge and skills for five strands of Digital Technologies, one of which is ”Programming and Computer Science”. Because this contains material that will be new to schools, the changes present several implementation challenges, especially professional development for teachers in the subject area, the development of teaching materials, and also advice for students to choose the most appropriate career path. This paper will give a comprehensive review of the quantity and quality of existing resources that are available for teachers to use as course content and for their own professional development, identify strengths and weaknesses in the resources, and gaps that need to be filled. The gaps represent opportunities for tertiary organisations and industry to support schools as they make the transition to the new structure.

Keywords
Computer Science, Programming, Information Technology Education, Curriculum, Pedagogies, Teaching, Learning, Kinaesthetic Activities

Background

A secondary school Computer Science curriculum can have a significant influence on student career paths, both for laying the groundwork for further study, but more importantly, for exposing students to the essence of the discipline itself.

In recent years few New Zealand schools have taught Computer Science as a discipline – at best there have been modules on programming at some schools, and more often computing education has been focused on general-purpose applications and skills. To compound this problem, courses that teach "computing as a tool" have given students the impression that Computer Science might be an extension of these topics because of the lack of corresponding courses between secondary and tertiary education. The new technology curriculum (released in 2007) provided a generic framework for teaching technology, but computing teachers found it very difficult to map their subject onto the generic topics, and many schools resisted the integration with the technology curriculum, which resulted in a reliance on unit standards. Consequently courses offered fell outside the official NZ Curriculum, and developed a second-rate reputation (Bell, Andreae, & Lambert, 2010).

In 2008, two reports were released that highlighted the poor state of computing in schools (Carrell, Gough-Jones, & Fahy, 2008), (Grimsey & Phillipps, 2008). As a result the Ministry of Education called together a "Digital Technologies Experts Panel" (DTEP) representing industry, tertiary and high schools. By mid 2009 it had produced a body of knowledge, and recommendations that resulted in Digital Technologies becoming a distinct area within the Technology Curriculum. Alongside this development cognisance was taken of teachers' professional development needs as they grapple with more change. Amongst other initiatives, in September 2009 university Computer Science departments began developing a guide to resources to support implementation in time for 2011.

This paper will give a comprehensive review of the quantity and quality of existing resources that were identified in the process of collecting teaching resources, identify strengths and weaknesses, and highlight gaps so that that these can be filled.

Implementing CS in Secondary Schools

The Digital Technologies Expert Panel recommended that digital technologies be delivered as five "strands": Electronics, Programming & Computer Science, Digital Information, Digital Media, and Digital Infrastructure. Achievement standards are being written for these strands to assess specific knowledge and skills not address by the generic technology achievement standards; at the time of writing, the level 1 (for year 11 students) standards have been drafted, and levels 2 and 3 are in progress. As well as the implementation of these new achievement standards, teaching and learning guidelines are being created specifically for Digital Technologies to give clear guidance on how the standards could be taught, based on the body of knowledge associated with these strands. While these will provide specific guidance on issues like which features of a programming language might be taught, it doesn't provide the actual resources for teaching the topic. This is where a guide to resources, the focus of this paper, plays an important role. While teachers are free to use whatever teaching methods are appropriate for their environment, most will appreciate strong guidance and ready-to-use resources, particularly given the large amount of new material that they will need to learn themselves, and then prepare to teach.

This paper focuses on a strand which introduces significant changes: Programming and Computer Science. This strand looks at computing as a discipline rather than computing as a tool, and will introduce a range of Computer Science topics that go well beyond computer programming, and their success will depend on having competent and confident teachers to deliver the courses. Relatively few teachers have a background in Computer Science, with many originally having taught typing, commerce or maths. For the changes to NCEA to be successful, NZ teachers need to be provided with a rich source of resources to teach the new topics, and they will require extensive professional development (PD) to be able to make use of them. Given the very short timeframe (less than one year to prepare for the new Year 11 courses), it will be particularly valuable if existing resources for teaching can be identified and rated so that it is easy for teachers to select the ones that will enable to them to implement courses with the minimum of effort. Fortunately, as will become evident from the survey later in this paper, there is indeed a wealth of suitable resources.

Methodology

Towards the end of 2009 relevant online and offline resources were searched to support the new topics in the Digital Technologies body of knowledge. The methodology used was to exhaustively scan a wide range of computing teaching resources, and document any that appeared suitable to support the new topics. This included:

- Direct contact with individuals involved in similar initiatives in the UK, US and Australia
- Going through repositories such as the CSTA Repository (Computer Science Teachers Association, 2006) and CITIDEL (Computing and Information Technology Interactive Digital Educational Library) (Villanova University, Virginia Tech University, 2007)
- Going through collections of Computer Science material written for schools from organisations such as CS Unplugged, MaTHmaniaCS, CS for fun, PLTL, KLA QwikWiki, TeachICT and CS Inside.
- Monitoring extensive discussions on teacher support mailing lists, where teachers recommend resources to each other.
- Performing searches on YouTube using terms like "Computer Science", "Programming" and "Education", and looking for videos that are related to good ones that have already been identified.
- Looking at textbooks in Programming and Computer Science written for beginners' use.
- Examining online encyclopaedias and dictionaries, especially Wikipedia, and following external links from these.
- Looking for resources already developed for teaching towards pre-university entrance examinations overseas such as AP (Advanced Placement) in the USA and AQA (Assessment and Qualifications Alliance) in the UK.
- Exploring resources published to encourage female students to learn CS.
- Looking through CS departmental websites of universities for teaching materials and graduate student projects that were shared online.
- Performing internet searches for pages that would be relevant.

This resulted in a vast collection of videos, visualisations, lesson plans, textbooks, podcasts, wikis, programming tutorials and various other kinds of teaching resources (Murugesh, 2010), a draft version of which is available online[1]. Almost all of the resources are either available free of charge, or at a relatively low cost. These resources were then compared with standard curricula, including the Association of Computing Machinery (ACM) K-12 Model curriculum (ACM, 2003) and the new Digital Technologies Achievement Standards and Body of Knowledge (MOE, DTEP, 2009). Setting aside material aimed at tertiary students, we identified around 30 major sources for high quality resources that can be readily used by secondary school teachers.

Results

In this section we will highlight some of the material found in the survey, with the aim of giving examples of the kinds of resources that are ready for NCEA use, those that will need to be simplified, and finally, areas that do not have any resources. The weakly resourced areas will need to be addressed, and contributions to complete the shared pool of resources could be made by tertiary institutions, experienced teachers, or writers contracted specifically for this purpose. We begin by examining some of the resources that are at a suitable level and cover a broad range of topics.

General Resources

Teachers are able find concise explanations of Computer Science terminology using online dictionaries and encyclopaedias. Wikipedia (wikipedia.org) is a major source, and despite its lack of a formal quality assurance process, for computing terms it can provide a good starting point for definitions, and external links to useful material. Other useful dictionaries identified were FOLDOC (foldoc.org), Dictionary of Algorithms and Data Structures (nist.gov/dads/), Computer Science Research Library (www.cs.mu.oz.au/~csyeo/csrl/), and TECHtionary (techtionary.com). Another general resource is textbooks in Computer Science that cover a broad range of topics. Of particular relevance are those that have been developed in the UK for training towards qualifications such as the AQA.

The basic concepts that appear in the NZ body of knowledge are often taught at first year undergraduate level at universities, so using the first few lectures from such courses can be relevant for school use. A wide array of lecture notes, video lectures and podcasts are available from various universities. However in certain cases, some modification and tailoring will be required to make these appropriate for school use.

Another general set of resources that is freely available are those that provide kinaesthetic activities aimed at school-aged children. The CS Unplugged (csunplugged.org) and CS for Fun (cs4fn.org) websites provide extensive free material aimed at teaching CS concepts to school students; related resources are also at MATHmaniaCS (mathmaniacs.org) and The Computing Science Inside project (csi.dcs.gla.ac.uk). Offline activities such as these are sufficient to cover the requirements of the standard, although they can also be integrated with programming exercises if desired. For instance, the Greenroom (Kölling, 2010) and Scratch Unplugged (Ben-Ari, 2010) have programming activities that are based on CS Unplugged kinaesthetic activities. In addition, teaching

[1] http://www.cosc.canterbury.ac.nz/tim.bell/dt/

programming concepts using robotics in schools is becoming more and more popular. Entire curriculums are being developed to get girls involved in robotics (IRCS, 2001). However, robotics kits can be expensive for schools to purchase.

In order to properly map the specific resources to NCEA level, each of the three main learning objectives within the Programming and Computer Science strand will be discussed separately. At level 1 (usually year 11) students would be working with a relatively introductory version of these topics, but by level 3 (year 13) they would be looking at broader and deeper coverage.

Learning Objective 1: "Demonstrate an understanding of concepts across Computer Science and Software Engineering"
At level 1 this is covered by a simple understanding of the concept of an algorithm, the role of programming languages (including compilation and translation), and a simple introduction to interface evaluation[2].

Visualisation of algorithms is a popular medium for teaching the concept of algorithms. The better visualisations let users change parameters like problem size, magnification, and the initial condition of data sets (Martin, 2007). A problem with many visualisations is that they are too confusing for students.

Another way to teach algorithm is using role-play activities, or data structures built out of students. The kinaesthetic activities mentioned earlier demonstrate many algorithms effectively. For example, csunplugged.org has a "battleships" searching activity that contrasts linear search, binary search and hashing, and with follow-up activities it is easy for students to appreciate the massive difference in performance between algorithms. An activity from the KLA collection that represents pointers by having students place their hands on another student's shoulder provides a powerful "inside" view of how data structures work.

The concept of programming languages can be demonstrated by getting experience with compilers and interpreters, to appreciate what their roles are. Many free systems are available to support language compilation and interpretation, although students will probably need to be supplied with complete sample programs since these may be in languages that they haven't yet learned to program in.

Simple interface evaluation is covered in one of the CS Unplugged activities (based on non-computing devices such as doors and stoves), although a new exercise involving gadgets such as microwave ovens and mobile phones might be more relevant for helping students to become critical of real interfaces. Constructing such an exercise wouldn't be difficult, but this is one important gap identified by our evaluation.

At level 2 the body of knowledge concepts include complexity, tractability and computability; compression, error detection and correction, and encryption; the idea of formal grammars; and the software development lifecycle. Several resources are available that cover intractable problems, especially in graph theory, such as map colouring exercises, online

[2] Interface evaluation is actually published with the second objective, but in the Achievement Standards it has been grouped with the CS Concepts.

games and kinaesthetic activities. An area that is lacking materials is the area of formal grammars, as the resources for this topic tend to be aimed at CS graduates and go into greater depths too quickly. However, there are resources on automata theory aimed at young students, which can be used to convey the idea that programming languages are specified precisely (although technically this is only the lexical part of the language). Also at this level, there is a reasonable coverage of materials in software development methodologies in terms of tutorials, case studies, and exercises for giving a basic understanding of the process and lifecycle.

HCI evaluation at level 2 requires a slightly more formal approach. There is a limited amount of resources, such as articles on heuristic evaluations and theoretical material, so this area will benefit from activities and tasks to illustrate the use of usability heuristics in the evaluation of interfaces that is aimed at high school students and the contexts they live in.

At level 3 the body of knowledge advocates students having a broad view of a range of topics in CS and Software Engineering, with a view to making them aware of the issues that exist in various topics, even though they won't know many of the actual techniques and tools in those topics. Teachers may choose the areas they are comfortable with. We have identified well resourced areas as Computer Security, Databases, Visual Computing, HCI, Intelligent Systems, Networks, Ethics, Information Retrieval, Data Communication and Web Computing. Those areas that have little suitable coverage are Operating Systems, Distributed Computing and Information Management. We have identified the weakest areas as Formal Methods, Discrete Structures and Computer Architecture, meaning that we could only find a few resources suitable for creating an understanding of these concepts for senior high school students.

Learning Objective 2: "Be able to understand, select and design data types, data structures, algorithms, and program structures for a program to meet specified requirements"
In general, this objective is focussed on the design of programs, rather than writing and debugging them. Much of this is best learned from experience, and apart from specific exercises, the best value from on-line resources is to help train the teacher in this area so that they can guide students through it. The objective also includes some material on data structures and data representation.

Level 1 of this objective is focused on the *design* of simple program structures, including the understanding of data types and control structures. There are lectures in generic data structures that are free for educational use, as well as some that are specific to programming languages like Python and Java. Various privately made YouTube videos offer easy to follow tutorials on implementing simple to complex data structures such as lists and arrays, trees and also functions and classes in Python and Java. Introducing programming logic to students can be done in some interesting ways using kinaesthetic activities such as the Programming Languages task from CS Unplugged. There are also games and activities that teach computational and logical thinking such as the ones from CS for Fun, and several Kinaesthetic Learning Activities (KLA's) to teach concepts in functional programming, control flow, data structures and functions, amongst other things. Also, a range of tutorials and applets exists that clearly explains various searching and sorting algorithms and the use of various data structures.

Level 2 includes advanced representations of data (such as arrays, lists or user-defined types), and using programs with methods. There are videos, role play activities, and online tutorials that teach the concepts of arrays, lists, trees and other data structures, although some are linked to a particular programming language. Exercises that use methods and functions are usually available as extensions of lesson plans.

At level 3 the scope of the objective is to understand the properties and limitations of data types, programming using arrays or lists, methods with parameters and return values, and perform file handling. There are many resources on number systems (binary, hexadecimal, floating point numbers etc.), including kinaesthetic activities, textbook chapters, online number convertors, and videos. Programming exercises that use searching and sorting techniques incorporating arrays and other data structures are also available.

Learning Objective 3: "Be able to read, understand, write, and debug software programs using an appropriate programming language, tools, and software development process"
This objective is focussed on learning to write and debug programs. One of the first issues is working out which language should be taught. The standards are not prescriptive about the language, but just the features it must have. Teachers will need guidance on choosing a suitable language. In many cases it may be driven by local expertise or by the expectations of a tertiary institution so that students can transition smoothly to post-secondary study.

At all levels of the programming and software development objective, the Internet is a rich source for resources. Programming languages and IDE's commonly used at a beginner level are Scratch and Alice. They both use a drag-and-drop approach that encourages exploration by students as they learn programming principles, and both have extensive teaching resources available from their websites (scratch.mit.edu and alice.org). Greenfoot is an intermediate programming environment that introduces Java programming in a very graphical environment, avoiding students having to learn the finer points of Java syntax right at the start. Extensive exercises suitable for secondary school students are available from the teacher-only "Greenroom" on the Greenfoot website (Kölling, 2010).

When students graduate from the drag-and-drop environments to more general-purpose programming languages, the current popular choices in New Zealand include Python, Visual Basic, Java, C, C++ and C#. These popular languages are supported with a growing number of free on-line resources and teaching materials that are very helpful at this level.

Video tutorials are a great way for learning and revising topics in programming. These can supplement the teachers' professional development activities. Universities often offer free video lectures on YouTube, which has a growing number of tutorials.

Another great way to teach programming is using PLTL (Peer Led Team Learning), where a group of students work together on an exercise cooperatively in small groups led by a peer leader, who is usually someone who knows the field and has done the exercise before (Huss-Lederman, 2007).

An area that really lacks resources here is the software development *process*. There is considerable material about how to do software engineering, but at the school level it is more appropriate for students to understand the motivation for software engineering rather than learn particular methodologies in detail. For example, students could investigate a software disaster (such as the Heathrow T5 or Denver airport baggage handling systems, or the INCIS system in New Zealand), and investigate what went wrong in the process. There is material on the internet relating to these events, but a more focussed lesson plan or guide would be helpful. Also useful would be tutorials that explain and compare the different development methodologies and exercises in test-driven development aimed at school level.

Conclusion

The survey has shown that there is a rich range of resources available that could be put to good use in New Zealand secondary schools. There were clearly a few areas where resources were limited and further development work would be valuable, and where some resources are too complex for use in the school environment. A narrated list of existing resources, at least for the level 1 objective, is being prepared in mid 2010 for teacher feedback and comments. The feedback will enable us to highlight resources that have proved to be useful, and identify the areas that teachers need more help with. New Zealand tertiary institutions that are involved in supporting school teachers will then be able to develop and publish appropriate resources to eliminate those gaps. Computer Science departments throughout NZ are collaborating to provide support for teachers as they work out how to deliver the new material. In addition, one initiative at the University of Canterbury to help with this is a new course in Computer Science Education where graduate students will do projects to produce resources especially aimed at the weaker areas identified by this survey. These projects will then be evaluated by school teachers, and their usefulness documented and eventually shared in the resource pool.

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Teaching Web Based Accounting Information Systems: Benefits and Pitfalls

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Abstract

The purpose of this paper is to present the experiences of teaching part of a second year accounting information systems (AIS) course using a web-based AIS and another part of the same course using a traditionally installed stand alone system.

In an earlier paper, one of the authors developed a Small Business Web Based AIS Model that depicts the issues surrounding the selection and use of web-based AIS for small and medium enterprises (SMEs) in a New Zealand context. The experience of the lecturers and the students is analysed and used to evaluate the model.

While there were some issues surrounding the use of the web-based AIS product, most of these could be dealt with, and they also served to reinforce a number of the theoretical aspects that are covered in the course. The findings of this paper were consistent with 5 of the 10 aspects of the Small Business Web Based AIS Model without contradicting the other 5 aspects of the model.

Keywords
Accounting Information Systems, SME

Introduction

In an earlier paper, Nesbit (2009) developed a two phase model for the issues surrounding the selection and use of web-based accounting information systems (AIS) for small and medium enterprises (SMEs) in a New Zealand context. The model was named the Small Business Web Based AIS Model.

This paper describes the experiences and perceptions of introducing the use of a web-based accounting information system (Xero) into a second year accounting information systems course from the perspective of the lecturers involved and a sample of students enrolled in the course. The proposed Small Business Web Based AIS model is evaluated in the light of these experiences and perceptions.

Conclusions are drawn as to the success of the introduction of Xero into the course, and recommendations are made as to how some of the issues raised could be addressed in future offerings of the course.

This paper seeks to address the questions of:

- How successful was the introduction of Xero into the course?
- How can the issues that relate to Xero being web-based be addressed in future offerings of the course?
- How do the experiences of introducing Xero in to the course relate to the Small Business Web Based AIS model?

Background

The Accounting and Information Systems Department at the University of Canterbury introduced a new second year Accounting Information Systems course (ACIS243) in 2008. The typical breakdown of students in the course is 80% students majoring in accounting who are needing to meet the academic admission requirements for the New Zealand Institute of Chartered Accountants, with the other 20% majoring in information systems or management.

In the 2008 offering one part of the course included the use of one small business AIS with Mind Your Own Business (MYOB). This has been traditionally installed as a stand-alone personal computer based application.

For the 2009 offering of the course it was decided to include the use of a second small business AIS, and the decision was made to use a web based product (Xero). The main reasons behind the introduction of Xero were that it would demonstrate:

- An implementation of an application service provider (ASP) or Software as a Service (SaaS) model for the implementation of an information system, which are some of the concepts covered in the theoretical aspects of the course.
- An accounting application that is based on business centric activities as opposed to the traditional look and feel to AIS as found in many other products. This business centric aspect is one of the key ideas

in the Resource-Event-Agent (REA) model for the design of databases for AIS as described in McCarthy (1982), with this also being covered in the theoretical aspects of the course.

Although it wasn't considered at the time, the fact that Xero is web-based meant that the information technology services (ITS) department didn't need to install or maintain Xero was advantageous as there was no burden on the ITS staff even though this was new software. From the lecturers point of view it was advantageous as network infrastructure issues did not need to be taken into account

Methodology and Structure

A brief review of the background to the Small Business Web Based AIS model is presented including a summary of the literature that was reviewed along with the model itself.

The approach to how the two AIS products were taught is described, along with the issues that arose for the lecturing staff as a result of one being a traditionally installed stand alone system and the other being a web-based system.

The results of a survey of a sample of the students about their experiences and perceptions are produced and analysed, with the findings being used to evaluated the Small Business Web Based AIS Model.

A limitation of this study when it comes to the testing of the Small Business Web Based AIS Model were that it was testing the perceptions of students whose experience in using the AIS products was limited to a small number of tutorials and an assignment. As a consequence it may be impromptu to assume that their views will reflect the views of those using the products commercially. A further limitation is that due to the small sample size it is not possible to make statistically significant generalisations about the perceptions of all of the students in the ACIS243.

Review of Previous Work

The background to the development of the Small Business Web Based AIS model included a literature review that covered issues relating to:

- SMEs, IS adoption and outsourcing including the work of Al-Qirim (2003), Collins (2006) and Bressler and Bressler (2006)
- The application service provider (ASP) model for acquisition including the work of Lee, Lee, Kim and Lee (2007), Sharma and Gupta (2002) and Kim and Kim (2008)
- The software as a service (SaaS) model for acquisition as covered in Bradley (2008) and Lin (2004)
- The cloud computing model as covered in Weiss (2007), Buyya, Yeo and Venugopal (2008) and Kim (2009)

Based on the range of definitions of the ASP, SaaS and cloud computing models a grid of generic and specialised terms was developed for web-based information systems as shown in Table 1. Some of the issues raised in the context of web-based accounting information systems for small businesses will relate (a) to organisations in general or to small businesses specifically and (b) to the generic information systems or to accounting information systems specifically.

	Organisations in General	**Small Business**
Generic Information Systems	Web-based Information Systems	Web-based Information Systems for Small Businesses
Accounting Information Systems	Web-based Accounting Information Systems	Web-based Accounting Information Systems for Small Businesses

Table 1 – Generic and Specialised Terms for Web-Based Information Systems Developed in Nesbit (2009)

The Resource-Event-Agent (REA) model for the design of databases for accounting systems that was developed by McCarthy (1982) was reviewed, with particular emphasis being placed on the notions of being able to provide multiple views of the data (for owners of small business and for their accountants) and on the importance of modeling business events as opposed to the bookkeeping processes performed by accountants. The essence of both of these notions includes the concept of the accountant view of the accounting information being able to be extracted from the business event view, with the reverse of this not being possible.

The reviews of a number of users of small web based AIS were examined, and these were used to develop the proposed Small Business Web-Based AIS Model. The model depicts the most important issues for small businesses choosing to adopt a web-based model for their AIS. The model has both a business phase and a technical phase with the biggest blocks in each part of the model representing the most important issues to be considered for a small business adopting a web based AIS. The two phases of this model are shown in Figure 1 and Figure 2 respectively.

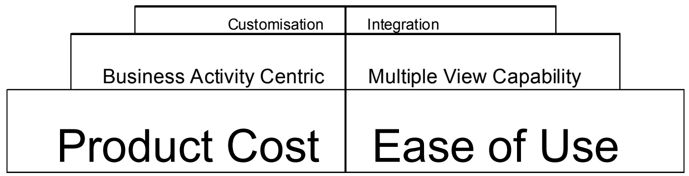

Figure 1 – Business Phase of Proposed Small Business Web-Based AIS Model Developed in Nesbit (2009)

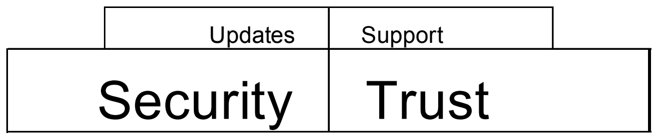

Figure 2 – Technical Phase of Proposed Small Business Web-Based AIS Model Developed in Nesbit (2009)

Incorporating the Two AIS Products into the Course

Two aspects are focused on in this section of the paper with the first being how the two AIS products were incorporated into the teaching of the course along with the lecturers' observations of how students reacted to the introduction of the web-based AIS. The second aspect relates to some technical issues that came about as a consequence of adopting MYOB and Xero, and how they were dealt with. Both aspects are related to the proposed Small Business Web-Based AIS Model developed in Nesbit (2009).

Incorporation of the AIS Products and Observations of Student Reaction

MYOB (the traditionally installed stand alone product) was covered in weekly lab tutorials across 4 weeks in the first half of the course, with the students then completing an assignment using MYOB. The most recent version of MYOB was used in the course; however it was not possible to make that version available for the students to use off site. A consequence of this was that students could use an earlier version of MYOB at home for the assignment, but if they loaded their data into the version that was available in the computer labs it would not be possible to take the data back home again.

Xero (the web based product) was covered in weekly lab tutorials across 4 weeks in the second half of the course. The issue of not being able to take data backwards and forwards between the computer labs and home for doing the assignment disappeared with the web-based nature of Xero. A number of observations were made by the lecturers involved with the course when the students started using Xero. Common comments made by the students who were majoring in information systems or management were:

- "this is so much easier to use because it is web based"
- "it feels like I don't have to know any accounting to use this one and that is really good"

The reaction of a number of the students majoring in accounting was a bit different and a common comment from some of these students was:

- "I'm not too sure about this one because I can't see what is happening to the transactions"

A common reaction from all of the students appeared to be the ease with which completing the lab tutorials and the assignment could be done anywhere because of the web-based nature of the application.

These reactions are consistent with different aspects of the business phase of the proposed Small Business Web-Based AIS Model. The comments about ease of use being clear in the model, and the comments from the accounting major students about not seeing what is happening to the transactions being a combination of the "Business Activity Centric" part of the model which is the idea of the application capturing the business activity of an event and converting that to the accounting information (transaction) about the event.

Technical Issues Related to the use of the AIS Products

Three main technical issues occurred during the computer labs, with one of these being associated with MYOB and two being associated with Xero.

The issue associated with MYOB which has been mentioned earlier in the paper is the incompatibility of the versions available in the computer labs (the most up to date version) and the version available for the students to install at home. This was dealt with by making it very clear to the students as the assignment requirements were being distributed what the issue was and that it would require planning of when and where the assignment was to be done. As a result this issue was not of great consequence, but it does however illustrate one of the potential benefits of web-based AIS in that all users are delivered the same version of the product via their browser which is strongly related to the “Updates” part of the technical phase of the Small Business Web-Based AIS Model.

The first of the technical issues related to Xero was that the product is continually evolving and the online documentation (which is the only form of documentation) is continually evolving. This particular issue is seen as being an advantage for the commercial use of Xero in that the documentation is always up to date to reflect any changes and updates that are being made, and as such reflects the “Updates” part of the Small Business Web-Based AIS Model.

However, this created an issue within the course. For the computer labs where Xero was being covered, handouts were being prepared for the students to work through. The handouts included screenshots of different parts of Xero, and in the second week of the course, changes were made to part of the Xero interface in the 3 days between the handouts being finalised and the students using them. This had a direct affect on what the students were doing.

The second of the issues related to Xero was related to the way that the trial version of the application was made available to students. The approach that trial versions of Xero are made available to the general public (and was used with permission from Xero for the students in the course) was changed one week into the three week period during which the students were working on the assignment. Students who had already completed the assignment were not affected by the change, nor were students who had not started the assignment, however many of the students who were part way through the setup of the assignment lost the work that they had done.

The two issues related to Xero both highlight the potential danger in the “Updates” part of the Small Business Web-Based AIS Model. That the updates are applied to everyone at the same time with a web-based application will in general be a good idea as non-technical owners of small businesses will not need to worry about performing the update themselves or pay a consultant to do the update for them.

The issues that arose with the updates were the timing of them, which may not just be an issue for the use of such a product in a learning environment. If a particular update was of significance, then businesses may want to delay the implementation of the update to a quieter time rather than have it cause potential hiccups at a busy time of the year.

Design of Survey

A survey was conducted of a sample of the students. Due to the timing of the survey (which was after the release of final results for the course for ethical reasons) there were responses from only 27 students.

In the survey the students were asked to indicate their level of agreement with a series of statements about a web based AIS like Xero and were also asked to indicate their level of agreement with the same series of statements when it came to a traditionally installed AIS like MYOB. These statements are shown in Table 2.

The students were also asked (a) what they saw as being the main advantages of Xero over MYOB and (b) what they saw as being the main advantages of MYOB over Xero.

1	Requires a high level of accounting knowledge and skill
2	Requires a high level of computing knowledge and skills
3	Is suited to a small busines owner with little accounting knowledge
4	Creates potential security risks for a business
5	Reduces the complexity of installing upgrades
6	Was straight forward for me to learn how to use for the ACIS243 assignment

Table 2 – Statements to Rate Level of Agreement with for Xero and MYOB

The survey was created in Survey Monkey with the students being emailed a link to the survey after they had received their final results for the course.

Survey Results

The levels of agreement that the students had with each of the statements are shown in Table 3 for Xero and in Table 4 for MYOB.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	0	6	3	16	2
2	0	4	10	13	0
3	9	14	3	0	1
4	1	15	8	2	0
5	12	14	1	0	0
6	19	7	1	0	0

Table 3 – Levels of Agreement with the Statements Relating to Xero

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	5	13	3	6	0
2	3	6	10	8	0
3	0	13	8	5	1
4	2	4	9	11	1
5	4	17	5	0	1
6	10	13	2	2	0

Table 4 – Levels of Agreement with the Statements Relating to MYOB

The comments made by students about what they saw as being the advantages of Xero over MYOB are shown in Table 5, with the comments made as to what they saw as being the advantages of MYOB over Xero being shown in Table 6.

Analysis and Discussion

That the lecturers observed the students who were majoring in accounting being more comfortable with MYOB, and the students majoring in information systems or management being more comfortable with Zero points to the importance of an AIS being used in small business being easy to use by the non-accounting focused owners.

With a sample size of 27 it is not possible to make any statistically significant generalisations about the perceptions of all students, however there are some patterns in the responses that are of interest and have the potential to be investigated with a much larger sample.

Advantages of Xero over MYOB
Can be used anywhere
Web based, ease of use
The simplicity of the interface
Its web based so can be accessed from any location of the users discretion
Also the xero interweb is a huge advantage
Easier, no installation or worry over updates
Xero is really user friendly, it looks and feels like any other business software program eg ms office. It can be accessed anywhere there is an internet connnection and a computer
Easier access than MYOB- need to have MYOB installed in order to use unlike xero which just requires internet access
We can access anywhere
Easy and understandable
access it anywhere on any computer
Updates by itself and is an online thing you can use at home as well
With Zero, it's Easy to use and very handful and useful in making reports and other things
The business does not need to install software to use Xero.
Being able to have your financial adviser log in to help
Its simplistity - just like using a website so anyone can use
Due to the rapid advancement of technology and the internet, the use of web based accounting packages will increasingly play a bigger role in the business world and how corporations to their books. Therefore it was invaluable for myself to gain some understanding of how such a web based accounting package operates
ease of use and ability to use whenever and where ever you have a internet connection
Xero is more user friendly and better for users without an accounting background

Table 5 – Advantages of Xero over MYOB Identified by Students

Advantages of MYOB over Xero
More secure, more reliable. Since Xero is rely on internet
For people with accounting knowledge, possibly more trasnperant.
The completeness of the product
Easy to use without too much Accounting background
Inventory management system with autobuild option. Cheaper ($300-$500 per/year for xero in too much in my opinion). More options for advanced users. Can be used over a network.
MYOB is very accountant focused with lots of extras that Xero doesn't appear to have yet. You control the data i.e. installed on one computer and when you choose to upgrade.
Can control update times
Very easy to use, well organized
Secure and good for small businesses
only installed on one computer so you have greater control over who uses it
More traditional approach. Once you are trained in it, its easy to use and other people cannot hack into it and use it to change things
Maybe with MYOB, the main thing that I noticed is you can see and control the inventory which we can't do with Zero
The business can control when to upgrade the software.
Being able to update it when you choose
The operater has more control. doesnt have to rely on the network to operate and when updates are undertaken
The impression I got was that it might still be more secure. Access to the accounting information system can be restricted to a single physical terminal when using MYOB. Therefore not anyone can make alterations using the software. Xero being web based could make it susceptible to online attacks (be it phishing or the like).
security, ability to control and keep within your own firewall. ability to cope with expansion and increasing business size
Slightly harder to use however not being web-based reduces risks associated with the internet.

Table 6 – Advantages of MYOB over Xero Identified by Students

The statement "Requires a high level of accounting knowledge and skill" (statement #1 in Table 2) was agreed with by 22% and disagreed with by 67% when it referred to Xero. when it referred to MYOB is was agreed with by 67% and disagreed with by 22%.

The statement "Is suited to a small busines owner with little accounting knowledge" (statement #3 in Table 2) was agreed with by 85% when it referred to Xero and was agreed with by 48% when it referred to MYOB.

The statement "Creates potential security risks for a business" (statement #4 in Table 2) was agreed with by 62% and disagreed with by 8% when it referred to Xero and was agreed with by 22% and disagreed with by 44% when it referred to MYOB.

A bigger sample size may result in the differences in perceptions of the two products being statistically significant when it comes to these three statements.

The potential significant difference in statement #1 and statement #3 points to Xero being more suited to people with a non-accounting background. This corresponds to the ease of use aspect in the business phase of the Small Business Web-Based AIS Model which is one of the most important aspects in that phase of the model. The potential significant difference in statement #4 points to the importance of the security issue, which corresponds to one of the most important aspects in the technical phase of the Small Business Web-Based AIS Model.

The relative advantages of the two AIS products that were identified by the students point to the importance of the ease of use and business activity centric aspects of the business phase of the model; and also point to the importance of the updates, security and trust aspects of the technical phase of the model

Conclusions and Recommendations

The conclusions and recommendations relating to this study are separated into those relating to the Small Business Web Based AIS Model; those relating to the use of Xero in ACIS243; those relating to the development of web based AIS products in general; and some overall conclusions, with these being set out below:

Conclusions and Recommendations Related to the Model

While some limitations in this study have been identified, the findings do not appear to contradict any of the aspects of the Small Business Web Based AIS Model. The findings of this study appear to be consistent with the following aspects of the model:

- Business Phase:
    - business activity centric and ease of use aspects
- Technical Phase:
    - Updates, security and trust aspects

The aspects of the model that do not appear to have been addressed in this study are:

- Business Phase:
    - customisation, integration, multiple view capability and product cost aspects
- Technical Phase:
    - support aspect

The aspects that have yet to be tested could be tested in a study that investigated the experiences and perceptions of the commercial users of small business web based AIS products. If this was to be done with a sufficiently large sample this would also address the limitations of this study when it comes to the aspects that appeared to be consistent with the findings of this study.

Conclusions and recommendations related to the use of Xero in ACIS243

While there were some issues that were experienced with the use of Xero in the course, many of these served to demonstrate some of the theoretical aspects of the course. As a result it is recommended that the use of Xero in the course should continue.

Documentation created for the tutorials should include links to parts of the system as opposed to screen shots of the system so that changes are less likely render the documentation inconsistent with the updated version. However there is still the potential that the links could change.

Discussions with the vendors regarding the timing of updates during the assignment should take place well in advance of the assignment so that there is some scope to move which weeks the assignment is happening in.

Conclusions related to the development of Web Based AIS in General

Developers of web based AIS products in general should be aware of issues relating to (a) the timing of updates and (b) the perceived problems associated with security and trust. These could well be factors that result in some small businesses choosing not to adopt web based products in favour of the more traditionally installed stand-alone AIS product.

An aspect to consider could be hosting updated versions in a manner that enables the old version to be used for a short period of time in parallel so that there is some control over the timing of updates.

Overall Conclusions

The introduction of web-based AIS into the ACIS243 course proved to be a success in terms of providing students with some experience that used an alternatively delivered application, and demonstrating many of the theoretical aspects of the course. The issues that arose can be dealt with in most cases, and in others can be used to provide deeper learning for the students when it comes to the adoption of web based AIS products.

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Use of Mobile Technologies to Enhance Student Engagement in Large Lectures: An Initial Exploration and Experiment

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Abstract

The pressure of increasing class sizes to gain financial economies of scale is seen by some as reducing the quality of the educational outcomes for students, with some of this reduction in quality focussing on the increasing lack of engagement and feedback between students and teachers/lecturers as class sizes increase. One aspect of engagement that diminishes as class sizes increase is the use of small group discussion around a topic, with one member of each group explaining their findings to the rest of the class with this then allowing the teacher/lecturer to give immediate feedback to the rest of the class.

Much of the literature surrounding the introduction of technology into the learning process has focussed on engaging students outside of the traditional face-face learning environment whether in a full or pure eLearning sense or as a supplement to face-face delivery. There has been some attention in the literature paid to the use of technologies such as "clickers" and other examples where technologies such as mobile phones and other wirelessly connected devices have been used with the explicit aim of enhancing student engagement.

This paper seeks to explore some of the pedagogical value that can be gained by the use of small group discussions with feedback, and how in larger classes of 200 or more students, some of this value can potentially be retained through the use of mobile technologies such as short-message-services (SMS) so that the students can give their group's response and the whole class can receive feedback from the lecturer within 2-3 minutes. This means that this approach is much more aligned to the literature surrounding the use of classroom response systems and clickers than it is to the literature surrounding mLearning.

A literature review is conducted that covers some of the background behind the paper including the benefits of small group discussion with feedback; and some examples of how SMS, "clickers" and similar technologies have been used within a classroom setting. This is followed by a description of a model for how a readily available product (SMS-Studio), with some extra development, can be used to enhance the engagement of students in large classes. The results of initial experiments into its use in a large first year information systems class of more than 300 students are also presented.

The paper concludes that the trial of the system has been successful when it comes to the cost of participation for students; the engagement of students; the filtering of responses from students; the ability to give quick feedback to the students on their responses; and the student reaction to the use of the system.

Keywords
Student Engagement, Student Learning, Mobile Technologies, Classroom Response Systems

Introduction and Methodology

The aim of this paper is to present the background and results of initial experiments into the use of mobile technologies to facilitate small group discussions and feedback in a large first year information systems course. While the use of mobile technologies suggests that this is an mLearning experiment, the use of the technology within a traditional lecture format and the immediacy of the feedback from lecturer to student sees this experiment being aligned with previous studies related to classroom response systems and clickers as opposed to mLearning.

The structure of the paper includes a brief literature review of the use of classroom response systems (CRS), clickers, short-message-services (SMS) and other related technologies within the classroom with the aim of increasing student engagement. This literature review identifies some of the issues and benefits associated with using such technologies in the classroom.

This is followed by a description of the system that was developed for the purposes of this study, which is in essence an off the shelf product (SMS-Studio) that is used to capture text messages and send them to a database, which has been developed to provide long term storage for the responses and to create a front end for quick feedback to students in the classroom.

A description of the experiments using the system in lectures for a large first year information systems course is presented along with the results of the experiments. This is followed by some analysis and discussion, which is followed by some recommendations and conclusions.

Literature Review

This section reviews a number of prior studies and concludes by identifying a number of important threads that are relevant to this paper.

Flies and Marshall (2006)

In a review of the literature on the use of classroom response systems (CRSs), Flies and Marshall (2006) highlighted that there are a number of areas for a concerted research effort in there use. They did however conclude that much of the existing literature was related to general learning literature and in particular the use of different learning models. Flies and Marshall (2006) went on to indicate that there was significant agreement that CRSs will promote learning when they are coupled with appropriate pedagogical methodologies.

Flies and Marshall (2006) also indicated that much of the research at the time had focused on individual use of the classroom response systems as opposed to small group use of CRSs, although they did note a small number of researchers that used CRSs in association with small group work. Logistical difficulties for academic staff; added costs for students, and students reacting differently to the use of the technology were also highlighted by Flies and Marshall (2006) as being issues in the implementation of CRSs that necessitated clear benefits being evident from their use.

Pedagogical considerations identified in the literature by Flies and Marshall (2006) included the timing of feedback to the possible use of next generation systems including wireless devices, with most of these considerations surrounding increased student interaction and participation in their own learning.

Flies and Marshall (2006) went on to identify a number of implications for further research which are reproduced in Table 1.

Implications for Further Research
Tightly controlled comparisons in which the only difference is the use, or lack of use, of a CRS.
CRS use in connection with diverse pedagogical approaches: (a) Group-based methodologies that are combined with group-based CRS use. (b) Varying degrees of anonymity in response collection. (c) CRS use for purely formative assessment modalities that scaffold learning.
CRS use in connection with diverse populations and content areas: (a) Same content area, but different populations. (b) Same population, but different content areas.

Table 1 – Implications for Further Research Identified in Flies and Marshall (2006)

Scornavacca, Huff and Marshall (2007)

The work of Scornavacca, Huff and Marshall (2007) described the development and trial of a short-message-service (SMS) based classroom interaction system. The theoretical background for this work included the use of large lecture theatres to produce effective and scalable approaches to teaching large classes, and how this approach can be used at the expense of student interaction which can result in reduced student engagement, motivation and learning as described in Freeman and Blayney (2005).

Using interactive technologies to engage students in peer discussion and activities, when guided appropriately by the lecturer can lead to effective learning outcomes for students as suggested in Mazur

(1998). This was subsequently cited by Scornavacca et al (2007) who went on to describe how the use of such interactive pedagogies requires significant overhead effort on the part of lecturers/teachers and that as a consequence, larger classes of 100 or more students are where most benefits lie.

The system developed in Scornavacca et al (2007) was based around the assumption that a large proportion of students have SMS enabled mobile phones with them during lectures, and that these could be used to enable the lecturer to receive messages from students during a lecture. The system developed involved the use of a SMS management tool (SMS Studio) and was used in two different ways during lectures. Firstly it was used to allow students to send messages to the lecturer during the lecture that could be responded to during the lecture or afterwards (open channel mode). Secondly it was used to present students with a discussion topic to be discussed in small groups, and then respond to multi-choice questions based on the topic (m-quiz mode). Approximately one quarter of the students participating in open channel mode, and over half of the students responding in m-quiz mode.

In the conclusions to Scornavacca et al (2007) it was identified that the additional channel of communication was of benefit to both students and lecturers and that there was a perceived increase in the quantity and quality of feedback from the students. It was also identified that an area for further research was related to any change in student learning and performance when using such a system, and whether this would be different across a range of contexts and subject areas.

Freeman and Blayney (2005)

The use of handheld keypads to gain feedback from students in an economics course instead of students raising their hands in response to questions was the subject of the work by Freeman and Blayney (2005). In their conclusions they identified that requiring students to respond to in class questions during class time can assist learning, but that the use of such devices is a costly alternative to asking students to respond to a question by a show of hands, even though this allows for quick feedback in large classes.

In the trial reported on by Freeman and Blayney (2005) the same pedagogical approach of small group discussion was used irrespective of whether the feedback mechanism was by show of hands or the handheld keypads. This enabled a comparison to be made between the two different feedback mechanisms using the same learning pedagogy. Students involved perceived some advantage when using the handheld keypads when it came to their interaction and understanding. The concept of anonymity was looked at as being one of the driving factors behind this perception, and that this may encourage students who are unsure about their response to engage and interact more than they might with a more public display of a show of hands.

Beatty, Gerace, Leonard, & Dufresne (2006)

The importance of designing effective questions for classroom response system (CRS) teaching was highlighted in Beatty et al (2006). In this study they used a “question cycle” (reproduced in figure 1) as the core in-class instruction in physics courses. Part of their findings included that instructors who used a CRS needed a good understanding of how to pose appropriate questions for their use. The question cycle involved posing a question for discussion in small groups before covering any related content. The students responded to the question in multi-choice format with the results being shown in a histogram which are then used as the basis for discussion with the entire class. Beatty et al (2006) identify a three part framework for designing questions for use with a CRS. The three are being (a) the role that the questions play; (b) the goal of asking the question; and (c) how the goal of asking the question is accomplished.

A range of tactics were also identified in Beatty et al (2006) with these being (a) tactics for directing attention and raising awareness; (b) tactics for stimulating cognitive awareness; (c) tactics for formative use of response data; and (d) tactics for promoting articulation, conflict and productive discussion.

In their final summary and conclusions Beatty et al (2006) mention the that effective questions for use with CRS should be developed with a threefold pedagogical objective of (a) a content goal; (b) a process (cognitive) goal and (c) a meta-cognitive goal:

- The cognitive goal is the topic to be covered
- The process goal is the set of cognitive skills to be addressed and developed
- The meta-cognitive goal is the perspective about the overall subject that is to be reinforced

Beatty et al (2006) go on to conclude that this threefold objective can be met through four complementary mechanisms:

- The posing of the question can focus the students' attention on particular issues
- Students' pondering of the questions can stimulate cognitive skills
- Displaying the answer histogram can convey information regarding the students' knowledge in relation to the rest of the class
- Discussion can impact students' engagement and learning, and inform the teacher of how the students are engaging with the material

Four different tactics were identified for maximum learning:

- Remove non-essentials
- Compare and contrast
- Interpret representations
- Strategise only

Beatty et al (2006) go on to indicate that the design of effective questions for a CRS can be challenging and time consuming even when done using a framework similar to that used above. They also highlight that well designed questions are only one aspect of a question driven approach, and that pedagogy, the way in which the instructors use questions to interact with students in the classroom, is more important.

Beatty et al (2006) conclude by stating that question driven instruction as carried out in this study is based on formative assessment, and as such is self correcting, and as a consequence can provide valid feedback to the teacher regarding student learning.

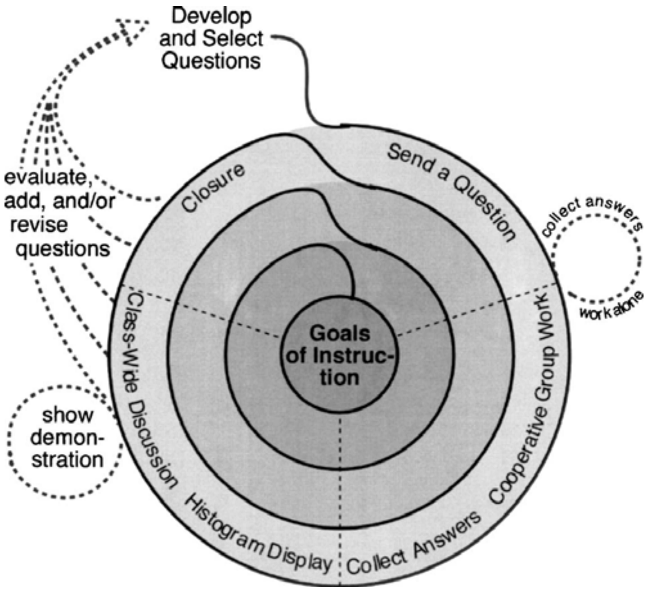

Figure 1 – The question cycle used in Beatty et al (2006)

Nelson and Hauck (2008)

In a case study of the use of clickers in an introductory management information systems course Nelson & Hauck (2008) found that use of clickers significantly improved students' perception of their performance in the course and that the use of the clickers also met with higher rates of class attendance and of student performance. It was also found that the more the clickers were used, the higher the students' perceptions were when it came to active learning, motivation and providing feedback.

Part of the background to the Nelson and Hauck (2008) study was the desire to increase student engagement and sustain student interest across a large core introductory course. The overarching research questions in this study were "How can classroom response systems be used to assist with overcoming inherent challenges of large lecture classrooms?" and "what system features and traits should be sought in a classroom response system?"

In the literature review conducted by Nelson and Hauck (2008) a number of factors that promote effective learning in the classroom were identified including active learning, providing feedback, increasing attention span and motivation. All of these are seen as being particularly challenging in large lectures as cited in Beatty (2004) and with Net Generation learners as cited in Robinson and Ritzko (2006). The importance of feedback was also cited in Bangert-Downs, Kulik, Kulik, and Morgan (1991) with the timing of the feedback being seen as especially important as cited in Azevedo & Bernard (1995) and Kulik and Kulik (1988)

In the conclusions to the study it was stated that the use of CRS technology can fundamentally change the classroom environment for both students and instructors. The benefits to the students as indicated by this study were: increased interest and participation levels during classes; increased comprehension of material; and greater perceived performance in the class.

Kennedy and Robson (2008)
This piece of work described the use of tablet PCs and Classroom Presenter software and how they are used by instructor and students within a first year mathematics course in an undergraduate information technology degree. Slides on the instructor's tablet are sent via a wireless network to the student tablets. The students use electronic pens to write, draw, or annotate the slide and then send their work back to the instructor. The instructor can display, discuss and comment on selected responses.

Some of the key findings of Kennedy and Robson (2008) included the importance of the use of the right types of questions; the concept of using revision questions to start classes; that students have reacted positively to the experience; and that students will work together on the questions as there is one tablet for each pair of students. One of the key aspects to the success of this particular project has been the ability for the instructor to select "interesting responses" to share with the class and that the feedback to the student can happen quickly.

Important Threads Identified
Eight important threads that are relevant to this particular paper can be seen in the literature that has been reviewed.

1. The cost and simplicity of the devices is an issue that was identified in Scornavacca et al (2007) where mobile phones were used because the vast majority of students have a mobile phone with them. In Freeman and Blayney (2005) the cost of the handheld devices was seen as being a factor that would result in similar approaches not being adopted. In Kennedy and Robson (2008) the cost of the tablets used could well prove to be a stumbling block in adopting this form of technology.

2. The importance of pedagogy before technology while implicit in a number of the studies was explicit in both Flies and Marshall (2006) and Beatty et al (2006).

3. The importance of anonymity was identified as being a major issue in Freeman and Blayney (2005).

4. The importance of the impact on learning and not just on student engagement was an issue that was identified in Flies and Marshall (2006), Scornavacca et al (2007) and Nelson and Hauck (2008). In these studies there were typically reports of students being happy using CRS or SMS technologies, but that it was in some cases problematic to measure the impact on learning.

5. The importance of providing feedback to students, and the timeliness with which the feedback is given was an issue identified in Kennedy and Robson (2008), Nelson and Hauck (2008) and in Flies and Marshall (2006).

6. The importance of constructing effective questions was identified in both Beatty et al (2006) and Kennedy and Robson (2008).

7. The application of the technology to large classes as opposed to smaller classes was specifically mentioned in Scornavacca et al (2007) where it

was hypothesised that at least 100 students would be needed in a class to overcome the overheads associated with using such technologies in the classroom.

8. The creation of an additional communication channel was identified as being of use in Scornavacca et al (2007).

Amongst the eight threads identified, there are two relating to barriers (cost and simplicity in thread 1 and the overheads in thread 7), with the other six threads relating more specifically to the benefits to student engagement and learning.

Description of System

The software (SMS Studio) that was used in the study by Scornavacca et al (2007) was purchased and forms the backbone of the system. The essence of this software is that when it is running and a mobile phone has been plugged in to the USB port of the computer that it is running on, the computer sees the mobile phone as being a GSM modem. The software can be configured so that when a text is sent to the phone a service runs. Each service can, amongst other things, remove the text from the phone and issue a range of commands. One such command can be to execute an SQL command, such as the INSERT command to a specified database connection.

For this study, the SQL command that is executed each time a message arrives on the mobile phone is shown in Figure 2, with the database connection being an ODBC connection named “SMS Studio Automated System” with this ODBC connection talking directly to an Access 2007 database, with the structure of the database being shown in Figure 3.

```
INSERT INTO IncomingMessages
(Sender, Recipient, MsgText, MsgDateTime)
 VALUES ('%MsgFrom%', '%MsgTo%',
'%MsgText%', '%MsgDate% %MsgTime%')
```

Figure 2 – SQL Command Executed for Each Incoming Text Message

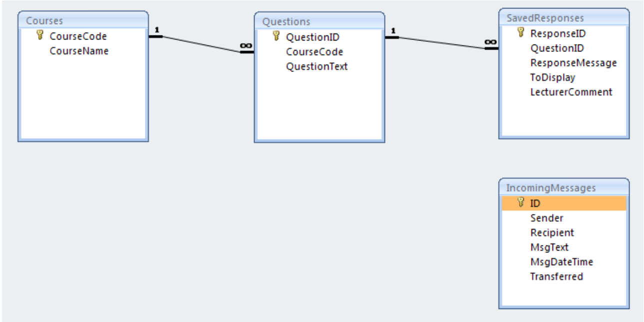

Figure 3 – Structure of Access Database

The incoming text messages are inserted into the IncomingMessages table by the SQL command. The user of the system creates questions that are asked to the class, and can transfer the messages from the IncomingMessages table to the SavedResponses table and assign them to a question that has been created.

The user of the system can select which responses to display to the class as shown in Figure 4 (but with the screen not being displayed on the projector in case there are some inappropriate responses). Once the responses to share with the students have been selected, a form can be displayed showing just those responses at which time the screen can be shown on the projector as shown in Figure 5.

It is also possible to have two mobile phones plugged in to different USB ports and have SMS Studio recognise both of them as being GSM modems and receive and process text messages from both phones at the same time. This has allows student to send responses to a choice of two different mobile numbers from different providers, thereby making it possible for more students to participate without any cost.

Some consideration had been given to the use of SMS server technologies in this project but the costs of the technologies were too great for what in essence is a pilot study, and would also involve students being charged for each response they sent in.

At the time of writing, an Access 2007 database is being used with this being stored locally on the laptop that SMS Studio is installed on. Some consideration is being given to writing the responses to a web-based database such as MySQL using PHP and creating links to the questions and responses from the Learning Management Systems (LMS) site for the courses involved.

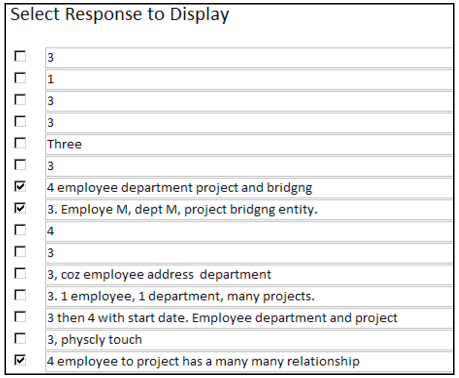

Figure 4 – Selecting Responses to Display to the Class

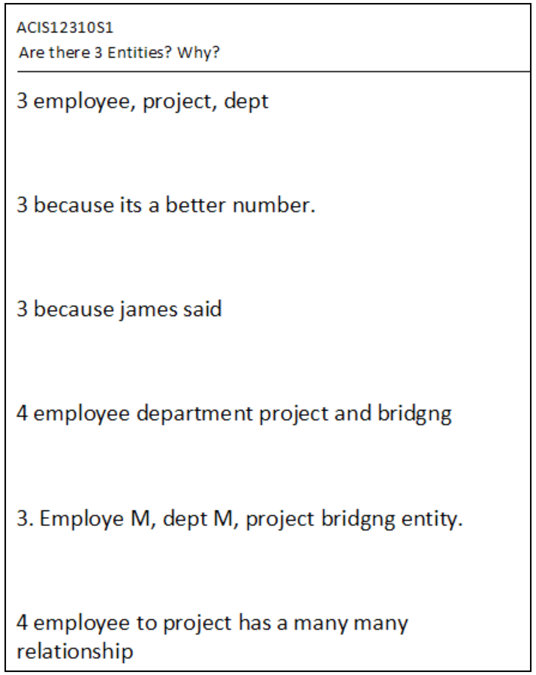

Figure 5 – Displaying the Selected Responses to the Class on the Projector

Design of Experiments

The experiments conducted to date have been in the ACIS123 (Information Systems and Technology) course which from 2010 has been a compulsory course for all students in the Bachelor of Commerce at the University of Canterbury. There are in excess of 300 students enrolled in the course with attendance typically range from 200-250 students at each lecture. The experiments conducted were:

Experiment #1

An initial trial of the system where the students were asked to text their name and favourite colour to either a Telecom or Vodafone number that was displayed on the screen.

Experiment #2

In a database management systems lecture the students were provided with a description of the requirements for a small relational database. The students were asked to discuss in small groups how many entities there would be in the entity relationship diagram and have someone from each group text in that number. The students were told that there would be between 1 and 6, which in essence made this a multi-choice type question.

Experiment #3

Later during the same lecture as experiment #2, the lecturer covered the need to create a bridging entity when encountering a many-many relationship. The students were given another description of a small relational database, and were asked to discuss in small groups if there were 3 or 4 entities, and why they thought there were that many. Again, one person from each group was asked to text in the response from the group.

Experiment #4

In an introductory eCommerce lecture, the students were asked to discuss in small groups the reasons why some people choose to not purchase things online. As in the other experiments, one person from each group was asked to text in their response.

Results

This section presents the results of the four experiments described in the previous section, and then goes on to outline some of the observations of the lecturers and some feedback from the students.

Results of Experiment #1

The purpose of experiment #1 was to test and see whether the system was actually working, and within 2 minutes 148 responses had been inserted into the Access database. The need to not have the responses displayed before they were filtered was apparent when there were 4 responses out of the 148 that would not have been appropriate to display.

Results of Experiment #2

With this experiment being in essence a multi-choice question, it was possible to use the "voting" service in SMS-Studio to process the response and produce a graph of the answers. The graph was displayed with 1-2 minutes of the text messages coming in. The graph is shown in Figure 6. The correct answer to the question was in fact 3, and the graph shows that the majority of students were correct.

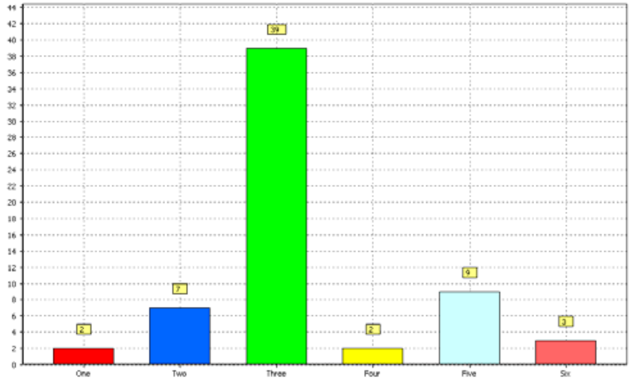

Figure 6 – Graph of Responses from Experiment #2

Results of Experiment #3

There were 76 responses received to this question of which 2 were inappropriate to share with the entire class. Of the other 74 there were 20 responses that included more than just the number of entities and included a reason why. The correct answer to the question was that there were 4 entities and not 3, with the reason for the 4th being the need for a bridging entity because of a many-many relationship.

The responses that can be seen in Figure 4 and Figure 5 showed the range of responses and some of the reasoning. The response of "3 because James said" was shared with the entire class and resulted in a light hearted moment. Some students were heard to say "oh, I get it now" when they saw the responses that had the correct answer and a reason associated with the need for the bridging entity.

Results of Experiment #4

This experiment resulted in 48 responses being received. Interestingly two were not related to the question and were:

- "U r going to fast"
- "Speak a liltle louder cnt hear at the back"

Of the other 46 responses, 13 were shared with the class with these being shown in Table 2. These responses indicated that the students collectively already had a good understanding of the issue at hand that was able to be acknowledged.

Security and trust. :)
Lack of trust
Security and payment method
Security reasons and cant test out th good
Fear of security, unfamiliar with technology
Dnt have a credit card or the security of the payment nt safe
Security
Risk- cant c the actual product so dont no what its really like
1- to see quality 2- payment dificulties
Might not be a safe transacting (in terms of sending their credit card details). They cant see the physical product, it could be faulty, diffrent or non existent
Because may be some old people dont know how to drive competer
Clothes sizes might not fit cant try on before purchase. Postage costs might be high
Trust ISSUES AND phyical COMPONENT..

Table 2 – Responses from Students Shared With Class

Observations of Lecturers

One of the observations of the lecturers involved in the use of the system in ACIS123 was that more students participated than would normally have done so. In fact, in the lecture prior to the first experiment, one of the lecturers attempted to have a small group discussion just prior to a break in the middle of the lecture. The students were told that after the break they would be asked for feedback. The response from the students was interesting in that close to half of the approximately 250 who were present did not come back to the lecture after the break. Of those that did come back to the lecture, only one was willing to share what they had talked about.

It was also observed by one of the lecturers that in the week following experiment #2 the students appeared to interact more verbally at that stage of the course than they had in the previous three semesters when that lecturer had been teaching that part of the course. It may be that this is related to the students discovering in experiment #2 that if they made an incorrect response, they were not made to feel inferior, and as a consequence their trust increased making them more willing to share verbally. This could point to the idea of students sharing anonymously and not being judged as being an approach to increasing the trust, willingness and confidence to share verbally. While this is not the subject of this particular paper, it could be the focus of further studies to determine whether this idea has validity.

Feedback from Students

At the end of the lecture where experiment #4 was conducted, the students were asked to text in their perceptions of the system. There were 7 responses sent in which is too small a sample size to make generalisations about. However these responses were all positive and are shown in Table 3.

Easy communication.
Its awesome. Saves speaking out in lectures
It is good
easy way
Its good cuz alot of pple dnt lik speaking up in lectures bt wif this they can still hav there say
It is good
Its a brilliant idea! I can say things and no one will know its me and its not out loud.

Table 3 – Responses from Students about Their Perceptions of the System

Analysis and Discussion

There is evidence of the eight important threads identified in the literature review in one or more of the experiments, observations of the lecturers and the feedback from students about the system.

The cost of devices and as a consequence the ease of adopting them was observed by the lecturers during the experiments, with the level of participation in the experiments also suggesting that cost will not be an issue with this approach. With the system allowing students to text to either a Telecom phone or a Vodafone phone, this has also reduced the potential cost for students when participating. These factors served to address some of the barriers that there identified in the threads in the literature review.

The importance of pedagogy before technology ties in with the importance of constructing effective questions and the importance of the impact on learning and not just engagement. The question asked in experiment #4 was more open-ended than those posed in the earlier experiments and appeared to be part of the reason why there was a better range of responses. The feedback from the students indicates a greater willingness to engage without having to speak up in front of a large number of peers. This aspect also ties in with the anonymity issue identified in the literature which is identified in some of the student responses.

Conducting the experiments showed that it is possible to filter the responses and share those seen as being pertinent to the class within 2-3 minutes which is consistent with the importance of providing feedback, and providing it in a timely manner.

The system deals with the number of responses that can typically be sent in with a class that is larger than 200 as shown in the experiments and the responses from the limited number of students suggest that they find it to be a useful approach.

The creation of an additional communication channel was evident in the two messages sent by students about "the lecturer going too fast" and about "not being able to hear in the back row". This was not an intended use of the system in this study, but proved to be useful as the lecturer was able to slow down and speak a bit louder as a response to the feedback.

Conclusions

The system that has been developed and trialed in ACIS123 has been successful to date and has demonstrated some of the important aspects for such systems that are in the literature.

The particular aspects that have been successful include:

- The low cost of the devices and participation for students
- The level of participation in activities compared with what is possible in large lectures normally
- The ability to quickly filter the responses, share them with the class and give feedback about the responses
- The reaction of the students to the use of the system

At the time of writing, the degree of success from the perspective of the lecturers is such that the system will continue to be used in ACIS123.

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Selecting the best students for IT Programmes: what determines “best”?

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Abstract

For students who enrolled in a Level 5 Diploma(cf 1st year degree) in Information and Communications Technology between 2004 and 2009 in New Zealand, data have been gathered for factors that might predict success. These include age, gender, ethnicity, part- or full-time status, previous tertiary programmes completed and length of time between enrolment and start date. Measures of success examined include graduate status, total number of courses passed, total number of merit grades gained, percentage of courses passed and number of semesters taken to reach graduation. The two most important determinants of success are age at start, with older students performing better and number of days between enrolment and start date, with the greater time gap leading to higher success outcomes. The interplay of age and gender suggested that for younger students (under 25), being female was a better predictor of success, whereas for older students this difference disappears. There were indications that Māori students performed less well than NZ European students, but only the number of Merits gained was significantly lower for Māori.

Keywords

Student selection, success factors, computing and IT education, tertiary education, New Zealand

Introduction

Until recently, it has been necessary to accept any applicant for the Diploma in Information and Communications Technology Level 5 (DipICTL5) who met the entry criteria. The current economic recession has resulted in a significant increase in the number of applicants concurrent with the imposition of a government cap on the number of students that can be admitted. As a result, the current policy to accept all applicants on a "first-come-first-served" basis until the cap is reached has come into question. An alternative solution would be to introduce a closing date for applications and then select the "best" applicants. This raises the question as to how "best" should be measured. Clearly "best" should be synonymous with "most likely to succeed". A review of the literature on this topic indicates that factors that have been examined include gender, age, student's self-predicted grade, career ambition, high school grades in general and in specific subjects, previous post-school courses, learning style and problem solving skills (Goold & Rimmer 2000) gender, prior computing experience, learning style and academic performance (Byrne & Lyons, 2001), previous academic ability, personality, learning styles, interview performance, character references, gender and ethnicity (Ferguson, James & Madeley, 2002).

Findings from these studies have been ambiguous. Goold and Rimmer (2000) were specifically addressing computer programming in first year degree students in Australia, comparing results of the "Basic Programming Concepts" course with "Information Technology" taken in parallel. Using Kolb's LS12 (Kolb & Smith, 1986), they were able to measure students on both the Concrete Experience to Abstract Conceptualisation dimension (Relative Abstraction) and on the Active Experimentation to Reflective Observation (Relative Activity) dimension. Davidson, Savenye and Orr, (1992) had found that abstract learners do better than concrete learners in computer programming. However, Goold and Rimmer's results showed that whilst Relative Abstraction was positively correlated with performance in the Information Technology course, there was no significant relationship with programming results. Previous experience of programming was weakly linked to overall performance, but not to exam marks. Problem-solving ability also had a significant positive correlation with IT results and a weaker positive relationship (not significant) with Programming. They also found that gender affects performance only in the first semester, with females scoring less well than their male counterparts. By the second semester, the difference had disappeared.

Byrne and Lyons (2001) investigated success factors for a programming course delivered to first year Humanities undergraduates in Ireland who had elected to take this course. Unlike computer science/information technology classes that are on average 72% males, 61% of these participants were female. Overall, they found no significant gender differences in performance, although females did score slightly higher. Of the small number of participants who had prior experience of computer programming, the females scored higher than any other sub-group. Also using Kolb's Learning Styles Inventory, they found that students with a "Converger" style (combining greater abstraction with active experimentation) had the best results – although they were not statistically significant. In terms of previous academic study, there was a small, non significant correlation between Maths and success in Programming (.353) there was a much stronger correlation of .572 with science (significant at1% level).

Ferguson, James and Madeley (2002) examined possible success predictors for UK medical students. They found that 23% of variance was accounted for by previous academic performance. Women tend to outperform men in this field. However, women's clinical grades were best predicted by "service quality" variables in their personality test outcomes, whereas men's grades were best predicted by "intellectual growth". Interestingly, using Kolb's PSI, these researchers also found that having the "Converger" style was the best predictor of success. However, they caution that learning styles can change over time.

Other possibilities for our students include health status, literacy/numeracy level, having a student loan and/or allowance, social support during study and possibly other factors not yet identified. Observation has indicated a possible link between date of application and enrolment and starting programme of study. The long term intention is firstly to identify past trends, then conduct a longitudinal study to follow a new cohort and finally to identify and test interventions to support those students who would appear to be in "at risk" categories. The purpose of this initial research is solely to examine those factors that are currently recorded in the student application and/or in the Management Information System. The analysis is confined to domestic applicants between 2004 and 2009 who started the Diploma in Information and Communications Technology programme and did not withdraw during the first two weeks. The findings of this initial study will be used to create a number of tools to assess students at the beginning of 2010. These will include a measure of learning style, an assessment of literacy and numeracy levels, a survey etc. There is no intention to use the findings of this research to exclude potential students. If the findings indicate that there are specific factors that place some individuals at higher risk of failure than others, then the next phase will specifically address the efficacy of interventions intended to create greater equality of opportunity to succeed. Formal approval to conduct this research was given by the polytechnic's research committee.

Methodology

Data for all New Zealand domestic students (i.e. this data did not include International students) who had enrolled in the Diploma in Information and Communications Technology Level 5 (DipICTL5) at a Polytechnic on the North Island of New Zealand between 2004 and 2009 was extracted from the Polytechnic's Management Information System. This data was then checked manually for obvious input errors. The researcher's knowledge of these students and information contained in their student records was used for this purpose. It should be noted that students can join the DipICTL5 programme in either February or July of any year and a full-time student would take two semesters to complete if they passed all courses at the first attempt. This left 250 usable student records, 181 males (72.4%) and 69 females (27.6%). Data collected included gender, date of birth, date enrolled, ethnicity, full- or part-time status, number of courses in which enrolled by semester and whether they had withdrawn, no passed, passed or passed with merit. Students must pass a total of 18 courses, including 9 compulsories obtaining at least 80% in each to graduate. A mark of

95% or higher produces a merit grade. Whether or not students had graduated was also recorded.

In order to ascertain the date of application, student files were examined. It was discovered that this data had not been collected consistently and so no further investigation of this specific variable was possible in the current study. Similarly, details of previous academic achievement at other institutions including high school were only recorded for some students. Records were also used to ascertain whether or not each student had undertaken previous tertiary study and if so, at what level and computing content.

Two additional independent variables were derived, age at start and number of days between enrolment and course start. Other possible measures of "success" in addition to graduate status were derived. These were percentage of courses passed, number of courses for which a merit was gained, total number of courses passed and time taken from first enrolment to graduation. For some calculations, grouped variables were created e.g. age at start, number of courses passed, in order to allow for calculation of statistical significance using chi squared.

Results

Figures 1 – 5 below give percentages for demographic and success variables by specific criteria. Figures in red italics indicate statistical significance at a confidence level of <0.5.

Percentages within Gender	Male	Female
Full-time	*90.1*	*66.7*
NZ European	74.6	72.5
NZ Māori	18.2	21.7
Other ethnicity	7.2	5.8

Percentages within Gender	Male	Female
Aged under 19 at start	*39.2*	*26.1*
Aged 19 - under 25 at start	*23.2*	*21.7*
Aged 25 – under 35 at start	*22.1*	*21.7*
Aged 35 and over at start	*15.5*	*30.4*
Days enrol to start <30	60.2	60.3
Days enrol to start 30>	39.8	39.7
Graduated	30.9	33.3
Left without graduating	56.4	55.1
Passed less than 5 courses	37.0	39.1
Passed between 5 and 17 courses	32.0	27.5
DipICTL5 still in progress	12.7	11.6
Obtained 5 or more Merits	10.5	5.8
Obtained between 1 and 4 Merits	35.4	40.6
Passed no courses	14.9	18.8
Passed some, but less than 50%	26.5	13.0
Passed more than 50% but not all	34.3	31.9
Passed 100% of courses taken	24.3	36.2
Graduated in 2 semesters	57.1	62.5
Graduated in 3 or 4 semesters	30.4	16.7
Graduated in 5 or more semesters	12.5	20.8
Completed previous course Level 2 or higher	19.9	30.4

Figure 1: Demographics and success criteria by gender

Percentages within Ethnicity	NZ European	NZ Māori	Other
Full-time	83.2	85.4	82.4
Aged under 19 at start	40.0	25.0	17.6
Aged 19 - under 25 at start	20.0	29.2	35.3
Aged 25 – under 35 at start	18.4	33.3	29.4
Aged 35 and over at start	21.6	12.5	17.6
Days enrol to start <30	57.5	78.7	58.8
Days enrol to start 30>	42.5	21.3	41.2
Graduated	30.8	27.1	52.9
Left without graduating	57.3	56.2	41.2
Passed less than 5 courses	35.7	45.8	35.3
Passed between 5 and 17 courses	33.5	27.1	11.8
DipICTL5 still in progress	11.9	16.7	5.9
Obtained 5 or more Merits	*9.7*	*4.2*	*17.6*

Percentages within Ethnicity	NZ European	NZ Māori	Other
Obtained between 1 and 4 Merits	*41.1*	*27.1*	*17.6*
Passed no courses	15.1	20.8	11.8
Passed some, but less than 50%	21.6	31.2	11.8
Passed more than 50% but not all	32.4	35.4	41.2
Passed 100% of courses taken	30.8	12.5	35.3
Graduated in 2 semesters	60.3	38.5	77.8
Graduated in 3 or 4 semesters	29.3	23.1	11.1
Graduated in 5 or more semesters	10.3	38.5	11.1
Completed previous course Level 2 or higher	22.2	25.0	23.5

Figure 2: Demographics and success criteria by ethnicity

Percentages within Age Group	Under 19	19 – under 25	25 – under 35	35 and over
Full-time	37.8	22.0	22.5	17.7
Days enrol to start <30	52.8	63.6	68.6	61.2
Days enrol to start 30>	47.2	36.4	31.4	38.8
Graduated	37.1	28.1	29.1	28.6
Left without graduating	52.8	66.7	60.0	44.9
Passed less than 5 courses	33.7	40.4	47.3	30.6
Passed between 5 and 17 courses	29.2	31.6	23.6	40.8
DipICTL5 still in progress	10.1	5.3	10.9	26.5
Obtained 5 or more Merits	*2.2*	*5.3*	*14.5*	*20.4*
Obtained between 1 and 4 Merits	*44.9*	*28.1*	*27.3*	*42.9*
Passed no courses	*16.9*	*19.3*	*18.2*	*8.2*
Passed some, but less than 50%	*27.0*	*29.8*	*20.0*	*10.2*
Passed more than 50% but not all	*36.0*	*35.1*	*30.9*	*30.6*
Passed 100% of courses taken	*20.2*	*15.8*	*30.9*	*51.0*
Graduated in 2 semesters	54.5	56.2	62.5	66.7
Graduated in 3 or 4 semesters	33.3	25.0	25.0	13.3
Graduated in 5 or more semesters	12.1	18.8	12.5	20.0
Completed previous course Level 2 or higher	24.7	15.8	21.8	28.6

Figure 3: Demographics and success criteria by age group

Percentages within Previously Studied Tertiary Programme at Level 2 or Higher	Level 2 or higher	No previous programme above level 1
Full-time	80.7	19.3
Days enrol to start <30	63.2	59.4
Days enrol to start 30>	36.8	40.6
Graduated	31.6	31.6
Left without graduating	56.1	56.0
Passed less than 5 courses	36.8	37.8
Passed between 5 and 17 courses	31.6	30.6
DipICTL5 still in progress	12.3	12.4
Obtained 5 or more Merits	8.8	9.3
Obtained between 1 and 4 Merits	36.8	36.8
Passed no courses	7.0	18.7
Passed some, but less than 50%	33.3	19.7
Passed more than 50% but not all	33.3	33.7
Passed 100% of courses taken	26.3	28.0
Graduated in 2 semesters	52.6	60.7
Graduated in 3 or 4 semesters	15.8	29.5
Graduated in 5 or more semesters	31.6	9.8

Figure 4: Demographics and success criteria by level of previous tertiary programme

Percentages within <30 or >30 Days between Enrol and Start	<30	>30
Full-time	58.3	41.7
Graduated	*27.9*	*33.0*
Left without graduating	61.9	50.5
Passed less than 5 courses	*45.6*	*27.8*
Passed between 5 and 17 courses	*26.5*	*39.2*
DipICTL5 still in progress	10.2	16.5
Obtained 5 or more Merits	*8.2*	*10.3*
Obtained between 1 and 4 Merits	*29.3*	*46.4*
Passed no courses	19.7	11.3
Passed some, but less than 50%	23.8	22.7
Passed more than 50% but not all	32.7	34.0
Passed 100% of courses taken	23.8	32.0
Graduated in 2 semesters	50.0	68.8
Graduated in 3 or 4 semesters	31.0	18.8
Graduated in 5 or more semesters	19.0	12.5

Figure 5: Demographics and success criteria by enrolment more or less than 30 days before start

It can be seen from the previous Figures that only a few relationships between variables were sufficiently strong to be statistically significant. More females study part-time and they tend to be older. Students who identify as NZ Māori were less likely to achieve merit passes. Age was also a factor in predicting merit passes, with older students gaining more. Pearson Product Moment correlations were significant at the 0.01 level for this and for the relation between increasing age and percentage of courses passed. Students who enrolled more than 30 days before the programme started were more likely to graduate and gain more merit passes. The actual number of days between enrolment and programme start has a positive correlation with total number of courses passed (<0.01) and with percentage of courses passed (<0.05).

A number of gender differences emerged which did not prove statistically significant. However, when gender and age-group were both factored in, some interesting patterns emerged. For example, only 16.9% males who were under 19 at the start of the programme graduated within two semesters, in comparison with 33.3% of females. Also in the under 19 age group, 33.8% of males ever graduated in comparison with 50% of females. This difference continued into the 19 – under 25 age group with 26.2% of males and 33.3% females graduating. However, in the older age groups, gender did not predict success by any criterion.

Finally, a number of Stepwise Multiple Linear Regressions were used to identify the most parsimonious set of predictors of each measure of success. The potential predictors in each case were Age at Start Date, Gender, Time difference between enrolment and programme start (Time Diff),ethnicity, being part-time or full-time, and having completed a previous tertiary programme at Level 2 or above. For total number of courses passed, analysis terminated after two steps with two predictors extracted, Age at Start, sr_i^2 = .08, t = 4.775, p = <0.05 and Time Diff, sr_i^2 = .03, t = 2.952, p = <0.05. At step 2, with Age at Start and Time Diff entered into the equation the multiple correlation coefficient (R = .331) was significantly different from zero, $F(2, 241)$ = 14.841, p = <.05, and 10.2% of the variation in the dependent variable was explained by the set of independent variables (R^2 = .110, adjusted R^2 = .102).

For other regressions only Age at Start was extracted accounting for 5.6% variance in percentage of courses passed and 5% in number of merit passes.

Discussion

These results indicate that of the independent variables studied only two had a statistically significant relationship with the various measures of "success" for students on the Diploma in Information and Communications Technology Level 5 programme. The most important factor overall is age at start, which had a positive correlation with total number of courses passed, total number of merits gained, percentage of total courses passed and a negative correlation with number of semesters from start to graduation. However, age does not predict whether or not a student will actually graduate. It would seem that the older the student, the better they will do on each course in which they enrol, but that older students are also less likely to complete the whole programme and graduate. It is possible that older students have more constraining factors such as family and financial responsibilities but also more work experience which might enable them to get jobs with only partial qualifications. This is worthy of further investigation using interviews. The other implication for the importance of age at start is that as educators, we need to see how we can support the younger students. Future studies could examine the importance of social support during study, using a mixed age range in group assignments, pastoral care requirements etc.

The other factor that has correlations with a number of success measures is the time between enrolment and start of programme. The initial enquiry that was the catalyst for this research was that our current practice of accepting students on a first-come-first-served basis might need to be reviewed to ensure we enrolled the students most likely to succeed. However, these findings show that the earlier a student commits to their programme of study, the more likely they are to succeed. In the second stage of this research, the application date will also be taken into consideration. Clearly, it is unlikely to be simply the act of enrolling early that makes the difference. The next questions to be asked concern the specific characteristics of those who make an early commitment. These could include social support, encouragement from High School tutors, previous success in computer–related courses, passion for computing, being highly organized, being eligible for a scholarship etc.

Neither age at start nor time difference between enrolment and start have been reported in previous studies as predictors of success. It is worthy of note that although Byrne and Lyons (2001) were working in Ireland, they also stated that the average male:female split in Computing classes was 72:28. They indicated that although females might have a slight disadvantage in terms of having less familiarity with computing and computer teaching environments, they soon overcame this. Females with prior computing experience were the sub-group that obtained the best results. In this study, females tended to pass a higher percentage of the courses in which they enrolled and be more likely to finish in two semesters but these results were not statistically significant and overall, females were less likely to graduate or to get merits. The fact that more females study part-time and that they tend to be older might be relevant to this outcome. Further investigation is needed. It is also worth exploring what we as tertiary educators can do to help female students overcome any initial sense of being in a male dominated environment.

Ethnicity produced only one statistically significant result. Students who identify as Māori are less likely to achieve merit passes. Although not statistically significant, they are also less likely to graduate and more likely to leave without passing any courses. According to the New Zealand Ministry of Education's website "poor academic preparation, poor cultural preparation, an essentially non-Māori dominated environment, loneliness and isolation, whānau responsibility, lack of availability of academic support from the provider and whānau, low socio-economic backgrounds, teaching and learning methods, identity and a lack of space to simply be Māori" are key factors in explaining the difficulties faced by Māori students. How these issues can be addressed in the tertiary computing education environment requires further investigation and then implementation.

The next phase of this research has already started. More data about incoming students was gathered on the first day and measures such as learning style, literacy and numeracy level are being collected. These students will produce their first set of results in July 2010. Analysis of trends found in semester one may then lead to the collection of further data in semester two.

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Managing “At Risk” students and pass rates with SPSS

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Abstract
Both the Tertiary Education Commission and the Ministry of Education are now moving fast to lower ITP funding for courses with low pass rates. It is imperative that academics understand student progression towards individual outcomes and pass rates of courses. Pro-active management with powerful tools for improved student outcomes will be very advantageous in future. Following work by McCarthy (2005) and Scott (2005) on student retention, completion and progression, Potgieter, Ferguson and Roberton reported during 2009 on several experiences regarding student outcomes. The authors have since developed and now demonstrate a sophisticated tool for general use by proactive programme managers, specifically a statistical model to predict success of the pass/fail categories for IT students. This paper provides opportunities for further study and reference for reflective practice by programme Managers at ITPs.

Keywords
Completions, Pass Rates, SPSS, At Risk students

Introduction
In recent years, the Tertiary Education Commission (TEC) has been promoting specific expectations regarding student outcomes (Tertiary Education

Strategy 2007, Tertiary Education Strategy Monitoring Information 2008, TEC to publish educational performance information, 2010). During March 2010, the newspaper NZ Herald contained two government announcements indicating changes to impact on tertiary institutions: Funding to be aligned to student outcomes and limitations to student loans. TEC expects of institutions to report on performance and initiatives in their business plans and so it is essential that academics improve their understanding of student progression towards individual outcomes and corresponding pass rates as part of their proactive management practices.

At WINTEC, executive views mention a five-year aspiration for reputation of "Quality and Student-Centeredness" (Our Direction, 2009). One of the eight key strategic themes is "Quality and Outcomes", stating amongst other things, that the institution pursues "High levels of student satisfaction and completion rates". Further commitment is reflected in the institution's Academic Direction (2010) –

> *"Student retention, especially in the early stage of their study programme is a key strategy in improving student completions. We will improve this by having a more explicit and integrated school and support service approach to retention and ensuring we have the processes in place to monitor and report on progress made."*

Institutional practice is therefore that attendance monitoring is closely monitored by the Student Experience unit during especially the first half of each semester in order to minimize early fall-out. While attendance does not necessarily imply successful course completion, it appears to be recognized widely as an important contributing factor, as is also evident from research by Potgieter and Ferguson (2009) regarding international students at one institution.

In addition, Programme Managers of the School of IT assess progress of students after especially the first two assessments and discuss possible action with tutors and Student Experience services for individual support. Finally, the tutors of the School of IT observe behaviour of students and of course academic performance to identify those with significant weakness in participation, response indicating comprehension and, of course, passing assessments! Action is taken with and/or without other role players.

These and other activities became known internally as the Management of 'At Risk' students. From 2009, staff immediately focused heavily on class attendance, but only gradually increased management activity. With attendance monitoring running through the semester (albeit with slight reduction after first six weeks), staff from the School of IT wondered about the focus periods during a semester regarding academic performance.

The proposition was that the final outcome of student performance (pass/fail and final mark at end of semester) is already clear halfway through the course (semester). This implies that special intervention per student could be futile later on in the semester. It also implies that action is required very early in the semester, and therefore very close scrutiny of academic progress is required over the first half of the course.

The added benefit of knowledge about the likely final outcome for a student early on during the semester is also that one could avoid "last minute crisis" attempts to help students pass, if there is evidence of very poor likelihood of success and therefore very low return on investment. It sets some sort of "point of no return".

There is, of course, very severe danger in this view in that students could become "doomed to fail" when tutors strongly believe in their inability to influence outcome after a certain point. One should take note of this significant problem of "self-fulfilling prophecy" and one needs to work on avoiding that possibility. However, the fact remains that if evidence shows very low probability of success, one ought to be realistic about why intervention attempts are still being made, the investment with low/no return and implications for students.

But first it would be useful to understand patterns of student progress and have some prediction abilities. This involved analysing historical data without consideration of the interventions that were made. It shows what the typical progression of students is with current intervention practices. Obviously one can therefore not consider the impact of interventions, but the argument is that at this stage one does not even know what student progression typically is! Implications of not considering specific interventions are revisited at the end of the paper.

Planning empirical explorations

Before the empirical stage, the following research questions were formulated:

1. Are the first three assessments indicators of the likelihood of final course outcome?
2. Is final course success best described by pass/fail or the final mark itself (described as the *"best outcomes parameter"*)?
3. How accurately can one predict the final outcome after each of the first, second and third assessments?
4. Re exceptions: Are the number of students recovering from initial failure or failing after initial success, significant?

Resulting Null-hypotheses (H_0):

1) Re overall model and *"best outcomes parameter"*
    a) Model with A1, A2 and A3 predicts final mark satisfactorily
    b) Model with A1, A2 and A3 predicts pass/fail satisfactorily

2) Re only first two assessments
    a) Model with A1 and A2 predicts *"best outcomes parameter"* satisfactorily
    b) Model with only A1 predicts *"best outcomes parameter"* satisfactorily

One will also want to know whether exceptions to overall model prediction (incorrect predictions by the model) are acceptably low. The statistical procedure will be Discriminant Analysis with the following analyses to support it: Multivariate Analysis of Variance (MANOVA) to explore the interactions among predictor variables and Analysis of Variance to establish whether a statistically significant difference obtains for the variables, split on the basis of the pass-fail categories (Tredoux & Durheim, 2002).

But it was also the intention to learn about statistical tools to create something that could be used as an instrument in future. So SPSS was used to provide a richer framework for future use and to create reference material for colleagues. Finally, the intention was to learn about the organisation to make first observations about current practices for improvement. This is part of a philosophy of reflective practice. The project therefore has similarities to *exploratory* case studies (Yin, 1993) but is also *intrinsic* (Stake, 1995) since the authors have a personal interest in the situation.

Exploring empirically

The School of IT's degree level programmes BInfoTech and GradDip IT were analysed. These students share all but one of their classes, so it gives us an opportunity to compare student cohorts. Importantly, most students on GradDip are from overseas (mostly India) and all of them have degrees, of which a significant proportion are IT degrees. BInfoTech also has a significant number of international students (average about 25%), which contributes to research regarding outcomes for international students.

Data was extracted from the institute's student database for 2009, semesters one and two, as well as Summer School. (Summer School is used for students following a pathway from the diploma (DipICT) into the degree and for one of the intakes of GradDip IT).

Unwanted columns were removed, such as student identification and assessment methods. The file contained 1480 records. Data was cleaned data up by removing a considerable number of lines:

1. 1110 lines remained after removing fields for Final Mark that are empty or not Pass/Fail (Empty fields occur in cases of very early student withdrawals, students changing enrolment, errors in enrolment administration and credit transfer for specific modules).
2. 621 lines remained after removing records with no mark for any one of the first three assessments (empty fields occur when there was an administrative error, or when students changed enrolment late in the semester).

This left us with a total of 621 records, which happen to be from 204 different students, which is about 95% of the 215 students in the full data set.

Analysis: About the SPSS calculations

The sample was big enough for assessing one year. Table 1 shows some high level descriptive statistics, some of which are of concern:

1. The mean assessment 1-3 marks are nearly the same and all just above the pass level of 50% - this means just under half of the students fail during assessment.
2. However, the mean final mark is significantly higher and with much smaller standard deviation than that of the individual assessments.

Table 1: Descriptive Statistics

	Mean	Std. Deviation	N
Fin_Mark	66.234155	15.3496691	621
Ass1M	53.336634	27.2994170	621
Ass2M	51.405990	27.8364583	621
Ass3M	50.165354	26.8254017	621

Before exploring possible fundamental reasons for a significant difference between final mark and the first three assessments, it is important to verify the data again. It was found that there is good reason to remove more records from the sample:

1. Courses for which marks for only two assessments are recorded (e.g. Special Topic with only a presentation and report).
2. Courses not using all of the first three assessment fields for results (i.e. using some of the remaining five fields).
3. Courses where assessment marks are not recorded in percentages (appears to be the practice of a particular tutor).
4. Students missing results for some assessments (ie final mark calculated on fewer assessments than for peers, for whatever reason).
5. Combinations of the above caused by situations where marks of several assessments were combined before loading it.

The file size then drops by 107 to 513 lines, which is still from over 90% of the students and therefore an acceptable sample size.

Table 2: Descriptive Statistics

	Mean	Std. Deviation	N
Fin_Mark	66.274951	14.9166168	513
Ass1M	58.714191	24.9770898	513
Ass2M	55.877875	25.5781867	513
Ass3M	55.691481	24.5680650	513

It is noticeable from Table 2 that the mean for Assessments 1-3 is now higher, but it remains notably far below the mean of the final mark. Also noticeable is that standard variation of Final Mark remains much smaller than that of Assessments 1-3. One would have to pose the question why this happens. Anecdotal evidence from browsing the student data base indicate that for many courses, the first three assessments contribute significantly less than 40% of the final mark and that marks for assessments increase later in semester. This matter ought to be investigated further.

Analysis: Towards testing hypothesis

What does the data say about the possibility of predicting outcome for the student? Stepwise multiple regression was conducted using final mark as dependent variable, with the following predictors: Assessment 1, Assessment 2, Assessment 3, Qualification and Semester. Significance of the model is within boundaries:

Table 3: Model Summary from SPSS

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.551[a]	.304	.302	12.4586503	.304	222.954	1	511	.000
2	.615[b]	.370	.375	11.7901720	.074	60.500	1	510	.000
3	.634[c]	.403	.399	11.5641649	.025	21.129	1	509	.000
4	.640[d]	.409	.405	11.5076318	.007	6.013	1	508	.015
5	.646[e]	.417	.412	11.4427391	.008	6.778	1	507	.009

a. Predictors: (Constant), Ass3M
b. Predictors: (Constant), Ass3M, Ass1M
c. Predictors: (Constant), Ass3M, Ass1M, Sem
d. Predictors: (Constant), Ass3M, Ass1M, Sem, Ass2M
e. Predictors: (Constant), Ass3M, Ass1M, Sem, Ass2M, Qual
f. Dependent Variable: Fin_Mark

Results for the stepwise procedure showed that sequencing for entering and retaining predictor variables in the model is as follows: Assessment 3, Assessment 1, Semester Assessment 2 and Qualification. These are the variables that contribute most to the model explaining final results from variables, ie the variables that most closely predict the final outcome for a student.

It seems that a tentative start may have been made in selecting predictors for a model - the proposed model explains 41.2% of the final mark. Note that the strongest model for prediction contains Assessment 3, Assessment 1, Semester, Assessment 2 and Qualification - Assessment 2 therefore falls to the side in favour of Semester. This observation is revisited during reflection at the end of the paper.

Findings on the analysis of variance (ANOVA, table 4) relate to overall significance of the predictor model, answering the question whether the four predictors allow one to predict learner scores on each dependent variable. F values are significant at probability level of 0.000 which signals that these variables allow its use for predicting final marks of students.

Table 4: ANOVA results for models

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34606.413	1	34606.413	222.954	.000[a]
	Residual	79316.381	511	155.218		
	Total	113922.794	512			
2	Regression	43028.625	2	21514.313	154.770	.000[b]
	Residual	70894.169	510	139.008		
	Total	113922.794	512			
3	Regression	45854.270	3	15284.757	114.296	.000[c]
	Residual	68068.524	509	133.730		
	Total	113922.794	512			
4	Regression	46650.594	4	11662.649	88.069	.000[d]
	Residual	67272.200	508	132.426		
	Total	113922.794	512			
5	Regression	47538.102	5	9507.620	72.613	.000[e]
	Residual	66384.693	507	130.936		
	Total	113922.794	512			

a. Predictors: (Constant), Ass3M
b. Predictors: (Constant), Ass3M, Ass1M
c. Predictors: (Constant), Ass3M, Ass1M, Sem
d. Predictors: (Constant), Ass3M, Ass1M, Sem, Ass2M
e. Predictors: (Constant), Ass3M, Ass1M, Sem, Ass2M, Qual
f. Dependent Variable: Fin_Mark

The standardized Beta coefficients (Table 5) indicate how each variable contributes to the prediction model. The Beta coefficient signals change to dependent variable (Final Mark) from change in a predictor variable. It can be seen that Assessment 3 and Assessment 1 have more impact than other variables**.** For the t values, the higher the value the more significant the impact of the variable in predicting learner scores on the dependent variable, Final Mark. Again Assessment 3 and Assessment 1 stand out as having the most significant impact.

Table 5: Coefficients

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	95.0% Confidence Interval for B Lower Bound	95.0% Confidence Interval for B Upper Bound	Correlations Zero-order	Correlations Partial	Correlations Part	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	47.639	1.364		34.927	.000	44.959	50.318					
	Ass3M	.335	.022	.551	14.932	.000	.291	.379	.551	.551	.551	1.000	1.000
2	(Constant)	42.122	1.473		28.606	.000	39.229	45.015					
	Ass3M	.232	.025	.382	9.305	.000	.183	.281	.551	.381	.325	.722	1.385
	Ass1M	.191	.025	.320	7.784	.000	.143	.239	.522	.326	.272	.722	1.385
3	(Constant)	36.230	1.931		18.762	.000	32.437	40.024					
	Ass3M	.232	.024	.382	9.472	.000	.184	.280	.551	.387	.325	.722	1.385
	Ass1M	.197	.024	.329	8.152	.000	.149	.244	.522	.340	.279	.720	1.388
	Sem	3.613	.786	.158	4.597	.000	2.069	5.158	.129	.200	.157	.997	1.003
4	(Constant)	35.046	1.981		17.687	.000	31.153	38.938					
	Ass3M	.211	.026	.347	8.170	.000	.160	.262	.551	.341	.279	.643	1.555
	Ass1M	.183	.025	.307	7.448	.000	.135	.232	.522	.314	.254	.685	1.460
	Sem	3.587	.782	.157	4.586	.000	2.050	5.124	.129	.199	.156	.997	1.003
	Ass2M	.057	.023	.097	2.452	.015	.011	.102	.300	.100	.084	.737	1.357
5	(Constant)	31.013	2.506		12.375	.000	26.090	35.937					
	Ass3M	.210	.026	.347	8.199	.000	.160	.261	.551	.342	.278	.643	1.556
	Ass1M	.172	.025	.287	6.906	.000	.123	.220	.522	.293	.234	.663	1.507
	Sem	3.478	.779	.152	4.464	.000	1.947	5.008	.129	.194	.151	.994	1.006
	Ass2M	.066	.023	.114	2.850	.005	.021	.112	.300	.120	.097	.710	1.392
	Qual	2.743	1.054	.091	2.603	.009	.673	4.813	.138	.115	.088	.951	1.052

a. Dependent Variable: Fin_Mark

The question now is how well these variables predict a Pass/Fail, as well as the so-called incorrect predictions. Outcomes are predicted correctly for 75% of course enrolments – see Table 6. A pass is forecast but then the student fails, fortunately for only 1.6% of course enrolments.

Table 6: Incorrect predictions

			PREDICTED Fail	PREDICTED Pass	Total	
ORIGINAL	Count	Fail	48	8	56	11.0%
		Pass	120	337	457	89.0%
	%	Fail	85.7	14.3	100.0	
		Pass	26.3	73.7	100.0	
	% (Overall)	Fail	9.4%	1.6%	100%	
		Pass	23.4%	65.7%	100%	
			32.8%	67.3%		

25% of outcomes predicted incorrectly (23.4% + 1.6%).
Remarkably 23.4% predicted to Fail but then they eventually Pass.
Note that only 1.6% predicted to Pass who then unfortunately Fail.
Interestingly 89% of students who continued to the end, Pass.

It is also clear that 23.4% pass after a fail was predicted from the model. This change from fail to pass partially reflects an increase in the marks occurring after the third assessment.

Regarding previous reference to a possible "best outcomes parameter" (ie. Final mark vs Pass/Fail), one sees that the model explains 41.2% of the final mark and 75% of the Pass/Fails. It would appear the model is stronger in its ability to predict Pass/Fail rather than the final mark. The ability to predict Pass or Fail for three quarters of the students is noteworthy.

Analysis: Hypotheses and Research Questions

While the above interpretation is useful and interesting, a scientific interpretation revisiting hypotheses formulated earlier on is required:

1. Model with A1, A2 and A3 predicts final mark satisfactory: YES (41.2%).
2. Model with A1, A2 and A3 predicts Pass/Fail satisfactory: YES (75%).
3. Model with A1 and A2 predicts Pass/Fail (*"Best outcomes parameter"*) satisfactory: NO, because it lacks the most important predictor – Assessment 3
4. Model with only A1 predicts Pass/Fail (*"Best outcomes parameter"*) satisfactory: NO, because it lacks the most important predictor – Assessment 3.

Also, exceptions to overall model prediction (incorrect predictions by the model) are acceptably low, considering good statistic fit, ability to forecast for three quarters of students and the fact that the majority of incorrect predictions still turn out positive for students when they pass rather than fail. (This matter, however, relates to the noticeable increase in final marks, which needs to be investigated).

Returning to the research questions posed earlier:

1. Are the first three assessments indicators of the likelihood of final course outcome? Yes, they are generally good indicators.
2. Is above final course success best described by pass/fail or the final mark itself (described as the *"best outcomes parameter"*)? Pass/Fail best describes success, being accurate for 75% of students with the first three assessments.
3. How accurately can one predict the final outcome after each of the first, second and third assessments? Prediction is relatively weak until Assessment 3.
4. Re exceptions: Are the number of students recovering from initial failure or failing after initial success, significant? The number is relatively low and in favour of the student.

One could therefore conclude that Multivariate Analysis of Variance (MANOVA) of the first three assessments could accurately predict Pass/Fail for three quarters of the students. This, of course, assumes that the currently unexplained increase of marks over rest of the semester continues in future.

However, from the above it appears that the ability to predict final marks and/or Pass/Fail without Assessment 3 is rather weak. Since Assessments are recorded in order of occurrence, the timeline for more accurate prediction extends accordingly. In practice it means predictions early on in the semester are fairly inaccurate, especially since there is a noticeable increase after the first three assignments towards the final mark.

Possible improvements

There are several opportunities to improve the model by reviewing data and parameters:

1. Investigation of the increase in marks after first three assessments – it might be very explainable, considering integration of learning, student development and intervention.
2. The presence of two or fewer assessments for some courses ought to be followed up – apart from the obvious academic consideration, are changes required to data processing with SPSS?
3. Comparison with other years, especially considering the sample year contained industrial action by staff, possibly impacting on patterns.
4. Since Semester makes an impact in the model, it ought to be explored for explanation, even with the relatively small Summer School.
5. Explore the possibility of different patterns of progression during a semester as the students progress over a multi-year study programme.
6. For generalisation the range of qualifications ought to be increased in the organisation (across academic fields) and/or inter-institutional.
7. Considering the high proportion of International students as a possible significant sub-group, classifying origin for predictor is advisable.
8. Some international students already hold partial or full IT degrees, which could influence the pattern of marks, so classification might be advantageous.
9. Consideration of interventions per course taken during the semester – this might be the cause of increase of marks towards final mark.

10. Improvements to future extracts from the students database for sampling to exclude non-relevant enrolments.
11. Formally reviewing that SPSS analysis has been done satisfactorily from the perspective of statistical practice.
12. Capturing results as quickly as possible in the semester, in order to enable earlier prediction for use during planning of intervention.
13. Addressing the practice, by tutors of a few courses, to use other than percentages for some of the assessments on a course
14. Considering how to approach qualifications using competency-based instead of performance based assessments.
15. Using historical data and SPSS, performing prediction for each student and comparing to a list of "At Risk" students drafted by academic staff.
16. Reviewing assessment schedules to do and record two assessments early in the semester, in order to inform intervention decisions.
17. Building mechanisms (procedures, software, manuals, etc) to simplify data processing and interpretation for Programme Managers.
18. Exploring simpler calculations with Excel to overcome or avoid the complications of SPSS and student administration systems.
19. Literature exploration regarding influential matters from the perspective of learning in the ICT discipline.

In summary, there is a range of opportunities available for incremental refinement of the current approach. The above list is reflective of possibilities from the perspective of information systems, general and ICT-specific teaching and learning, organization development, academic management, research methodology and so on.

Conclusion

The concept of using a sophisticated statistical tool on unverified historical data in very limited time range is challenging. Data is often messier than anticipated, statistical analysis is complex and organization practices not focussed to add value. This is a good learning experience to plan more mature projects.

Statistical analysis shows that the final outcome for most students is already set by the third assessment, but that predictions after the first two assessments are premature as many students improve dramatically.

This observation of statistics and experience of the projects enables the authors to more comprehensively plan future initiatives to improve student outcomes as expected by stakeholders.

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Relevance of CCNA for students working in Industry

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Abstract
Cisco network certifications are gaining popularity among ICT students due to an increasing demand for these qualifications by industry employers. The aim of this paper is to determine how useful CCNA knowledge, skills and the qualification itself are to the ICT industry. There was a specific focus on roles relating to telecommunications/ networking. Students of a New Zealand Polytechnic working in this industry and studying CCNA were interviewed to evaluate which aspects of the course related to their employment. Data was obtained about the relevance that interviewees felt the course had for them, for new employees and for their employers. Relevant comments by participants about the course structure, course content and possible benefits to their career are also included.

Keywords
Networking, Telecommunications, Cisco, CCNA, Education

Introduction
Networking is one of the four core subject areas taught in the School of IT at the Waikato Institute of Technology (Wintec). Along with general networking modules, the four Cisco Certified Network Associate

(CCNA1 – CCNA4) modules are taught in the Bachelor of IT and in the two Diplomas in ICT (levels 5 and 6) programmes. The CCNA courses prepare students for an external exam which, when passed, gives students the CCNA qualification. The school also offers these courses to the public in the form of evening classes from 5-9pm. People working in the ICT industry have been consistently enrolling in these classes since their inception in 2001.

Preparing students for employment is an important goal of NZ Institutes of Technologies and Polytechnics (ITPs). The authors surmised that the students who also work in industry have a body of experience that could help in understanding and evaluating how well the course is aligned with industry needs. This paper investigates which aspects of the CCNA course are, and are not, used by these students in their employment. Aside from those that directly relate to their job, there may be skills and knowledge taught in CCNA that are transferable to other aspects of their work. These are also investigated.

It is possible that interview participants had previously learned some aspects covered by CCNA through on-the-job training, other courses, or work experience. These aspects are included in this research as the course is also taught to many students who have not worked in industry nor been exposed to the aforementioned training.

It is important to note that all the people interviewed were employed in Hamilton, so results are geographically localised. However, it could also be indicative of what is happening around New Zealand as 32% of those interviewed work in a major multi-national telecommunications company and there are a variety of roles included (Table 2). This research could be further extended to include people from different parts of New Zealand, or other countries, to discover whether there is a variation to the results and conclusions in this paper.

Rationale for this Study

The authors wanted to ascertain how well aligned the CCNA course is to industry needs. The curriculum course content and assessments are set by Cisco and accessed online, therefore limiting the theory and practical skills that can be taught. Despite these limits there is some flexibility, where instructors may use this research to emphasise topics that are discovered to be widely used by industry in their classes. This would be taught in conjunction with the rest of the material required for students to succeed in the course. The intention behind 'going the extra mile' in this way is to provide more awareness to full-time students of what is happening in industry and thus further help in their preparation for employment. Cisco may also find this study useful when designing the next version of the course and it may help when evaluating other general networking courses.

Literature Review

Cisco and Microsoft are considered to be industry leaders in vendor-specific ICT certification (McGill & Dixon 2004). Unlike some professions (e.g. accounting and legal), ICT does not have a profession-wide certification. However there are professional bodies (NZ Computer Society 2009, IEEE Computer society 2009) and vendor-specific certification is very highly regarded

(Jovanovic & Bentley & Stein & Nikakis 2006) by key stakeholders including; employers, educational institutes and students (Roberton & Corbett, 2004; McGill & Dixon 2004; Gutierrez & Tawa 2003).

While the authors were unable to find any research that specifically addresses the questions raised in this paper, they discovered research that discusses student feedback on the CCNA course itself (Gutierrez & Tawa 2003), as well as a wider context where views on multiple ICT certifications including CCNA were sought after (White & Carew 2006, McGill & Dixon 2004).

The work by McGill & Dixon (2004) investigates "student perceptions of the benefits and risks of having ICT certification", of which some students who participated were working in industry. Their focus is different to this paper. It also surveyed a different range of students and included several certifications.

Others highlight issues of integrating ICT certifications in tertiary education (Jovanovic, Bentley, Stein & Nikakis, 2006; Roberton & Corbett, 2004, Gutierrez & Tawa, 2003; Koxiniec & Dixon, 2002; White & Carew 2006), as well as a host of possible risks of ICT certifications. Examples are; the on-going debate about how appropriate they are for an academic environment like universities (Koxiniec & Dixon, 2002; Jovanovic, Bentley, Stein, & Nikakis, 2006; Hitchcock, 2007), and the concern about unbiased neutral groups for course design and assessment (McGill & Dixon, 2004). Despite all this, there clearly appears to be a positive movement towards including ICT certifications in tertiary education (Koxiniec & Dixon, 2002; Hitchcock, 2007; McGill & Dixon, 2004; Roberton & Corbett, 2004, White & Carew, 2006; Gutierrez & Tawa, 2003).

Effects of certification on salaries and possible advantages to potential employees are not the main focus of this paper, but are included. Interviewees are asked about career progression and their perception of benefits to potential employees.

Rajendran (2007) analysed a variety of telecommunication job advertisements and discovered that a significant number of employers indicate that it is required/beneficial for applicants to have Cisco knowledge and skills. Though not specifically mentioned in that paper, Cisco certifications were requested in many of the Cisco related job advertisements. McGill & Dixon (2004) recognise that "Certification is perceived as an important factor in achieving employment" and also notes that "increasing numbers of job advertisements specify a preference for those holding certifications." This is supported by the TechRepublic (2009) report that states: "67% of hiring managers believe that certifications impact the salaries of potential employees".

Method

Interviews were the selected tool to obtain data. Approval to proceed was first obtained from the Wintec Ethics Committee and each participant gave an informed consent. Students who matched the criteria below were identified from the school's database and two pilot interviews were conducted to ensure questions were relevant and useful.

Interviews were conducted (Oct 2009 - Feb 2010) with people who had completed CCNA3 or CCNA4 since 2006 and who were currently working in the telecommunications industry. CCNA3 was chosen as a minimum criterion for those selected for the interview because by this stage they would have been taught three quarters of the CCNA material and be in a position to relate it to their work.

During the process the authors found that interviews were an excellent tool for this study. It gave them a thorough understanding of each participant's role and tasks within their organisations. It also gave insight into their feelings and perceptions. Although the format and main questions were the same across all interviews, it was found that each interview was quite unique and needed to be slightly tailored to each participant.

Some participants changed jobs between studying for CCNA and the time of the interview. If both jobs were in the telecommunications field then each job was treated independently and two sets of data (data samples) were obtained in these cases. If the participant was working in the telecommunications industry but changed to another field, then data was collected for their telecommunications role only.

When each interview was completed, the participants were emailed the notes taken and given an opportunity to modify the recorded responses.

Results

Employers ranged from large multi-national corporations to small businesses. There were 18 participants (16 males and 2 females) and 22 data samples in total. There were 4 (22%) participants that worked in more than one role during the time when they studied the course and the interview. One participant was self-taught and all others studied for their CCNA at Wintec. There were no participants that moved out of the telecommunications field at any time. One person gained employment after they completed the course, another part way through the course and one was working part-time. Everyone else was working full-time while simultaneously studying the course. Interestingly, the participant who was self-taught was the only one observed to have needed multiple attempts at the external exam to pass.

Company	**Number of Data Samples**
A	7 (32%)
B	6 (27%)
C	3 (14%)
Other	6 (27%)

Table 1: Participant Employer Distribution

Role	**Number of Data Samples**
Network Helpdesk Officer	5
Network support Engineer	4 (2 Incident Management Specialists)
Systems Engineer	3
IT Technician	3
Systems/Network Administrator	2
Other	5

Table 2: Participant Employment Role Titles

Participants largely (73%) came from 3 companies (table 1). Seventeen (94%) had completed all four modules. Five (28%) of these had passed the external exam, 6 (33%) were planning to take it within a year, leaving 38% who had no immediate plans to attempt the exam.

Participants were asked to rank the importance of CCNA knowledge and skills in their current role on a scale of 1-5 (Not Important – Vital). The average was: 3.4. Participants were asked to rank the importance of CCNA knowledge and skills for a new employee joining their team (i.e. doing the same job) on the same scale. The average was: 3.6.

Eleven (50%) samples ranked CCNA knowledge and skills to be more important for a new employee than it was for themselves. Eight (36.4%) considered it to be of equal importance for new employees and themselves.

Fourteen (78%) of participants indicated that their management highly recommended staff to study the CCNA course, and only one (5.5%) felt that it was a requirement for some roles in their organisation.

Although not specifically asked, ten (56%) participants felt that the CCNA course is of benefit to personal career progression. i.e. helpful if they were applying for another role or moving to a different company in the future.

The course appears to cover all details relevant to Cisco devices encountered in industry. However 4 (22%) mentioned other devices (e.g. Cisco Adaptive Security Appliances 5520/5510 and Cisco Call Manager for Voice over IP*)* that are not part of the CCNA course.

Relationship between Cisco course topics and industry usage:

Table 3 indicates (in the number of data samples) which aspects of CCNA are directly used in their employment, and which were considered transferable.

CCNA Course Topic	**Directly Used**	**Transfer able**
Network Communication Principles	19 (86%)	19 (86%)
Cabling a Network	14 (64%)	19 (86%)
Design Network: Subnetting	5 (23%)	10 (45%)
Design Network: Physical Layout	5 (23%)	7 (32%)
Routing Protocols	4 (18%)	5 (23%)
Routing Table Analysis	3 (14%)	6 (27%)
Access Control Lists (ACLs)	4 (18%)	10 (45%)
Network Switch Principles: STP	8 (36%)	7 (32%)
Network Switch Principles: Port Security	9 (41%)	7 (32%)
Virtual Local Area Networks (VLANs)	8 (36%)	8 (36%)
Wireless Local Area Networks (WLANs)	7 (32%)	8 (36%)
Wide Area Networks (ISDN)	3 (14%)	4 (18%)
Wide Area Networks (Frame Relay)	2 (9%)	2 (9%)
Wide Area Networks (Point-to-Point Protocol)	3 (14%)	4(18%)

Table 3: The number of data samples for each CCNA course topic

Eight (36%) indicated that learning how to configure/program Cisco routers and switches helped when configuring equipment from other vendors, another transferable skill.

Some other vendor equipment mentioned included: Alcatel-Lucent switches/routers (28%), Juniper routers (17%) and Allied Telesyn switches (11%). There was also mention of Riverstone routers, Hewlett Plackard and Nortel switches.

As well as topics specifically included in the interview, 45% of participants added troubleshooting techniques to the list of acquired course skills used. Three (17%) also add the concept of redundancy, where one uses extra network links/components to ensure reliability.

Results Analysis

As the majority of those interviewed (94%) had completed all four CCNA modules, there is a sound comparison of industry requirements and course content. Although only a small number (28%) had actually taken the CCNA external exam, when this is combined with those that were planning to do so in the next year (giving a total of 61%), it shows that there is a desire to obtain the qualification. Many of those who were not planning to take the exam felt they just needed the knowledge and skills from the courses and would only take the exam if they were applying for another job.

As indicated in Table 3, the course topics that were most considered to be directly used in industry were; Network Communication Principles (e.g. the process of sending and receiving packets, Transmission Control Protocol, Open System Interconnection model etc) and Cabling a Network. Network Switch Principles, VLANs, WLANs and Equipment Configuration also scored highly.

The most relevant transferable skills were; Network Communication Principles and Cabling a Network. ACLs, Subnetting, WLANs and Network Switch Principles are also notable. As mentioned, troubleshooting techniques were added by participants (45%) as another transferable skill. It is suspected that if this was specifically included in all interviews, this figure may have been somewhat higher.

Participants largely (86.4%) perceived that it was of greater/equal importance for new employees to have CCNA knowledge and skills compared to themselves. This is in line with the literature, where Cisco "Certification is perceived as an important factor in achieving employment" (McGill & Dixon, 2004).

Participants, when asked about the value of CCNA for career progression, responded that they believed it was useful in their personal career, as 56% felt it was of benefit if they were to apply for another role. Many (78%) indicated that the qualification itself is not a management requirement for senior roles, but stated there was a strong recommendation by their managers for staff to study CCNA. In fact, the only person who started working part-way through the course related that one reason his new employer hired him was because he was studying towards a CCNA qualification.

Common participant sentiments are as follows. Fifty percent mentioned the hierarchical nature of their companies e.g. when Level 1 Helpdesk Officers discover network faults, they would attempt to resolve it or pass the fault on to a higher level engineer or third party vendor. It appears that the course was useful in such cases, as it gave a thorough understanding of IP networking which helped when resolving issues or when giving specific details to the higher level engineer/vendor, thus saving time and money.

Two participants (11%) worked on a mobile network, and both mentioned that they work in the same room as people from other divisions of their organisations (e.g. IP and Transport Layer Engineers). So it was useful to have knowledge of the different aspects of telecommunications provided by the course.

Two people (11%) felt the course was too long (it takes 2 years at Wintec - one semester per course) for students who also work in industry. Another stated that initially he thought it was a long course, but then realised that the length was actually perfect as it helped ensure the course material was thoroughly understood. It should be noted that those who were critical about the length of the course studied the older version of CCNA (version 3). This version requires students to complete each of the four courses consecutively. With the new 'Exploration' version, CCNA 2 and 3 can be studied simultaneously by those who wish to complete it in a shorter timeframe and are willing to undertake the higher workload. The speed of delivery was also noted as an integration issue in the literature (Koziniec & Dixon, 2002).

All participants commented positively on the course content. There was one Transport Layer Engineer who felt the course was very good, but recommends that some basics on Pleisochronous Digital Hierarchy (PDH) and Synchronous Digital Hierarchy (SDH) would be good for those working with the transport layer.

There are also specific comments of interest. One interviewee, who worked in a small business, mentioned a client who specifically asked for an engineer with Cisco certification. As there was no one at the time in the organisation that was CCNA certified, the company did not get the contract.

Literature suggests that having ICT certifications relate to salary gains, such as a higher base pay or higher average pay premium (TechRepulic, 2009; McGill & Dixon, 2004; Lamont, 2006). Yet there is no evidence of this relationship found in this study. Although 78% of participants indicated that it is highly recommended by management for employees to take the CCNA course/exam, there was only one that felt it was a requirement.

Conclusions

As a result of interviewing students who studied CCNA and also working in the ICT industry, the authors conclude that the CCNA course has a strong relevance to this industry in the Hamilton/Waikato region and is considered to be of importance to people in their career. It is also perceived to be of high value to new employees, for personal career progression and by employers. The CCNA course was highly recommended by employers rather than being a requirement.

There does appear to be a desire (61%) for people to get the CCNA certification by sitting an external exam, though few of the participants who completed all four CCNA modules (28%) went the 'extra mile' and actually took the exam. Further research could be done with a larger sample size to see the validity of this proposition.

All participants were very positive about the course structure and content. The course topics that were considered to be most directly related to their jobs were; Network Communications Principles, Cabling a Network and Troubleshooting Techniques. Network Switch Principles, VLANs and WLANs also scored highly. Network Communications Principles, Cabling a Network, ACLs, Subnetting and Equipment Configuration were considered transferable skills.

The number of transferable skills and range of knowledge identified by the participants indicates that despite the vendor-specific nature of the course, it is also sufficiently generic to be useful to those working in a variety of ICT organisations and telecommunications/ networking roles.

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Blended Learning: Lecturers have their say

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Abstract

To investigate the overall blended learning environment in a tertiary institute a revealing case study reflected student and staff perspectives on the effective blended learning environment which is increasingly influenced by e-learning and emerging technologies. This particular paper focuses on the teacher's perspective on e-learning, emerging technologies and the blended environment which most universities and tertiary institutes have now embraced to varying degrees. Qualitative data on the use of online and blended learning experiences by tertiary staff were gathered by email surveys and supplementary interviews. The study synthesised results from multiple sources within a tertiary institute and made recommendations and gave insight into optimal blended learning environments within the tertiary sector. Overall, the study provided a perspective on the psychology and strategic view of the learning environment for the future tertiary institute.

Keywords

Learning environments, blended learning, e-learning, IS education

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Introduction

All staff at the Eastern Institute of Technology (EIT), Napier, New Zealand were invited to comment verbally and by email to the research questions on the effectiveness of blended learning environments stated in this study. 35 staff out of 380 equivalent full-time staff responded with comments from a wide range of perspectives including marketing, academic, managerial and administration viewpoints. Some of the email feedback was augmented with background interviews. Interviews were held with the Academic Manager, the E-learning Advisor, the information systems (IS) Head of School responsible for a successful flexible delivery certificate programme, and a group of IS lecturers involved in a flexible mixed-mode cluster of certificates. This study on staff views was held in the period of 2006-2007, and was set in the context of a wider four year case study investigation by the author which included student quantitative and qualitative data collection within the e-learning and blended learning environments (Skelton, 2007).

Literature Review

The purpose of any educational experience should be more than delivering content and achieving formal assessment outcomes (Fraser 2001). The experience in reality today includes places (virtual and physical), laboratories, lecture theatres, tutorial rooms, offices, libraries, learning assistance centres, computer-based systems and many varieties of Internet-based learning content systems. "Teachers often speak of a classroom's climate, environment, atmosphere or ambience. They consider it to be both important in its own right and influential in terms of student learning" (Fraser 2001, p. 3). The teacher can affect the entire atmosphere of any classroom in a positive or negative manner. One special challenge for online teachers is the degree of influence they can have, within a learning management system, on the 'atmosphere' of the virtual meeting place. An additional complexity for the teacher in the blended environment is to balance the mix of timetabled campus classes and the activity online including the choice and quantity of e-learning material available on the Internet. Lecturers aim "to create a learning atmosphere that sustains motivation, promotes self-initiation and encourages collaboration" (Fetaji 2006, p. 4). A possible danger of pure online e-learning and fully flexible delivery programmes is a diminishing of the influence of the teacher or lecturer over the informal atmosphere of the learning environment. The inclusion of partially-qualified and lower-paid staff assisting in the delivery of flexible or online programmes also raises the issue of the qualified teacher being kept at arms length from the essential daily process of the learning environment. This relates to the efficiency and cost reduction business reasons at least partially driving the move to e-learning.

Research Questions

The research questions take a holistic approach to the entire learning environment in the tertiary sector which now seems to have a common approach to implementing e-learning and online courses within the overall offering of traditional and newer flexible programmes.

1. Are modern tertiary students experiencing a sense of being in a positive, encouraging learning environment? Has the recent addition of the learning management system (LMS) really enhanced the overall learning environments from the student's perspective? Previous research has provided some warnings for the losses

which may be incurred when online courses replace face to face interaction without adequate replacement for the traditional interaction. The competitive advantage of using the LMS may already be over with all tertiary institutes now utilising a web-based learning management system to some degree.

2. What elements help construct an ideal or optimal blended learning environment in a tertiary setting?

3. How can the best components of online e-learning be combined with the best components of the traditional ‘bricks and mortar’ classroom learning environments? Is there an ideal mix of the two types of environments?

4. Does e-learning in some form of implementation actually undermine or damage the ‘real-world’ learning environment? Are we simply forced by the trends and increase of Internet activity to ‘jump on board’ regardless of the cost to academic quality and sense of community?

Staff Responses

One academic with experience in setting up online and blended courses at various levels was supportive of the blended approach.

“No one ideal mix, but blended is definitely the best of both worlds allowing students flexibility but maintaining contact to prevent feelings of isolation and being "disconnected" from the learning process as many students (and lectures) feel.”

Administrators of regional centres were often in a unique position of being able to observe limited groups of students and lecturers operate in flexible delivery modes. These regional administrators were perhaps closer to the learning and teaching nexus than most managerial or administrative staff. These comments also confirm the importance of peer support while studying in flexible or online mode.

“As the Manager of a regional centre, my experience is that the students that study online need a lot of support to stay motivated. We have some that come into the Centre and work regularly with another student that is doing the same online paper. This seems to work better. Most of them say they would prefer to be in a classroom situation.”

A senior manager’s viewpoint seemed to imply that the traditional learning environment may be holding the institute back from higher enrolments and from providing for the potential students requirements. These comments may indicate a managerial viewpoint that converting more courses to a pure e-learning mode would benefit a university financially and broaden the access levels of more potential students.

“It's about helping people get the knowledge -some want to come on campus and others don't. So for those that don't, why do we insist that they come here for orientations and classes? The best of each (campus and online) will not necessarily combine - as that might not be what the students actually want. Does e-learning in some forms or implementations actually undermine or damage the ‘real-world’ learning environment? No - this sounds kind of precious -isn't learning really about ensuring that people get the knowledge - does it matter if it's delivered on line or in a classroom?”

Some teaching staff involved with online or newer flexible courses shared their knowledge of features that help with blended delivery. Discussion forums provide a medium for class participation with the advantage that students have time to consider the question and think about their answer. One lecturer discussed his/her experience with students who may be reluctant to contribute to a discussion in the classroom or lecture theatre but may be happy to join in because they feel somewhat anonymous in a discussion forum, and are more comfortable writing than speaking. However, there are some students who, due to language difficulties, or the perception that their writing skills are inferior to those of their peers, will need some encouragement to put their thoughts into writing.

One staff member involved with commercial course delivery and management had received feedback from business clients who send their staff on block courses. The business clients indicated:

"They want quick responsiveness to technical issues when engaging in the online environment. Businesses think that the online system should look slicker and more up-market – Moodle is primarily built for academics by academics. Businesses with students on online courses want more structured groups and classes in physical settings to complement the online materials."

Students sponsored by businesses appear to require structured class tutorials to support their online courses. These comments would indicate that online courses designed for students involved in the workplace cannot be left in a purely online environment.

Some lecturers reported verbally that managing the online learning environments and mentoring remote individual students can take more time and resources per student than a standard class of on-campus students. An example was given of one remote student in another city who required special assessment locations and invigilators, and special tutor assistance which utilised at least one lecturer for several hours each week. These sorts of examples helped illustrate that institutions must sometimes absorb uneconomic enrolments in an overall programme which includes online, flexible or distance students. Some lecturers felt strongly that the personal contact by students with other students is often a strongly motivational factor in the enjoyment of any course. They also pointed out that institutes cannot assume that fluent use of computers by students and full access to broadband Internet exists in all homes (currently 84% saturation of NZ households, 2008).

"I feel that many people enjoy the people contact in education, and would not choose a purely online environment. However some people like the flexibility of pure online learning which allows them to work around work, family etc commitments or because they are not very mobile (e.g. older people, people in wheelchairs etc). Pure online learning can also be easier for people coming back to study - several people have told me that enrolling at a tertiary institute is quite scary."

Blended Learning Supported by Staff

The blended approach appeared to be widely supported by most academic staff. However, there was no particular consensus on how this could be defined, or indeed whether an ideal blended prescription could ever be defined given the wide range of learners and breadth of programmes. This respondent also included a warning about implementing e-learning courses too quickly without adequate academic training, and raised the issue of retaining a unique set of knowledge.

"I think blended learning can be valuable in many ways. One is to encourage independent study. Rather than the lecturer presenting information, learners can be tasked with investigating topics. It is also easier to create learner activities."

Some academics were supportive of a blended approach to learning environments but saw the need for adaptability of the learning environment according to the type of learner and the type of course. The adaptability of the e-learning environment was also mentioned by academic staff where the scaffolding and depth of material can be changed automatically according to the usage of the student. This is one clear advantage of e-learning compared with traditional classroom settings. One lecturer also saw the role of the lecturer or teacher as the custodian safeguarding the academic quality regardless of the type of learning environment.

"I see a working combination of e-learning and the classical classroom approach, where the classroom approach typically 'teases' the student to find his way in the e-learning environment. The Internet is indeed a trend, and still arises in all aspects. E-learning might be something that goes with the flow without a firm argument if you just take into account to succeed at the exams. In real-life one encounters the Internet. In real-life one has to be able to do some sort of e-learning just to keep up with the pace of progress in technology. So, I'd say, e-learning is not just potentially an efficient environment to reach more students, but also a necessary preparation to succeed in real-life careers. But to safe-guard academic qualities and sense of community I see a clear role for the tutor. It's exactly what a tutor needs to guide and verify."

Another academic staff member considered the modelling of usage of the blended environment by the lecturer as a critical success factor for students observing:

"Is there an ideal mix of the two types of environments? Again it depends on the level of integration wanted. Does e-learning in some forms or implementations actually undermine or damage the 'real-world' learning environment? Students can access material online and avoid coming to class as it is online anyway."

Staff were also aware of the potential resistance amongst non-IT teaching staff who may be mandated by the administration to launch online courses or move their courses into a more blended mode. This raises the issue that if a recommended blended learning environment was defined, the implementation of this may require additional time and training for all staff.

"Mandating a minimum level of activity in a blended learning environment is ok. Insisting that everyone have everything online is doomed to failure through lecturer resistance. However a sense of community can be enhanced."

Some staff have experience with flexible delivery courses that also attempt to provide a 'smorgasbord' of different ways of accessing materials whether by CD-ROM, printed workbook, Moodle website, drop-in classrooms, together with a number of other mixed options. These courses are not primarily online e-learning courses.

“For me the ideal would be to offer the flexibility of online learning but have more regular on-campus workshops for those students that need the f2f contact. Everything done in a f2f class can be done online as well and sometimes in a better way. So, in combining the two.”

Most staff did not believe that e-learning in some forms or implementations undermined or damaged the ‘real-world’ learning environment. They mentioned examples where students had thrived in the online environment.

“I don't think it does and I think the flexibility of online learning has opened pathways for many students who are too shy to speak up in class, as suddenly with online learning they get to have their say as well without others being present to "judge". In my experience I have found a greater sense of community in the online groups than some of the face to face classes. But, as with face to face classes, a lot depends on the personality of the tutor.”

Once again, another lecturer reinforced the view that a fixed ideal mix of the online and class environments may not be achievable. However, if the two environments were considered in the development of teaching materials then a better integration can take place.

“The mix will vary depending on the type of course and the learning styles of the students. I do not believe there is such a thing as an ideal mix. The two environments should not be developed separately; the e-learning materials and traditional materials must be considered together as important components of the learning experience.”

Another repeated reflection from active teaching staff was that in their recent experience some students were attending fewer classes due to available materials online.

“If online materials duplicate the traditional materials students often stop attending class and this can give students the impression that attendance is not necessary.”

A non-teaching staff member with a strong interaction role with external organisations implied some resistance from teaching staff with the comments:

“We have to 'jump on board' with the internet and e-learning. We talk about 'lifelong learning', well that applies to teaching staff as well as students! I know that many teachers are 'fearful' of the power of the internet but I think that is because they don't understand its capabilities. We should all be learning new ways to teach more effectively and if that involves using the internet then 'bring it on'. I don't think that this needs to be at the cost of academic quality or the sense of community - it's more of a challenge for teaching staff to be creative about how they use it and how they monitor the use.”

One staff member felt that the practical considerations of the effects of online learning were as important as the pedagogical aspects. The teaching load is often measured by the number of timetabled hours in a semester. As this teacher pointed out, that measurement technique may no longer be a fair assessment of teaching workload in the mixed-mode environment.

"Clear timetable of both in-class and online activities is needed for clarification to student and to staff. Step by step introduction to the technology - demonstrated, written, and practiced. i.e. accessible to learners at any time. Clear ground rules and realistic expectations for online participation and contribution High value placed on relationship with learner and the collective of learners both in-class and online. There needs to be regular contact by facilitator/tutor in online environment. Online and class-based activities are participatory and contribute to a collaborative learning environment."

The insight required by the online teaching staff was also acknowledged by one respondent, as well as the potential for students to be contributing to the course knowledge and assessment framework. Training for staff was also seen as essential for the success of new programmes that include online learning. Staff also acknowledged that under some conditions staff themselves could be resistant to engaging with the e-learning environment. If the environment is driven from senior management rather than grown 'organically' then the institute may not achieve optimal results.

Flexibility of Approach and Delivery Important

Another opinion from an academic covered the threat of the costs of top-down driven e-learning causing teachers to be forced to deliver online or blended programmes without the relevant theory, skills and experience, to the detriment of the learning experience. Transitioning from in-class to a blended learning environment should not be assumed to be natural or easy (Duebal 2003). It requires existing teaching skills to be utilised in a very different context, and the transition can be enhanced through training, peer support and other techniques. Top-down driven e-learning may foster teacher resistance to engaging with the environment in positive and exciting ways to add to learning opportunities. Respondents also considered that the academic level of the programme should be an influence on the weighting of online e-learning versus on-campus or traditional materials. In fact, the lower level certificate courses appear to favour a more traditional structure with workbooks (paper-based) and more hands-on materials than Internet-based materials.

At foundation course level I think that it is critical not to overdo the online 'stuff' at the expense of the development of basic study skills and interpersonal skills. Blended learning which creates an environment which really makes learning more accessible for all students is the only valuable option. Where accessibility, for some, comes at the expense of the majority of learners then it may be that the more appropriate (and flexible) approach is to provide a fully online learning environment for those unable to access class based learning and to build a class-based environment which incorporates e-learning at an appropriate level for the other group.

One Head of School felt that labelling a course as “online” may not always be helpful to the students. Students may wish to enrol in a particular course and then decide upon which delivery options are most suitable for them.

The mix of blended learning environments should be adaptable to the learning style of the student. The use of the word “online” tends to stereotype the course which can be off-putting to teachers involved and also students. Sometimes we find that students wish to enrol as a traditional campus student but reserve the right to invoke flexible, online or workbook-delivered learning environments after the initial enrolment.

Some practical courses (for example, computing or carpentry) will probably always require a minimum of campus based activities.

The flexible and blended courses must compromise some things, for example, the access to software applications, laboratory facilities and still need a physical resource for assessments.

From a management viewpoint, it can be difficult to prove that all students have been learning and undertaking the course apart from the assessment results. This is an issue with institutes and universities required to report to the government on the numbers of bona fide students actually enrolled, current and engaged in the course.

It can be difficult to measure the level of ‘engagement’ within a blended environment as attendance no longer is required necessarily. The number of ‘contacts’ may help e.g. phone calls, emails, use of drop-in classes, and assessment performance, but these may not equate with the normal scanning and interaction that takes place in a classroom-based course.

Commercial providers of online systems often provide a web-based and/or DVD learning environment but assessment for industry certification is undertaken independently by another company. Therefore, as long as the student makes maximum use of the resources and achieves a successful result on an external test the student and original provider are satisfied regardless of the learning style or type of usage of parts of the learning environment. Another staff member asked whether our campus will become just a place for students to plug in their laptops? At the lower levels students need to learn from other students – we may lose this in a pure online environment. Pure online courses can actually be less efficient than traditional campus classes in terms of economies of scale and number of tutor hours required to complete one cohort of students from start to finish. One team at EIT has pioneered new flexible National Certificate of Computing Level 2 (NCC2) and NCC3 programmes, providing workbooks, CD and bag, some online material together with drop-in computer classrooms with tutors. Assessment is performed on campus and through online evidence. This flexible-delivered programme has been very successful but is not dependant on online e-learning but rather a mixture of traditional resources, email contact, and the ability to work from home, work or on-campus. An interesting outcome has also been the new teaching environment of the lecturers involved

– most of the contact is by email or phone, with assessment verification also an integral part. The drop-in classes are mainly staffed by tutorial assistants rather than fully qualified lecturers. This example of the ideal blended environment has been successful in terms of student numbers and course satisfaction.

One academic with significant experience in developing and managing online courses had some warnings for institutes and universities.

In the race to get courses online many organisations are neglecting those aspects of course design and development that may be the pivotal factors in retaining students and ensuring their success. Lecturers and course designers (often one and the same), need training in both the pedagogical requirements of online learners and the technology skills to provide a seamless learning environment. They also need an allocation of time for course development and support of their students.

One staff member believed that there are lessons that can be learned from the environmental ways in which students learn outside of the structured teaching delivery and assessment methodology. This opinion illustrated the widespread belief in the powerful effect of the learning environment in general.

Students 'soak knowledge in' from the example of teachers, the lecturer's personality, values etc. Students also benefit from talk and conversation – "as you walk around" doing daily tasks in the presence of the class and students. Also the general environment is important: the physical landscape, buildings, use of music, books, journals, and that feeling of general absorption. So official curriculum content may not be as persuasive as person-to-person content. How can these types of environmental and emotional experiences be incorporated into an online or blended learning environment? It will be a challenge, but I feel that we still need the personality of the teacher to be able to shine through. If we lose the personal influence of academics we run the danger of becoming a faceless institution driven by policy and procedures. The quality of the student experience remains an important aspect of our institutions (Corder, Horsburgh & Melrose, 1999).

Other examples of lecturers utilising features of the Moodle e-learning system include the use of online discussion forums encouraging students to participate in class discussions online. Some lecturers are beginning to provide incentives for student participation by making the forum comments contribute to assessment for the subject. This also allows students who may be reluctant to verbally participate in class to use the discussion board as a backup mechanism.

Conclusion

Examples of Moodle usage were cited by staff and various lecturers at EIT utilising the online e-learning software in diverse ways. Not only may they be different in depth of utilisation but the creative expressions within the online framework may also be reflective of the personal styles of individual lecturers. For example, some lecturers are still avoiding placing any course material on the LMS however this is becoming less likely due to most Faculties now requiring lecturers to display the course outline and skeleton lectures as a minimum requirement. A second group of lecturers includes those who are now placing the minimum material on the LMS such as course outline, welcome and some lecture notes while still delivering a 'bricks and mortar' course. An emerging third group of lecturers comprises those who are currently adding a good range of materials on the LMS (PowerPoint lectures, lab sheets, tutorials, course outline and weekly commentary). A fourth group of lecturers have now progressed beyond course material placement and are now experimenting with interactive quizzes, chat and discussion forums, wikis and other Web 2.0 technologies. Also there is some evidence that this fourth group is changing some of their timetabled teaching rooms to better complement their online activities. A final small group of academic staff are now directly involved with some emerging purely online courses where their entire teaching interface is through an online mechanism. The third and fourth groups of academic staff are probably not acting under compulsion from their managers but rather are seeing the blended learning environment as an opportunity to improve their teaching, improve their student satisfaction, and create a richer learning environment overall for their students. Hennessey and Deaney (2004) confirm that teachers' confidence plays an important part in influencing their uptake of information technology and multimedia usage within their programmes. Tertiary teachers and lecturers will hold a wide range of pedagogical beliefs, IT skills and general confidence with new teaching techniques viewed as particularly influential (Mumtaz 2000).

Tertiary teachers and lecturers may therefore be placed on a gradient of mature utilisation of online e-learning environments. This aligns with Young's' e-learning maturity model (Young, 2001). Some lecturers are taking advantage of e-learning training opportunities, are open to change and are confident enough of their fundamental professional teaching abilities that they are prepared to experiment (and perhaps risk failure in some sessions and e-learning features). Dawes (2001) confirms this observation of how academic staff develop professional expertise in emerging technologies and how their motivation helps them to evolve from being potential users through the stages of 'participant', 'involved' and 'adept', through to 'integral users' ultimately. This study has already mentioned the potential disintermediation of the teacher within the online e-learning or blended learning environment (Downes 2006). Another developing area on the wider Internet arena is the growth of holistic and commercial content providers which may also disintermediate entire tertiary institutions (Clear, 2002). The use of Internet search engines and the phenomenal growth of user-edited dictionaries and resources modelled on Wikipedia has seen the rise of information and knowledge which is outside the direct control of the teacher or institute. The growth of certification courses provided by commercial companies with a higher level professional appearance and incorporating instructional design also generally surpasses the presentational quality of material provided by the average university or tertiary provider.

Academic staff were generally positive about the emerging presence of the online learning environment, and were also supportive of the concept of a balanced blended environment. The balanced blended environment was supported particularly by those staff who defended the pedagogical need for on-campus real world learning experiences by students.

Managerial and non-academic staff at EIT also expressed strong opinions on the need for progressing with online initiatives but reflected on some concerns with some academic staff who appeared to be resistant to the emerging online learning environment.

In conclusion, this paper investigating tertiary staff feedback has illustrated the wide range of opinions and levels of blended learning utilization within one university or polytechnic. This would also suggest a wide mix of blended learning environments across several universities and this would provide a wider scope for further research in this area. Looking forward, the information systems community has an opportunity to influence schools, universities and tertiary institutes to successfully integrate e-learning and emerging technologies to continually re-create a blended learning environment which adapts but does not damage the main channels of operation.

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The Changing Role of E-Commerce in Regional SMEs

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Abstract

This article examines the penetration of e-commerce within the strategic marketing mix of small to medium enterprises (SMEs) in Napier, New Zealand. A sample group of thirty businesses of various types was selected in Napier with a sixty percent response rate. It seeks to ascertain the level of e-commerce penetration into those businesses using the internet, those with websites of their own or industry supported, those involved with purchasing and selling online. Frequency of update, plans for future involvement and the percentage of e-commerce used for marketing was also examined.

A review of strategic marketing and e-business literature was conducted. This tied in with current NZ governmental proposals and actions to increase high speed broadband internet for business use to twenty-five major regions, including Napier.

It was established that the percentage of SMEs utilising e-marketing had increased since a previous study in 2003. However, despite the increase, the utilisation percentage appeared to remain low compared with other countries and NZ regions. Answers were sought as to why and what the future holds for e-commerce growth.

Keywords

E-Commerce, small and medium sized enterprises (SMEs), website marketing

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Introduction

This article investigates the level of e-commerce penetration in a range of businesses in Napier, New Zealand. Earlier studies have shown that e-commerce has been slow to become a strategic marketing tool of choice among small to medium enterprises (SMEs) in Taradale, a suburb of the Napier region (Skelton & McLay, 2003). This 2003 study showed that only 29% of retail businesses in Taradale indicated they had a website and only 4% allowed purchasing online. Other studies in the United Kingdom and New Zealand have shown relatively low SME uptake of e-business also (Levy, Powell & Worrell, 2005).

The aim of this research was to find out from a range of industries within Napier in 2009 whether e-commerce usage features more strongly in the strategic marketing plans of companies some five years after the earlier studies.

The paper provides a brief academic assessment of e-commerce and how it fits into SME's strategic marketing plans. The relationship between the two is investigated with a view to extract best practice usage. This is backed up through a literature review and the use of a telephone survey questionnaire. The questionnaire is compiled using both quantitative and qualitative research methods. The research methodology has targeted eighteen selected Napier businesses that fit the SME category. These SMEs by definition comprise 19 or fewer employees.

Literature Review

The development of the Internet and e-commerce has introduced radical changes in approaches to strategic marketing. As Wilson & Gilligan (2005) suggest, this includes changes to the rules of marketing, available market space and competitive advantage. A useful model put forward by Wilson & Gilligan (2005) about e-marketing shows the development of strategic thinking and competitive advantage as companies evolve in their internet marketing promotional experience. A four stage continuum is introduced. Companies move from being stage 1 unfocused dabblers with no strategic rationale, to stage 2 good housekeepers, applying e-marketing to the traditional marketing mix. Stage 3 sees more revolutionary type thinking with online shopping providing a virtual market place for tailored products to suit data based profiles of customers. The ultimate achievement according to Wilson & Gilligan (2005) is the stage 4 integrated e-marketing strategist company. Here, competitive advantage is leveraged by targeting unmet customer needs and new areas such as brand stretching opportunities are worked on.

A recent paradigm has emerged where one way push interruption marketing is giving way to permission marketing with trust based relationships being built around flexible offers , focused on specific needs of the customers, identified through permitted dialogue between buyer and seller (Godin, 1999, 2010). Initial contact of these leads can come about through placing "intelligent advertisements" (based on defined keywords) on search engines such as Google which can help attract customers who are actively searching for the types of products the SME offers (Sullivan, 2009).

The potential customer can be more discerning as he has access to many offers over the internet, while the need to respond in real time if possible becomes the challenge for the business making offers over the internet. So, while the market has opened up and expanded in reach, it has become more competitive and businesses of all sizes need to utilise the opportunities while avoiding the pitfalls.

The Henley centre (2000) has suggested that not all business to consumer (B2C) and business to business (B2B) customers view the internet and e-marketing in the same way and to this end they have identified six principal consumer segments and ranked these in order of interest in online shopping. From highest to lowest potential are convenience copers, experimenters, value shoppers (also known as mercenaries), ethical shoppers, habit die-hards and, at the lowest end, social shoppers who want physical interaction. If a business has a bricks and mortar component then the internet based presence can serve to make potential customers aware of the SME's physical existence and they can then come in to the shop as social customers.

Jelassi (2008) has commented that businesses need to be aware of potential channel conflicts where offering products horizontally, both online and in-store, can have a cannibalising effect. At times, offering certain lines only online can produce a vertically integrated channel which can help expand sales in the online area and have the effect of the online consumers trying the bricks and mortar offering as well.

Market Opportunities

The OECD Community Survey on ICT Usage in Households and by Individuals (April 2007) indicated households in New Zealand with access to a home computer increased by 25 percentage points to 71.6 percent from 2001 to 2006. In addition, nearly two-thirds of households (64.5 percent or 1 million) had access to the Internet at home. Data from the 2001 Census indicated that 37 percent of households had access to the Internet in 2001. However, the Household Use of Information and Communication Technology (ICT) Survey (2006), also points to the Gisborne and Hawkes Bay region as the area with the lowest proportion of households with Internet access at 54.1. The survey goes on to point out that over one quarter (28.6 percent) of all individuals made at least one online purchase in the previous 12 months, to the December quarter 2006. The 25 to 44 year age group were the most likely to make an online purchase, with 38.9 percent of individuals in this age group doing so. 30.8% of individuals have purchased goods or services and this was listed as their fourth most important activity behind email, banking and interaction with public authorities.

These figures point towards a healthy interest in internet usage and online purchasing which has increased in the last three years, so the opportunities are there both nationwide and in the city of Napier for SMEs to make strategic gains from having a website and online sales opportunities.

The 2006 business survey of the NZ ICT commission clearly shows larger businesses with 100 employees or more have a more active web presence than SMEs. However, the use of the Internet by NZ SMEs is climbing and in general by 2006 had surpassed larger business usage in the 2001 survey. The expansion of internet usage is increasing across the board. For example, using data issued by the UK Office for National Statistics (ONS) Internet sales by UK businesses rose to £163bn in 2007and are expected to triple from current levels by 2011. This has given rise to recent economic analysis which suggests having an online presence could be the key to driving consumer spending for small retailers (Howes, 2008).

Fifty-one percent of all sized NZ businesses indicated in 2006 that they had a website compared to 45% of NZ SMEs. The most common website feature was goods and services information (91 percent). Customer information collection was next (32 percent), followed by ordering of goods and services (28 percent).

Business to Business Opportunities

In the 2006 survey, fifty-four percent of NZ businesses indicated they used the Internet for purchases, and for SMEs the figure was 50 percent.

Chris Little, managing director of Premierline Direct, said: “The growth of the internet has really made products and services more accessible to business owners and is an ideal tool for companies looking to make time and cost savings by shopping around for the best deals, whilst also benefiting from the speed and simplicity the online channel offers” (Little, 2007).

The larger businesses were more likely to use an online facility to receive orders. For example, 21 percent of businesses with 6–19 employees indicated they used an online facility, compared with 43 percent of businesses with 100 or more employees. Overall 34 percent of businesses reported they used the Internet to receive orders for goods or services.

Government Policy

The New Zealand Government is promising its’ $3 billion broadband plan will deliver "quantum faster" internet speeds for Kiwis. Communications and Information Technology Minister Steven Joyce said “a new Crown-owned company will work with private sector partners as a key part of its plan to deliver ultra-fast broadband to 75 per cent of New Zealanders' homes, workplaces and places of study within ten years” (Joyce, 2009). The NZ Government has committed up to $1.5 billion of taxpayers' money for the roll-out and expected that to be at least matched by the private sector. The National Government with Prime Minister, John Key, has initiated and supported this project and expects the move to bring New Zealand into the 21st century, enabling it to compete with countries such as Korea, Singapore and Hong Kong. "We are a small country, we are a long way away and if we want to connect with the world in the cheapest, most efficient way possible, we have to have world-class broadband capability” (Joyce, 2009). Twenty-five towns and cities are covered by the initiative including Napier.

Research Method

This research involved the use of structured questions with predetermined response options (closed) followed by a qualitative response option inviting respondents to discuss new initiatives planned regarding e-marketing.

A carefully selected cross-section of organizations in Napier was chosen. Thirty Napier businesses across fifteen diverse business sectors were contacted by telephone and eighteen responses were obtained via a telephone survey. The SMEs taking part in the survey were represented by twelve owner/operators and six employees with knowledge of the company’s internet involvement.

1	Do you have 19 or fewer employees?
2	Do you have business internet access and e-mail?
3	Do you make purchases for your business on the internet?
4	Does your company have its own website? – Stand- alone or industry related?
5	How often is your website updated?
6	Can people purchase products or services direct from your website?
7	What % of your marketing $ are spent on e-marketing?
8	What new initiatives regarding e-marketing are planned – Open ended.

Table 1: Survey Questions

Results

From the data collected, the sample population was placed into eleven industry type categories. The number of businesses who have internet access and email showed 89% coverage by Napier businesses sampled. Two thirds of businesses sampled make internet purchases but only 22% make online internet sales. Half of the businesses had their own websites and a further 22% had a web presence on an Industry link. An interesting finding included the average percentage spend on internet marketing to market spend overall was relatively low at 11.69%; however tourism, and accommodation spent 30% of their budget on e-marketing while computer and accounting firms spent 20%. Specialist retailers only came in at 11%. This was the average of all companies spend.

Discussion

While the literature recommends internet and e-commerce use and emphasises e-tailing as a growth area, this was not shown in the survey. Napier Retailers surveyed are only spending on average 11% of their marketing budget on e-marketing. This is the same average spend as other SME types surveyed.

The availability of e-commerce online payment for e-tail products is very low. Table 2 shows that Napier companies are offering their products in a blended e-commerce environment as discussed in the literature review, are early adopters positioned as good housekeepers but moving towards the revolutionary level of the model discussed. Those who do are currently receiving customer service awards for their efforts. One company surveyed, won the Napier CBD Customer Services award for retailers 2009 as their bricks and clicks combination offering of customised jewellery and accessories provided a winning combination.

The bookstore surveyed aligns itself with the idea mentioned by Jelassi (2005) of a vertically integrated offering where the retail store offers the majority of book lines and the online offering is an exclusive speciality line.

Industry Type	Internet / email	Internet purchases	Web page on Industry link	Own website	Internet Sales	% Internet spend
Tours (2)	2	2	0	2	0	27.5%
Accommodation (1)	1	1	0	1	1	33%
Books(1)	1	1	0	0	0	2.5%
Accounting(2)	2	2	0	2	2	17.5%
Computers(1)	1	1	0	1	0	20%
Automotive(2)	2	1	1	0	0	2.5%
Specialist Retail(5)	5	3	1	3	1	11%
Music(1)	1	1	1	0	0	2.5%
Lawnmowers(1)	0	0	0	0	0	0
Appliances(1)	0	0	0	0	0	0
Curtains(1)	1	0	1	0	0	2.5%
Total(18)	**16**	**12**	**4**	**9**	**4**	
Average (weighted)	**89%**	**67%**	**22%**	**50%**	**22%**	**11.69%**

Table 2: E-commerce Penetration

Feedback from the survey showed that although over 65% of firms had some web presence, they were not diligent in updating their websites or responding in real time as the literature recommends. In addition, these firms that put out information about products and services were not carefully appealing to consumer market segments but offering what they had to all. They were not interrupting with their style of marketing and were moving to permission style marketing as they were responding to customers who sought them out.

Conclusions and Recommendations

E-commerce literature was reviewed regarding the incorporation of e-commerce into the strategic marketing mix. A survey was conducted to gain insight into the use of the internet and e-commerce among a selected cross-section of organizations. Thirty Napier companies with 19 or fewer employees were contacted (SME's) and eighteen respondents provided relevant, up to date information.

Findings showed an increase in the use of the internet by Napier SMEs and consumer households (customers) over the 2006 National Survey results and other earlier research.

The new government initiative for faster internet is targeted to businesses & Napier is included in the first rollout. This means excellent opportunities for further online expansion.

It appears that e-commerce penetration in SMEs in Napier is relatively modest possibly because of a perception by businesses that the internet marketing spend needs to be contained in relation to the overall marketing spend. There is a need for a better understanding of potential e-business benefits, quick response to customer and competitor practices and a development of staff skills and knowledge of internet based technologies.

SMEs may benefit from a customer records database where they can be easily managed for online marketing. This database can be the start of true customer relationship marketing (CRM) material providing regular electronic mail out newsletters. This will help the SME make offers tailored to the individual needs of the customers.

The surveyed SMEs are taking a close look at social networking sites. One book store puts product on the market via a vertical integration channel strategy which sees the books on offer varying from those in the bricks and mortar store.

Some companies have enrolled with Google Advice and are looking at ways to improve their search engine results and this search engine optimization is an ongoing issue for SMEs involved in e-commerce.

The companies surveyed that used e-commerce the most provided an online sales option and communicated to the customers via the traditional marketing mix approach. These four companies have reached the stage 2 'good housekeepers level' as per the Wilson & Gilligan (2005) model. Closest to the revolutionary 'type three level' would be the company who links their site to industry review sites and actively reads these reviews and replies to them. As the SME owner commented, a positive reply to a negative comment can completely turn the situation in the firms' favour.

The surveyed SME's are part of a trend to leverage off industry efforts and get their first internet presence via a listing of their peers. This can be a good start it may be recommended from this study that SMEs take the next step and work with professionals to produce their own website offerings which combined with up to date information systems and updated customer data base relationship management packages will enable them to reach the third level of our model- customer profile offers. One company surveyed has identified that customers have a product buying cycle and this knowledge can be used to target sales. For several companies a goal was the implementation of an online booking system. The idea of online payment options via credit card still had some SMEs concerned about security issues and the hassle of refunding if they paid in this way.

Another area recommended for SMEs is that if they offer products online they do not hold large inventories of stock but have the ability to order stock in a just-in-time fashion. An area that interested some SME's was the idea of a virtual interactive display room which would be a good way for a potential customer to view a backpacker establishment or other products. Other

SMEs felt that they would rather have the customer come in for viewing as with the customer physically across from them, they felt they had an increased chance of completing a sale. Small businesses with no Internet presence cited no room for expansion on their existing customer base. However, it is recommended that all SMEs get a presence as competition can cause customers to move and there is no room for complacency.

The research project has shown that more SMEs are getting involved with stage 1 and 2 e-commerce and planning ways to step into customer profiling and full integration.

Future studies could look at ideas touched on here, to explore and expand the role of e-commerce in SMEs in regional centres including the potential for gaining markets through social networking integration, the introduction of virtual display rooms and overcoming the reticence that still exists to utilize online payment.

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First Year Programming: Using Competition for Motivation

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Abstract

This paper explores the use of an optional programming competition as motivation for first year programming students through examination of a case study. The case study involved monitoring student interest and involvement in an optional programming competition that was introduced to students at the start of the semester. Students were surveyed at the beginning and at the end of the semester with the results being compared with the actual number of competition participants. The study found that although student interest was initially very high, actual participation was much lower with students commonly citing time constraints and a lack of inspiration as reasons for not submitting competition entries. Although final submissions were lower than expected, the overall experience was found to be positive, and also provided additional beneficial from a lecturer's perspective.

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Keywords

Programming, competition

Introduction

The motivation of first year programming students on IT related degrees often rests at varying levels. Experience has shown, and research agrees that enrolled students come from a variety of backgrounds with varying levels of programming knowledge (Roberts, 2000) (Ladd & Harcourt, 2005). At one end of the spectrum are students with minimal programming knowledge who can often find the course content very challenging. At the other end of the spectrum are students with extensive programming knowledge who can find themselves unchallenged and even bored by the course content (Roberts, 2000), which can result in lowered motivation (Race, 2001). Coupled with this wide spectrum of student abilities, programming is often gets a bad rap as a 'boring' subject (Jenkins, 2002). From a lecturer's perspective, it can become a difficult task managing and motivating such a wide range of abilities (Ramsden, 1992). Time must be spent teaching the core group of students and helping those who are struggling. But at the same time, the top students need to be occupied and encouraged to further their programming skills. It is the motivation of these top students which forms the focus of this paper.

Previous research has suggested that using an optional programming competition is a good way to engage, challenge and occupy top students in first year programming courses (Roberts, 2000; Ladd & Harcourt, 2005). This paper presents the results of a case study that introduced an optional programming competition to UCOL's first year programming paper. The paper will proceed by detailing the how the competition was introduced and how student interests and opinions were gauged, next the results of the experience will be present, and finally conclusions about the case study will be given.

Approach

D101 Software Development ran during the second semester of 2009 for 16 weeks, and had a total of 60 students who engaged for the duration of the semester. The paper consisted of four summative assessments:

- Theory Test – 20%
- Assignment – 30%
- Practical Test – 20%
- Final Exam – 30%

The optional programming competition was introduced to the class during the first lecture of the semester. The competition was open to any type of program so long as it was original and written using the C# programming language. The slide shown in figure 1 was used to introduce the competition.

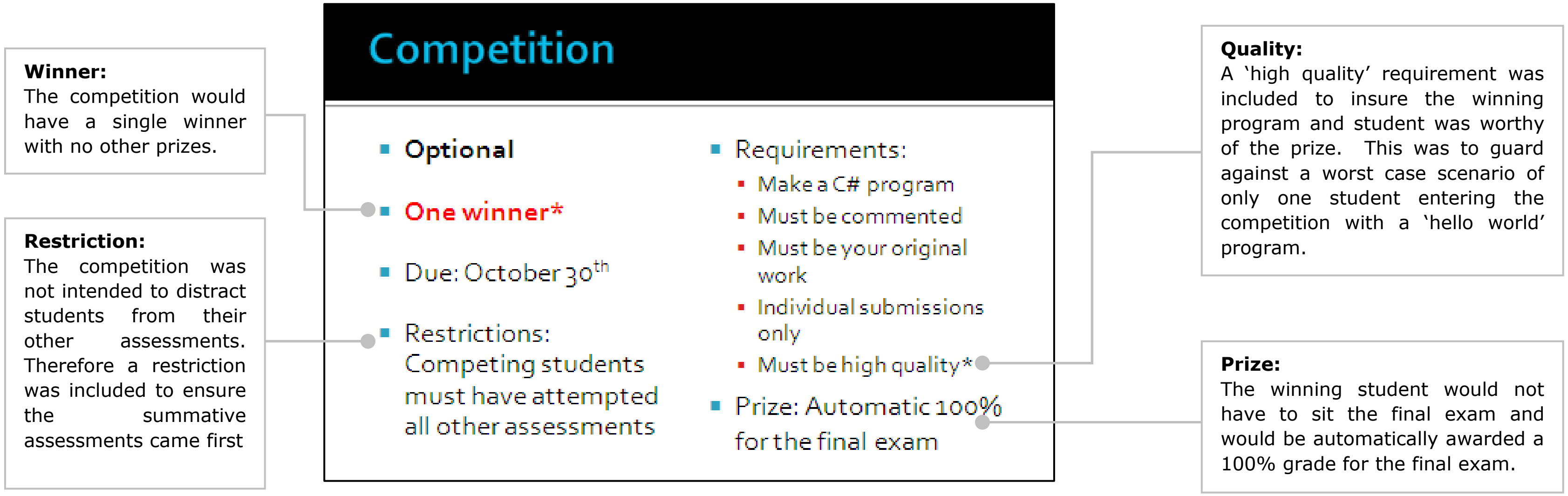

Figure 1. Competition introduction slide

After introducing the competition, the students were anonymously surveyed during week 3 to gauge interest. Figure 2 shows the survey used, the results of the survey are presented in the next section.

D101 Competition:

Are you planning to enter? (circle one)

Yes Probably Possibly No

Comments:

____

____

____

Figure 2. Initial survey given in week 3

Did you enter the competition? Yes No

If you didn't, why?

- I started, but didn't finish
- I couldn't think of an idea
- I didn't have enough time
- Other:________________________

____

____

Figure 3. Survey given after the competition closed

Throughout the semester students were reminded and encouraged to participate in the competition during lecturers and practicals. After the competition closed the students were again anonymously surveyed primarily to ascertain reasons for why they did not participate. Figure 3 shows the survey used.

Finally, survey results were compiled and analyzed in light of the actual number of submissions and the experience as a whole was reflected upon. The next section presents these results.

Results

Figure 4 shows the results of the initial survey given in week 3. The initial survey was given in class with 59 students participating.

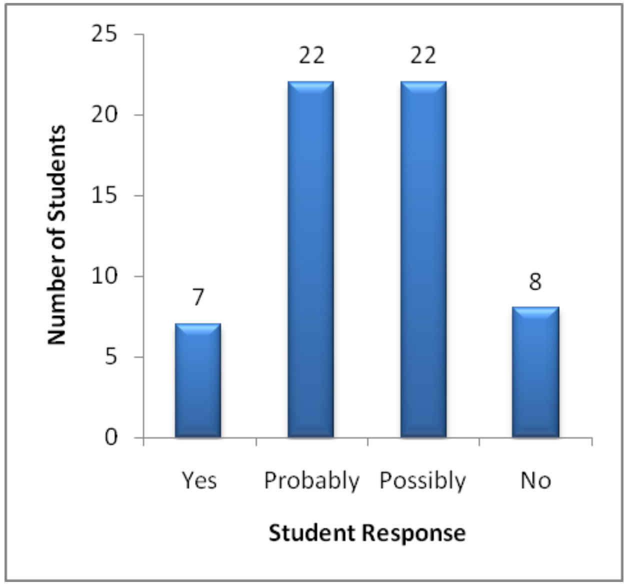

Figure 4. Student responses to initial competition survey

The results of the initial survey indicated a high amount of interest among the students surveyed with only eight students (13%) responding with a definite no. The results also show that almost half of the class (49%) was either planning or probably planning to enter the competition. Of the students who made comments, eight focused on needing to think of an idea first, and ten focused on not having enough confidence or skills necessary to compete.

Figure 5 shows the number of students who actually submitted competition entries compared to those who didn't (the total number of students is based on the number of students still engaging by the end of the course).

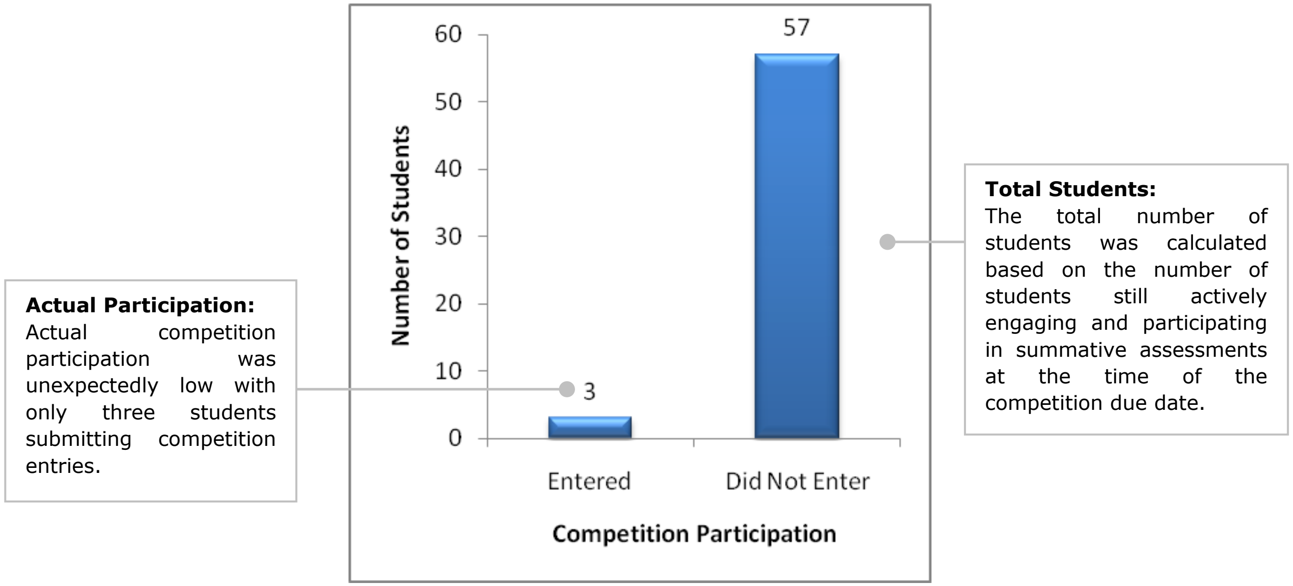

Figure 5. Actual Competition Participation

Figure 5 clearly shows that the rate of actual competition participation was much lower than what could reasonably be expected given the initial survey results. The initial survey indicated that 49% of the students were either planning, or were probably planning to enter the competition, compared with an actual participation rate of 5%.

Figure 6 shows the results of the survey given after the closing of the competition. Figure 6 gives some insight into why the actual competition participation rate was so much lower than what was expected. Figure 6 shows that eight students (15% of those surveyed) began work on competition entries but did not finish. In addition, Figure 6 also shows that 20 students

(38%) cited not being able to think of an idea as the reason for not participating. Students who gave different reasons (i.e. students in the 'other' category) commonly cited a lack of knowledge for not participating (7 of the 12). The remaining 13 students indicated a lack of time as their reason for not participating in the competition.

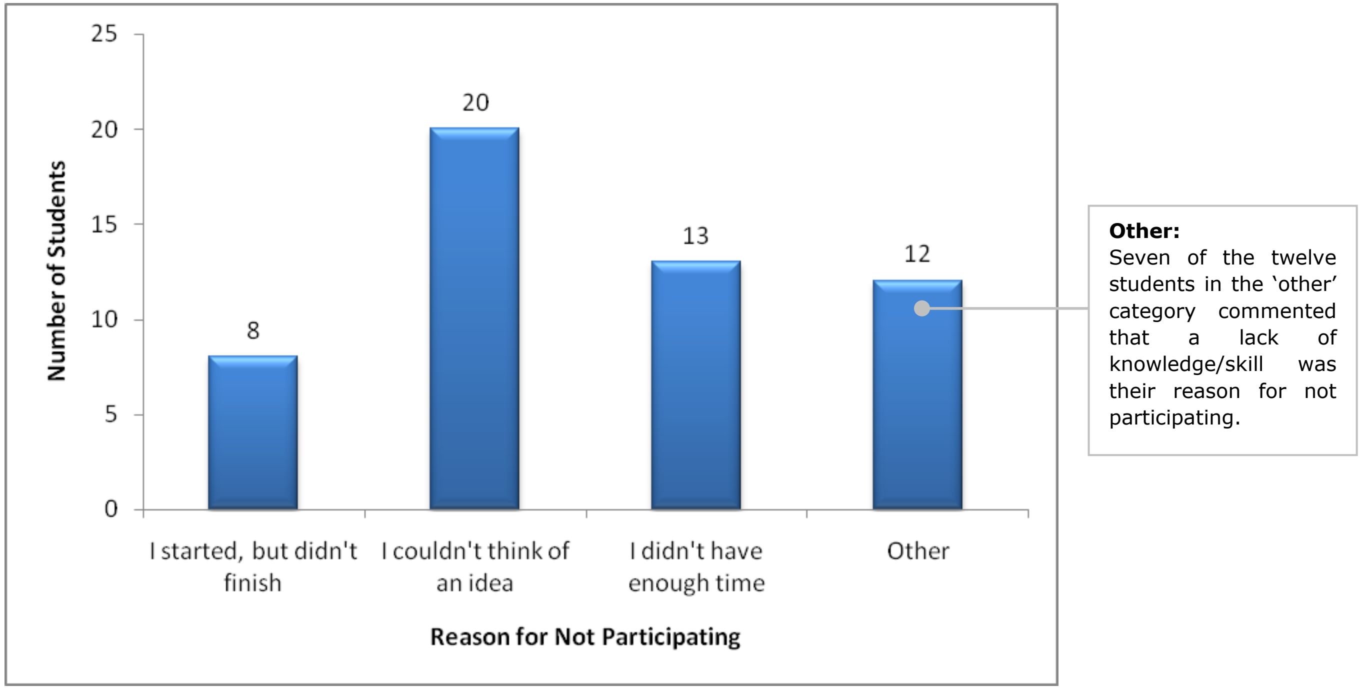

Figure 6. Student Reasons for Not Participating

Conclusions

The surprisingly low number of entries raised the question of whether or not to award the competition prize. The possibility of not awarding the prize was an option due to the 'high quality' requirement of the competition (i.e. if none of the entries were considered worthy of the prize it would not be given out). The three entries consisted of a currency conversion application, a 3D Tic Tac Toe game, and an APA referencing tool. Fortunately, the APA referencing tool was a significantly complex and high quality application which could be used to produce correctly formatted APA references. As a consequence, the student who submitted the APA referencing tool was awarded the competition prize. As expected, the student had already gained A-, A, and A+ grades for the other three summative assessments for the paper.

Although the initial survey results indicated high interest in the competition, the actual competition participation rate was low (only three students entering). The post competition survey revealed that an additional eight students had also been working on competition entries but did not finish. It also revealed that a large number of students (38%) cited not having an idea as the reason for not participating.

Anecdotal evidence suggests that providing a theme for the competition would make it easier for students to come up with an idea, and would hopefully increase the participation rate. A themed optional programming competition is expected to run again during semester two, 2010. In addition, providing some type of reward for all participants (instead of just the winner) could also help improve student participation, an idea gleaned from related research (Cormack, Munro, Vasiga, & Kemkes, 2006).

Moving beyond the statistical view of the competition the lecturer observed some unquantifiable benefits associated with running the optional programming competition. Firstly, the introduction of the competition and associated prize seemed to create a buzz of enthusiasm and interest amongst the students. The near end of semester lecturer, when the competition winner was to be announced, enjoyed huge attendance. Students were also very eager to see the winning application and code, and a significant class discussion ensued. Secondly, from a lecturer's perspective the presence of the competition throughout the semester became an extremely useful tool when managing top students who often finished class work ahead of schedule. The top students were often directed to the competition upon completion of their set work. Overall, the optional programming competition proved to be positive experience and will become a fixture of the D101 Software Development paper.

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Using Google Docs for the Early Identification of ‘At Risk’ Students

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Abstract

This paper explores the use of Google Docs as a mechanism for the early identification of ‘at risk’ students during the assessment process. A cloud computing assessment model is introduced and applied to a case study assessment involving 23 second year students. Monitoring and analysis of the assessment process revealed major advantages to using a cloud computing assessment model, specifically in the areas of progress checking, redirection of off track students, plagiarism, and on time submissions.

Keywords

Assessment, Cloud Computing, Google Docs, At Risk Students

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Introduction

An ‘at risk’ student can be defined as someone who is unlikely to succeed academically in their chosen field of study (Kagan, 1988). ‘At risk’ students are initially difficult to identify, and often only become apparent after the first summative assessment has been conducted, being highlighted by poor or nonexistent submissions. Unfortunately, research shows that academic failure lowers student motivation and self efficacy (Nilsen, 2009) (Schunk, 1991), and for many ‘at risk’ students this is the beginning of overall academic failure. This situation is made all the more worse when many of these students have great potential and with even a small amount of extra guidance would be more than capable of succeeding. One significant factor that contributes to this process is the lecturer’s restricted ability to monitor and direct student progress during the assessment process (i.e. feedback can usually only be given after submission) (Race, 2001). This is due to the limitations of the traditional assessment model (see figure 1). In practice, lecturers are often in the dark while students work on assessments, with the first opportunity for feedback being on the final submitted assessment.

The recent advent of cloud computing has introduced functionality such as online document storage, online document sharing, and real-time collaboration (Google, 2010). Utilising these new features provides a means for enhancing the traditional assessment model in a way that 'turns the light on' for lecturers during the assessment process. This enhanced assessment model will be referred to as the cloud assessment model (see figure 2). By utilising the online sharing functionality of cloud computing environments (i.e. students sharing their assessment documents with lecturers), this paper will show how lecturers are able to seamlessly monitor student progress during the assessment process.

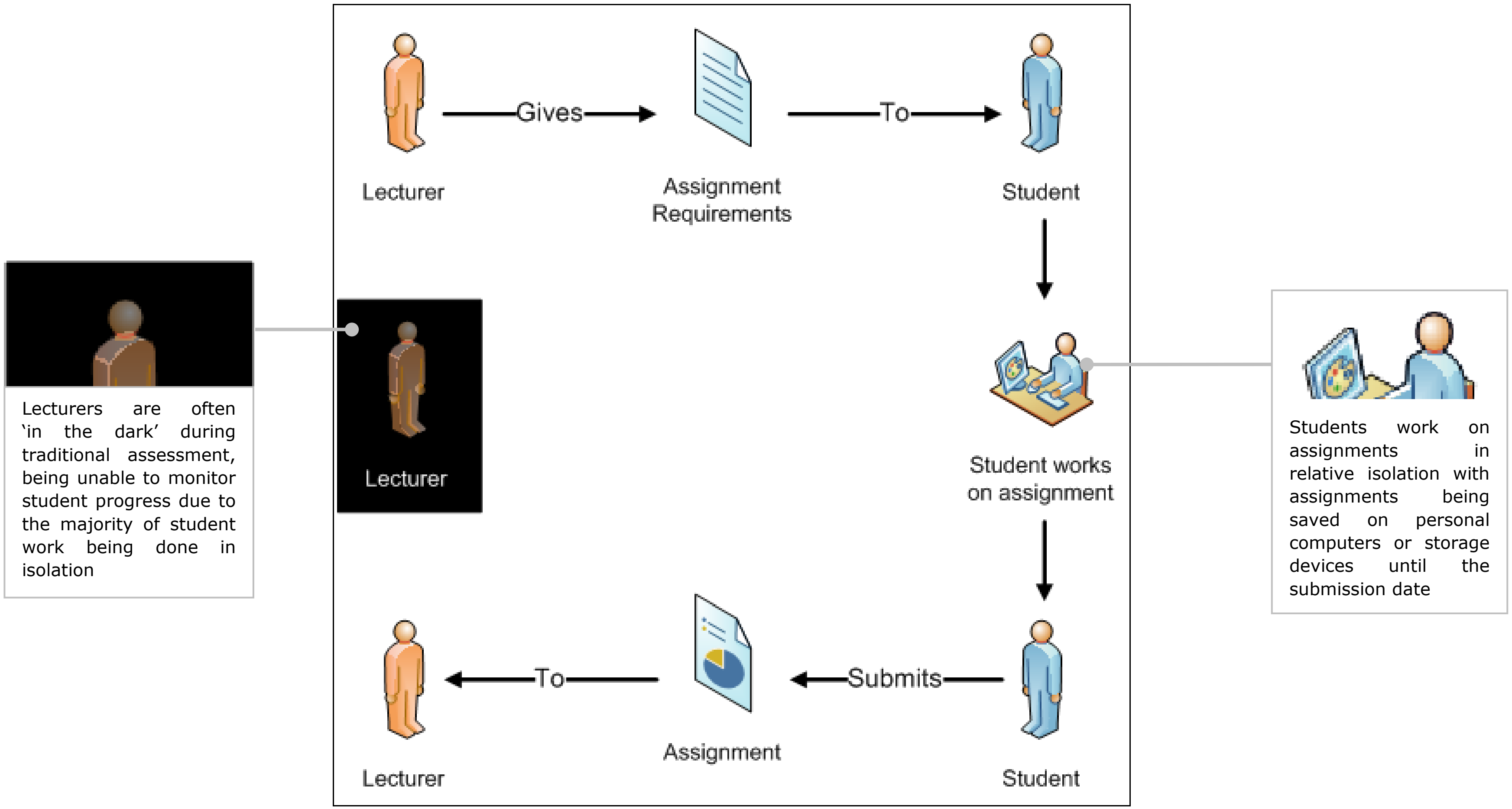

Figure 1. Traditional Assessment Model

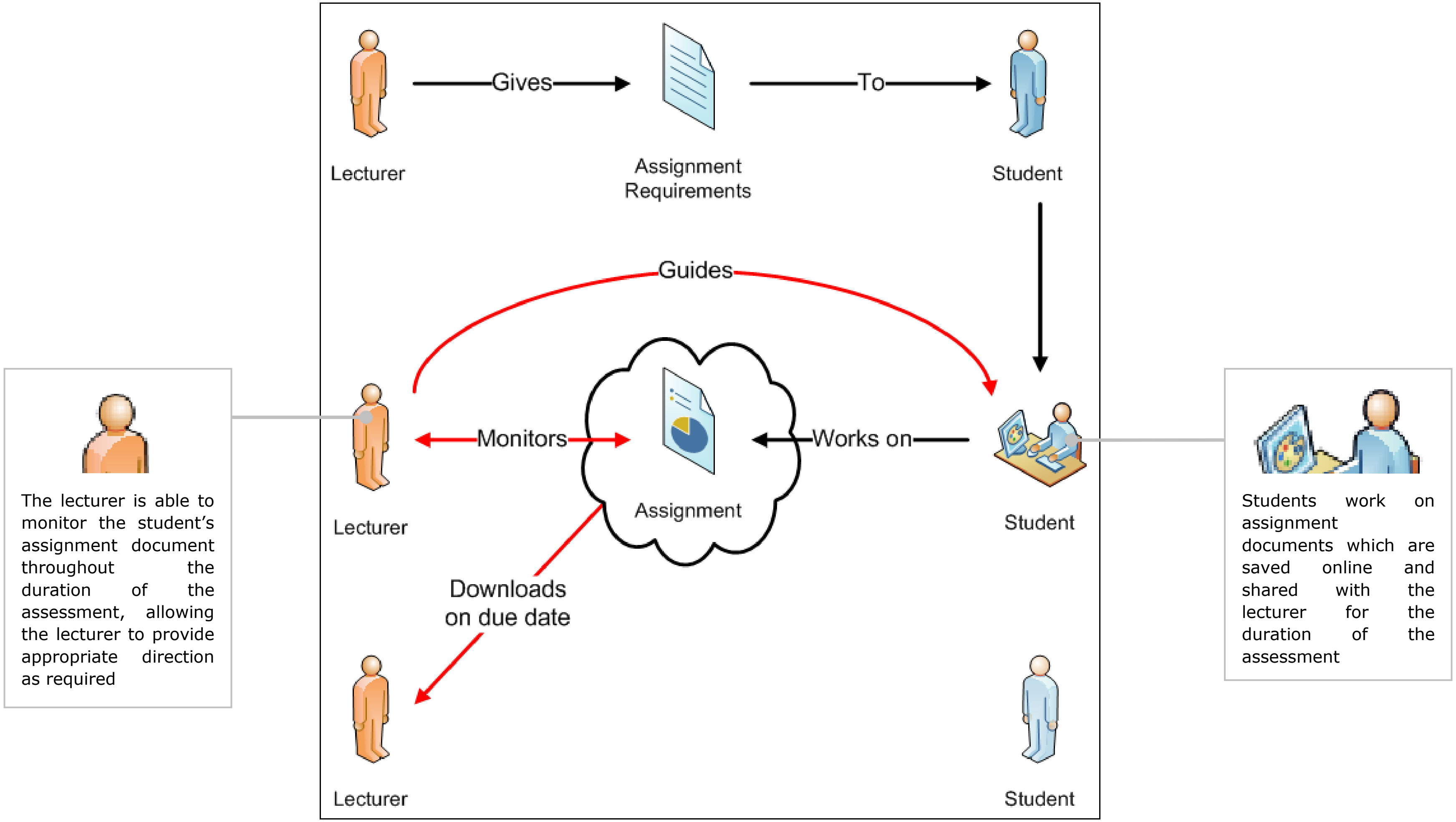

Figure 2. Cloud Assessment Model

This paper will proceed by detailing a case study assessment that utilised the cloud assessment model. The results and observations from the case study will be presented, discussed and conclusions will be given.

Approach

A second year project charter assignment for 23 second year IT Project Management students was used as a case study in order to explore the usefulness of the cloud assessment model. The assignment was the first summative assessment for the paper and required students to write a project charter for a given scenario over a span of three weeks. The assignment requirements instructed students to use Google Docs to create a document and share it with the lecturer. This blank document would be the beginning of their project charter. Once shared, the lecturer would then monitor and guide students as they worked on the assignment.

The next section presents the results of the case study and details observations made during the process.

Results

The results and observations from the case study assessment will be presented in order of occurrence.

Observation One

On the day the assignment was given, students were required to create and share their project charter assignment using Google Docs. Five days into the assignment only 17 of 23 students had shared their Google Doc. As a consequence, students who had not shared their document were followed up during the next face-to-face class. The four students who were in class created and shared their assignments that day, whilst the remaining two students created and shared their assignment later that week after some email correspondence.

Observation Two

After two weeks (one week until the due date) it was observed that a number of students had not made much progress. In some cases students had not touched the assignment since the initial creation and sharing of the document (as indicated by the last accessed/modified date attributes). In response, the students in question were sent reminder emails and some individual students were followed up in class with some informal encouragement. As a result, the majority of students who were followed up began to progress.

Observation Three

A particular student had done a significant amount of work on the assignment but had been moving in the wrong direction. As a response, the student was followed up in person and the redirection about the assignment was given. This involved reiterating the overall aim of the assignment and re-explaining what was expected. Consequently, the student went on to significantly rework their assignment to be more aligned with the assignment task.

Observation Four

Two days before the due date a number of students still had not made any significant progress on the assignment. In response, a reminder email was sent to the relevant students with an open door invitation if they needed help with the assignment. The email also included the due date, time, and weighting details. During the last two days students stayed up remarkably late and did a significant amount of work of the assignment.

Observation Five
On the due date, at the due time all the assignments were downloaded and saved for offline marking. This resulted in a 100% submission rate, removing the possibility for students to lose marks for late submissions. Students were given the option to continue working on the assignment past the due date and receive the standard 10% penalty per day. However, this was not an option taken by any of the students.

Conclusions

The observations made during the assessment process highlighted a number of significant advantages to using the cloud assessment model, not only for the early identification of 'at risk' students, but also for assessment in general.

Observation one illustrated the benefit of being able to quickly identify students who were slow in starting the assignment. The day one sharing instruction provides the lecturer with a clear indication of exactly which students have not started the assignment. This type of indicator is an inherent feature of the cloud assessment model provided students are required to share their assignments from day one. The identification of slow starters is however not as easily achieved when using a traditional assessment model.

Observation two builds on the first observation by providing the lecturer with the ability to observe exactly how much work students have done on the assignment at any given time. Although a similar mechanism exists in traditional assessment in the form of assignment milestones, the cloud assessment model offers a number of additional advantages. Firstly, traditional milestones are restricted to a single point in time whereas the cloud assessment model provides synchronous observations at any point in time during the assessment process. Secondly, traditionally lecturers can spend a substantial amount of time checking the work of students who are making good progress when this time could be better spent focusing on students who are struggling. The cloud assessment model improves this mechanism by providing means for the lecturer to quickly view the work of students who are making good progress while at the same time helping to quickly identify students who are struggling. As a result, the lecturer is able to focus more time and effort on those students to whom it would most benefit. Finally, the transparent nature of the cloud assessment model can also provide the lecturer with an overall view of the progress of the class as whole. This insight can be a helpful indicator as to which concepts the students are struggling to grasp, and which concepts would be worth revisiting during class time.

Observation three illustrated an extremely useful feature of the cloud assessment model as it relates to identifying 'at risk' students. Occasionally students head in the wrong direction when working on an assignment. This misdirection can often be due to an honest misunderstanding of the assignment question. Unfortunately, as a consequence, these students continuing spending time and effort working on an assignment, which from the outset is destined to be unsuccessful. In this instance, the lecturer was able to intervene before it was too late and redirect students focus for the assignment.

Observation four relates to the first and second observations and shows how having a real time view of student work can be used for focused follow up. Lagging students whose assignments would likely receive a fail grade were quickly identified, which provided a specific list of students to whom reminder emails could be sent. Having a literal view of the current state of student work also allowed for the reminders to be tailored specifically for each student instead of being generic in nature.

Observation five shows another advantage of the cloud assessment model with regards to assignment submission rates. Being able to download the assignment documents on the due date makes late or non-existent submission a thing of the past. This shows a fundamental shift in the way assignments are submitted. With the traditional assessment model lecturers must wait for assignments to be submitted (i.e. pushed by the student), whereas the cloud assessment model puts the onus on the lecturer requiring them to download the assignments on the due date (i.e. pulled by the lecturer).

Overall, the case study was useful in highlighting a number of ways the cloud assessment model can help with the early identification of 'at risk' students, as well as showing other benefits for assessment in general. These areas were specifically: immediate identification of late starters, real time monitoring of students progress, identification of misdirected students, early identification of students who are likely to fail, and lecturer controlled assignment submission. These features coupled with appropriate responses from the lecturer provide a way for identifying and helping 'at risk' students before it is too late.

Future work will involve examining the student's perspective of the cloud assessment model. Other future work will also aim to discuss other implications of using the cloud assessment model. One specific area will focus on how to establish appropriate levels of lecturer intervention. This is due to the foreseeable problem of having too much intervention and direction by the lecturer resulting in assessments with reduced credibility.

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First Year Programming: Engagement vs. Success Measurements from UCOL

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Abstract

This research paper sought to confirm the notion that high student engagement results in high academic success rates in first year programming. It also aimed to discover if high face-to-face engagement is necessary for success within a blended delivery environment. The study measured various aspects of student engagement over the course of a semester and compared this data with each student's final grade. The results suggested that high face-to-face engagement most commonly results in high academic success, however a linear relationship could not be reasonably established from the data. The research also revealed limitations in using individual student Moodle hit counts as a measure for online engagement.

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Keywords

Programming, attendance, engagement, success

Introduction

D101 Software Development is the first year programming paper on UCOL's Bachelor of Information and Communications Technology (BICT) degree. This paper forms the focus of this study. The D101 paper covers the fundamentals of programming in the C# programming language. Delivery is blended, consisting of face to face lectures and practical's, and is also supported online through Moodle. Lecture and practical attendance is not compulsory. This research paper seeks to confirm the notion that student engagement has a direct impact on academic success, and that face-to-face engagement is beneficial even within a blended delivery environment. The approach taken to test this notion was to measure various aspects of student engagement throughout the semester and then compare the data with each student's final results for the overall paper. This paper will follow a standard format by first briefly examining related studies, outlining the approach taken, presenting the results with a corresponding discussion, and will end with conclusions about the research.

Related Studies

A 2008 journal article states that for over 80 years research has shown that class attendance predicts academic performance (Dollinger, Matyja, & Huber, 2008). The article cites studies from 1927 (Turner, 1927) and 1931 (Jones, 1931) both of which indicate a negative impact between classroom absences and students grade point averages, right through to more recent studies in 2003 (Clump, Bauer, & Whiteleather, 2003) and 2005 (Gump, 2005) that show similar relationships between attendance and success. Beyond attendance, their study also explores many other factors that contribute to academic success, including: personality, past performance and verbal ability (Dollinger, Matyja, & Huber, 2008). Although attendance is not the only factor that impacts student academic success, it is often shown as a consistently significant variable.

Approach

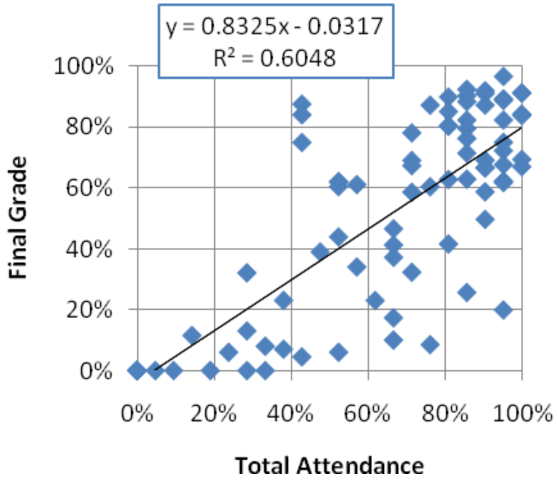
In order to examine the correlation between engagement and student academic success, a number of observable facts were recorded over the course of the semester. These facts were: lecture attendance, practical attendance, practical completions, and Moodle hits. This data was then used to derive some additional information: total attendance (lecture and practical attendance combined) and attempted practical completions (a percentage similar to practical completions that removes practicals that were not attempted from the equation). As a result, attendance and completion percentages were calculated for each student in each of the five categories: total attendance, lecture attendance, practical attendance, practical completions, and attempted practical completions. The attendance data was collected at the beginning of each lecture/practical. Practical completion data was collected during practical sessions as individual students completed the assigned work. Moodle hits were recorded automatically by the Moodle learning management system (LMS). At the conclusion of the semester the attendance and completion data was compared to each student's final grade. In addition, average attendance and completion percentages were calculated for students who passed the paper, students who failed the paper, and students who failed the paper (excluding no shows).

Results

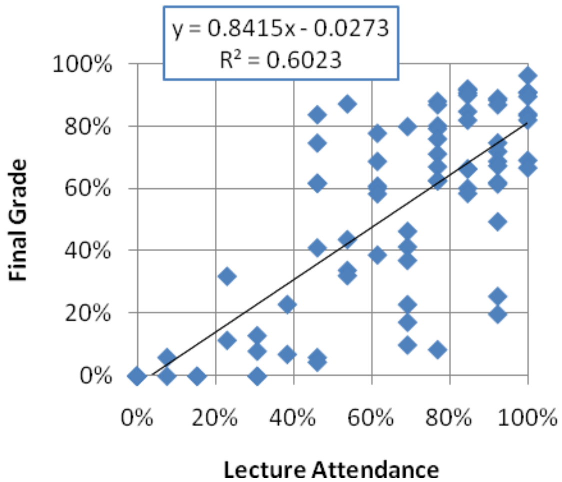
The D101 Software Development measured a total of 83 enrolled students. The data comparing final grades against attendance and completion percentages are presented in the form of scatter graphs.

- Graph 1: Final Grade VS Total Attendance
- Graph 2: Final Grade VS Lecture Attendance
- Graph 3: Final Grade VS Practical Attendance
- Graph 4: Final Grade VS Practical Completions
- Graph 5: Final Grade VS Attempted Practical Completion
- Graph 6: Final Grade VS Moodle Hits.

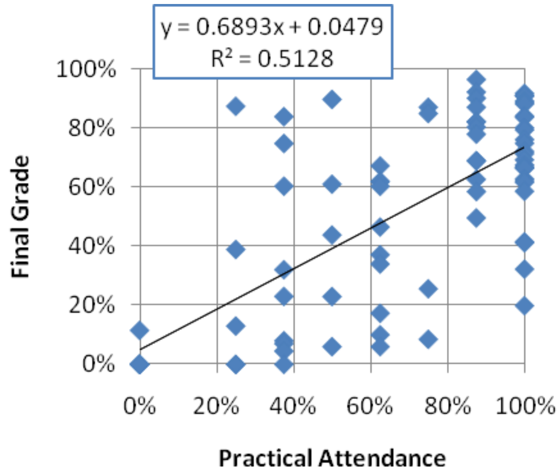
Trend lines are also included. It should also be noted that a limitation of the scatter graph is its inability to show duplicate values (e.g. students with the same final grade and same engagement level appear as a single point on the graph). Finally a column graph is used to display the pass/fail averages for each engagement type (Graph 7). Pass/fail averages for the Moodle hits category is given separately due to the hit count not being a percentage (Table 1).



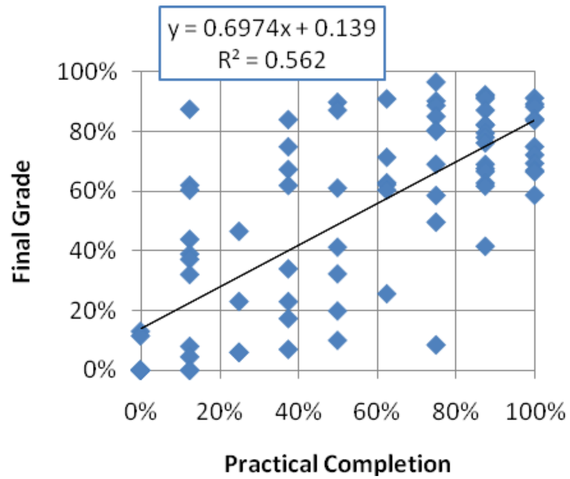
Graph 1. Final Grade vs Total Attendance



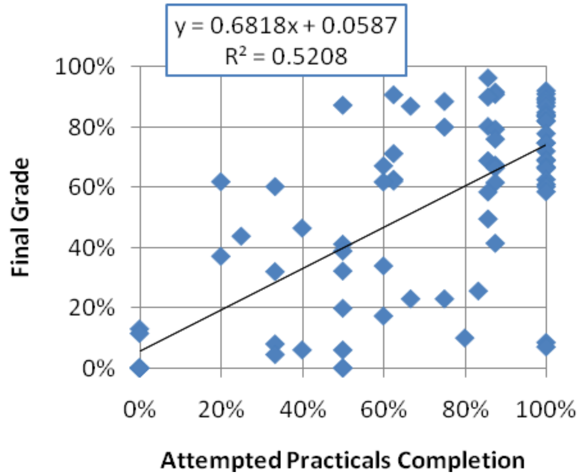
Graph 2. Final Grade vs Lecture Attendance



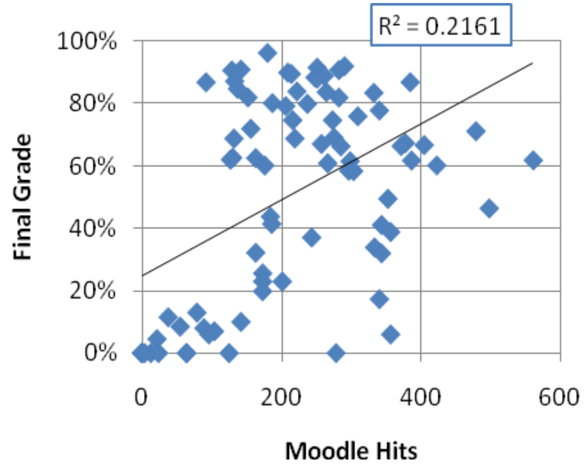
Graph 3. Final Grade vs Practical Attendance



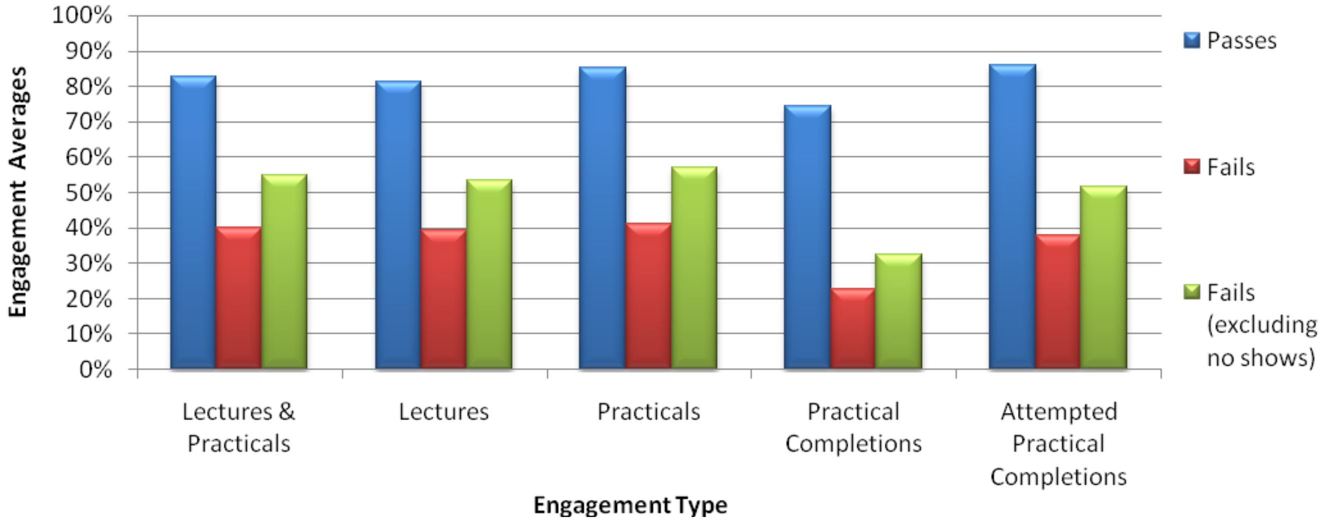
Graph 4. Final Grade vs Practical Completions



Graph 5. Final Grade vs Attempted Practicals Completion



Graph 6. Final Grade vs Moodle Hits



Graph 7. Engagement Averages vs Engagement Type

Table 1. Average Moodle Hits for Passing and Failing Students

Student Group	Average Moodle Hits
Passing Students	258
Failing Students	155
Fails Students (excluding no shows)	178

Discussion

The scatter graphs (excluding the Moodle Hits graph) show stronger concentrations in the top right corners, indicating that high engagement generally results in higher marks. Graphs 1-5 lean towards a linear relationship existing between face-to-face engagement and academic success for approximately 50-60 percent of the population (given by the r-squared values). This relationship is also supported by the attendance/completion averages (Graph 7) which also show that on average, students who passed the paper had much higher attendance and completion rates. Although a correlation appears to exist this should not be used to imply direct causation as there are many other factors that contribute to academic success (Dollinger, Matyja, & Huber, 2008), a discussion of these factors is however outside of the scope of this research.

In interpreting the data it should also be noted that the practical completions and attempted practical completions only measure students who completed practicals during their timetabled practical sessions. Accordingly, these measurements do not take into consideration students who completed the practicals in their own time outside of the timetabled classes. This factor may account for the reduced r-squared value in Graph 3.

Although the graphs show a stronger concentration in the high engagement/high grade area, the data begins to splay substantially in the middle section of the graphs. This splaying of the data is caused by students with relatively low engagement who still achieved high grades, and also students with relatively high engagement who ended up with low grades. These occurrences are contrary to the idea of linear relationship. Closer examination of the (for want of a better word) offending students reveals likely reasons for the splaying of the data. The low engagement/high grade students were individuals with prior programming experience, and it would be feasible to assume these students may have felt engagement was not a necessary requirement in order to be successful in this particular paper. Secondly, the high engagement/low grade students consisted of two main groups. The first were students who engaged strongly during the first half of the semester but did not complete the major assessments toward the end of the semester (i.e. the final assignment worth 35% and the final exam worth 30%). The second were students who were unfortunately awarded a zero grade for a 35% final assignment due to plagiarism.

Interestingly, even though the Moodle hits averages from Table 1 seems to suggest that higher Moodle hits result in higher grades, Graph 6 (Moodle hits scatter graph) is less conclusive than Graphs 1-5. This can be seen in the large spread of hit counts amongst both passing and failing students. The r-squared value (~20%) also indicates a low probability of a linear relationship between Moodle hits and final grade. This phenomenon either implies online engagement has little impact on academic success, or is perhaps more likely due to factors that surround how the Moodle hit count is generated by Moodle. According to Moodle documentation, the hits figure represents a count of the areas of the site students have visited since the creation of their account (Moodle.org, 2009). A closer examination of the data reveals that repeated actions (e.g. multiple views of the exam roster) are all counted as individual hits. The validity of the hit count is also degraded due to the fact that it is not a true measurement of how long students spend with a particular online resource (e.g. a student who opens the weeks lecture slides and views them slide by slide extensively for two hours is awarded the same individual Moodle hit as a student who accidently opens the weeks lecture slides and quickly closes it). The data may also be skewed by students who choose to download material for offline viewing. For example, instead of accessing lectures slides via Moodle on multiple occasions (which would result in multiple hits), some students may access the lecture slides once (resulting in a single Moodle hit) and then elect to save the information to portable storage devices for future use (a practice relatively common amongst the student body).

Conclusions

This study agrees with the existing literature and supports the notion that high student engagement, in general, translates to increased student success rates. The study also suggests that high face-to-face engagement is still necessary and beneficial for success in blended delivery courses. However, the notion of a linear relationship existing between engagement and success is not conclusively supported by the research results.

Due to the blended delivery of the D101 Software Development paper, the study attempted to measure individual student online engagement by examining the Moodle hit count. However, little correlation was found to exist between the Moodle hit count and students final grades. Although interesting, it was felt this observation was not sufficient to conclude that online engagement had no direct impact on student success. This was due to closer examination revealing that Moodle hit counts are likely not an accurate measure for student engagement with regards to online resources. This position is based on the manner in which the figure is generated, coupled with the variety of student habits surrounding the use of online resources. Consequently, if a future replication or related study were to occur it is recommended that a more valid way of measuring student engagement with regards to online resources be formulated.

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Using Web 2.0 in teaching and learning: A wiki case study

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Abstract

This paper informs and demonstrates to educators how web 2.0 technologies could be incorporated into their teaching and learning. It describes a case study that uses a wiki as the content container that allows for the inclusion of shared media, such as Flickr, SlideShare and YouTube, plus social media, such as Twitter. The use of a supporting blog that manages out of context content is also described.

Keywords

Wiki, Web 2.0, Teaching, Learning, online, Media Wiki, WikiEducator, Wikiversity

Introduction

As the rate of change of Internet based technologies continues to accelerate, innovative methods of managing personal information and knowledge need to be developed and considered. As a tertiary educator in information technologies, the author has been exploring technologies to manage this change and support teaching and learning in a blended environment.

From an educator's view, there are two interacting systems that need to be taken into account: the pedagogies (strategies or style of instruction), and the technology to support the strategies.

This quality assured paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Previously the author developed an educator centered, information and knowledge framework for a blended teaching and learning environment (coined "the virtualMe"), which included the development of a web-based software artifact (Verhaart, 2009). Observations were made as to features that would be desirable for both the teacher and learners. A significant problem with the artifact was its custom built design, and as such, findings needed to be transferred to more open systems.

The internet has evolved from being content driven to one of harnessing the collective intelligence, or moving from Web 1.0 to Web 2.0 (O'Reilly, 2005). Web 2.0 technologies are characterised as managing social structures rather than just content, and include social networks (e.g. Facebook, Linked-in), blogs, and wikis.

The research into a teacher centred, technology supported environment has been conducted as an action research project. As part of the action research, a case study into the use of a wiki and blog as support tools has been undertaken. The question "can Web 2.0 technologies be used to support a blended teaching and learning environment?" is the central question that this paper will explore.

Background

Prior to considering the technology and pedagogy using a wiki, the author developed a custom tool to explore delivery in a blended teaching and learning environment. Findings from the earlier research developed a framework, called virtualMe (Verhaart, 2010) which is shown in Figure 1, and includes:

1. a user management sub-system, to control access and tracking details;
2. a taxonomy structure, to organise the content;
3. a sniplet model to store the content;
4. a multimedia object (MMOs) model with associated metadata described in the multimedia vocabulary markup language (MVML);
5. an annotation framework to manage sharing of information and knowledge and allow for both out-of-context and in-context comments to be managed; and
6. a presentation layer to manage the user interface.

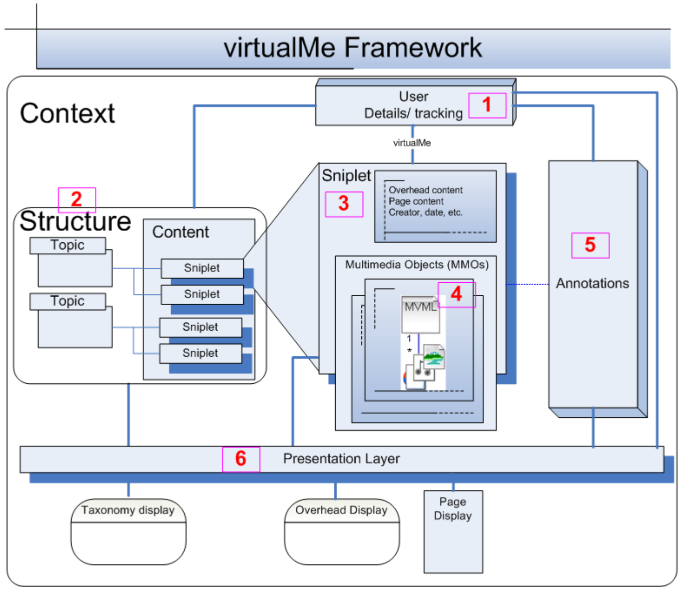

Figure 1: virtualMe framework

Verhaart (2009) compared the custom built virtualMe system to that of a wiki, so placing the research into a wiki environment was a natural progression. Further, many researchers have - and are - exploring the use of wikis in an educational setting, particularly to create collaborative learning activities (Choy & Ng, 2007; Wheeler, Yeomans, & Wheeler, 2008; Lin, Sajjapanroj, & Bonk, 2009).

Briefly, wiki means "quick" in Hawaiian (Louridas, 2006), and has been described as follows: *"Wiki is a piece of server software that allows users to freely create and edit Web page content using any Web browser. Wiki supports hyperlinks and has a simple text syntax for creating new pages and crosslinks between internal pages on the fly" (Leuf & Cunningham, 2002).*

Several major educational projects have also adopted wiki technology as their delivery tool. Notably, WikiEducator (http://www.wikieducator.org) Wikiversity (http://www.wikiversity.org), and Wikibooks (http://www.wikibooks.org). These are all collaborative projects where many educators are providing content into a common pool and use the engine that drives Wikipedia, MediaWiki. Indeed adding content to Wikipedia itself is being used for assessments by some tertiary institutions (Dickison, 2010). The research here, however, centres on a tool for an individual educator, and this is probably more closely aligned to Wikispaces (http://www.wikispaces.com) with over 3.4 million users and 1.3 million wikis (Tangient, 2009a). The wiki application is not only available as a stand-alone system, but is integrated in many Learning Managements Systems (LMSs) such as Moodle.

The closest match to the virtualMe framework is probably Wikispaces, however, with the significant adoption of the MediWiki engine and the transferability of findings to WikiEducator, and Wikiversity it was considered prudent to explore its suitability.

Earlier research identified a need to provide support for unstructured content, that is, content that did not easily fit into the wikis taxonomy, and other web based solutions were explored. The use of Blog technology, has proved to be a suitable technology to meet this need.

A *Blog* or "weblog" (Winer, 2002) is an online diary or journal, typically documenting the day-to-day life of an individual, and has become a way in which individuals can record unstructured comments and allow reader annotations.To understand the impact of Blogging, Blogs (or web logs) have steadily gained popularity, and in November 2006, Technorati, a blog search engine, was tracking more than 57 million (BBC, 2006), and by 2008 346 million people globally reading blogs (Singer, 2009).

3 Generations of pedagogies

- *Behaviorist/cognitive*
- *Constructivist*
- *Connectivist*

The second part of the discussion in this paper, relates to the pedagogies that can be supported through the use of the wikis and/or blogs. In a blended teaching and learning environment pedagogies for both distance and face to face need to be considered. At the 2010 DEANZ Conference, in Wellington, New Zealand, Terry Anderson described three generations of distance education pedagogy. These included: Behaviourist/cognitive, constructivist and connectivist. (Anderson, 2010), where: behaviourist/cognitive includes, self paced and individual study; constructivist, working in groups; and connectivist, using networks and collectives. For a blended environment, behaviourist includes instructivist, where content is "taught" to students, as in a lecture. It needs to be noted that in a blended environment, multiple strategies are used to engage students, with different pedagogies suiting different situations. Therefore, in order to be useful in a blended teaching and learning environment ideally all three pedagogies should be supported.

Methodology

This paper describes part of a larger action research project, and considers the use of Internet 2.0 tools, such as wikis, and blogs to see whether they would be suitable for a Web enhanced teacher centered blended teaching and learning environment. The overall research question for the research being "*can a framework be developed to acquire contextualized information and knowledge that may exist in a variety of data types, a source*?"

The first cycle of the research (1985-2002) involved using static web pages to investigate use in teaching and learning, followed by the conversion to a database driven web site (2002-2005). Findings from this cycle were synthesized and a third interactive prototype was developed and used (2005-2008). The current prototype investigates the use of open source tools to in which the framework can be developed and is described in this paper. The action research cycles are based on a methodology described by Bourner(2002) and are described in detail by Verhaart (2009).

The implementation of the wiki and blog will first be discussed. This will be followed by examples grouped in the three pedagogical areas identified by Anderson (2010) of: behaviourist/cognitive; constructivist; and connectivist.

Background to the technology

Wiki

Verhaart (2010) describes the development and implementation of the wiki solution and breaks the development into three parts (**Figure 2**):

1. Hosting
2. Content construction
3. Content delivery

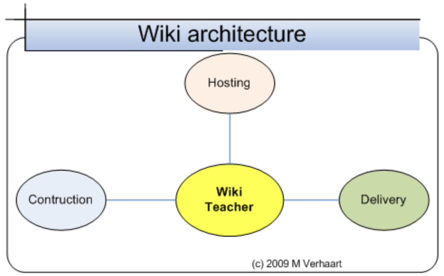

Figure 2: implementing a teaching and learning wiki

HOSTING

As this is a research project and there is a necessity to trial different technologies, it was decided to privately host the wiki. MediaWiki was chosen for the following reasons (Verhaart, 2010)

- Media Wiki has extensive use, as the environment used by Wikipedia the largest global wiki.
- It is used by WikiEducator, Wikiversity and Wikibooks.

- The software is Open Source.
- Has an active extension community continually adding new functionality.
- Supports a wide variety of multimedia types, and has the capability to be extended (e.g. add YouTube and Flickr functionality).
- Would enable the researcher to offer an informed contribution to the existing wiki communities.
- As the software can be installed on a private host, this enables the researcher to gain an understanding of the technology underpinning the wiki.

Content construction

Building teaching and learning content in MediaWiki is not as straight forward as expected. While, wiki means "quick" there is a learning curve required to understand the cryptic wiki syntax, as it is not in a "what you see is what you get" (WYSIWYG) interface.

Secondly, MediaWiki is primarily designed to manage the huge Wikipedia encyclopedia, whereas this research considers the use of a wiki in a blended teaching and learning environment. Fortunately, the designers of MediaWiki provided the four ways in which MediaWiki can be extended.

1. By adding to a common JavaScript page that is loaded with each web page in the wiki.
2. Using templates, to automate common layouts.
3. Using PHP extensions that add additional code to the MediaWiki engine.
4. Using a Widget extension, which allows code to be generated on a standard wiki page in the Widget namespace.

There are other tools and features that fall outside this but are never-the-less very useful when using the tool in a blended environment. These include the ability for students to create personal sub-wikis and a Zooming application – ZoomIt (Russinovich, 2009) which is easily installed on a Windows based PC.

Extending MediaWiki

The following extensions were added to the MediaWiki created for this research to and allow for the specific needs in a blended teaching and learning environment.

Common JavaScript extensions: Two extensions were added to MediaWiki. The first to hide the navigation/toolbar, was required when projecting the page onto a large screen. The screen area used by the left navigation/toolbar reduced the viewable area significantly. A second extension was the ability to Hide/Show the body of a table, which was used to create interactivity in the presentations where questions could be asked then solutions revealed. This was done when Help Desk problems were displayed and the solutions were revealed after discussion, on an overhead.

Building templates allowed for common designs to be implemented. Most pedagogies follow a standard pattern and using templates provides a consistent look and feel on the pages for parts of the learning object such as Objectives, Questions, etc.

Adding references. Interestingly many presentations that the author has observed do not cite or reference correctly, yet, students are asked to provide accurate referencing in their assessments. MediaWiki has a referencing system which is reasonably free format, however, as the author's institute requires APA from students a way to reference using this style was developed.

Referencing tools such as zotero look for COinS meta-data on a page, this has been implemented using a template to generate the correct meta-data and reference in the footer.

BLOG

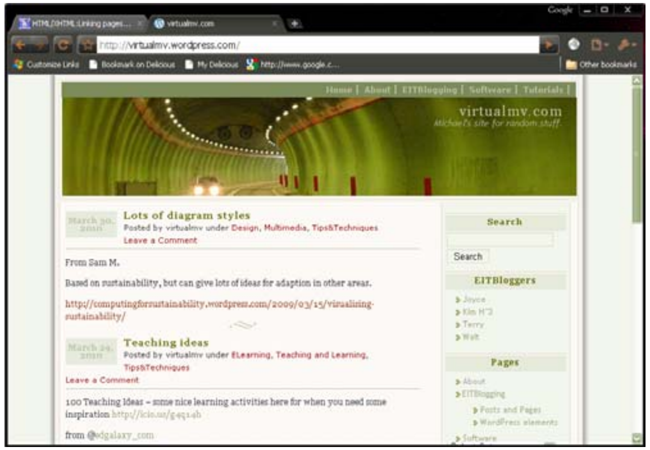

Figure 3: WordPress blog showing unstructured content

Unlike the wiki technology, where extensions are required to enhance the functionality for a blended teaching and learning environment, the Blog in this research is used to manage unstructured data (Figure 3). While there are some advantages in privately hosting a Blog, WordPress provides a platform that provides all of the functionality that would be included on a private blog, with the advantage that updates and maintenance are automatic. Initially EduBlogs was used (which uses the WordPress engine) but, limitations in allowing posting via email and mobile devices, plus the inclusion of advertising made the shift to WordPress desirable.

CONTENT DELIVERY

The author has used the wiki for over 12 months and has trialed several different ways to present the wiki to students. This includes: presenting the wiki in a lecture, providing wiki pages that contain directions to learn software products and languages such as MS-Access, MySQL, HTML, Flash and JavaScript.

The following discussion considers various pedagogical teaching and learning techniques as identified by Anderson (2010), using a wiki or blog. The merits or otherwise of each technique are beyond the scope of this paper.

Delivery: Teaching use cases

Behaviourist/cognitive.

This includes self paced and individual study, and is based on Gagne's Events of Instruction (1965 as cited by Anderson, 2010) and enhanced by the "cognitive revolution" and includes: chunking, cognitive load, working memory, multimedia effect (Sorden, 2005 as cited by Anderson, 2010). In this pedagogy content is the primary driver.

Lecturing ("sage on the stage") is still a significant delivery medium in most tertiary institutions, and indeed is used extensively in Conferences. Delivering content in a lecture format from a wiki presents many challenges. Firstly, the text needs to be large enough for a projector. Detail in diagrams needs to be clear enough, and what you (as a teacher) are talking about may need to be highlighted. Further, as a wiki is designed for reading, care has to be taken so that projections are not swamped with too much text!

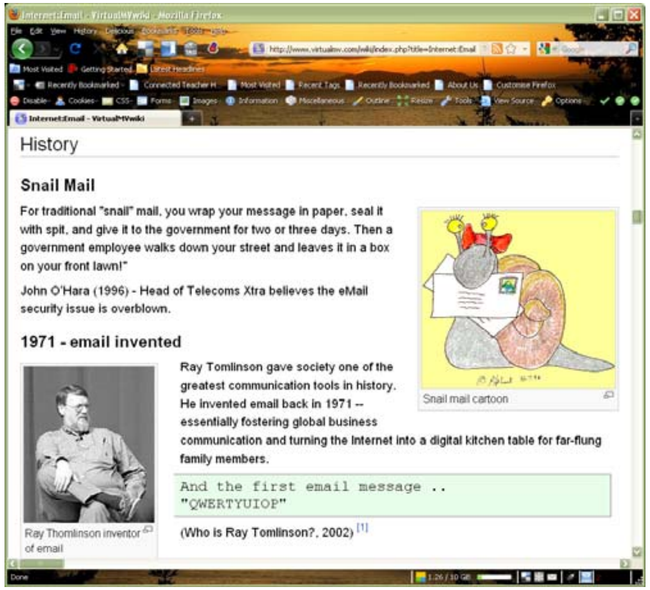

Figure 4: A wiki lecture presentation in Firefox

The author has used the wiki to successfully deliver content in a lecture format, where browser text resizing is used. Both Internet Explorer (IE) and Firefox (Figure 4) have the capability to enlarge text without enlarging images (Chrome 2.x does not). The wiki navigation bar uses valuable space, and using the common.js extension it is possible to hide this when presenting.

A workbook or learning tasks can be presented in the wiki (Figure 5). Students are able to have the web-browser open plus the application they are using (in the example notepad to learn HTML) and can view the instructions alongside their work. A drawback of this approach is that students can cut and paste from the browser to the application. Notice that in Figure 5 the *objective* “pedagogical template” has been used.

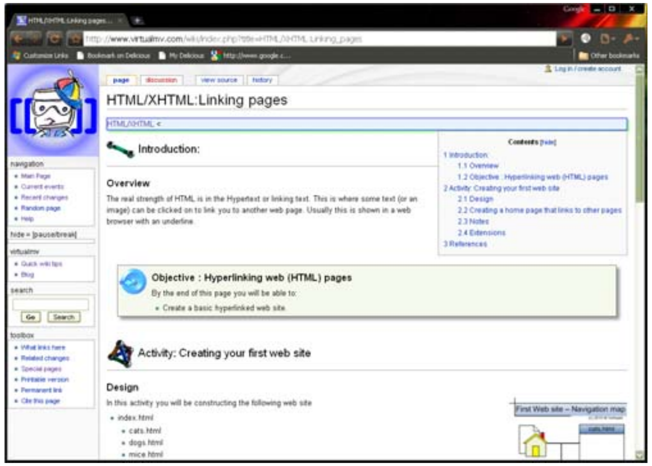

Figure 5: A wiki learning task presentation in Chrome

The Blog was used to post content that did not fit into the wikis taxonomy, and as such served as a way to disseminate unstructured content.

Constructivist

Constructivist pedagogies center on socially constructed knowledge and consider that the process of knowledge acquisition is what is important (Jonassen, 1991 cited by Anderson, 2010).

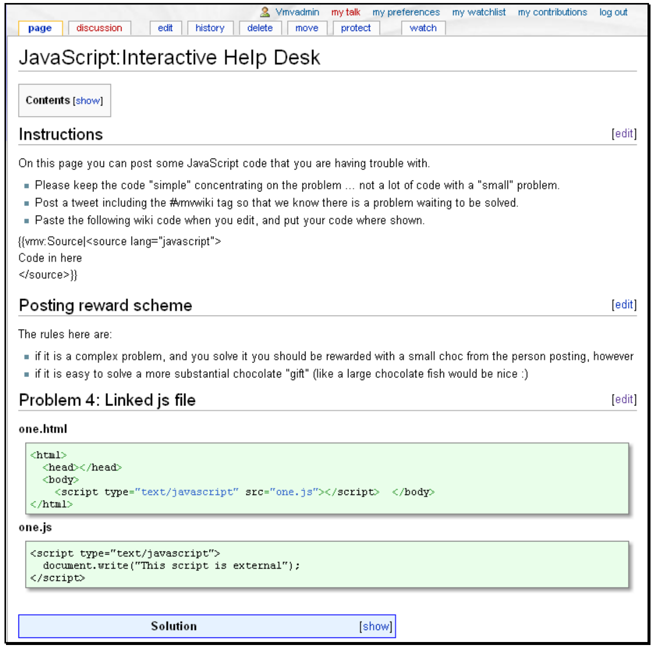

Figure 6: An interactive help desk

In the wiki, constructivist learning can take place as students are able to edit the actual web pages. As an example in a JavaScript class an interactive help desk page was been created allowing students to post problems they were having (Figure 6). Once solutions were found they were placed in hidden tables so future students could try to work out the solutions prior to seeing the solution. While several problems have been posted – they are the result of problems encountered in a face to face class – they have been entered onto the page by the author.

Constructivist learning can be supported in a wiki, as students can build their own sub wikis off the main wiki by branching off their user ids. Access to their pages is available on every page via their userid.

Incorporating assessable items into the wiki has been trialed, where students have been asked to add content as part of a research assignment. This is in the true form of the wiki where knowledge is co-created. Additionally, adding the quiz extension allows students to assess their progress in an interactive way (Figure 7).

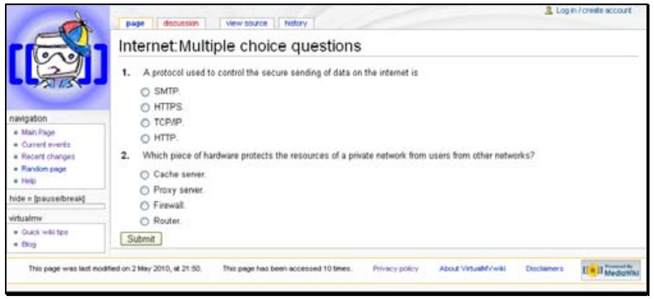

Figure 7: A wiki quiz

The Blog can also be used to provide constructivist learning opportunities as postings can be discussed via comments. However, in practice the Blog was used to present unstructured content and comments were not added by students.

Connectivist

Connectivist pedagogies focus on networks, that are based on a shared common interest, are mostly self organising and learning can take place beyond the course (Anderson, 2010).

As a demonstration of how the wiki could be used to support connectivist pedagogies, a page used for presenting at the DEANZ 2010 conference contained a live twitter feed, plus the inclusion of a Google presentation document and this is shown in Figure 8.

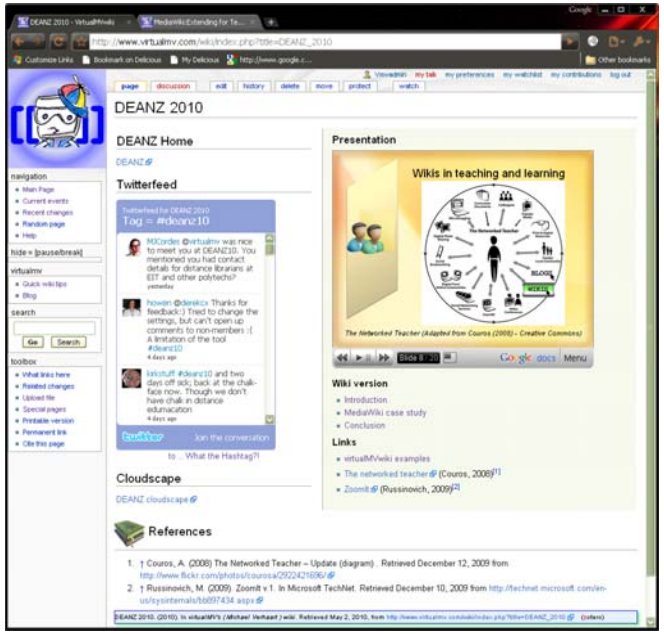

Figure 8: A wiki showing a live twitter feed and inclusion of Google Presentation doc

Other connected technologies that have been successfully integrated into the wiki include a Flickr feed, where images with a specified tag are displayed, Google docs (presentation), YouTube, and SlideShare.

A potential problem linking objects to a tag to identify appropriate images, or filter tweets is that anyone (globally) could create a tweet or image with that tag and it would display on the wiki. So far this has not been an issue.

The use of the Blog also allows connectivist learning activities, as students – and the global community – can comment on posts.

Conclusion

Teachers use multiple ways to facilitate learning of students. The central question identified at the start of this paper was "can Web 2.0 technologies be used to support a blended teaching and learning environment?

The paper initially looked at how a wiki could be implemented and considered a three stage model: hosting, content construction, and content delivery. From a research perspective, the wiki was privately hosted to allow for extensions related to pedagogy to be installed, while the Blog was publically hosted as WordPress provided the functionality necessary to develop innovative learning opportunities.

The paper then described how the wiki/blog combination could be adapted to the three eLearning pedagogies identified by Anderson (2010): behaviourist/cognitive – through the use of the wiki as a presentation tool; constructivist – through using the interactive nature of the wiki and comment feature of the blog; and connectivist – allowing for the inclusion of social media such as twitter, and cloud applications such as Google documents. This illustrated that Web 2.0 technologies could be used to support blended teaching and learning.

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ICT4D: A model for engagement with indigenous communities for ICT-enabled change

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Abstract

Technology implementations in remote areas of South America, and, for that matter, other parts of the developing world have had limited success or final benefit for the recipients. In one particular case in the remote Peruvian Andes, a New Zealand team engaged with the local population to form an approach for rolling out the Internet with the result being one of the highest uptakes of technology in Peru and a huge benefit for the recipient communities. The approach, or method, developed for the project has been called "Community Centric Empowerment" (CCE). This paper outlines the reasons for the development of the methodology, describes its elements and how it was applied in the implementation of technology in the developing world.

Keywords

Peru, community, empowerment, research methodology, indigenous peoples, sustainability, ICT4D

Introduction

In 2001, at the request of the Peruvian Government, a team from the Department of Computing and Information Technology at Unitec Institute of Technology were asked to help the remote farmers in the Antabamba region in the high Andes. According to the Peruvian government, the people of the Antabamba region were suffering from a decline in their standard of living despite the country's burgeoning economy. Initial visits to the Andes were undertaken by members of Unitec's Centre for IT Research and Development (CITRUS), and a situational analysis study was carried out to gauge exactly what was the plight of the local farmers. The journey led the team to two of the poorest areas in Peru - Huancavelica and Apurimac. There the team found communities that had only had road access to the outside world since 1995. Since the road went in, the carriage of Western products, culture and marketing had all but decimated these people's lifestyle and communities. Until then their traditions, practices and culture had sustained these communities for nearly 1000 years.

The purpose of the project therefore, was to see if technology and information and communications technologies could assist the Peruvian farmers to regain some control over their resources and minimise the negative impact of 'progress' ('progress' used in the western sense) on their societies. In order to achieve these aims the team had to devise an appropriate research methodology. This paper outlines the development and application of that research methodology.

Background

The project fell into the category of projects known as "ICT4D 1.0", prior to the pervasive use of mobile phone technology in developing world contexts and later projects known as "ICT4D 2.0" (Heeks, 2008).

ICT4D

"The term ICT4D refers to the opportunities of Information and Communication Technology (ICT) as an agent of development. Research in that field is often focused on evaluating the feasibility of existing technologies, ……. in the context of developing regions" (Sutinen & Tedre, 2007). As Heeks notes, there are three major reasons that we "should give priority to ICT application for the poor in developing countries" (2008). The first is a moral argument, that the majority of our resources in the 'developed countries' is spent on optimising the already wealthy as opposed to the potential for addressing the "planet's megaproblems" on the frontline of which the poor live. The second argument is one of enlightened self interest both to protect the developed world from threats from the angry and dispossessed and to raise their standard of living and align our interests. Third, the argument of personal self interest, developing systems for the third world and addressing fundamental human needs is intrinsically more interesting and satisfying.

The role of information and communications technology (ICT) in this development process is potentially critical. "Economic, social, and political life in the 21st century will be increasingly digital, and those without ICT will be increasingly excluded" (Heeks,2008). Moreover as Heeks noted communities themselves are choosing ICT enabled solutions as well as more physical solutions such as drinking wells. But as further noted ICT4D projects have had a mixed history and there is an increasing focus on "Sustainability: The failure of many ICT4D projects to deliver and survive prompted a new emphasis on ensuring the longevity of such projects." (Heeks, 2008)

Accordingly the team were motivated to avoid what we termed the "tractors for Africa" problem, where we merely delivered the hardware technology and failed to focus on sustainability (fit to local context and needs, training, power, ongoing funding and maintenance).

Project Context

The Central southern Andes mountain region of Peru is permanently exposed to geophysical and geological phenomena, which have had catastrophic effects and pose an ongoing threat to the safety of the local population and the development infrastructure (National Committee of the International Decade for the Reduction of Natural Disasters and the National Institute of Defence, Peru, 1994). This includes earthquakes, landslides, floods and even droughts, all contributing to this being one of the harshest physical conditions on earth. By 2000 Peru was in the process of recovering from a Civil War that had left 69,280 people dead (Gass, n.d.). According to Gass, this war had been primarily fought in the very rural areas that the then-new Free Trade Agreement with the US was projected to hit the hardest. Much of the associated political violence and civil war had taken place in the most poor and abandoned rural areas such as the departments (regions) of Ayacucho, Huancavelica, Apurimac, and Junín located in the central southern Andes (Vasquez, 2005).

According to Orihuela (2009), by 2004 of the post-conflict era, there were over 40,000 rural development projects for a total of more than $US2 billion and Huancavelica and Apurimac were among the "privileged" zones of infrastructural spending in conjunction with poverty-alleviation programmes for the repopulation of the most war-torn areas (Huancavelica and Apurimac). However, the programme failed to reverse the trend, as Huancavelica and Apurimac have had the lowest annual rates of growth of adult population for 1981 to 2007 at 1.4% compared to a national average of 2.8%.It was into this background of new political stabilisation and government spending and support programmes that the Unitec New Zealand's CITRUS team were invited, by the New Zealand representative of the Peruvian Government, Javier Leon, and the Centro International de Papa (CIP), to submit a proposal to NZAid. The goal was to assist the remote highland farmers in the Huancavelica and Apurimac regions by distributing the centralised knowledge and the wired and wireless technology that is available in the cities to these remote areas in order to give these communities more control over their own resources, information on crop growing, markets, education and direction. The plan to achieve this was to link these areas via satellite to the Internet.

The CITRUS team believed the first step was to understand how these communities had lasted so long, and so successfully, living in some of the harshest physical conditions on earth, through a bloody conquest, a civil war and several political and economic revolutions. In lifestyles that appear as primitive, backward and undeveloped there clearly lay significant strength and knowledge that surpasses the developed world's ability to be self-sustaining.

Research Methodology

The project team's desire to effect change in a sustainable manner implied the need to shift the responsibility and ownership of the project to the participant communities. Therefore it was necessary to develop a methodology to ensure this happened. Several approaches were gleaned from the literature. While the team's process was at times intuitive and pragmatically driven, there were some underlying principles consistent with other research approaches that "undertake research in a culturally appropriate way, which operates in a mutually respectful partnership,[and therefore] requires forethought and agreement about the process to be adopted" (Charkova *et al.* 2003).

Research Approaches

Research in this area cannot escape the influence of Paulo Freire. Working in the neighbouring country of Brazil, in Recife in the early 1960's he specialised in the tradition of existential phenomenology - what later became known as the pedagogy of the oppressed and he subsequently published under this title. Freire (1972; as cited in Crotty, 2003; p149) said there was indivisible solidarity between humans and their world; that no dichotomy could be made between the two. "Authentic reflection considers neither abstract man nor the world without men, but men in their relations with the world" (Freire, 1972 p54; as cited in Crotty, 2003; p149).

He further says says that not without dialogue can there be liberation and that true dialogue cannot exist without critical thinking and that only dialogue can generate critical thinking and reflection (1972; as cited in Crotty, 2003; p 153). Freire goes on to say that dialogical [processes] are where both parties are regarded as equally knowing subjects – engaging together in critical thinking and a "quest for mutual humanisation".

Freire (1972; as cited in Crotty, 2003; p 157) equates participatory action research with critical enquiry, and again (1972; as cited in Reason, 2001) emphasised the importance of helping disadvantaged people develop critical thinking so they could understand the ways in which they were disadvantaged by the political and economic conditions of their lives and could develop their own organised action in order to address these issues.

While not consciously undertaken as an action research project the team's approach shared many of the features of action research outlined by Elden and Chisholm (1993) namely (a) a problem focus (b) action orientation (c) cyclical process (d) collaboration/participation.

Tupu et al (2005) use a similar approach with the Kaupapa Maori qualitative research method when reporting on the case of six Maori women enrolled in a Bachelor of Computing Systems at Unitec New Zealand. Their experience was to undertake research in a culturally sensitive manner operating on a mutually respectful partnership with the women in the study. The method they used to collect the data used the beginnings of "whakawhanaungatanga (establishing family-like relationships)" (Bishop, 1996). From this New Zealand experience, came some understanding of models for working with indigenous peoples such as the Quechuan Indian communities involved in this project in Peru.

Also Bishop and Berryman (2006) talk about the importance of building relationships and interactions that respected aspirations for self-determination, in the context of indigenous Maori. They talk about the concept of "Te Kotahitanga" which is "a collaborative response towards a commonly held vision, goal, or other such purpose or outcome" (Bishop and Berryman, 2006; p274). One of the prime tenets of "Te Kotahitanga" is that once those in external authority have had an opportunity to consider their own positioning, they are generally able to see that (re)positioning to be within discourses that offer solutions rather than blame and frustration, offers more opportunities to realise their own aspirations – along with those of those working towards self-determination.

The concept of "people-centered development" was carried out by the Katalisis project team who worked in the same Andean regions of Huancavelica and Apurimac (and several other regions as well), according to Sherwood (2008). Sherwood reported that they compared a "people-centered development" with a "technology-centered development" process. They found that from the view of the indigenous people the "people-centered development" process produced an active outcome with the locals capable of solving their own problems; as opposed to the "technology-centered development" process which produced a passive outcome with the locals continually in need of assistance.

Sherwood (2008) also described one of the processes used by the Katalisis project team in Peru as "taking a spin" by using a spiralling outwards process with a central starting point and then going through the stages of encounters, historical analysis, initial test, first results, hope, broadening, experimentation, confidence, diversification, deepening, autonomy, and finally, organisation.

According to Bartle (2009) poverty is a problem because there are disparities in wealth; some have more than others. If genuine equality were possible, then poverty would not be a problem. Closely associated with wealth are power and capacity. Communities (and individuals) that have lots of one, usually have lots of all three. So to improve the conditions of people in low income communities, poor communities, marginalised communities they need to have more wealth, power and capacity. Closely associated with these three concepts is democracy. The meaning of democracy is "power to the people" (demo = people, cracy = power) (Bartle, 2009).

"When we say we want to empower a community, we mean that we want to democratize it. That does not necessarily mean we want them to have votes to choose their representative (as in the British or American political model). It means we want the people (not just individuals) as a whole (collectively) to have power. We want to find ways for the community to have more power, wealth and capacity." (Bartle, 2009)

Partnership and Understanding

These approaches then, informed the team's dialogues with the local communities. After overcoming the initial distrust, scepticism and curiosity around the presence of the Unitec New Zealand's CITRUS team in these areas, the team learned that the Huancavelica and Apurimac people were desperate to provide a healthy future for their children and were agonising over the rapid slip and decay of their society. Each farmer, mother, politician, alpaca farmer, schoolteacher, missionary, child and youth interviewed, had a story to tell. In a population of 35000, over 400 were interviewed (some many times) and another 1200 attended community instigated meetings to convey their thoughts and impressions.

Phenomenology, the Qualitative Research approach of focusing on people's subjective experiences and interpretations of the world (Husserl, 1982), was the approach the team took to understand the challenges, sadness, and frustrations these people were feeling around the decimation of the society and environment that had sustained them for so long. Over a period of one year the CITRUS team listened and moved through the phases of community storytelling, Fig 1 below. These phases included the initial cry for help and the desire to show to the team what was happening to their society.

Figure 1. Depicting the community meeting

The second phase was dominated by stories of how things were and what things used to be like. The third and perhaps the most crucial part was understanding from the stories the values, philosophies and the informal networks that were entrenched in the culture. These formed the fabric that had knitted these people together for over 1000 years. The solid foundations on which to build technology which might have impact, lay within these philosophies that had withstood the centuries of external assaults.

It was during this last phase, after coding and analysing hours of conversations that strong themes began to emerge. Once the team thought they understood an important theme they would bring it back to the farmers, the women and the elders. The team asked them to show and teach them their way, in their terms, using their resources, to check that the team had understood the essence of these common themes. In many cases as time went by the people would approach the team to explain more, sometimes coming back as many as 10 times. To build common understanding the people were encouraged to tell their stories in a visual way. One of the easiest ways of sharing knowledge was a set of drawings done using paints from one of the local primary schools.

The first concept explained to the CITRUS team by the locals was *family*. Without family, the team were told, their young could not be nurtured and learn from the experience of the elders. Without family they could not exist and grow to support future generations without solid role modeling and nurturing.

The second concept explained by the locals was *community*. Without community the team were told, families could not share their wisdom and experiences. They were not able to learn from the experiences of other families to grow and be wise about matters of life, love and the respect that needed to be bestowed on their environment and community. The community is an extension of the family as shown in Figure 2. From here the wisdom is nurtured shared and passed on. It is here that the wisdom of their elders is cast and passed on for centuries.

Figure 2. Picture of family and community

The last concept explained to the CITRUS team was the *environment* and this was explained in a manner that was so clear and obvious that the team could not help but reflect upon the modern world's perception and neglectful attitude towards the environment. Clearly, the team were told, the environment provides the very air everyone breathes, the water everyone drinks, the grass that feeds the animals which provide meat and clothing, the soil that grows the vegetables. See Figure 3 below. To the locals, the environment and ecology is what gives them, and everyone else, life. Whatever it was the team was going to do, clearly they needed to nurture and enhance it with every action.

Figure 3. The peoples' interpretation of the environment and life cycle.

This depiction of the core values of the community, showed the contrast between their present existence and key challenges facing them. Two major needs were perceived at this point. The first critical need was to gain ready access to markets and information in order to sell crops and animal products at viable prices, rather than those gouged by venal middlemen. The second was knowledge to grow better crops and improve animal husbandry.

Action and Change

The community had collectively and collaboratively drawn on the central values which had sustained their past and saw new forms of knowledge and technology as a way of enhancing the quality of their and their children's lives. In dialogue with the team the communities identified the ways in which computer technology would address their pressing needs and match their values.

The team identified the need for suitable hardware and communications technology to link the remote communities to the internet as a vehicle to gain access to markets, information and knowledge to support the farmers, their families and communities. The team working with local technology capable partners duly implemented CIC's (Centres de Informacion y Communicacion) and internet connectivity enabled by satellite communications.

The communities then empowered themselves by using computer technology as a vehicle to gain knowledge to improve their existence. Initially the computers were used by the farmers, who were trained by local community facilitators, and in the evenings accessed the internet to gain knowledge of market conditions in the cities, link to buyers of their products and to CIP the potato research centre in Lima. As a byproduct of the availability of the centres during the day (when they were unused by the farmers), they were taken advantage of by the local schoolteachers, community and womens' groups, youth and even the preschoolers (in a form of kohanga reo known as 'wawa wasi'). This appropriation of the technology was driven by local wishes and needs and supported by local facilitators who saw opportunities and provided education and training.

Unexpected byproducts of the centres were the enabling of such projects as the winning of contracts for work on local river irrigation schemes by the Mujeres Desplasadas (the displaced women evicted from their homes by the shining path guerillas).

The Unitec New Zealand's CITRUS team called this:

> "*Community Centric Empowerment*". (Young & Muller, 2006).

Community centric empowerment therefore encapsulates a community identifying what it cares about and empowering its members to take actions that support the very basics of life, social interaction, and relationship with their environment. The Quechuan people have a very highly developed awareness of the interconnectedness between their life, their social structures, and their environment. How these things relate to the quality and provision of future generations is also clearly understood and embedded in the very foundations of their culture. Technology can now link them to knowledge and education both for the present way of life and the generations yet to come.

Evaluation

A first hand view of six of the centres and their active use by the communities was evident in a mid project inspection visit carried out in 2005 by the first two authors of this paper.

As noted by Clear & Young (2007) the project has positively impacted the lives of many remote communities in the highlands of Peru, resulting:

> "…in over 40,000 people in four remote regions and hundreds of communities being able to increase their standard of living and communicate with suppliers and advisors in major cities and research centres".

A Masters thesis sponsored by an NZAID Postgraduate Field Research Award 2005/06 has evaluated the impact of the project (Newman, 2006). The findings were positive about the project's impact and the sustainability of the intervention, and reported how the community ownership of the centres had led to an absence of negative uses of the technology.

Conclusion

This paper has reported on the development of a methodology to introduce computing and technology in an ICT4D context. Approaches to engaging with indigenous communities in a manner which respects their values and needs and generates true partnerships, have the potential to bring about technology enabled change in sustainable and useful ways.

After living through the Andean experience and being humbled by the clear priorities of this ancient culture, the CITRUS team saw that there are philosophies that could be adopted as underlying values for the computing disciplines.

These philosophies focus on the core human values of family, community and environment. These communities already have a sophisticated awareness of how to coexist in their environment, whereas many ICT4D projects have had a mixed history and have been required to rethink their approach with an increasing focus on sustainable interventions (Heeks, 2008).

The 'community centric empowerment' model outlined in this paper illustrates a proven research methodology for building sustainable partnerships to jointly undertake IT enabled change. The model is one with the potential for addressing the "planet's megaproblems" (Heeks, 2008) on the frontline of which the world's poor live.

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Poster Papers

Leadership in ICT Organizations: Skills or Experience?

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Abstract
Today, access to information and communication technologies (ICTs) plays an essential role in both economic and social development. A diverse portfolio of ICT solutions is contributing towards a significant change in corporate business processes worldwide. ICT organization leadership is essential for setting up competitive businesses, managing global corporations, adding business value and providing valued products and/or services to their potential markets. Successful ICT organization leaders need to use a mix of technical skills, managerial skills and relevant management and technical experience so as to be able to provide effective leadership.

Keywords
ICT Leadership, Technical Experience, Technical Skills, Management Skills, Personal Attributes.

Introduction
Today, the diverse portfolio of ICT solutions - ranging from the Internet to wireless networks to digital phones and cable systems - is contributing towards a significant transformation of corporate business processes worldwide. Many organizations worldwide, consider ICTs as being essential for setting up competitive businesses, managing global corporations,

adding business value and providing valued products and/or services to their potential markets. Within the last decade, investment on ICTs has become the largest component of capital expenditure within most organizations. As capital investment on ICT within corporations continues to grow, there is an expectation that ICT managers and strategists optimize the investment on technology. They are required to demonstrate leadership so as to not only maximize the benefits of the application of ICTs and other technology solutions but must also avoid the many risks (economical, social and cultural) that are associated with rapid technological change. Within the past few years, numerous academics, theoreticians and strategists have developed and proposed frameworks to make the ICT leadership more effective. What's more, there has been much debate over factors that influence successful leadership of ICT organizations. Some academics and practitioners place high value on experience whilst others insist leadership as an attribute is more influential (than technical experience) in directing ICT leadership towards success.

We examined different views on factors that influence the effectiveness of a leadership role and in this paper we present a brief outline of the outcome.

Findings

In brief, from the review of literature and case studies it became apparent that a combination of skills and personal attributes impact of the success of leadership within ICT organizations. Numerous parameters (such as personality type, emotional intelligence and organizational culture) also impact on effectiveness of ICT leadership. Within the ICT sector, previous experience is often considered as one of the key criteria when organizations select individuals for ICT executive roles. However, whether it is a valuable criterion to be included in the selection process has been vigorously debated. Based on this study, we suggest that experience can make ICT leaders more effective. However, we cannot look at experience in isolation. That is to say, experience must be considered in conjunction with other relevant factors and parameters. Experience can play a significant role if it is relevant to other criteria for selecting ICT leaders – such as leaders' skills, knowledge and professional capabilities.

Overall, a successful ICT leader needs to possess variety of managerial skills, a combination of relevant personal attributes and additional relevant experience with the use of technology and strategic developments within the ICT sector.

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The Language of Computing and IT: Read with Understanding

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Abstract

Each profession has a specific collection of vocabulary which sets it apart from others. Those working in a particular profession, including educators in the field, are not necessarily aware of the language requirements specific to their field.

This poster highlights the specific language needs of Wintec's Diploma of Information and Communications Technology, Level 5, (DipICT L5) modules. This marks the beginning of a study directed towards assisting tutors in understanding the numeracy and literacy requirements of their courses, in terms related to the Literacy and Numeracy for Adults framework (Tertiary Education Commission, 2010).

Keywords

Literacy, Numeracy, TEC

Introduction

The Tertiary Education Strategy 2002-2007, is focused on the skills development necessary for participation in society. TEC have developed a comprehensive framework against which literacy and numeracy requirements may be measured. The "Read with Understanding" learning progression describes the steps that classify the complexity of word structures. The learning progressions are aimed towards assisting tutors in developing material that will embed literacy and numeracy into their programmes, particularly at levels 1-4. The TEC guidelines for strengthening literacy and numeracy through embedding (Tertiary Education Commission, 2009) offer four major guidelines at the course level. These are; Know the demands, Know the learner, Know what to do and Know how to do it. This poster illustrates the results of the first phase of a study that will concentrate on the "Know the demands" guideline. It focuses on the expectations placed on DipICT L5 students by the literacy and numeracy requirements associated with the programme curriculum.

Content

Selected NACCQ Blue Book prescriptions are used by Wintec's School of Information Technology for the three streams associated with the DipICT L5 programme. These prescriptions have been analysed with word frequency counter software (Cobb & Bailey) to discover patterns and commonalities in the specific words used. The results of this analysis are charted in Figure 1.

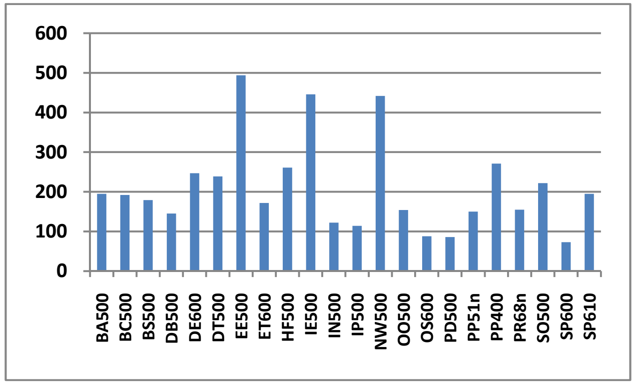

Figure 1 – DipICT L5 Programme Modules: Number of Different Words (Decoding Step 1 & 2 removed)

This initial analysis illustrates the specific language needs of the programme.

Further possibilities for study include the mapping of sample learning materials used by tutors in the DipICT L5 programme, against all the TEC Literacy and Numeracy for Adults learning progressions. The aim would be to develop, in tutors, a greater awareness of the literacy and numeracy expectations of students enrolled in the programme.

Conclusion

Expectations of skills and background knowledge required by students entering the DipICT L5 programme are not always explicit (Hagen-Hall, 2007). Further studies will seek to identify the literacy and numeracy expectations inherent in the teaching and learning materials developed to meet the learning outcomes specified in the Blue Book prescriptions.

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ARGOS Data Storage and Analysis

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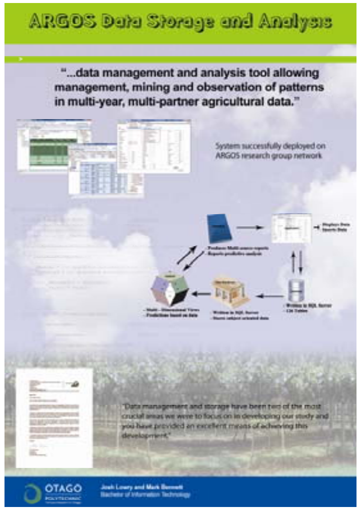

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ARGOS is a longitudinal, multi-disciplinary study of the sustainability of New Zealand Agriculture and looks set to grow for many years.

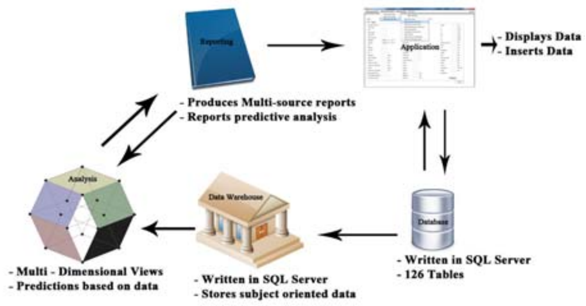
Data management and storage have become critical areas in the multi-institutional programme. This project has we have deployed software allowing ARGOS members to manage, mine and predict outcomes based on the data set.

The solution

Technical complexity:

- OLTP & OLAP databases
- Complete SQL Server solution for data entry and standard reporting
- Advanced data warehousing and data mining module with:
  - Multidimensional cube analyses
  - K-Clustering
  - Neural networks

The ARGOS database contains 146 tables containing up to 158 fields each. The number of records in the database is well over 100,000. Each table has defined primary key (composite where available) and foreign key relationships. These tables are grouped into four schemas; sheep and beef, kiwifruit, dairy, and general.



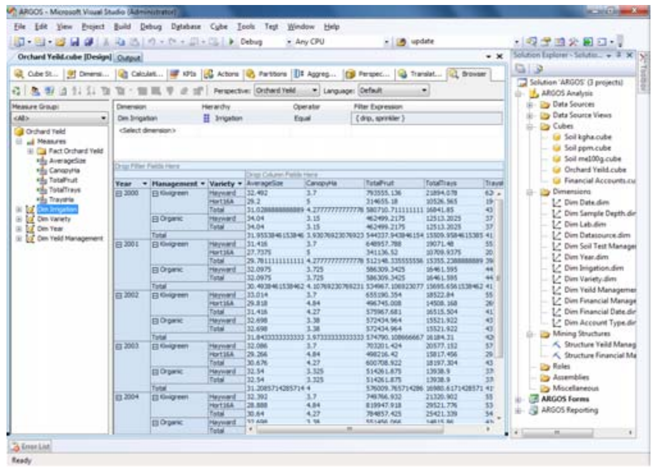
The analysis and warehousing aspect of the product is implemented with Microsoft SQL Server Analysis Services (SSAS). The real value to the client in this project was the ability to extrapolate patterns from the raw data that they had collected. In order to do this, an OLAP (Online Analytical Processing) tool was required.

In order to analyse the data within the ARGOS database, it first had to be transferred to a subject-orientated database. It was decided that this data warehouse also be scripted in SQL Server 2008, as this allowed easy transportation of data from the transactional database to the subject-orientated database.

Once the analysis was complete, the product required the ability to produce analysed output in the form of reports. As all aspects of the product so far were based on Microsoft tools, the group investigated Microsoft reporting tools, and discovered Microsoft Reporting Services. As it was a part of SQL Server 2008, it integrated smoothly with the frontend, the SSAS project, and the transactional and relational databases. It had the means to effectively display both transactional data and the results of analytical data processing, and provided the ability to easily access these reports from the Visual Studio ReportViewer form control.

The data warehousing, mining and reporting component of the product contains several complex interacting systems. Data is first transferred from the relational database into a read-only subject orientated data warehouse. The reporting service then pulls this data through the analysis database, at which point the mining algorithms are performed on the data and outcomes generated. These algorithms are also complex; the neural network algorithms are designed to simulate a learning process similar to that of the human brain.

The whole mining process has been designed to suit the end user who does not know much about data mining. The entire data migration process from the relational database to the subject orientated database is automated with a single button click on the front-end. The data mining then takes place automatically and the user can immediately load reports with predicted outcomes from the new data.



An International Student's Learning Journey: from red to green

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From red to green

A reoccurring image in my study in New Zealand is the traffic light icon I first met in the Jade development environment. It turns red when the things go wrong and turns back to green after everything is reorganized. My learning has been sometimes painful with lots of 'reds' which I turned to 'greens' through hard work and with help from others.

In the beginning...

In (red) China I studied three-year diploma in computing and English language at Jiangsu Institute of Information and Trade Technology. My motivation to come and study in (green) New Zealand was because there was a pathway to a degree which gave me advanced entry because of my study in China. I wanted to study in an English language and in a western teaching system. When I first came to study in New Zealand I studied programming courses at the same level I had studied in China but there were very different. The difference was the strong emphasis on doing. For example, we studied Software Engineering in China by learning facts out of a book. Now I had to design and write a series of linked programs. At first I was stuck. My teacher told me we can "either eat our own dog food or drink our tasted home brew". I progressed through being brave enough to experiment with code.

A capstone project

My capstone project followed a student assessment from creation to marking and beyond. The goals established at the beginning of the project were to provide more assessments for an introductory level programming class and to provide students with quicker feedback on their progress and to ease the marking workload on the course teachers. My personal goals were to increase my programming experience and develop a portfolio of work, to creatively problem solve and to try to use the knowledge about how to develop software I had learned in theory classes.

I began by modifying existing tests: transferring the assignment sheets and model answers into a standard format. My first impression was that the tests were difficult but I progressed when I saw the patterns behind them. I next produced new tests based on different problem domains. At the end of this task, I had a deeper understanding of all the patterns involved.

Having gained enough experience from the previous two tasks, I designed and produced an application which marked the practice tests. There were many stops and starts as I learned a lot about unit test frameworks and software design.

After that, I worked as a peer support tutor providing help for students' practicing for the programming tests. My students' faces turned red when they were frustrated and cleared up again when I was able to help them. I observed many coding errors and was able to change the marking application to take these into account. I have also worked as a teaching assistant in lab classes, which gave me the chance to know more about the expectations from both teachers and students.

Several times throughout my final project my industry supervisor and I did a XP sprint to develop a time logging application to record time spent on phases during the Personal Software Process. The screen turns green when recording time and red when the work is paused. In the Unit Tests I developed the screen is green when all goes perfectly and warns with a red background if there is a test fails. The final 'green light' of my project which made me proud of my work was seeing students being assessed with my assessments and helping mark their work.

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The Elusive Sweven of Successful, Swasivious Schooling of Subnetting

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Abstract
The title of this poster essentially means 'the elusive dream of successful, persuasive teaching of subnetting' and has been created with the intention of presenting the approaches used over the past years to teach subnetting, and ask for feedback and suggestions from other teaching practitioners. It seeks to improve the process and methods of teaching and learning this topic, such that the end result is better student understanding.

Keywords
subnetting, learning, tutorial, fun, Kolb, ideas

Introduction
Internet Protocol (IP) subnetting is a fundamental skill set for networking. It is the practice of taking a network address range and dividing it up into smaller (sub) networks which allows for hierarchical structuring, easier management and security of a network. Subnetting and troubleshooting of subnet problems is a significant learning challenge for students.

Findings
Within the Bachelor of Technology degree at NMIT, subnetting is taught in the second year Net200: Computer Networking course. The author, an ITP

lecturer of nearly ten years, has tried many and varied approaches to teaching the esoteric subject of subnetting. To date, experience has shown that many 'infrastructure' streamed students successfully graduate without fully understanding the topic, nor being functionally able to subnet. This is not a short-term tragedy as subnetting calculators are typically used to set up subnets for corporate networks, but what may be a hindrance for the graduate in the long run, is that their lack of subnetting skills and understanding may hamper their post-degree troubleshooting capacity.

Summative subnetting results (a small part of overall testing) over 2009 & 2010 show an unsatisfactory 26% and 47% pass rate respectively (albeit not statistically meaningful). The increase from 2009 may or may not be significant, but as new activities were used in class in the first semester of 2010, the author is hopeful!

Approaches

The various approaches to teaching subnetting that have been applied over several years of teaching are listed below. These approaches have ranged from Kolb's learning cycle 'Reflective Observation' to 'Concrete Experience' in order that "every individual problem solver performs best by tracing the entire cycle him- or herself." (Kamis & Topi, 2007). Also, as stated in Atkins & Caukill, *Serious Fun and Serious Learning* (2009) "it seems intuitive that creating fun and possibly game-like interactive situations and artefacts is a sensible way to provide authentic learning four our students." Specific tactics have included:

- Chalk and talk, with practice based, interactive tutorials
- Analogies (postal, geographic, etc)
- Summative tests (including 24 hour preparation)
- Simple network simulations using NetSimK
- Practical implementations (summative projects)
- Food: black/red/green liquorices, pink/white marshmallows, multicoloured M&M's
- Contests with rewards
- Second Life project
- Practice outside on pavement using chalk (chalk and walk? ;-) (2010)
- Formative online quizzes - do and redo (2010)
- Student authored "Xtreeeme Networking!!!!1~" subnetting game (2010)

Conclusion

Although the above activities are deemed helpful for learning subnetting, and the student feedback about them has been positive, the suboptimal results speak for themselves. Further work must (and will) be done to improve future outcomes.

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‘Same-Origin Policy’ Circumvention for Legitimate, Dynamic Web Development

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Abstract

The emergence and proliferation of web services and social networking websites has highlighted the requirement to retrieve data from other websites. Without this ability, interactive and engaging web applications that use Asynchronous JavaScript and XML (AJAX)-based applications are hamstrung. Abandoning them would leave today’s users frustrated. However, there are genuine concerns regarding possible misuse of AJAX when employed to access data from different domains. Examples include harvesting sensitive information to effect identity fraud and illegally accessing credit card accounts at the victim’s expense.

The browser-enforced Same-Origin Policy (S-OP) seeks to prevent scripts from facilitating this misuse; the policy enforces considerable limitations to the power AJAX-based applications have when trying to create a richer browser experience for the user, however.

This poster illustrates four different methods that well-intentioned web developers can use to circumvent the S-OP, namely Proxies, HTTP Access Control, Flash/crossdomain.xml and JavaScript Object Notation with Padding (JSONP). Each allows their AJAX-based applications to send requests to a domain other than the requests’ origin, and receive data in response. The

relative merits of the four methods are compared and recommendations are made

Keywords
AJAX, Same-Origin Policy, Web Browser Security, Web-development.

Introduction
Web applications such as Facebook, Windows Live Hotmail, that displays emails instantly when a user selects one from their inbox YouTube, Google Maps, that displays new segments of the map as the user drags their mouse around and Gmail, that automatically checks for new emails, have become part of our lives. Their functionality and lasting appeal relies in part in their ability to operate asynchronously between the client and the web server. Permitting this ability, however, has a downside – it allows malicious exploitation.

Cross-Site Scripting (XSS or JavaScript Injection), is one of many types of malicious attacks that can be deployed against web applications. Exploiting one of a number of known web vulnerabilities, they may allow an attacker to steal users' session cookies or redirect users to malicious Web sites that exploit Web browser security issues. (Cenzic, Inc., 2009, p24)

Content
By 2009, Cross-Site Scripting accounted for 17% of all vulnerabilities found in web applications, (Cenzic, Inc., 2009, p. 11). Use of the S-OP allows scripts running on pages *originating from the same site* to access each other's methods and properties with no specific restrictions.

The ability to create dynamic web content that engages website visitors is significant in creating satisfying user experiences. AJAX technologies potentially offer users such an experience; however the strictures of the Same-Origin Policy make life difficult for the developer. The intention in this paper is to see how best to overcome the hurdles, while respecting the original intentions of the policy. Experiments with the four main known ways of programmatically circumventing the Same-Origin Policy, using both client and server-side web technologies, gave some interesting results. These findings are shown in the poster, along with figures that further explain some of the techniques.

This report will provide example code to demonstrate each circumvention method, and discuss the benefits and drawbacks of each method. In its conclusion, this report will discuss the probable future of making web applications that require cross-site requests, and reflect on which circumvention method is recommended in the meantime.

Conclusion
The Same-Origin Policy circumnavigation methods used each had pros and cons – the one developers should choose depends upon the particular implementation.

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Industry education integration: improving students' course subject application

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Abstract

This poster abstract discusses ways of incorporating applications in industry and non-profit organisations into courses to allow students to get a clear view on how the course subject is applied and used. Value-add is found in integrating industry contacts into courses to let students pro-actively work towards a match with industry, rather than validating their study after passing the majority of courses.

Keywords

Industry relationships, industry-institute integration, industry-academia collaboration, pre-graduation industry experience, applied technology experience.

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Introduction

This poster abstract describes established relationships, and initiates further discussion on the role of industry and non-profit organisations in applied technology courses, with the purpose to give students a clear view on job perspectives while still studying.

Understanding the different backgrounds of students, the educational institute, and the industry and organisations are paramount for finding common grounds that establish a fruitful cooperation.

Students participate in pre-graduation industry experiences that are blended with their subject papers. This is different from internships that are typically a sequel to completed papers. Industry and organisations connect to a group of students as they are learning their paper subject. The educational institute is a mediator allowing the lecturer to keep a close match between the paper material and industry requirements.

Goals

We want to strive towards a good match between student capabilities and industry requirements. That means: 1) allow students to experience what is expected, and how the subject is applied; 2) allow the lecturer to respond to ever changing market needs with modifications to teaching materials and techniques; and 3) allow industry and organisations to communicate with a group of potential/future employees to express their offerings in detail related to the course subject.

Different backgrounds

Newly learnt subject topics are illustrated in class with a few examples. These examples are typically small-scale and tailored to supporting these new topics. A wider, realistic, and often more complex environment is found in industry and organisations. This opens up new challenges in applying significantly more factors.

Scheduling such sessions requires flexible planning as the course timetable not necessarily matches events in the market place that can be very supportive for the students' learning.

Site visits

Site visits give students early access to real-life environments in which the subject material is applied. It shows the trade-off between an optimal technology driven solution, and a less-optimal resource-driven solution. Resources typically involve time, money, and people in relation to market needs.

Students get a better understanding of what is expected. Understanding the course subject becomes more a job requirement than an educational requirement.

Guest speakers

A different person from a different (non-educational) context who delivers a similar message puts trust in the usefulness and need to master the subject. Illustrations of real-life examples provide a rich context to relate the course content to actual events. The effort industry is willing to put into discussing the subject with the students is understood by the students as a support for their education as a required foundation.

Industry directed assignments

Assignments can be chosen such that they benefit industry/organisations. These are typically low-cost, low-priority assignments to allow for longer time-spans and generally available resources. The students are directly involved in industry requirements and work relationships when applying their course subject. As they learn the subject they are constantly exposed to the relation with industry. This gives students input *during* their study to direct and steer their focus, and to adapt to a wide range of inputs that need to be filtered for their needs.

Future work

Further research is needed into approaches and communications finding common grounds for students, the educational institute, and the industry and organisations. More insight is required into working with a shared goal that is beneficial for all parties. The provisional conclusions of this abstract require confirmation through evaluations.

Results

Several relations have been established with industry in Hawke's Bay that allow students to interact with real-life events in the market place. The students benefit from first contacts in industry, and are more able to prioritise and understand the relevance of the subject material.

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CityScape: panoramic exhibition system

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Gareth Dorset

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This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

This paper describes the development of CityScape. Cityscape is an immersive panorama attraction that allows visitors to explore areas and express their creativity, building a community narrative. This project was awarded 100% by our industry assessment panel***.***

The project is described, both in terms of development and finished artifact.

Development process

CityScape was developed using the Agile Development Framework. The clients were Samuel Mann and Joesphine Regan for the initial stages, then the Otago Settlers Museum for the robust delivery.

In the first iteration a brainstorming session provided the starting point for detailed consideration of ethics, stakeholder analysis, extant research and management plan – all culminating in a proposal. The second iteration focused on the production of a functional delivery. Task analysis provided a clear understanding of needs of different users, including museum visitors of different ages and languages, and of the requirements for deployment in a museum setting. These were represented as dialogue diagrams and extensively tested as paper based prototypes. Cityscape was developed in C# with a T-SQL database for the backend data storage. C# was chosen due to the main input control device, the 3D mouse, having a

"Telescope" allows visitors to explore the panorama, and to zoom in on areas of interest.

Instructions graphically represented and in English, Te Reo, Cantonese and Japanese.

Panorama of 31,273 images stitched together to provide multi level of detail imagery.

If the visitor selects a known point of interest such as a heritage building they are presented with other images including historic views or building interiors.

Montage of CityScape panorama, controls, console and gallery. The visitor moves around the image, zooming as required; selects a point of interest; this capture is presented on a "easel" (along with previous captures of the same area, and other images such as building interiors); the visitor then selects and frames their preferred image; lastly positioning it upon the separate gallery where it slowly ages.

software development kit in C#. The choice of T-SQL for the database was due to its well developed interaction with applications developed in C#.

Deployment

In the third iteration, CityScape was implemented as a robust exhibit for the Otago Settlers Museum. It was deployed through November 2010 and will be again running in public following redevelopment of exhibition space in 2012.

CityScape was deployed as three parts: Cityscape Authoring, Cityscape Panorama and the control system. The Cityscape Authoring program manages panoramas of 31,273 separate images and associated points of interest. The Cityscape Panorama program uses an image pyramid naming scheme and adaptive buffer control to give a smooth immersive experience. Both programs are built in C# and communicate via a database.

The purpose built control system displays the whole panorama and allows the user to explore, select, frame, and display images. The gallery "ages" over time to create an ongoing community memory bank.

Since finishing this project and graduation, two of the development team have found employment in interactive exhibition development. Full details of development available at http://bitweb.ict.op.ac.nz/wiki/Cityscape_Evidence_Portfolio_Part_A

Turning Them Back from the Brink…

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Joy Gasson

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A. STUDENT.
Week beginning: 1/04/10

IN521 Maths Adrienne Dearnley	Tuesday 8:00 – 10:00	Friday 8:00 – 10:00
IN501 Professional Practice Karen Love	Monday 1:00 – 3:00	Thursday 10:00 – 12:00
IN505 PC Maintenance Tim Elder	Monday 10:00 – 12:00	Thursday 8:00 – 10:00
IN 511 Programming 2 Joy Gasson	Tuesday 10:00 – 12:00	Friday 10:00 – 12:00

Comments:

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For how long should we keep enrolling failing students?

When a first year student has failed all papers in their first semester, should they be allowed to re-enrol?

These students present a high risk in terms of course completion, but should they be excluded after only one or even two semesters?

In the Bachelor of Information Technology programme at Otago Polytechnic in 2010, a contract system has been introduced for students who are identified at high risk of failing their course. The students are interviewed individually and terms of their enrolment is laid out in a formal letter from the Head of School:

- Enrolment is for one semester only,
- Further enrolment is dependent on successfully completion of current semester,
- The student must ask each lecturer at every class to sign their Attendance Register,
- The Attendance Register must be handed to the First Year Coordinator at the end of each week,
- The Polytechnic may withdraw a student who fails to meet these requirements. This would mean an immediate stopping of Student Allowances.
-

The Contract system explicitly addressed our concerns for success for a small group of students. It allowed a constructive discussion with students about improving their pass rate, and accentuated that attending class is the first and critical step for successful learning. The comment section encouraged lecturers to discuss and write about positive characteristics of learning practice. The weekly meeting with the First Year Coordinator reiterated the need for attendance and encouraged confirmation of changed behaviours as they emerged.

By the end of the semester, it was apparent when students had not met the terms of the Contract. They will not be enrolled in the next semester. The system worked for half of the at-risk students. For these students, attendance at classes had a profound effect on their engagement in the course, the relationships they developed with other students and their success within the course.

Student 1: *It got me in the habit of coming to class.*

Student 2*: It helped to find someone else in the same boat. I didn't know X before and now we work together all the time.*

Student 3: *I thought that I could skip classes and be OK. But I never knew what the class was doing. I didn't want to appear stupid so I just said I was OK and kept failing.*

Lecturer 1: *The greatest comeback since Lazarus!*

Lecturer 2: *It seems so simple, just to insist and check on attendance.*

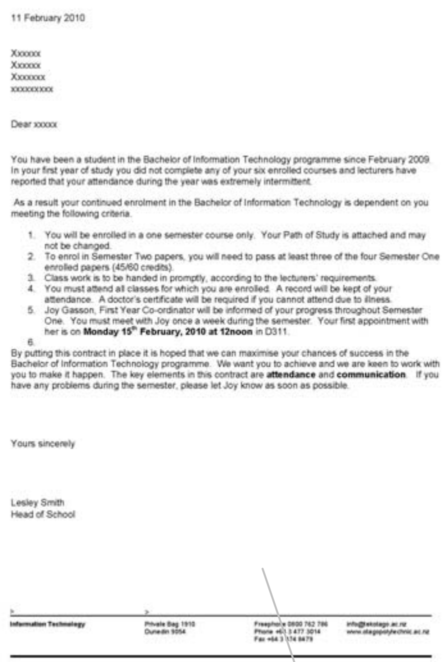
Lecturer 3: *Accountability fostered responsibility which in turn facilitated achievement.*

Lecturer 4: *It gave them the chance to redeem themselves, yet provided a structure for everyone to work within.*

Lecturer 5: *I really don't have words to describe the difference. It is like having two totally different students.*

Lecturer 6: *I am so proud of student X. He got the top mark for the paper (70 students) this semester.*

Lecturer 7: *It is reassuring to see such increased confidence and overall enjoyment in learning.*



11 February 2010

Xxxxxx
Xxxxxx
Xxxxxxx
xxxxxxxxx

Dear xxxxx

You have been a student in the Bachelor of Information Technology programme since February 2009. In your first year of study you did not complete any of your six enrolled courses and lecturers have reported that your attendance during the year was extremely intermittent.

As a result your continued enrolment in the Bachelor of Information Technology is dependent on you meeting the following criteria.

1. You will be enrolled in a one semester course only. Your Path of Study is attached and may not be changed.
2. To enrol in Semester Two papers, you will need to pass at least three of the four Semester One enrolled papers (45/60 credits).
3. Class work is to be handed in promptly, according to the lecturers' requirements.
4. You must attend all classes for which you are enrolled. A record will be kept of your attendance. A doctor's certificate will be required if you cannot attend due to illness.
5. Joy Gasson, First Year Co-ordinator will be informed of your progress throughout Semester One. You must meet with Joy once a week during the semester. Your first appointment with her is on **Monday 15th February, 2010 at 12noon** in D311.
6.

By putting this contract in place it is hoped that we can maximise your chances of success in the Bachelor of Information Technology programme. We want you to achieve and we are keen to work with you to make it happen. The key elements in this contract are **attendance** and **communication**. If you have any problems during the semester, please let Joy know as soon as possible.

Yours sincerely

Lesley Smith
Head of School

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Dunedin 9054

Head of School formal contract

Subvert Web Development Project

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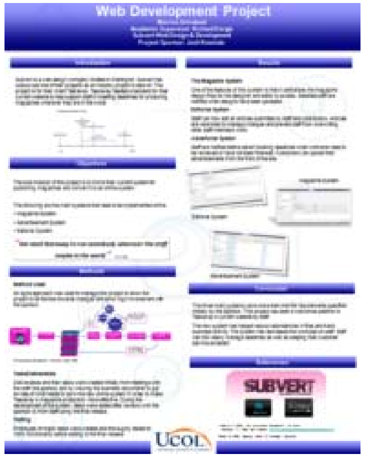
Richard Dargie
Private Bag 11-022, Palmerston North 4442



Abstract

The purpose of this project was to develop a Website backend for the Subvert Web development company.

The system required the conversion of a legacy magazine publishing system to an online system. To accomplish this, the project required the development of three main features:

1. The centralisation of magazine design files for designer and editors to access.
2. The ability to access and edit articles submitted by both contributors and staff. A versioning system was needed to track this process.
3. An advertorial system was needed to allow customers to upload advertisements. The system would then notify staff of contracts needing to be renewed or finalised before the publishing deadline.

An agile methodology was use to develop the system. This was an incremental and iterative approach using the Agile System Development Life Cycle (Ambler, 2009).

The new system has helped reduce file redundancy and enabled the tracking of business activities and decreased staff workload leading up to a magazine release.

Keywords

Capstone project, agile methodology, advertorial system, web development, magazine editorial system,

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Introduction

Subvert is a web design company located in Wellington. Subvert has outsourced one of their projects as an industry project to take on. The project is for their client Tearaway. Tearaway needed a backend for their current website to help support staff in meeting deadlines for producing magazines wherever they are in the world.

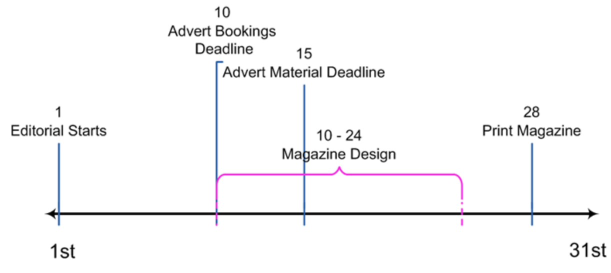

Figure 1: Monthly Magazine Cycle

Methodology

An agile approach was used to manage this project to allow the project to be flexible towards changes and allow high involvement with the sponsor. The agile approach used was a The Agile System Development Life Cycle (Ambler, 2009)

Tasks/Deliverables

Deliverables and their tasks were created initially from meetings with the staff, the sponsor and by viewing the business documents to get an idea of what needed to be in the new online system in order to make the magazine production more effective. During the development of the system, tasks were added after reviews with the sponsor or from staff using the final release.

Testing

Prototypes of major tasks were created and thoroughly tested for 100% functionality before adding to the final release.

Results

The Magazine System

This was completed with one of the key features being the centralisation of magazine design files for designer and editor to access. Staff is notified when designs have been uploaded.

Editorial System

This was completed. Staff can now edit all articles submitted by staff and contributors. Articles are versioned to manage changes and prevent staff from overwriting other staff members work.

Advertorial System

This was completed. The staff is notified before advert booking deadlines when contracts need to be reviewed or have not been finalised. Customers can upload their advertisements from the front of the site.

Figure 2: Sample screen outputs

Conclusion

The three main systems have more than met the requirements specified by the sponsor.
The new system has helped reduce redundancies in files and track business activity. The system has decreased the workload on staff. Staff can now easily manage deadlines as well as providing excellent customer service.

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Information Technology Plan and Google Adword Project

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Abstract

Smart Business (New Zealand) Limited is a small business that provides core business services such as payroll, financial, phone and administration to business's who wish to pursue outsourcing. In addition, Smart offer franchising opportunities to business minded people who wish to set up a unique business.

The Information Technology Plan and Google Adword project is one that has benefited Smart. The "Novel Way" methodology has provided a process where a high quality project has resulted. The organisation has been thoroughly analysed, investigated and summarised to produce strategic goals and Google Adword prototypes that have assisted with the completion of the final IT products. Local IT suppliers assisted with the IT plan in providing relevant information about each unique technological solution.

The overall benefits for Smart include better decision making, more website traffic, better customer satisfaction and support, and more competitive technologies.

Introduction

Within this document includes the process and findings of how the Smart project progressed and resulted. There were several steps taken to ensure that both IT products were produced to the highest standard possible. Overall Smart will use the IT products to grow their business with maximising the use of technologies currently available.

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Methodology

A strategic planning methodology called the "Novel Way" created by the Novel Management Group, Georgia, United States of America. There are six steps that were followed:

Step	Description
Customer Initiation	Defines what the strategic objectives are. A project proposal is constructed.
Vision, mission, and value statements	Smart's vision, mission and value statements are identified. These are the back bone for the strategic plan.
Organisational assessment	Identifies the external and internal factors of Smart. A SWOT analysis is administered.
Analysis of strategic goal priorities	Strategic goals are identified and prioritised within governance, administrative and financial measures.
Create strategy	A baseline scorecard diagram, strategy maps are designed. Google Adwords are designed. The strategic document is constructed.
Implement the plan	The Google Adwords are displayed within the Google Account and the IT plan is communicated to Smart.

Table 1: Novel Way Steps

Table 1: Novel Way Steps discusses the process of creating the information technology plan. The Google Adwords were analysed, designed, constructed and implemented within this methodology.

Results

- A decision-making IT plan for future technological investments
- Technologies are analysed in detail and suitable for Smart management.
- Google Adwords have 159 more impressions and are more efficient for Smart.

Conclusion

Thus can conclude that the Smart project has proven successful for both the project student and the project sponsor. The two IT products will give value to the growth of Smart within 2010 by providing functionality and technologies that will be competitive and current.

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Multistage Quality Checks in Designing, Developing and Delivering Computing Degrees

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Abstract

In this poster paper, the quality checks required at the different stages of designing, developing and delivering computing degrees at a New Zealand Institute of Technology are reviewed. These quality checks are both internal and external to the institution and are for undergraduate and post graduate degrees. The multiple quality checks required ensure that any degree that is approved has undergone, and continues to undergo, rigorous scrutiny.

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Keywords

Computing, degrees, quality

Introduction

In New Zealand, degree programmes are provided by government training establishments (institutes of technology, polytechnics, universities and wananga) and by private training establishments (PTEs). Non-university training establishments in New Zealand wishing to offer degrees are subject to multiple quality checks, most of which are mandated by the New Zealand Qualifications Authority (NZQA), which approves the degrees and accredits the training establishments. Unitec offers three computing degrees: Bachelor of Computing Systems (BCS), Master of Computing (MComp) and Doctor of Computing (DComp). This paper describes the quality checks applied to these degrees.

Quality Checks

There are three distinct stages in the development and delivering of a degree programme that require quality checks both internal and external. The first stage is the design and development of the programme. During this stage the majority of the quality checks are all internal. The next stage is the approval and accreditation of the degree programme and the main checks here are external. The third stage is the delivery of the degree and at this stage the quality checks are both internal and external.

Design and Development

The first stage in the design and development of a degree programme is the market analysis and business case. This is checked internally by the senior management of the institution (Joyce 2002). Once approval is gained to proceed, the academic development team prepares the documentation which is checked both internally by the institution and externally by consultation with the industry.

Approval and accreditation

The NZQA appoints a panel of seven: six external and one internal academic from another department. The panel members read the documentation then visit the institution to view the facilities and resources and talk to the academic staff, senior management and other staff as required. Their written report is then sent to the institution and they make a recommendation to the NZQA Board. Approval is for the viability and rigour of the programme and accreditation is for the ability of the institution to teach it to the required standard.

Moderation, Monitoring and Review

Assessments of all degree courses undergo both internal and external pre- and post- moderation. This process must be described in the programme regulations and adhered to. A panel of four internal academics assesses DComp assignments and presentations. Internal and external academics moderate samples of marked BCS and MComp assignments and BCS examination scripts. An external academic moderates all DComp assignments and MComp and DComp theses are examined by external examiners. All degrees are monitored on an annual basis by an external academic.

All programmes are also required to undergo a five year review. This involves both internal and external panel members who review a comprehensive self-evaluation report and make recommendations and/or requirements for the continuance of the programme. Feedback from students by way of anonymous course and lecturer evaluations is also reviewed.

Conclusion

Academics in New Zealand institutes of technology often complain about the multiple quality checks, but can be confident that the quality of their degrees has been very thoroughly checked. Some of the quality checks (e.g. those for thesis examinations) are similar to those used in New Zealand and overseas universities but others (e.g. those for monitoring and external moderation of assignments) do not seem to be applied in New Zealand universities.

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Assessing with a unit test framework: testware construction strategies

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Purpose

We extended a unit testing framework so that it could automatically mark programming assignments. Assignments change, programming languages change, and students' work varies greatly. We sought a software architecture which would cope with these changes.

Approach

Our first design goal was to make it easy to author the tests. A domain-specific language (Ghosh 2010) was created to allow a test author to think about just describing the data structures and methods the student was required to construct. This 'minilanguage' (Raymond 2004) allowed definition of a higher-level language to specify the appropriate methods, rules, and algorithms for the task at hand. It reduces global complexity relative to a design that uses hardwired lower-level code for the same ends. Specifically it hides the details of assertions within the unit testing framework (Beck 2002) and hides the reflective code (Sobel & Friedman 1996) required to detect and run the student code from a program which observe and modify properties of its own behavior.

Shearing layers (Foote and Yoder 2000) were used to further factor the system so that artifacts that change at similar rates are together. A base class contains the methods which ran student code and accessed data within their work, a subclass contained the code which asserted that desired features should be present and subsequent subclasses marked specific questions.

Because the programme was embedded within the architecture of a unit testing framework we got ‘for free’ a generic engine to run the our tests of student code and a GUI to present the results of tests. The Jade programming language specific version of xUnit (JSC 2009) provided a base JadeTestCase class from which from we inherited the assertion methods that determine whether a unit test fails or succeeds. It allows a unit test run to be structured with methods to set up data in a known state (the test fixture) before a unit test starts and to tear down that data when the unit test has completed. The associated JadeTestListenerIF interface (the listener object) controlled the way the results are captured, displayed, and analyzed. And finally the JADE development environment enabled execution of a selected unit test method or all unit test methods for a selected class by pressing the F9 key.

Findings

The overall result is a domain specific language which allows easy authoring of tests to mark programming assignments. Here is code which defines what the student should have done. This is isolated by shearing layers in successive super classes from the code which detects what the student actually did and the code which compares the teacher’s desires and the students’ work and assigns marks or provides detailed feedback of what is incorrect and how to fix it.

Automated marking of programming assignments reduces the workload of teachers and increases the speed at which students get feedback about their coding. The immediacy of the feedback starts their test addiction. We are beginning to explore variations in the type of feedback the software gives to students to see what effectively prompts them to them improve their code. Future work will involve porting the system to another programming language.

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R&D Vouchers: Business Continuity of IT

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Abstract

Wintec introduced a scheme to do a $5,000 project with Research, Development or Knowledge Transfer for an organization. The first project, proposed by Employer Partnership Group for IT, was done on Business Continuity of IT. Feedback indicates it was successful and we learned about the scheme, engaging community, IT issues for industry and informing teaching.

Keywords

R&D, Business Continuity, ITIL

Literature context

We used ITIL and other literature to develop assessment criteria for this review.

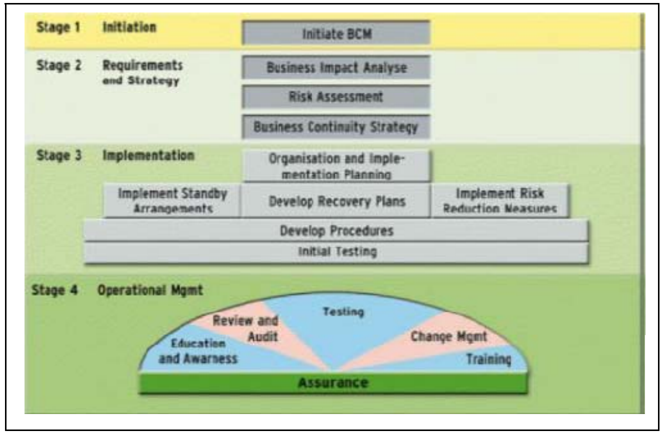

Figure 1: ITIL's for stages of Business Continuity

The review itself was undertaken as follows:

Area	Review
ICT service continuity management	- understand ICT continuity requirements - identify ICT specific aspects of any existing continuity management practices, including any documented ICT service continuity plan - compare practices to appropriate assessment criteria and assess - identify any opportunities for improvement
Risk mitigation	- identify – - possible risks to the ICT environment - the probability of the risk occurring - the impact of the risk - identify any opportunities for improving existing risk mitigation practices associated with identified risks
Miscellaneous	Additional points associated with business continuity and/or ICT specific continuity may arise for discussion/assessment as the review proceeds. In keeping with the methodology outlined in this document, where possible appropriate assessment criteria will be identified for comparison and findings will be summarized in a similar manner, including the identification of any opportunities for improvement.

Figure 2: Review plan reference list

The assessment is not an audit and is therefore largely subjective, based on an understanding of the business and ICT environment gathered through interviews (and follow up questions) with relevant staff, partners and suppliers of the client organisation as well as a minimal amount of observation. Detailed observation and testing to validate responses was not included within the scope of this review.

Observations re IT

Positive aspects for NGO sector (considering funding):

	Community Org 1		Community Org 2	
Review area	Assessment	Points	Assessment	Points
• Policy and scope	Partial	1	Partial	1
• Requirements and strategy	Partial	1	Adequate	2
• Implementation				
• Risk mitigation	Partial	1	Partial	1
• Emergency response plan	Partial	1	Adequate	2
• ICT service continuity plan	Inadequate	0	Inadequate	0
• Documentation	Partial	1	Inadequate	0
• Operational management for assurance				
• Format and distribution	Partial	1	Partial	1
• Education and awareness	Partial	1	Partial	1
• Review and audit	Partial	1	Partial	1
• Testing	Adequate	2	Partial	1
• Change management	Adequate	2	Adequate	2
• Training	Adequate	2	Partial	1
Overall (out of 36)		14		13
Average	Partial	1.16	Partial	1.08

Rating & points		Assessment
Complete	3	Agreed with more than 100% of the appropriate assessment criteria
Adequate	2	Agreed with between 75% and 99% of the appropriate assessment criteria
Partial	1	Agreed with between 50 and 75% of the appropriate assessment criteria
Inadequate	0	Agreed with less than 50% of the appropriate assessment criteria

Figure 3: Overview findings

Space insufficient to report in more detail. Provided each organization with detailed report.

Learning

About industry/community organizations:

- Some areas of obvious concern
- Organizations appear low-resourced
- They appreciated it and wish for more

About project:

- Short notice to release staff from teaching
- Much more effort than anticipated 100 hours
- Using a good framework was very useful
- Manage scope and expectations very closely

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Acknowledgements

Wintec for funding, Bruce Ferguson for advice, NGOs for collaboration.

B2B large scale, large organization: Dell – a case study

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Introduction

Dell is a pioneer in electronic commerce (E-Commerce), leading the industry as one of the first companies to allow its customers to custom configure and purchase computers online. In recent years, Dell has extended this functionality all the way to an Enterprise Resource Planning (ERP) system for true B2B commerce.

Literature review

According to a list of traffic figures for leading e-commerce sites released by comScore Media Matrix (as cited in Maguire, 2002); Dell's E-Commerce website had 11.4 million visitors in 2002. According to Rappa (2010), Dell was still listed in the same rating, but the measurement had changed and Dell was now listed top in a unique category.

Rating	eCommerce Website	Visitors
1	eBay	34.4 million
2	Amazon	25.6 million
3	Yahoo Shopping	24.5 million
4	**Dell**	**11.4 million**
5	Barnes & Noble	8.2 million
6	MSN Shopping	7.3 million

Table 1 – Leading eCommerce sites by visitors

Dell as a B2B Enterprise

The Dell eCommerce model has given it a lean cost of doing business and a learning curve to apply when extending this into the B2B sector. Dell delivers business to business (B2B) E-Commerce transactions that allow organizations to lower their procurement costs (Dell, 2009). With a B2B E-Commerce solution in Dell, companies can shop online from within their own Enterprise Resource Planning (ERP) "procurement" application and return the contents of their shopping session back to ERP system electronically.

Website	Category/Model	Ranking
eBay	Auction Broker	Top
Amazon	Virtual Marketplace	Top
Yahoo Shopping	Portal	Top
Dell	**Manufacturer Direct**	**Top**
Barnes & Noble	Affiliate Model	Top
MSN Shopping	(not listed)	(none)

Table 2 – Leading eCommerce sites by category

Dell defines B2B Integration E-Commerce as server-to-server communication over the Internet integrating both systems and business processes to dramatically transform the way they conduct business with their partners, suppliers, and customers (Dell, 2009). According to Dell, by electronically integrating these processes, they not only benefit in process efficiency and information accuracy, they also increase their ability to respond and interact with each member of a business relationship.

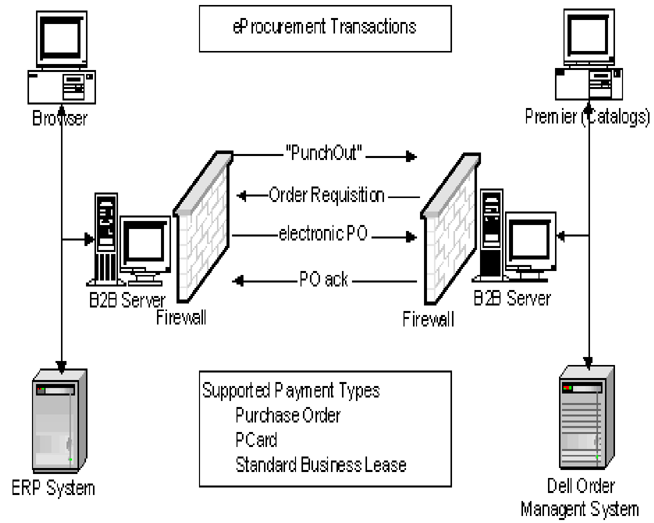

Figure 1 Diagram of eProcurement Transactions

Dell Service	Dell B2B Division Name
Web site hosting to provide small business with own website and web storefront	www.DellEWorks.com
E-Commerce services including reselling	Gigabuys
Dell/Ariba alliance to create inexpensive tools for B2B e-commerce	Dell B2B marketplace exchange
'Brick to Click' works with dot.coms to improve business efficiency for SMEs starting in e-commerce	Dell consulting
Equity and incubation services for early-stage Internet companies	Dell ventures
FAQs: diagnostics, customer discussion forums, parts ordering dispatch requests, service call status	www.Support.Dell.com
Automated detection, diagnosis and resolution through Internet	Resolution assistant

Table 3 – Dell's B2B eCommerce service products

Summary

Dell has integrated the comprehensive campaign management system with their existing customer relationship management (CRM) system, moving the company much closer to its goal of a closed-loop online marketing environment.

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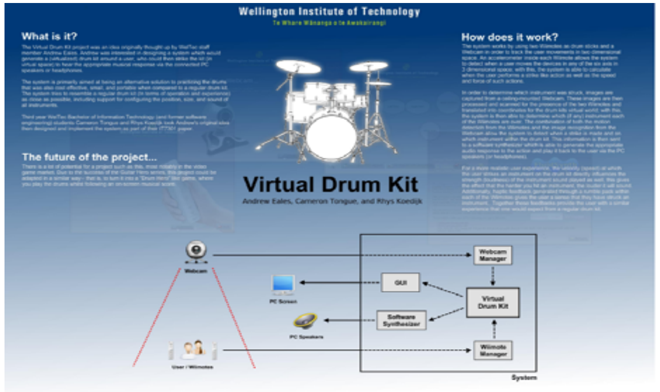
The Virtual Drum Kit



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Abstract

This project was to produce a virtual drum kit which could generate the sound of drum beat/s, activated by two hand held Wiinotes as drum sticks and a Webcam to track the users movements in two dimensional space. An accelerometer inside each Wiinote measures the velocity (speed) at which the user strikes, allowing the system to detect when a user moves the devices in any six axis in 3 dimensional space. This will calculate when the user performs a strike-like action as well as the speed and the force of such action to generate varying volumes of sound. A ceiling mounted webcam will capture the position of the two Wiinotes to see what drum each Wiinote is over.The combination of both the motion detection from the Wiinotes and the image recognition from the Webcam, allow the system to detect when a strike is made and which instrument within each drum kit. This information is then sent to a software synthesizer which will generate the appropriate audio response to the action, and play it back to the user via a PC, speakers or headphone.paper

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What drives a hacker – thrills, power or money?

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Introduction

The purpose of this project was to determine the motivation of an internet hacker. To obtain sufficient information, two key research techniques were implemented, a survey and most importantly a literature review. The survey was carried out on twenty random people from the general public of central Christchurch.

Literature review

Some selected examples of writings found include Hiaasen et al (2009) who identified Albert Gonzalez as the person responsible for one of the largest ever cybercrimes. Gonzalez started hacking because of the thrill he gained from it. However as time went on his intentions were for financial gain. Overall he stole at least 170 million credit card numbers and made millions of dollars as a result. $1.1 million alone was found buried in his parent’s backyard. He is facing a life sentence for the numerous cases against him.

IT Security (2007) reviewed five of the most famous hacking cases at that time and found that the motivations were for fun, seeing what they could get away with, intellectual stimulus, notoriety, identifying security flaws, free software, financial gain and curiosity. These incentives are not new to the issue of what motivates a hacker; they are in fact sharing a repetitive pattern from which a key set of motivators can be identified.

In summarising the motivators of a hacker, Zamora (2003) claims the key word is information If we take this theory, then when hackers are searching for credit card details, personal credentials, IP addresses, business secrets or software code they are indeed searching for information. However, because information is such a generalised it is important that we still understand the motives such as financial gain, thrill, power, curiosity, intellectual stimulus, revenge or the ability to cause mischief.

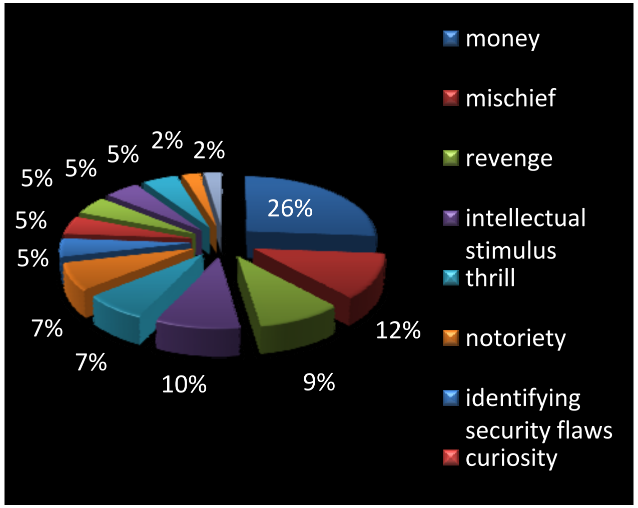

Figure 1 – Reported motivators of Hackers

Results

As a result of a survey, Figure 1 represents the percentage of each motivator recognised in the literature review. The six highest motivators according to literature are money, mischief, revenge, intellectual stimulus, thrill and notoriety. Some of the highest motivators recognised are simply the cases that have been brought to media attention. Comparisons between the literature review and the survey are found in Table 1.

Motivator	Literature Review	Survey Results
Financial Gain (Money)	26%	12%
Mischief	12%	12%
Revenge	9%	10%
Intellectual Stimulus	10%	10%
Thrill	7%	10%
Notoriety	7%	10%
Gender: Male	19%	80%
Unknown	81%	20%

Table 1 – Comparison motivators of Hackers

Conclusions

In summary, the research shows that financial gain and the ability to cause mischief are the two most common drives for internet hackers. Motivational objectives vary between age ranges and the top two motivations for internet hackers are related to the mainstream of hackers identified around the world.

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Trust and Confidence in eBay and TradeMe: a Comparison

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Introduction

The ease of access to online shopping has meant a rapid increase in its use. Also the sense of fun and adventure of online auctions, with the ever-present hope for a bargain, has meant the huge increase in use of this area of the Internet. In this case, the comparison was between the "big two" successful online shopping websites, eBay and TradeMe to examine the issues of trust and confidence of people who conduct transactions on these websites.

Literature review (selected)

Consumer peace of mind is one of the most important factors when shopping online. Consumers are faced with the possibilities of financial loss, non-delivery, and possibilities of performance risk (qualities of product). Thus consumers need protection to help them overcome any perceived risks and to promote trust and confidence (Griggs, 2009). There are a variety of key factors involved in establishing consumer trust and loyalty to a website, to promote consumer satisfaction and help them decided to make a purchase and one of the most significant is security (Martin & Camarero,, 2008). Positive experiences of security will increase consumer satisfaction and consequently enhance trust and the probability for repurchase (Martin & Camarero, 2008).

Comparison

EBay, along with many other online stores use PayPal for secure online purchasing. PayPal can protect people from fraud and also help people claim money back from bad purchases. PayPal has a dispute resolution centre to resolve any problems occurring after the buyer may have experienced such issues as non-delivery or receiving goods that are different from that described in the listings (PayPal, 2009). TradeMe's SafeTrader manages the exchange of both goods and money (SafeTrader, 2009). Both buyer and seller sign up to SafeTrader first and agree

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on the details of their transaction. When the buyer buys a product, the money is paid to SafeTrader who hold it in a secure ASB Trust Account. Shipping is tracked and after the buyer has received the product and has signed for it, SafeTrader pays the money directly into the seller's account and the transaction is complete.

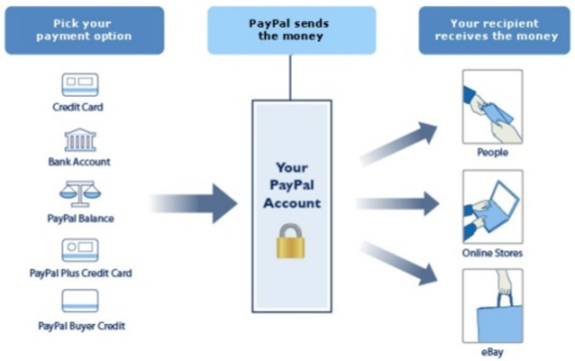

Figure 1 –The PayPal payment process

Figure 2 – The SafeTrader payment process

Results

Results of a survey conducted in Christchurch confirmed security as a significant factor for online shopping or auctions. The survey further showed the level of trust that people were prepared to put into eBay and TradeMe.

Conclusion

It appears that most people are aware of the risks of online shopping and auctions and agree security is a major issue for them. The survey having been conducted in Christchurch there was some degree of bias in the responses towards the use of TradeMe, but trust and confidence in eBay was still high.

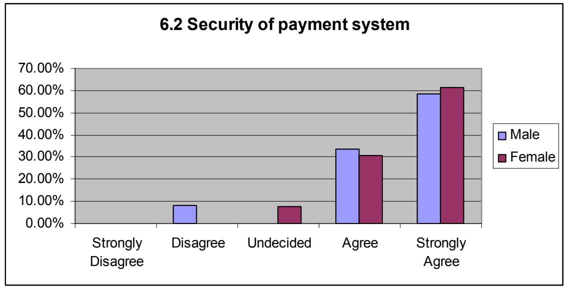

Figure 3 – Security of the online payment system

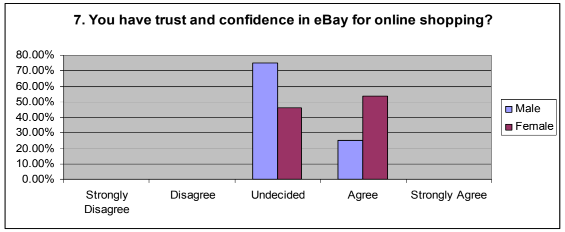

Figure 4 – Trust in eBay and TradeMe

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Hastings District Council – An IT Internship

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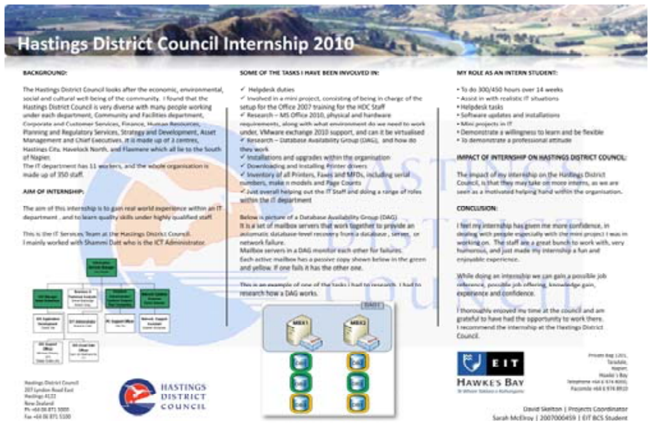

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Abstract

This poster describes an Internship experience by an EIT Bachelor of Computing student engaged in a variety of IT tasks and roles at the Hastings District Council.

Keywords

Internship, Work Integrated Learning, Capstone Project

Introduction

The aim was to allow the internship student to assist the IT Department at the Hastings District Council in a wide range of IT tasks. These included:

- ✓Helpdesk duties
- ✓ Involvement in a mini project, consisting of being in charge of the setup for the Office 2007 training for the HDC Staff
- ✓ Research – MS Office 2010, physical and hardware requirements, environmental requirements, VMware exchange 2010 support, virtualisation.
- ✓ Research – Database Availability Group (DAG), and how do they work
- ✓ Workstation and Operating System installations and upgrades within the organisation
- ✓ Downloading and Installing Printer drivers
- ✓ Collating an inventory of all Printers, Faxes and MFDs, including serial numbers, make, models and Page Counts.
- ✓Assisting the IT Staff and doing a range of roles within the IT department

The intern assisted a wide range all employees at Hastings District Council and learnt customer relationship skills through these experiences.

The Role

- To work embedded at HDC for 300/450 hours over 14 weeks
- Assist in with realistic IT situations
- Helpdesk tasks
- Software updates and installations
- Mini projects in IT
- Demonstrate a willingness to learn and be flexible
- To demonstrate a professional attitude

The intern worked for 350 hours embedded in the HDC workplace from February, 2010 until June, 2010. 100 hours was set aside for the production of reports for EIT supervision.

Results (or Findings)

This internship was the first intern that Hastings District Council had undertaken in conjunction with the Eastern Institute of Technology. The IT Manager at HDC expressed satisfaction with the flexibility of the student to cope with a wide range of tasks, the adaptability to be rotated throughout the IT Department and the customer relationship skills displayed.

Conclusion

This internship experience was a valuable experience for the student proving that flexibility and soft skills are marketable qualities for the IT industry and internal IT departments.

Client feedback has been positive and EIT would expect further interns to be appointed at the Hastings District Council as a result of this successful experience.

Interactive Lightshow

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This poster paper describes a configurable interactive lightshow, designed for projection onto building exteriors.

There has recently been a flurry of building projection installations. Typically, artists and designers construct images that map to a building's exterior from a carefully positioned projector. This, however, is a difficult and time consuming process, prohibitive for our client who needs a more flexible system: one that can be easily configured for any building where the opportunity for night-time marketing arises, and quickly set up on site. This calls for a solution set that is based upon dynamic building mapping and algorithmic interaction.

Building projection can be considered along two dimensions of complexity: the nature of the interaction; and how the surface is treated (Figure 1). At one end of the surface continuum, the building is treated as if it is a flat surface (like a movie screen) and the viewer is forced to ignore the confusion caused by the non-flat and mixed medium surface. At the other end, the building shapes are used to *generate* interaction – the lava flows down the columns; the balls bounce on the window frames, and so on. (A third dimension, that of design elements, is not considered here).

The Interactive LightShow is implemented in the Processing language. There are two major components - a dynamic mapper, and the lightshow application system.

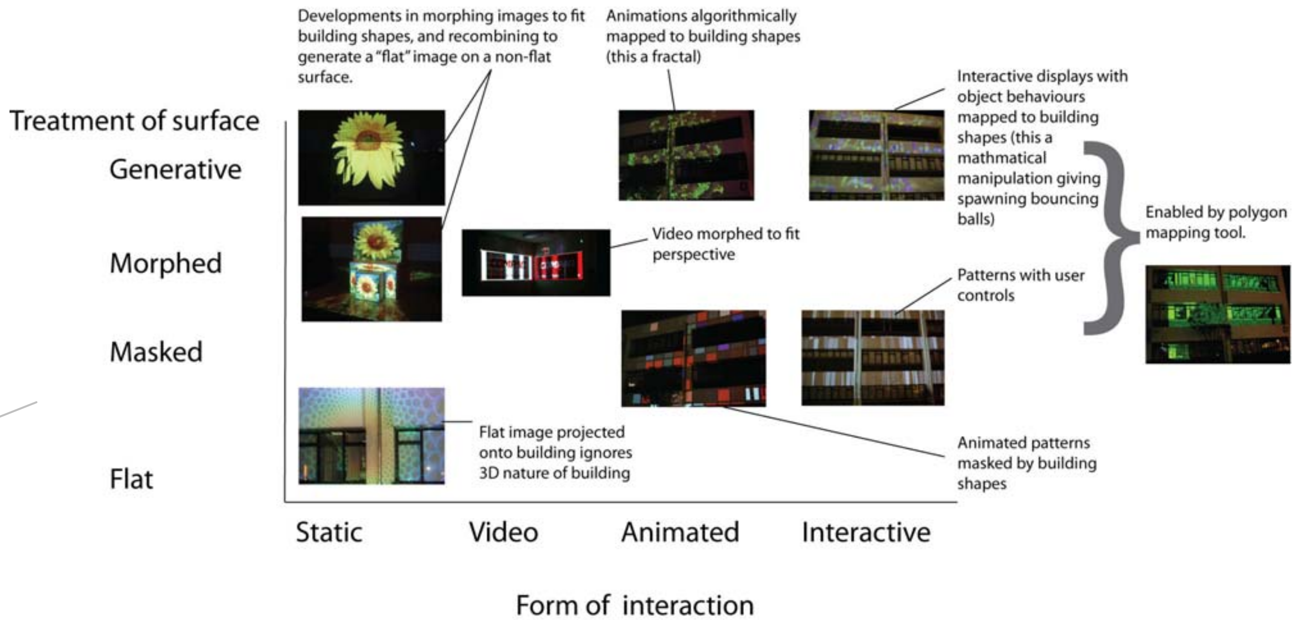

Figure 1: Interaction and surface dimensions of building projection. Images are those developed for this project.

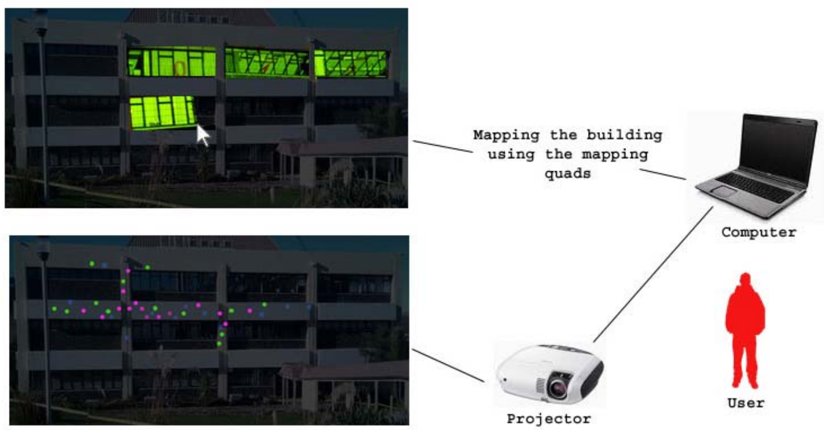

Figure 2: System diagram showing building mapping software which dynamically generates constraint maps for the display software. Here, coloured balls are bouncing along the building horizontals.

Rescue me: tangible collaboration

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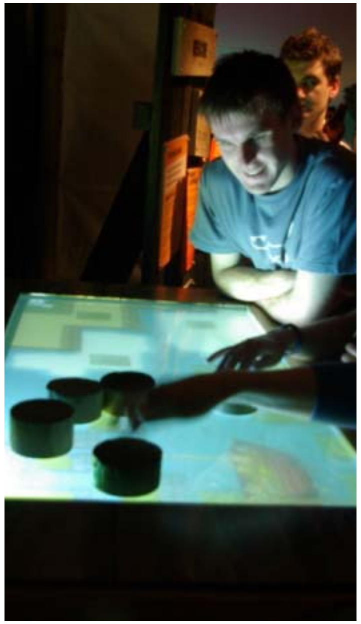

The purpose of this paper is to describe the development of a tangible collaboration tool for the communication of principles related to cooperation and resource use decisions in a science centre environment.

Keywords**:** museum, computing, tangible, cooperation, game

Rescue is a table-top rescue scenario with a shipload of people awaiting rescue. The players use wooden blocks to maneuver rescue implements (bridge, rope, ladder) to help the people transverse a series of obstacles. The game is designed in such a way that it is very difficult for one player to complete the task alone (there aren't enough resources). Decisions about survival are made on several levels as the player is being forced to make decisions about who survives (the shipwreck splits the whole group in two, the survivors have different abilities, and some islands have limited capacity).

Rescue is implemented as a finite state machine, in C#. Up to 100 survivors are generated by the shipwreck, splitting in two directions. Arriving on an island changes the person state to "seeking" which, in the absence of a tool to get off the island, generates a general milling about. On collision with an island edge they either turn around, or, with a suitably small percentage, fall into the sea. Arriving in the sea

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switches state to swimming, whereby they swim back to the ship.

The tools provide a means to move from island to island – either across water or to higher levels (implemented as separate islands). The tools are implemented using ReacTIVision fiducials (http://reactivision.sourceforge.net/). ReacTIVision is open source cross-platform computer vision framework for the fast and robust tracking of fiducial markers attached onto physical objects. The fiducials (think amoeba-like barcodes) are detected by a webcam modified to detect infrared. This, along with a projector for the gameplay and speakers, are mounted under a sheet of etched and strengthened glass. The box supporting the glass contains infra-red lights and is lined with aluminum foil to create consistent illumination. Fans expel air from the box. The projection is bounced off a mirror to lengthen the throw to enlarge the playing surface.

When the player moves or places a fiducial marker (on the underside of the tool blocks), it is detected by ReacTIVision which sends a message to the C# application. The tool is graphically shown at a fixed offset from the wooden block – the survivors then walk, climb, slide or swing over the tool as appropriate. Multiple tools can move used or moved simultaneously.

The game is always running, so there is no start, nor end state. Any successful survivors who reach the Rescue tent are rewarded by the rescue flag being raised (height represents the number of successful survivors in last ten minutes). Pre-recorded sound files “help me”, “I’m hungry” and so on to attract attention, along with “thank you” messages when using tools, with increasing joy as survivors near the goal.

Managing a Network with Freeware: Who's the Man?

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Abstract

Managing a Local Area Network (LAN), where students have administrative privileges to both client and server machines, raises some interesting challenges. The risk of 'breaking' the LAN is high, especially where students are required to install and configure networks as a component of their specialist computing and IT courses. A freeware network monitoring application, "The Dude", is used by the school's network technician to assist in managing the network and for locating problems as they arise.

Keywords

The Dude, freeware, network monitoring

Introduction

Interest in using free and open source software is growing worldwide and this includes network monitoring and analysis tools. The Dude is a freeware network monitoring application designed to be run on Windows and is made by the MikroTik Company. It will also run on Linux, using Wine. A main point of difference, in comparison to other network monitoring applications that display device lists, is the creation of a visual map of the network.

This poster explains the reasons behind the Wintec School of IT decision to use this tool, the benefits associated with its use, and illustrates some of its key features.

Content

There are a number of benefits associated with using The Dude. It can monitor any network device or protocol that uses SNMP, with the ability to build new probes that allow the user to monitor other areas; e.g. applications. Link speeds between devices can be checked with a quick glance at the map, and alerts can be configured in a variety of ways to alert network administrators to potential faults on the network. The history for each device, including outages, CPU usage, HDD usage, etc. are all stored and can be bought up in list or graph format, as desired.

The Dude has built in tools, such as SNMP walk and telnet, to administer devices and it has a web-based interface that enables remote viewing and configuring of network maps. The application includes full back-up and restore tools, along with the ability to customise any section of the user interface.

Some of the tool's key strengths include the following:

- It's free and is a very small application (3.6 KB)
- A Unique map layout, which allows for quick updates on hardware and network states

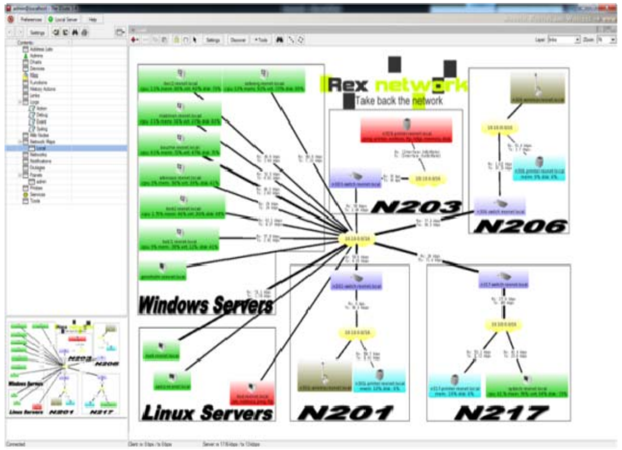

Fig. 1 Screenshot of 'The Dude' monitoring a network

- Comprehensive configuration available for setting up monitoring and alerts
- Connection to and administration of devices on the LAN using telnet, Winbox, etc.
- An array of tools that can be used for diagnosis, control, and testing of network components and devices
-

Some of the limitations are:

- No native support for Linux or Mac
- Minimal official documentation
- Limited group control from inside The Dude; e.g. it's not possible to reboot multiple computers at once
- No authentication option available when using SMTP for sending emails
- No proper database solution in place for storing device histories (this is currently in development)

Conclusion

In spite of its limitations the fact that The Dude is free and meets our requirements makes it an attractive proposition. While not as easy to set up as some of the mainstream, licensed network monitors, it has many great features and has proven itself to be very reliable. The Dude clearly shows that just because a program is free, it doesn't mean it has to be inferior.

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eHeritage Dunedin

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This poster paper describes an interactive 3D model engine, powered by a database of varied historical resources, has been deployed at the Otago Settlers Museum (to be populated and exhibited as a time-based representation of Dunedin)

The challenge

Previous work in this area has attempted to automate the production of the 3D environment. This project has taken a different approach, based largely on the realisation of the necessity of the human in the loop. This means we need a complex system that supports has several aspects:

- Archival investigation
- Curatorial and exhibition design
- Modelling
- Exhibit interaction and learning

To support these various interactions with information, the eHeritage solution can be considered a framework, or a set of solutions.

Data

Town planning maps, historical photos, paintings, journals - 160 years of Dunedin's history stored in a variety of formats, and housed in a multitude of locations. How can these disparate forms of data be brought together to illustrate the evolution of the town since its settlement?

The eHeritage Dunedin software collates data of different formats into a central database, and strives to utilise as much of possible in its virtual depiction of Dunedin: planning maps are overlaid over modern satellite imagery to effectively illustrate the land reclamation process; 3D buildings are textured with historical photos; and users are able to interact with buildings to call up additional written information where available.

3D models
The 3D shapes automatically extruded from the GIS software form simple, crude models. How do we turn these shapes into complex, detailed models that are both historically accurate and aesthetically pleasing

GIS

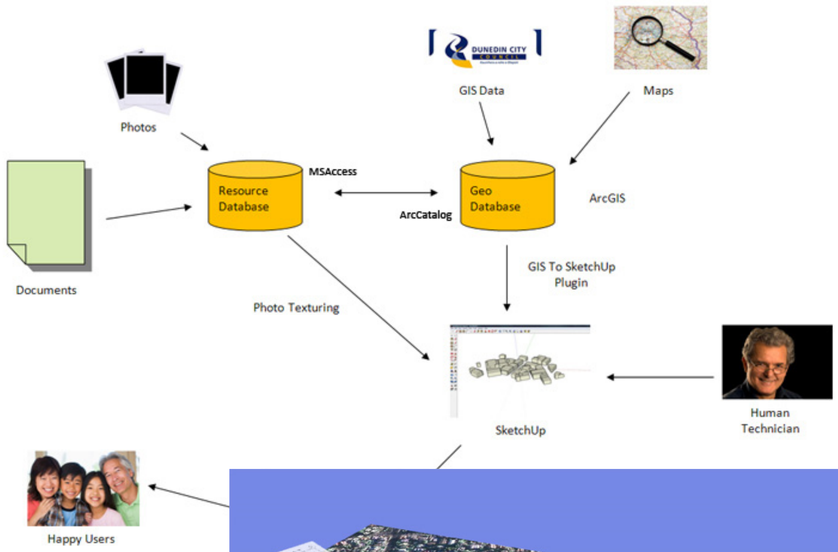
The archival photos and historical town planning maps are all of varying sizes and quality, and are taken from different angles and orientations. How do we use these resources to accurately recreate the town as it once was?

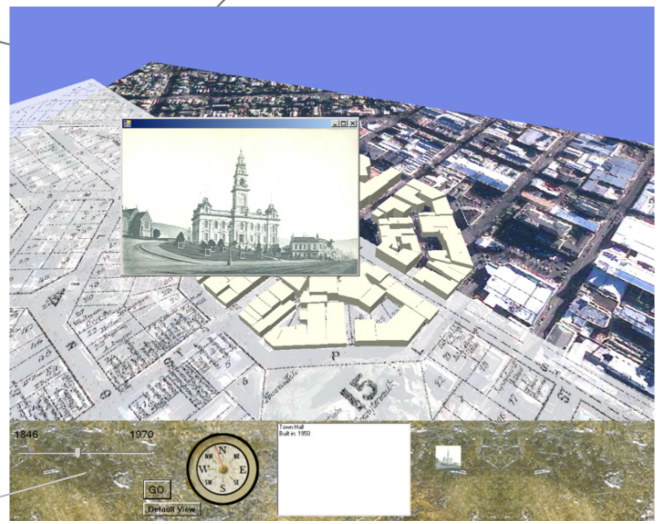
We used spatial manipulation software to georeference historical maps to modern GIS land parcel data. Then, using hi-resolution satellite imagery, we were able to trace present building footprints over archival maps. These footprints can then be automatically extruded to 3D models, perfectly positioned in a global context.

The eHeritage Dunedin software is currently installed on computers at the Dunedin City Council ready for Using 3D modelling software developed by Google, we can quickly add detail to models, and texture them with actual historical photos and paintings to create an authentic environment. The software is also closely tied to Google Earth, which allows users from around the world to 'adopt' a building and refine its detail themselves, thereby creating a 'living heritage' community project.

the next phase of development, looking ahead to its installation at the Otago Settlers Museum in 2012.

Full details of development available at
http://bitweb.ict.op.ac.nz/wiki/
EHD_Final_Marking_Schedule





eHeritage framework

Spatial/temporal ArcGIS Explorer frontend

When Failing Is Passing: Turning A Failed Project Into Success

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This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

At Christchurch Polytechnic Institute of Technology the Bachelor of Information and Communication Technology (BICT) degree has a 400 hour Capstone project that every student must complete. This is an industry based project that draws on the theory that the student has learnt over the three years of the degree. Typically our students successfully complete these projects (with a range of grades from A^+ to C^-). However there are occasions when for any number of reasons a student does not deliver the project requirements. In many cases good project supervision identifies these problems before the project end date. Can and should the student be given the opportunity to salvage a failing project and how should this opportunity be delivered.

Keywords

Capstone Project, Failed, Project Requirements

Introduction

This project is an actual example of one that was identified by academic staff as destined to fail as it was approaching the 60% stage of the project life. The type of corrective action taken to give the student the chance to recover the damage and hence pass the project is typical of how this problem has been handled for the small number of times this has occurred in past projects. In these cases the students has been given the task treating the project as a pilot study, writing a reflective essay targeting problems that had been encountered and suggesting corrective actions.

Methodology

Once the original project was identified as failing and the lack of quality of the output had been determined the client was advised that the original outcomes were not going to be achieved. The project was identified as failing when the student indicated that he had to generate special program code to allow different web browsers to run his web based application. Examination of the code showed major design and concept flaws. The student was then directed to cease all work on the original project and guided through the requirements and scope of producing a Reflective Report.

Formal Project Management and Risk Management plans were implemented. Rapid Application Development (RAD) and Rational Unified Process (RUP) were two methodologies used in this project.

Results

The project in question finally scored a grade in the B range. This was due to the quality of the Methodology Essay and the Reflective Report. Both these reports identified and examined the major factors that had influence over the project outcome. The student also detailed these could have been controlled from the project commencement

Conclusion

Capstone projects which have initially addressed the project problem and requirements but for a number of reasons are not able to be completed as originally envisaged can under many circumstances quite legitimately be converted into pilot studies, prototypes and research projects provided the required reflective studies are completed, the deficiencies of the original project scope recognized and a suggested way forward is provided

Community Projects: A Network Development Plan

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Abstract

At Christchurch Polytechnic Institute of Technology the Bachelor of Information and Communication Technology (BICT) degree has a 400 hour Capstone project that every student must complete. This is an industry based project that draws on the theory that the student has learnt over the three years of the degree. The School of Computing has for many years had strong liason with a number of Christchurch Secondary Schools. These schools from time to time are a source of industry based projects that are then assigned to suitably skilled degree students.

Keywords

Network, High School, Infrastructure, Development Plan

Introduction

This network development project for Rangiora High School was assigned to an extremely capable networking student and supervised by the author of this poster. The school had several ongoing and important requirements.

- To create accurate documentation of the existing network which had grown in a some what ad hoc manner.

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- Development network specifications for a new building about to be constructed

- Research requirements for an overall new network

- Develop a new network plan that was future proof and would work existing technologies until replacement time.

Methodology
A questionnaire was devised and distributed amongst key staff members to allow as much knowledge about the existing network and requirements to be gathered as possible. After researching industry standards and having discussions with the project supervisor regarding current documentation requirements the project was based around two main industry standards

- CISCO standards were used to document the existing and new network infrastructures

- Ministry of Education fibre optic cabling standards were used for fibre optic diagrams

Formal Project Management and Risk Management plans were implemented.

Results
Current and future network requirements were documented. In addition a cost benefit analysis was produced and existing major network weaknesses of missing or incorrect documentation, fragmented network expansion plans and multiple file servers were identified as the project progressed.

Conclusion
Capstone projects which have clients who are outside the normal business model are more prone to failure because of lack of expertise of the contact staff involved. This project suffered none of these weaknesses and provided the customer with a set of documentation that has allowed expansion to commence already. If it was not for the fact that this research was completely cost free the school would not currently being enjoying the benefits of this project.

Assessing the Learner: Using Real Time Assessment

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Abstract

In many teaching environments it is often difficult for the lecturer to ascertain if the student group is absorbing the lecture content in the manner expected by the lecturer. Such issues as class size, the pre-knowledge of the class, the class age all have bearing on the method of course content delivery which means that the same material could be delivered in different variations each time. For many subject areas formal assessment may not be a practical means of establishing if the 'general concepts' are being grasped by the majority of the student body. In these situations 'real time' electronic communications between staff and students during the lecture as an informal assessment method provide feed back as to student understanding.

Keywords

Ubiquitous Presenter, Real Time Assessment, Students, Lecturer

Introduction

Introductory programming has always been a challenge to teach. At CPIT we experience a wide range of ability and prior knowledge in our students. One of the greatest learning hurdles is teaching logic and then applying this to both 'real world' problems and programming problems. In Term 1 of this year

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Ubiquitous Presenter was introduced to students on a trial basis to attempt to inform both the students and tutor what progress was being made in their understanding of key aspects of the subject.

Methodology

Power point slides converted to the Ubiquitous Presenter file format (.csd) and uploaded to the University of Portland file server were accessed by the student body. These power point slides contained either simple 'multi choice' questions or questions of the type 'complete the list'. Each student typed their correct answer on their version of the power point slide and then submitted to the tutor for real time comment, discussion etc.

Results

Minor technical problems involving the configuration of network computers and the use of Firefox as the internet browser frustrated both students and staff but even with the low data volumes used the quality of the instant feed back was valuable in confirming the progress of the subject matter and allowed reinforcement of course content at the time that it was most relevant.

Conclusion

Where this type of curriculum teaching is suitable for inclusion into course delivery it is an accurate means of promptly confirming course material is being understood by students and is a simple way of involving all students in the group. The author is continuing to develop course material for the original programming paper and also for a second programming paper.

Numeracy tools

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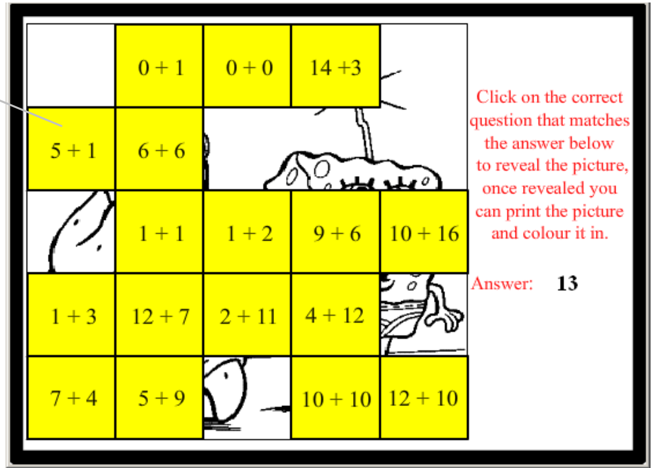
Solve the sums and then print out the cartoon picture for colouring in

(Nicole Morris)



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Introduction

The Southern Regional Health School is a school for children who are sick. They are a state school for students from Years 1 to 13 who are too ill to attend full-time education at their usual school. They teach students anywhere in the South Island. The School of Information Technology at Otago Polytechnic has recently begun working with the Southern Regional Health School to explore ways of enhancing learning experiences for the children of the Health School.

Designing Online Learning is a new course within the Bachelor of Information Technology. The course is aimed at providing students with the skills to create computer-based/web-based tutorials. It is intended to provide students with an understanding of the principles of learning and how computing can provide effective support for this process.

Numeracy tools

In the final assessment, students were asked to create a learning tool for children's numeracy : "the task must be in Flash and should involve some action scripting. The theme must be related to children's numeracy".

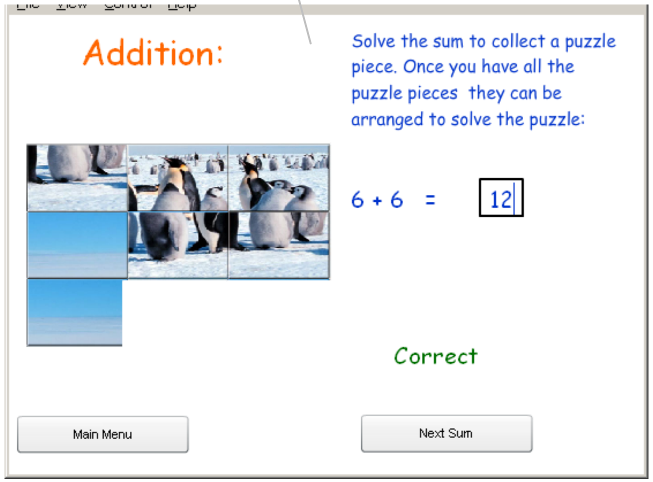
The project was assessed in two stages. Firstly, planning. Students described their learning tool, in terms of definition and architecture. Definition comprised motivation (how better than a pen and paper version); need for application; audience analysis; objective; audience goals and learnings from other learning tools. For architecture, students provided detailed storyboards for every relevant screen of their product. The focus here was on the levels/types of interaction to be provided by the product, with choices justified in terms of HCI and educational contexts.

The product was assessed in terms of the use of interactivity and multimedia elements to effectively deliver the educational content in an engaging manner. Other criteria included navigation, robustness and consistent design.

Conclusion

Students found this the most enjoyable assessment of the course. The staff at SRHS liked how the tools were focused on engaging interactions with appropriate rewards. This has been the first stage of what we hope will be a successful partnership.

Solve the sums and obtain a puzzle piece that you can then rearrange into a picture. (Tom Waymouth)



Ordering numbers, teddy keeps score.

(Richard Monistori)

NZCS and Communities of Practice (CoP) – Where to?

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Abstract

The NZ Computer Society (NZCS) is developing impressively towards significant national presence. This poster summarizes the range of NZCS initiatives as possible contribution towards future larger study regarding Communities of Practice (CoP).

Keywords

Computing practice, Community of Practice

Introduction

Wegner (2006) states that "Communities of Practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly". Professional associations are increasingly using concepts of CoP for learning activities. At NACCQ 2009 conference, three papers referred to CoP by ICT practitioners, in relation to capstone projects (Chard et al), virtual teams (Martin & Nesbit) and online learning (Seitzinger et al). A significant CoP case study of NACCQ has been published by Nesbit (2009).

NZCS

A CoP is sometimes studied with use of a framework summarizing (eg. UNESCO 2006). The NZCS Vision Statement states "To advance ICT <u>Professionalism</u> and <u>Education</u> for the <u>benefit of New Zealand</u>" while the Mission Statement says "NZCS promotes education and <u>sets policies, standards and practices</u> for ICT in New Zealand" (underlining added). From this and observation of NZCS website (2010), a five-point framework is used: Professionalism & Practice, Education & Development, Networking & Events, Advisory & Representation, Operations/Admin. The

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populated model in Figure 1 might be used for further study CoP study of NZCS.

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http://www.ibe.unesco.org/en/communities/community-of-practice-cop-in-curriculum-development.html

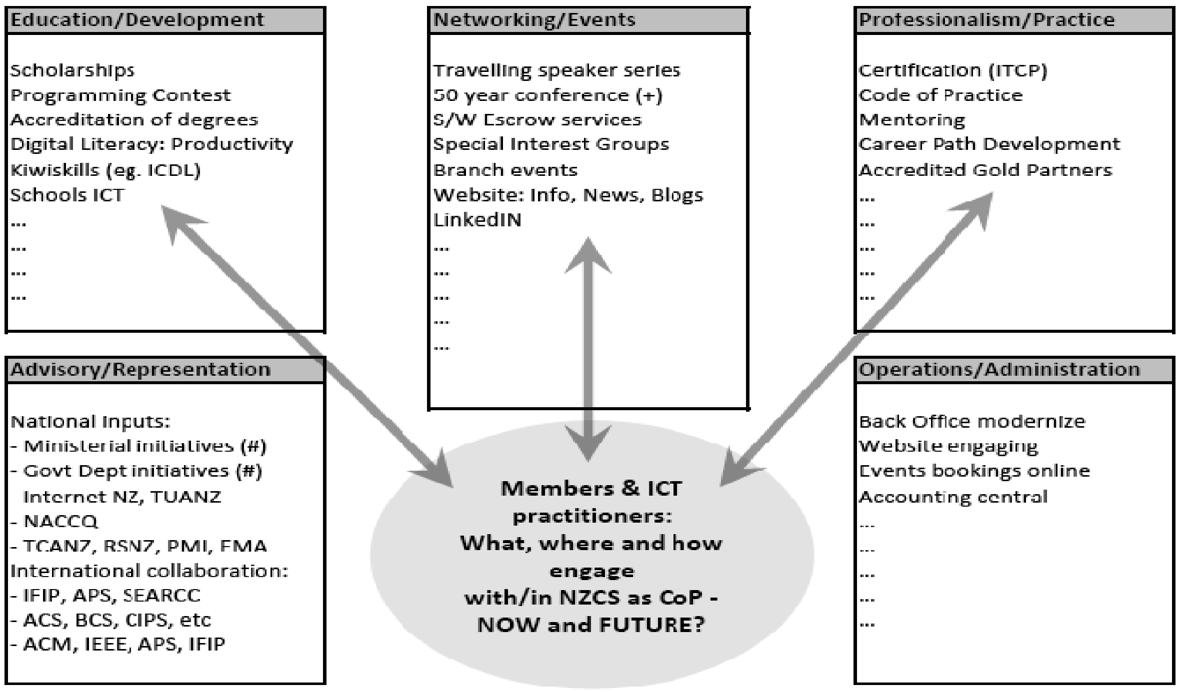

Figure 1: NZCS initiatives

Business Intelligence courses: Learn from America?

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This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

A survey was done by Teradata University Network among academics associated with the Association for Information Systems for discussion during the 2009 Business Intelligence Congress in Phoenix Arizona, December 2009. Problems with technology and poor data sets should ring warning bells for New Zealand. Special accommodation for our many SME's would be advisable.

Keywords

Business Intelligence, Data Mining, Data Warehousing, Knowledge Management

Introduction

Respondents were from 77 tertiary institutions ("85 Schools") of which over 90% are universities and less than 10% other than American. Courses were mostly in graduate environment for more than one year (figure 1), taught by MIS discipline (figure 2), covered under large range of course names, using large range of software (figure 4), experiencing most challenges relate to technology but pedagogy not far behind (figure 5).

Most mentioned challenges were 39 comments re Technology, with Software (Affordable and Reliable) and Datasets (Real-world), both at 16 mentions. Regarding Pedagogy: "Finding a suitable textbook (6); Realistic, meaningful, hands-on experiences (7); Meaningful cases (4)" and 6 others.

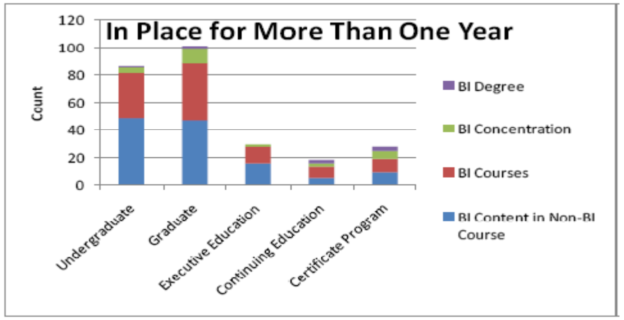

Figure 1: Period of existence

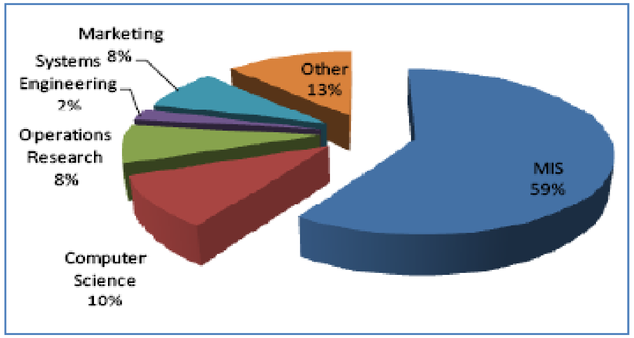

Figure 2: Disciplines teaching BI

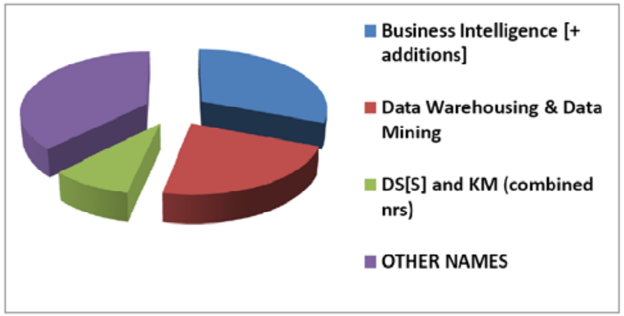

Figure 3: Range of course names

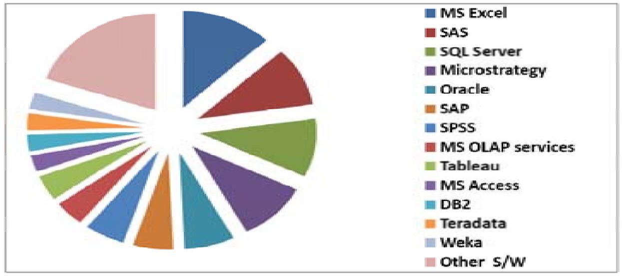

Figure 4: Range of software mentioned

Microsoft, typical enterprises and "Other" specialists software each comprises about one third of the software mentioned.

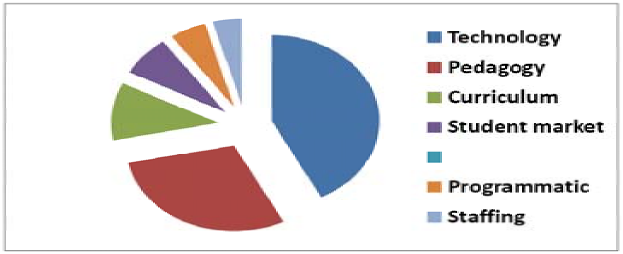

Figure 5: Challenges most mentioned

Other interesting comments

- Opportunity for inter-departmental linkages
- Should go beyond business reporting into advanced modelling [and] knowledge discovery
- Cover traditional cubes, tables and reports as well as more recently emerging multiple types of data, more real-time and more predictive analysis
- Sometimes taught by Accounting department – hence the emerging course title "Business Analytics"?

References

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Access NACCQ conferences with NZCS Code of Practice?

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This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

The NZ Computer Society (NZCS) drafted a Code of Practice as part of initiatives to increase professionalism. This poster suggests a way to use this in self-reflection on NACCQ conferences rather similar to the work of Simon et al (2008).

Keywords

Computing practice, Code of Practice

Introduction

The NZCS Vision Statement states "To advance ICT Professionalism and Education for the benefit of New Zealand" while the Mission Statement says "NZCS promotes education and sets policies, standards and practices for ICT in New Zealand". In the Code of Practice document, Education and Research are covered under two headers on one page, comprising 3% of the total number of pages.

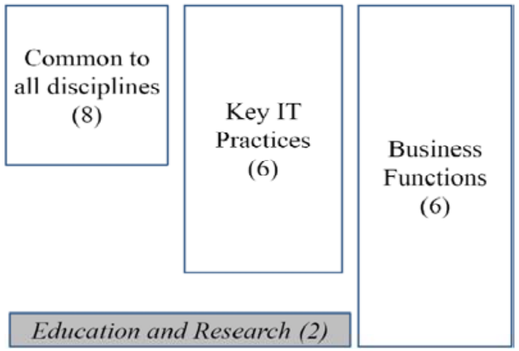

Figure 1: Areas

Education and Research

Casual observations are that in most years there are several papers at the NACCQ conference covering the range for Teaching:

- When preparing courses (4)
- When delivering courses (3)
- When assessing student ability (2)
- When tutoring students (5)

Figure 2: Education

Guidelines regarding research might appear obvious for the experienced ITP researcher:

- Be aware that perceived research goals are expected to offer benefits to the organisation or its clients but not to the detriment of society or the public.
- Recognise the potential use or misuse of the outcomes of your research and only proceed with the research if you can justify to yourself the consequences.
- Avoid providing IT support of research on human subjects and animals, where such research is not legal, not consensual or (in humans) not authorised by the subject or, where relevant, by Ethics Committees or Authorities.
- Strive to safeguard the confidentiality and anonymity of private data used in research.
- Investigate the analysis and research by other people and organisations into related topics and acknowledge their contribution to your research.
- Where allowed by the organisation, share the results of your work with other researchers, through papers issued through research publications and presented to conferences.

Figure 3: Research

Possible further investigation

To promote the NZCS Code of Practice and contribute to Community of Practice, an analysis of NACCQ conference proceedings from the past five years might be undertaken. This analysis could assess evidence of self-reflection on parameters mentioned for teaching and research practices. It could also judge each publication item for its contribution (that might however require further pre-work to develop instruments for judging).

This analysis will not only reflect on historical practices, but obviously also serve as current self-reflection to contribute to the community of practice of NACCQ.

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The Perfect Storm of Literature Studies from International Students

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This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

"Special Topic – Current Development in IT" in GradDip caters for focussed study of topic of choice. We used it to capitalize on student's previous degree studies overseas (mostly India, most in IT). Students did the literature study during first semester of study. Assessment is done on presentation of the plan, final report, poster and presentation. We report experiences, insights and plans.

Keywords

Computing education, International students

Introduction

We assumed it should be easy for students considering their backgrounds! Total of 15 students of which 10 held IT degrees. Weekly classes, lead by tutor, took form of discussions of experiences. Also did individual consultation as required.

Course Prescription: The purpose of this module encourages the student to explore current developments in any area of the IT industry, investigating the theoretical foundations, the people who are driving the technology, and the impact on this type of technology.

Experience

A broad range of topics were chosen by students: Robotics, Artificial Intelligence, Data Warehousing, Cloud Computing, Call Centres, Nano technology, Biometrics, Multicore processors, Transport security and apparent particular interest in networking (Wireless, Security, Simulators, 3G, Privacy).

Anecdotal evidence indicates students experienced the study process as overwhelming, demanding and frustrating (albeit rewarding). Our concern is that early negative experience could be detrimental to confidence, motivation and satisfaction, thus learning outcomes.

The usual issues of international students manifested: Language (in classroom communications and writing), "plagiarism" and frail study methods. "*Instructional*" classroom tutoring is also preferred to independent work.

We noticed typical weaknesses in the ability to do literature studies: Absence of clinical approach, depending on weak sources, obvious gaps in sources, difficulty in processing range of material, slow when working autonomously, little synthesis, evidently uncritical, tend towards technical details vs oversight.

Studying current developments with its impact is complicated by the fact that solid/proven literature typically used for degree study students (NQF L7) appears to be not readily available. Also, sound/credible literature appears narrow focussed, less in public domain and written in complex style. All of these significantly increase the demands place on international students.

Other concerns about student skills include ICT use (for report writing and presentation), doing large pieces of work, genuine understanding/insight and student need for frequent individualized constructive feedback (but that requires significant extra time from the tutor).

Prior qualification played an unexpected role: Students with prior/overseas IT degrees were strong with technical details this saving time with reading. However, non-IT degree students more readily presented readable oversight, generalization and implication.

Final products were at required level (NQF L7) and sufficient quality to pass but it seems a messy road!

Learning and Conclusion

Noted/concluded:

a) In effect, students are doing part of a "mini-dissertation", namely the literature study.
b) Similarity to IT degree capstone project, eg. being "ambiguous and complex" (Chard, 2009)
c) Issues re being international student, become more intense for all parties involved.
d) Weak student skills re ICT (PC use etc), language and work methods becomes more exposed.
e) The current approach does not exploit the possibilities of students holding extensive IT training.

The future

All is not lost. Kourie (2001) humorously but also seriously proposed that "best practice teaching" actually *deprives the student of the benefits of self-discovery, intellectual ownership and responsibility*! Still, planned and controlled "anarchy" is perhaps advisable, so we are considering to at least -

a) Continue special support of international students
b) Explore NACCQ literature on Capstone projects
c) Explore *principles* of mentoring for mini-dissertations
d) Explore integrating student skills building into course
e) Explore literature on self-directed study
f) Explore doing ICT project in NZ environment

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Fletcher Easysteel – Health and Safety CD ROM Application

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Abstract

This poster describes a CD ROM application created in Macromedia Flash for Fletcher Easysteel covering a range of company Health and Safety policies. Content is presented in an interactive environment to give the user control of the application while appealing to their senses through the use of multimedia elements.

Keywords

Multimedia, Interactive, CD/DVD ROM.

Introduction

The aim was to create an interactive application on a CD/DVD ROM that can be distributed to all Fletcher Easysteel offices for employees to use as individuals or in a group conference situation.

The application could also be installed on the main server so the screen saver can be run to give employees another avenue to access the material.

Health and safety are key values in the Fletcher Easysteel workplace. Making the employees aware of the key health and safety issues and implementing them are crucial to the company and to the health and well being of the employee.

Keeping the message in front of the audience and reaching a wide range of the audience in different locations in a workplace and throughout the country is a key problem.

The audience targeted was all employees at Fletcher Easysteel, these includes metallurgists, engineers, drivers, floor staff, marketing and sales people as well as contractors and customers of Fletcher Easysteel. The audience is multicultural.

Structure

Creating the application in Flash allowed multimedia elements to be included that would appeal to the users senses and added interest to the topic. Making the application interactive gives the user the ability to view it at their own speed.

The use of animation and relevant images created a dynamic eye catching introduction to the application. Using images of local staff enhanced their feeling of ownership.

Navigation was interesting and intriguing to the user but also clear for the user to use.

The use of external input text boxes helps future proof the application and updating company policies quick and easy with no need to open the Flash programme to make alterations.

Keeping the strong corporate feel to the site helped to maintain a consistent look and feel. Keeping buttons in the same position helped with navigation and avoided user frustration.

Results (or Findings)

Building an application like the Fletcher Health and Safety CD ROM re-enforces that planning of the project is crucial. The storyboard keeps the project to a deadline and acts like a contract between client and project builder. The gathering of all multimedia elements before you start helps keep the momentum of the project flowing.

Communication and testing with your client, keeps all parties in the loop and aware of what is being created.

Conclusion

The application is professional looking. The user knows who and what the site is about. The use of multimedia engages the user and holds their attention.

Client feedback has been positive.

Computing & IT Careers: Utilising a National Resource for Teaching and Learning

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Abstract

Career Services, is a New Zealand government organisation providing extensive job career information online.

This poster illustrates the breadth and depth of information about computing and IT jobs available from this web site. It suggests ways in which this national resource can be effectively utilised for the benefit of students studying computing and IT in institutes of technology and polytechnics (ITPs).

Keywords

Career Services, computing, ICT

Introduction

Information on job careers has been available from the Career Services web site for a number of years. Wintec School of IT students, and potential students, have been provided with direct access to this information (Figure 1) since 2006.

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Fig.1 PowerPoint Slide with Hyperlinks to ICT Careers

The prospect of using this information in a variety of teaching and learning situations, however, is a recent development. The Tertiary Education Commission (TEC) Literacy, Language and Numeracy Action Plan has helped highlight these opportunities. The TEC plan proposes a significant increase in the amount of explicit literacy and numeracy teaching and assessment that is embedded into vocational training.

Strategies for utilising the Career Services ICT job information to help implement the TEC plan and for other teaching and learning opportunities are featured in this poster.

Content

The Career web site includes extensive information about ICT careers including; typical salary ranges (using links to the Seek Salary Centre), stories about people working in particular jobs, alternative names for jobs, as well as the qualifications typically required, with links back to the Tertiary Educational Organisations (TEOs)

Opportunities for using this information in an academic environment include:

- Classroom teaching and learning; Literacy & Numeracy skills (TEC action plan)
- Learning to search with purpose and/or focus; e.g. for NCC L3 students
- Quick quizzes and assessments, based on web site content
- STAR (Secondary Tertiary Alignment Resource) courses; e.g. illustrating skills requirements
- Contextualising Blue Book modules; e.g. HD600 Helpdesk (Personal attributes, goal setting, and outcomes)
- Further opportunities include;
  - Informing students, secondary school teachers and careers advisors
  - Marketing STAR courses

Conclusion

Academics are constantly looking for new and innovative ways to engage students in the teaching and learning environment. The TEC imperative to embed literacy and numeracy into vocational training provides a further incentive to innovate. The Career Services web site provides a rich source of ICT job information that can help academics meet the TEC imperative while further mining the content to the benefit of both the students and the wider ICT academic community.

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Tertiary ICT Enrolments: Attracting Students – A recipe for success?

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This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

The Wintec School of IT offers a range of ICT qualifications, building from foundation certificates to diplomas, with 3 specialisation streams, and a degree. These provide potential students with a comprehensive selection of ICT vocational education and training pathways, leading to a wide variety of employment opportunities in the industry.

In this poster the authors explore a variety of strategies designed to help maintain the viability of these ICT programmes, in spite of the peaks and troughs of fluctuating demand.

Introduction

Following a global trend, tertiary ICT enrolments in NZ declined from a peak in 2002 to a trough in 2007. In spite of the fluctuating enrolment numbers the Wintec School of IT has managed to retain its full range of ICT qualifications.

This poster explores a variety of strategies considered by the authors to be critical to the continued success of school's ICT programmes.

Content

An analysis of Wintec ICT enrolment trends, illustrated in fig.1, mirrors the downturn in NZ tertiary ICT enrolments from 2002 to 2007, followed by a subsequent reversal, coinciding with the global economic recession.

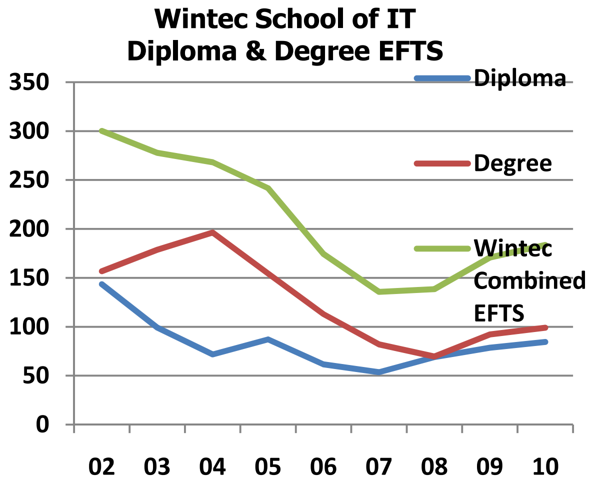

Fig. 1 Wintec School of IT Enrolment Trends

In spite of the decline, enrolment numbers were considered healthy enough throughout the downturn to maintain the dual pathways of diplomas and a degree.

Key success factors or strategies, reviewed on a yearly basis, that are considered to have helped maintain the viability of the School of IT include:

- The foundation certificate programmes that allow 'second chance' students, both school leavers and mature students, to meet the entry requirements for the diploma and degree programmes. The 27% contribution to the diploma level 5, illustrated in fig. 2, is typical for each intake.

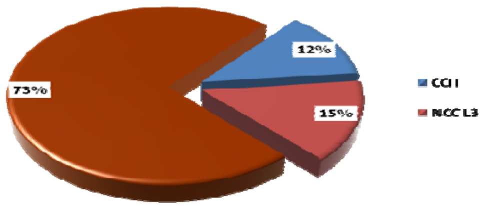

Fig. 2 Source of DipICT L5 Enrolments for 2010

- The provision of 3 distinct diploma streams, programming, systems support and technician, with a well defined pathway into the third year of the degree
- The number of international students enrolling in both the diploma and the degree programmes
- The formation in 2006 of the Waikato ICT Professional Learning Community (PLC), an association of Waikato secondary school ICT teachers. Professional development (PD) evenings, one event per term, are jointly planned and organised with a light meal provided, sponsored by Wintec marketing. Wintec enrolment data is analysed to identify contributing secondary schools and the ICT teachers from these schools are invited to the third year degree student capstone project presentations
- The integration of industry certification courses with the diploma and degree programmes, specifically Cisco CCNA, IT Essentials and Microsoft's MCP for Windows Server 2003/2008.
- Strong working relationships with industry as a result of engaging through the Employer Partnership Group (LAC) and the degree 3rd year projects

Conclusion

An analysis of a snapshot of ICT enrolment data reinforces the proposition that the success factors, or strategies, considered key to maintaining the viability of Wintec School of IT programmes, are working.

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IT & T Job Markets: National Trends & Global Commentary

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This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

Prior to the global recession, which came to the forefront of the business world and world media in September 2008, the ICT industry was experiencing critical skill shortages on a worldwide basis. Following the announcement of the financial crisis the NZ ICT job market experienced a major downturn in the number of jobs advertised on both the Seek IT & T and Trademe IT web sites. This poster traces the fall and recovery of the ICT job market in NZ and highlights recent global news articles indicating a return of ICT skills shortages.

Introduction

In 2007 a buoyant NZ economy and record employment figures, together with a serious decline in tertiary ICT enrolments, created a skills crisis in the ICT industry. Worldwide, countries were experiencing a similar drop in tertiary ICT enrolments, even as demand for suitably qualified and experienced personnel continued to grow.

The global recession, in September 2008, triggered a downturn in advertised ICT jobs in NZ and heralded an upswing in tertiary ICT enrolments. This combination of events meant that the ICT skills crisis appeared to be over. The current upswing in the NZ ICT job market, combined with global commentary, suggests that this is not the case.

Content

The effect of the global recession is illustrated in figure 1, with a 66% decline in advertised Seek IT & T jobs between September 2007 and September 2009.

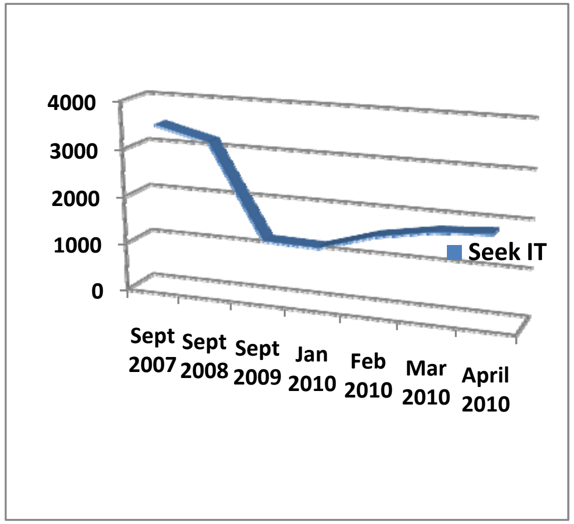

Fig. 1 IT & T Jobs Recession & Recovery

Over the same period the ITP sector has experienced a 24% increase in ICT enrolments, illustrated in figure 2. In spite of this increase there is still a shortfall of approximately 40% from peak enrolments reached in 2002.

Figure 1 also illustrates a 50% increase in NZ Seek IT & T job advertisements between January and April 2010. This increase, together with recent articles both in NZ and globally, highlights concerns that the skills gap is, once again, growing. The shortfall in tertiary ICT enrolments has the potential to exacerbate the situation.

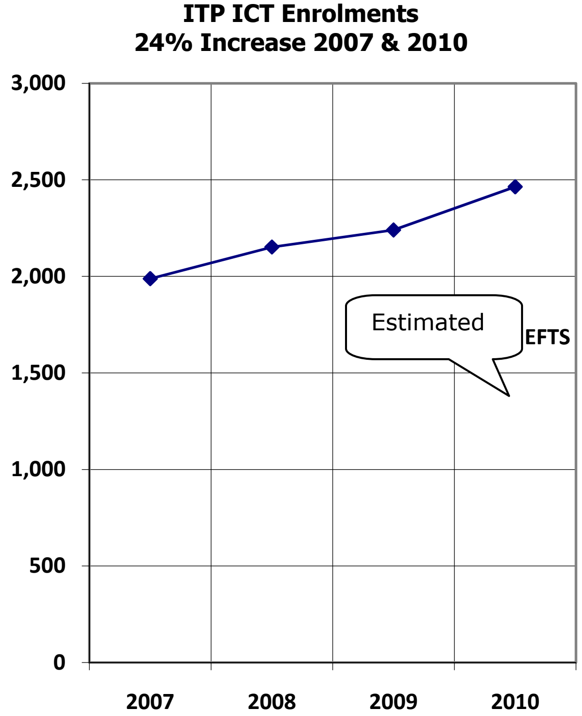

Fig 2 Enrolment Trends (Source: NACCQ EFTS Contributions)

Conclusion

The predicted skills shortage in the global IT & T market is best summarised in this extract from a Gartner study (July, 2009); "....*once the economy recovers and IT budgets are restored over the next 12-18 months the IT industry in the [Asia] region will require about 1.5 million skilled personnel by 2012".* **Growth in enrolments is essential if another ICT skills crisis is to be avoided.**

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NACCQ EFTS Data (Accessed May 2010)

Sustainable Software Engineering

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Software Engineering classes work with a client to develop solutions to real problems. This year the class worked with the organisers of the Dunedin 350 campaign. In groups, the class developed applications to engage visitors and raise understanding of sustainability issues. The finished systems were successfully deployed in a marquee during the 350 festival day.

A sustainable practitioner in computing has a double duty - to reduce the footprint of computing, and to use the intelligent environment as a force for good - to increase the handprint of information technology.

Students worked through an agile and iterative methodology to produce a diverse range of interactive solutions for the client.

Solutions included:

An application displaying handy tips each day.

An interactive website where people interested in the 350 project can see other people's responses to the goal of 350 via videos and forums.

A flash game where the player is tasked with reducing the amount of carbon in the atmosphere by typing words that show on the screen. If the player is able to keep the carbon levels below 350 for the required about of time then they

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will win the game, if they fail to keep the carbon levels under control the carbon will enter runaway effect

A questionnaire based game about the 350 organisation focusing on climate change. Each question when answered gives the user feedback on their answer and gives one or two helpful tips on how the user can do things daily / weekly /monthly to help slow carbon emissions into our atmosphere.

An interactive quiz game that teaches healthy eating habits and the importance of using locally grown products in keeping with the inaugural Spring Food Festival.

A challenge to promote the use of public transport through a space-invaders style game.

A fun, exciting challenge on a website, which lasts 14 days (350 hrs). Each day you are given a challenge and a question to answer.

A flash game where players are given a scenario for example, a backyard, a class room or some other industrial environment. Players must then attempt to remove or identify specific objects that could potentially be contributing to the high carbon levels without removing the ones that don't. By doing this, users will become more and more familiar with objects in a real environment that they should avoid or use less in order to reduce these high carbon emissions.

Internship Programme

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Over the past year, Otago Polytechnic's School of Information Technology has been working closely with the Dunedin ICT Cluster, a network of IT companies supported by the Dunedin City Council Business Development Unit. As a result of this collaboration, an internship model has been launched which provides opportunities for Otago Polytechnic IT students to gain valuable business experience in local IT companies. Local companies have committed time and funding to the scheme, which also has financial backing from the DCC.

Internships have been either summer projects or semester based work placements. The internships will meet the need for 'work ready' graduates for the growing Dunedin ICT industry, and also encourage secondary school students to consider a career pathway in ICT.

Background
We can provide our students with excellent technical and professional skills, but there is no substitute for the learning which takes place in the workplace. In only a few weeks of exposure, they would have opportunities to discover how a real business operates, learn valuable self management skills and make useful contacts in the ICT community.

Currently, many of our students leave Dunedin to seek work in the IT field. By engaging with the ICT community through internships, these students will recognise Dunedin as a future career choice. The promotion of the internships and the increased likelihood of local employment will be an added drawcard in attracting students to ICT training in

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Dunedin. This may offer some resolution to the identified global skill shortages in this area.

Process
Matching students and employers was achieved through an evening "speed dating" event in September. Students did a round of short interviews to "convince each employer that they will be the best employee ever for their job". In preparation for this, we schooled the students – performing roleplays, and working on their CVs.

The employers were subsidised to employ the students through a grant from the Council's Industry Development Fund. While this funding will increase next year, the amount per intern will decrease over the next two years, with the intention of the scheme becoming self-funding. Having the interns actually employed has obvious financial benefits for them, and means the companies take responsibility for employment relations (ACC, insurance etc.).

Outcomes
With funding secured for this year, we go into the second round with the experience of the first. We will refocus the training and preparation. While our students were lucky to get fantastic employers, we will be investigating a mentoring scheme for students over the internship with a view to providing pastoral support and to help reinforce learning opportunities.

From our perspective – 9 interns placed, five were funded and four outside the scheme. Of those, one was immediately offered a full time position, two have been in part time positions and (having graduated in June) are now on fixed term contracts, one is still in part time work with full time offered on graduation. Overall a very positive experience for all which has raised the profile of our graduates and demonstrated the value of 'work ready' Polytechnic graduates.

DUNEDIN CITY COUNCIL
Kaunihera-a-rohe o Otepoti

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9 June 2010

Mr Philip Kerr
Chief Executive Officer
Otago Polytechnic
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Dear Mr Kerr

DUNEDIN ICT BUSINESS CLUSTER: THANKS TO LESLEY SMITH AND DR SAMUEL MANN

We wish to express our sincere thanks to Lesley Smith (Head of the IT Department) and Dr Samuel Mann from the Otago Polytechnic IT Department for the role they played in helping the Dunedin ICT Business Cluster successfully develop and implement the Dunedin ICT Internship Programme.

Facilitated by the City's Economic Development Unit, NZTE and the UPSTART Business Incubator, the Dunedin ICT Business Cluster developed an internship programme in response to the ICT companies in the city having difficulty in finding quality staff. One means to overcome this problem was to find a way to attract and retain quality students in the city, in particular from the University of Otago and the Otago Polytechnic.

We are very grateful for the role that Lesley Smith and Dr. Samuel Mann has played in the success of the programme. There is no doubt in our mind that without their support and commitment the programme would not have been the success it was. This is evident by the first year results achieved (please see below):

Internships awarded by companies: **32**
Jobs created once internships completed: ....**17** (4 permanent full-time; 6 permanent part-time; 7 on short-term contract)
FTE's: .... **7** (excludes the 7 short-term contracts)
New business created by intern after internship completed: .. **1**
Expected GDP value creation due to FTE creation: **$805,000**
Paid internships: **24**
Unpaid Internships: **8**
Companies involved: **12**

Feedback from companies who took on Otago Polytechnic interns from your IT department was extremely positive. In many respects companies felt that the students certainly "hit-the-ground-running" and were well prepared to take on the rigours expected in the work environment.

We are aware that for one significant IT company in the city, the work of Otago Polytechnic interns did contribute profit to the bottom line of the company they were with. A great outcome for the business involved and testament to the teaching focus and skill of the Otago Polytechnic team.

In our view, the IT Department is playing an important role in helping us combat some of the staff shortage issues Dunedin ICT business are facing today and we wished to take this opportunity to share that with you.

We are looking to place 43 interns into Dunedin ICT Companies in 2010/2011. It has been brilliant working with such an enthusiastic and dedicated team from the Polytechnic and we look forward to continuing to do so in achieving that goal.

Thank you again and if you have any questions at all, by all means please let me know.

Yours sincerely

Graham Strong
Business Development Advisor

Dare to be Digital: The Gender Influence

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Introduction

Is there a poor perception of the digital world? I raised my children to not be afraid of the computer, to put it to good use and have fun with it. My experience with other parents has given me an insight to why computing is not recognised as a career in its own right. My own children have deserted me for what they deem as a more exciting career. Other children have shied away from computers because parents have influenced them to choose a different career path. The perception of not making any money from computers is still there.

This is not a new problem. Camp(1997) investigated this issue, and it appears nothing has changed in the past decade.

Is it a gender influenced attitude like pink and blue? Is it built into our genetic makeup?

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The current situation at CPIT

The first year Bachelor of Information and Communication Technologies intake at CPIT in 2010 was a total of 61 students with 14 or 23% female this is consistent with other institutions in New Zealand. At the recent CPIT graduation 25% of the graduates in the BICT were female. Miller(2010) mentioned that only 12% of computer science degrees are awarded to women in the USA.

The current situation at a rural high school

Darfield High School is a co-educational, Year 7 to Year 13 school, located in rural Canterbury. There are currently 745 students studying at Darfield High School.

ICT courses at year 12 and at year 13 are provided by the school. Both are the current NCEA syllabus for ICT.

The current numbers in 2010 for year 12 is 59 students with 31 or 53% female. For year 13 the enrolled number of students is 33 and 13 or 39% of those are female.

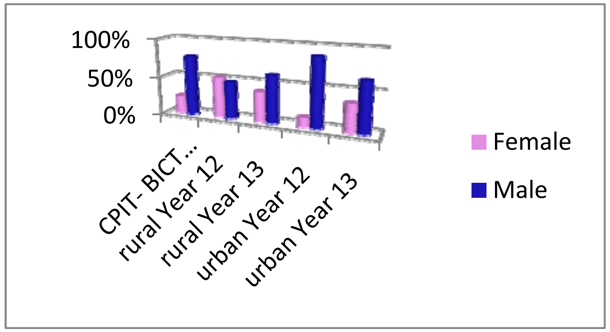
The current situation at an urban high school

Middleton Grange School is a co-educational, Christian school, located in Christchurch. They cover primary, intermediate and senior schooling.

ICT courses at year 12 and at year 13 are provided by the school. They use the syllabus from CPITs current Certificate in ICT.

The current numbers in 2010 for year 12 is 17 students with 2 students or 12% female. For year 13 the enrolled number of students is 11 and 4 or 36% of those are female.

Figure 1: 2010 student data set



Summary

It appears the number of female students entering the computing profession is still very low.

Schools, until recently, focused on unit standards which, due to its extensive and detailed program, do not allow creative ideas from students. It limits what can be shown/ taught in the time allocated.

Many schools currently use Microsoft Office applications in their teaching of unit standards. A new curriculum is being prepared for secondary schools. Will this be enough to encourage more students to experiment with ICT? Will it encourage female students into a digital world as more than an end user?

Further study will be required to investigate potential solutions to the shortage of females in the digital world. This may involve an online survey for secondary school students from a range of schools.

Acknowledgments

Enrolment data from Sue Crichton, Operations Manager, CPIT

Enrolment data from Lisa Blakemore, Digital Technologies Teacher, Darfield High School

Enrolment data for Middleton Grange School from Chris McCarthy, Academic Staff, CPIT

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Heinz Wattie Internship: An EIT final project

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This poster paper appeared at the 21st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Abstract

This poster presents the final over view of an internship carried out at Heinz Wattie, King Street, Hastings in the Information Systems Department. This internship was initiated by Riki-lee Toki who approached Heinz Wattie in order to complete the third and final year of the Bachelor of Computer Systems at the Eastern Institute of Technology.

The internship scope was to be involved with the development of a software application for the Pet Food department, to replace the legacy system which was not adequately fulfilling the requirements of the business unit. This internship was carried out under the supervision of a Business Systems Analyst of the Information Services Department.

Keywords

Internship, Final Project

Introduction

All third year Bachelor of Computer System students at the Eastern Institute of Technology must complete the ITPJ7.290 Final Project, a 45 credit level 7 course undertaken in the final semester of study. The student has the choice to elect either a project for a business or to participate in an industry based internship.

The internship described in the poster was carried out in the Information Systems Department, at Heinz Wattie, King Street, Hastings. The department is responsible for providing support to approximately 750 users in four locations across New Zealand. The internship was carried out in the IS department, under the supervision of Business Systems Analyst, Neil Jackett.

The major project carried out as an intern was in the development of an application for the Pet Food department sited in Hastings.

Heinz Wattie

Heinz Wattie New Zealand is part of the global business, with head offices in Pittsburgh, USA. Today the New Zealand business employs around 1,900 people, of whom approximately 350 are temporary or casual, producing food for New Zealand and export markets.

Internship tasks

As an intern I worked along aside Business Systems Analyst, Neil Jackett, on a daily basis in the Information Systems Department for a period of 14 weeks.

The implementation projects:

- The development of a .NET application to support the Pet Food manufacturing business unit. With this project I fulfilled a role primarily as junior Systems Analyst

- Upgrade of the current Citrix Server environment to Citrix Server 2008. In this project I was involved in business acceptance and user acceptance testing.

In addition to my involvement with these projects I also created reports for an individual user, using Microsoft Reporting Services and creating the SQL procedures required of the report, and also basic support roles for the organisation.

Benefits

The internship has lead to an exceptional amount of industry knowledge which will be of great value in my pursuit for a full time job.

- Extra in analytical assistance for the business analyst in the development of the application
- No costs to the organisation as I was an unpaid intern and the required resources were already available
- Allowed me to improve my current technical skill sets and knowledge
- Allowed me to gain real world experience within an organisation where information technology is vital to the success of the business.
- Allowed me to utilise the technical and communicative skills acquired as a student

Conclusion

The experience gained while an intern has proven to be a great way to conclude a degree, such as the Bachelor of Computer Systems. It has allowed me to be reassured in the fact that I am in the correct career path, and do possess the capabilities to become a contributor to the information technology industry. I highly recommend internships to other third year students.

Using design research in the development of a final year HCI class project.

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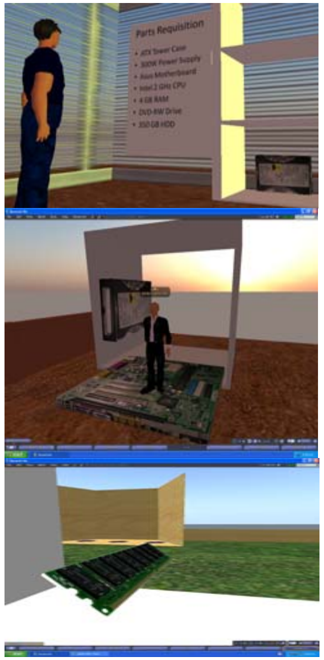

Abstract

The design of an interactive 3D PC learning environment by senior interaction design students for students on a first year Computer Servicing course is the focus of project based learning undertaken by the senior students.

Using a research by design approach (Plomp 2007) the HCI course project - with its series of deliverables - provides an intervention that can be examined through educational theories, for example Legitimate Peripheral Participation (LPP) as described by Lave and Wenger (1991) and Technological Pedagogical Content Knowledge (TPCK) as described by Mishra and Koehler (2006). This poster depicts a first iteration, where senior students develop the 3D PC in a group, and undertake preliminary testing with the help of first year students. A second phase will refine the course project and after evaluation and review a refinement of the intervention is to be produced and used in the next run of the HCI class

Keywords

Research by Design, 3D learning, HCI. Legitimate Peripheral Participation, Technological Pedagogical Content Knowledge

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HTML 5: Features and Limitations

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Abstract

Over the last decade dozens of proprietary technologies have been developed to expand the capabilities of the web. Technologies such as Flash, Silverlight, and XUL have greatly increased the functionality of websites; but at the cost of requiring users to install the vendor's plug-ins. HTML5 is intended to define an openly-produced, vendor-neutral language which allows developers to write applications that are not limited to one vendor's implementation or language. This poster examines features of HTML5 that may compete with proprietary technologies.

Introduction

HTML5 introduces over 25 new elements and dozens of new attributes for web developers to use (W3C, 2010). Many of these are minor additions that standardise web page markup.

Several articles published recently claim that the nearly-finished HTML5 will replace Flash and other proprietary plug-ins (Keenan, N.D.). Selected HTML5 elements were implemented in a sample website to test their usefulness.

Tested features

Canvas: The canvas element provides a drawing space for the browser. When combined with a client-side scripting language like JavaScript, the canvas element

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can be used to dynamically draw graphs, or turned into a 2D drawing application similar to Microsoft Paint.
Drag-and-Drop: The HTML5 specifications propose simple implementations of drag-and-drop page elements, reducing the need for complicated JavaScript code and therefore increasing stability and reliability of web applications.
Offline Storage: HTML5 offers an offline storage database, which works in a similar way to cookies in that domains are able to store data on the client machine. Where the offline storage database differs however is that the data can only be accessed by a client-side script.
Video: HTML5 video is intended to become the new standard way to embed video on the web. It has useful features such as built-in controls and automatic buffering, there continues to be debate over whether Ogg Theora or MPEG-4 should be the standard format. The element has a fall-back value that will display if the web browser cannot display the video element and it is possible to use an object or embed element so that older browsers can fall-back to non supported video content, e.g. Flash.
Audio: The purpose of the audio element is to provide a way of embedding audio content that does not require third-party plug-ins. Currently the recommended format for the audio element is Ogg or Wave but some browsers also support the MP3 format.
Geolocation: Using information such as the client machine's IP address and MAC address, the geolocation API can accurately estimate where in the world the client machine is. The getCurrentPosition() function of the API can return the latitude and longitude information of the client machine which can then be used to communicate with other APIs like Google Maps.

Conclusions

HTML5 has many great features which will help towards a standards-based web. The W3C estimates that HTML5 will not be entirely finished until 2022, so global implementation will be a slow process.

With the growing number of iPhone and iPad users that rely on HTML5 to see video content, we can expect to see many websites becoming HTML5-compatible in the near future.

The purpose of HTML5 is not to replace proprietary plug-ins, but some plug-ins may suffer a loss in market share as a result of HTML5 becoming more popular.

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Farmwise: agricultural simulation

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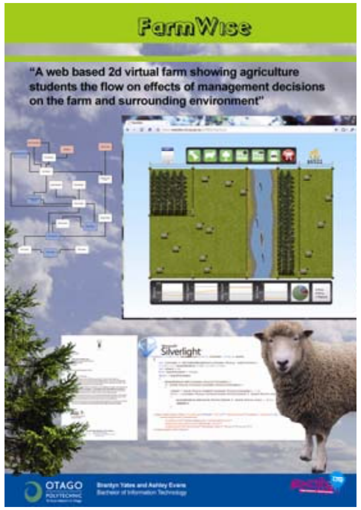

This poster paper describes FarmSim: A web-based 2D virtual farm showing agriculture students the flow on effects of management decisions on the farm and surrounding environment

FarmSim is a deceptively simple but most engaging 2D farm game that models the effects of management decisions on farm operations. It was developed in partnership with the Centre for the Study of Agriculture, Food and Environment of the University of Otago.

The technical complexity of FarmSim includes:

- Underlying computational model incorporating real and theoretical data
- Computation engine using linear, quadratic and sigmoidal transforms to simulate agricultural system
- • Full Silverlight 3 implementation allowing immediate cross-platform deployment for universal access

This poster paper appeared at the 1st annual conference of Computing and Information Technology Research and Education New Zealand (CITRENZ2010) incorporating the *23rd Annual Conference of the National Advisory Committee on Computing Qualifications*, Dunedin, New Zealand, July 6-9. Samuel Mann and Michael Verhaart (Eds).

Select individual animals, clusters of trees and also click and drag to create a selection box for selecting groups of animals. The selected items can then be moved to different positions on the farm – hence varying stocking rates - or drop in the sale cart to gain money for the farm.

From given unit and total cost information, the user can select how many animals to. If the user confirms they can then place the purchased animals in a single paddock.

The user can place new fence posts throughout the farm to create a new paddock. This paddock becomes a new object, inheriting the soil and vegetation characteristics of the original paddock, but now able to follow a different model trajectory.

The game has no start, end or pause. So, while there is no financial cost of exploring every variable before making a decision, the seasons relentlessly pass while the player is exploring– simulating the imperfect decision conditions of the real land manager.

Farm bank balance

Selected proportions of fertliser components and application rate (kg/metre) for cost per paddock size.

Choose the percentage of each variety of tree available and the density trees to be placed in a paddock. By rolling over each paddock in the farm the user will be shown how much it will cost to fill that paddock (if they can't afford it they will be given feedback at which point they can cancel the purchase).

Detailed information for each paddock available on rollover. Includes biodiversity measures not otherwise represented.

Paddock and stock health visually represented

Farm dashboard: Moisture levels; stock health; stream health; total feed.

Trees show maturity level of each variety in the cluster, total carbon sequestration levels of each variety and biodiversity level. The biodiversity is shown by the varieties of birds and a count showing the number of each kind in the cluster.

Water health and biodiversity levels. Are shown graphically with the varieties of fish and insects with a count corresponding to each variety.

Full details of development available at http://bitweb.ict.op.ac.nz/wiki/Traction_Media_-_Final_Documentation

Interactive Iterative Storyboarding

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Abstract

Storyboarding is a common technique in any multimedia application development, demonstrating system interfaces and contexts of use. Despite its recognized benefits, novice designers still encounter challenges in the creation of storyboards.

Storyboards and prototypes can be powerful tools to explore alternative design ideas as well as having early feedback on the usability of the application. Furthermore, problems and features that are confusing or complex in the design will often show up early, even with simple paper-based sketch prototypes. When brought face-to-face between designer and client it can help create a collaborative design magic. This poster summarizes the observations of using a storyboard approach in the workplace.

Introduction

Storyboards used in combination with prototypes are interactive mediums that sequentially display the functions an application system will perform. They are used to document, replica, and confirm the user requirements. The storyboard prototype simulates the interaction sequences in a system to allow users to test the system before very much code has been developed, (Borysowich, 2009).

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Furthermore, by using the storyboard prototype concept to develop an application, it will help end-users to understand and approve the system design earlier in the project (Borysowich, 2009). Additionally, storyboarding is useful when testing interfaces and presenting interface ideas. It helps to visualise the application concepts, exploring other alternatives and resolving any attribute details and developing interaction scenarios (Curtis & Vertelney, 1990).

This poster presents observations on the implementation of the storyboarding process as part of a student's industry based capstone project in the final semester of the BICT degree at CPIT in 2009.

Observations of Workplace Practice

1. **When to storyboard?**

When designing the interface of the system application.
When testing the interfaces, test the scalability, usability and complexity of the application.
When presenting interface or design ideas to the marketing team, development team, other designers or the client.

2. **Tools and techniques for storyboard**

Start minimalist with blanks to be filled in by the content-writer. These screens can be printed out to allow the content writer to pen in their contributions. It is much more interesting and productive when the content-writer is confident enough to write directly to the storyboard in its interactive form.
Use drawings to describe in graphic form the visible features of the interface.
Use screen shots for representations of the user interface.
Use paper based technique for a quick interactive storyboard-prototype technique.
Use interactive software that the designers are familiar with to create storyboard or any design ideas.
Use flow chart and navigational chart to help designer and the client visualise the user and system interactivity.

3. **Details to be put in the storyboard**

Start minimalist, allowing interaction in the whole process with other designers and the client, then take into account how many objects and actors might be present in a particular page. Additionally, include the design of user interactions with the interface. Furthermore, include basic information that will be beneficial for the developer such as, the font styles and sizes for each heading, sub-heading and body text are specified. Also, include flow and navigational charts specifying the navigation of the links, and alternative possibilities of user and system interaction.

Conclusions

Be interactive and iterative. Let the designers brainstorm their ideas individually in quick sketches using simple tools like pencil and paper. Have the designers meet as a group to discuss their ideas in front of a shared visual work surface. When the design team has agreement, meet with the client or the development team to consider any changes and suggestions. After several iterations, the design will be ready for sign off and implementation.

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The Current Status: Who Teaches What?

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Abstract

The first qualification in computing that was developed and approved by the National Advisory Committee on Computing Qualifications (NACCQ) was implemented in 1988. Over the following ten years all the polytechnics in New Zealand had adopted and taught at least one or more of the qualifications that were subsequently developed by the NACCQ. With the pending change of status of the NACCQ it is timely to review which Polytechnics are still teaching the NACCQ qualifications.

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Keywords

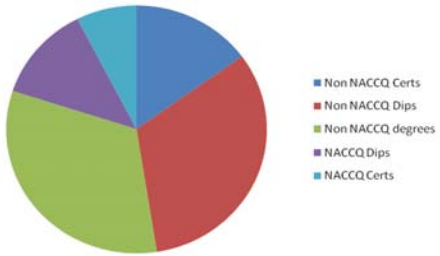
Computing qualifications, NACCQ, NQF

Introduction

The NACCQ has developed and successfully supported a number of qualifications over the past 22 years. The first qualification was a one year Certificate in Business Computing. This was followed by a further one year qualification the Advanced Certificate in Business Computing and finally a third, one year qualification the National Diploma in Business Computing. A six month or one semester qualification the Introductory Certificate in Computing was also introduced in 1990. With advent of the New Zealand Qualifications Authority (NZQA) National Qualifications Framework (NQF) in 1994, during the 2002 biennial review of the Blue Book the first two one year qualifications were revised and renamed the National Diploma in Information and Communications Technology L5 and L6. (Blue Book, 2009)

The current situation

A survey was undertaken in early May 2010 to determine which Polytechnics were teaching the NACCQ qualifications and what plans there were for 2011. The institutions websites were perused and information gathered for programmes of study up to level 7, post graduate programmes were not considered. This survey was totally dependent on the accuracy of the



NACCQ quals vs non-NACCQ quals

institutions websites but was compared to the information in the NACCQ secretariat.

According to the websites, three institutions are teaching the Blue Book level 3 Certificate in Computing (CIC). A further six institutions websites report that they are currently offering the National Certificate in Computing level 3 (NCC3), this is the unit standards based NQF qualification. Of these, two also offer the NCC level 4 and three teach the NCC level 2. Only one of these institutions offer all three levels of the NQF qualifications.

Currently 13 institutions have indicated they are offering an undergraduate degree programme. A further 11 institutions are offering a graduate diploma (level 7) with one institution not offering a degree but two graduate diplomas at level 7.

Of the level 5 and level 6 qualifications five institutions offer the NACCQ level 5 DipICT while 13 institutions offer their own level 5 diploma. In 2011 the number offering the NACCQ qualification remains at six however one institution has indicated they will be offering their own qualification and one will start offering the NACCQ DipICT level 5. Four institutions are currently teaching the NACCQ DipICT level 6 and this will be reduced to three in 2011.

Conclusion

This survey shows that 17% of the current polytechnics are offering the level 3 NACCQ qualification, CIC, 28% are offering the DipICT L5 and 22% are offering the DipICT L6. In 2007, 94% were offering an undergraduate degree and this has fallen to 72% in 2010. Only 33% of institutions offer the NQF qualifications with only one institution offering all three levels. 55% of the institutions are offering their own qualification at level 6 with 66% offering their own qualifications at level 5.

This year will see a change in status for the NACCQ. The results of this survey would question whether the NACCQ qualifications are meeting the needs of the polytechnics. A revisiting of the NACCQ qualifications and the refocusing of the philosophies of the NACCQ working groups would appear to be urgent and crucial.

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