

Facilitating Learning by Using Case Studies

Alister Macgregor

Trevor Nesbit

Aoraki Polytechnic

**Christchurch Polytechnic Institute of
Technology**

alister.macgregor@aoraki.ac.nz

nesbitt@cpit.ac.nz

Abstract

A number of issues can result in institutions seeking alternatives to industry based capstone projects in the final semester or year of three year qualifications in information and communications technology (ICT), whether they be three year degree programmes or diploma programmes such as the level 7 Diploma in Information and Communications Technology (DipICT – Level 7), formerly called the National Diploma in Business Computing (NDBC). One issue documented has been large numbers of international students as documented by a number of writers including Chard and Wempe (2004), Baker and Nesbit (2006).

The issue giving rise to this paper is where a small institution has built links with industry based clients through the offering of DipICT Level 7 projects, but due to a decline in student numbers has ceased the offering of the DipICT Level 7 programme. There was however a desire to maintain the relationships that had been built with the industry based clients.

The aim of this paper is to investigate the pitfalls and promise of using client case studies in a simulated work environment to fulfil learning outcome requirements in DipICT Level 6 courses so that these relationships can be maintained with industry based clients.

The framework used is small classes, full work days, multiple courses being taught at the same time and multiple clients. The framework used is described. A trial implementation is reported on, and feedback analysed from client, student, tutor and administrative views. Given this feedback, modifications to the process are suggested. The paper then discusses whether there is promise for investigating using these methods in a larger situation.

Keywords: Case Studies, ICT, Projects

1 Introduction

Aoraki Polytechnic is a small Polytechnic on the east coast of the South Island. The School of Information

Technology which offers Information Technology program has traditionally had about 30 EFTs on its Blue Book programs that have been taught at Level 4 and above. During 2007 Aoraki Polytechnic decided to stop offering Dip ICT Level 7. During the ten years that this qualification had been offered, significant liaisons with clients who provide capstone projects had been built up. At the start of 2008 there were a significant number of projects still available from clients. It was also expected that more clients would contact the institution during the academic year. Rather than turn these clients away, it was decided to experiment with changing the way DipICT Level 6 was offered. How this was done and the successes and failures of this methodology form the basis for this paper.

The outcomes of following this approach are compared with the aims of capstone projects that are part of DipICT Level 7 and degree level offerings at other Institutes of Technology and Polytechnics (ITPs). This is done with a view to ascertaining whether similar outcomes are achieved with this approach by looking at the work of Nesbit, Oliver, Hancock and Nesbit (2005), Fincher, Petre and Clark (2001) and Mann and Smith (2006). Another aspect addressed are the issues raised relating to international students as identified by a number of writers including Chard and Wempe (2004) and Baker and Nesbit (2006).

2 Methodology

The methodology for this paper can be broken down into the students, the clients and the delivery methodology used.

2.1 Student Needs

Towards the end of the 2007 academic year, a group of seven students approached the School about further study in 2008. They did not want to leave the Timaru district for further study. Some were completing DipICT Level 5 at the end of 2007. Some others had less than half of a DipICT Level 5 to complete and had indicated that they wished to continue studying. One student had medical

issues and had deferred completion of DipICT Level 6 from 2007. One other student who had previously studied elsewhere enrolled just before the start of the academic year, and another one joined the program at the end of the first term.

During discussions with the students about 2008 offerings, most had indicated a desire to be able to create and support dynamic web sites. The School realised that there were also some other areas that they were lacking skills in to increase their employability. These were mainly in the networking, hardware and user support areas.

The students also realised that having a portfolio of actual implemented business solutions would enhance their employment prospects.

2.2 Client Needs

By the start of the 2008 academic year, four clients had approached the school with non-mission critical work that needed doing. There was one e-commerce web site for a small business, an on-line enrolments and results database for a running club that could potentially be implemented at national level, a dynamic web site for an Auckland based non-profit support organization, and a small local school that wanted a redesigned network, a website, and the ability to share documents externally in a non-broadband environment.

Besides these clients, it was also expected that there would be internal requests, and other requests would come up during the year.

All of the projects would have been potential capstone project possibilities with some massaging of the requirements to fit the constraints of the academic learning outcomes required. They could also have been converted into case studies, and solved with no client involvement.

2.3 Delivery Methodology

Rather than deliver the program by the traditional lecture/tutorial combination with assignments and/or tests for assessment it was decided to offer a significant portion of the program in the following way.

The students would be timetabled for two six hour work days per week (Wednesdays and Fridays) in the computer lab. The start of the session would be a meeting where everyone would summarise their work to date, and a decision made as to the aims for the day. A requirements document for the day would be produced, any teaching required would be done, and then the tutor would act as a learning resource. It was not expected that the students would be able to finish the tasks during the session. The task list would be based on quantifiable outcomes required for one of the client projects.

Assessment would be by requiring progress on the latest work tasks to be presented at the start of each session. This would be quantified against the produced requirements documents.

Two thirds of the program would be delivered this way. The other third of the program would be taught in the traditional two 2-hour sessions per week, with standard

assessments. Not all students were enrolled in all of the courses that were to be taught using the methodology under discussion in this paper.

It was known that one of the first tasks that was required was setting up of the development lab area for the students. They were to be required to act as administrators, developers and testers on the network. They were also going to be network administrators for students doing a lower level document sharing course.

During the first term the following projects were selected:

- Setting up the student network
- Setting up the small business website
- Creating a contact management database for an internal client. This problem had arisen during the fourth week of the term.

The network was set up in the first two weeks, and then development work commenced. The tutor on the course had written a brief summary of all of the problems, quantifying outcomes, and any perceived problems. These were similar documents to those that had been written as customer project proposal documents for capstone projects in previous years. Although it was hoped to just work purely on client projects, it became obvious early in the process that there would be the requirement to have students hand in some formative assessed work in some areas before they could proceed to client projects. These were usually prototypes demonstrating the latest feature that the client work required.

2.3.1 Predicted Problems

While all methods of delivery have their weaknesses, the following were the particular problems that it was thought may arise:

1. The School's academic manager expressed some concerns about mapping work produced against required learning outcomes. He also had concerns about meeting internal moderation requirements.
2. Providing the potential for students to Pass or Merit their papers. These are the only two passing grades for the papers being taught.
3. Students having a knowledge that was only specific to the problems being solved, rather than the skill to apply their knowledge to other problems.
4. There was an internal administration requirement that results be submitted at the end of each term, and students were expected to be doing specific papers during a term.
5. Timetabling issues for students not enrolled on all the papers being taught using the stated methodology.
6. Timetabling issues for tutors in specialist areas that may be brought in to guest lecture.

7. Students falling behind with their work would find it difficult to catch up.
8. Student's work being their own.
9. Client expectations and timelines.

2.3.2 Dealing with the Predicted Problems

Prior to delivery, strategies were developed to deal with the perceived problems.

For problems 1 and 2, a template was set up matching the learning outcomes against what could be achieved by completing the projects. A simplified example of this is in Table 1 below:

Project Name:	Remote Development	Client	Web	Site
Learning Outcomes Addressed				
Module	Outcome			
PP516 (Java Script)	L/O 3-5			
PR656 (Server Side Scripting)	All			
DB600 (DBMS)	L/O 5			
PP515 (VBA)	L/O 3-5			

Table 1 – Learning Outcome Map

To Pass always required that the set of tasks be completed to the client's requirements, and Merit standard was generally set to provide some extra functionality, documentation or testing. The breadth of knowledge issue was to be dealt with by small formative assessments.

Any potential missing outcomes were identified, and these were to be taught separately, and usually assessed by research project or written assignment. Two specific examples were to demonstrate knowledge of the history of programming languages, and to complete a formal normalisation. These were both handed out as assignments to be completed during the breaks between term 1 and term 2.

Problem 4 was to be solved by a meeting with the Faculty Academic Manager that the program being delivered was attached to. It was demonstrated how interim results were being recorded, and noted that after the first term, papers were more likely to conclude earlier rather than later than actually "timetabled".

Timetabling issues were seen as the problem of the main tutor on the program, as he was also in charge of timetabling for the school. The particular year under question had more part-timers teaching on the program than in previous years, and a new program had also been introduced. The general school timetable was set up as normal, and a simple shared calendar was set up for the students indicating what was likely to be taught in each session. This was to be subject to change, unlike the course outlines that the School hands out for other courses on the program.

It was known from the previous year that the students who were going to be doing the program were higher than

normal achievers, and they had previously showed a surprisingly strong sense of self-motivation. A key indication of this was a statement that they were "more interested in learning stuff than passing courses" as they indicated in a meeting at the start of the program. One way student issues were to be dealt with was by requiring oral presentations to the group at the start of each session. Marking was done by the tutors with the students present at the time. Group work was not to be used as it was thought that all the cases could be completed by a well motivated Level 6 student. Early on one student started falling behind, but the suggestion that they withdraw from the particular papers and enrol in some other offerings or alternatively have formal examinations for their assessment was sufficient motivation to bring them up to the required standard. The one student who was a deferment was to be assessed using different assessments. This was to be discussed and agreed with the particular student, as it was felt that they were more interested in gaining the qualification than learning.

Client expectations were to be dealt with by the main tutor on the program being the primary interface with the client. If these projects had been capstone projects, the tutor would have been less involved. This was expected to create more work for the tutor, but solve more problems than it created.

2.3.3 Further Problems

Unpredicted problems that had to be dealt with were as follows:

- Extra students wanting to enrol on the program at the end of the first term.
- Staff members leaving or having to be reallocated, placing strain on other staff. The School had had a very stable work force for the previous five years.

The extra students who were enrolled were treated as new employees of the group. It was the responsibility of the group to bring them up to speed on the development environments being used. The particular students enrolling were more interested in maintenance and support rather than development, so it was fortunate that the majority of the teaching in these areas had not been done by the time the student joined the course.

Staffing issues were dealt with by involving extra tutors in the delivery under discussion. This added further risk to the process. Any new staff were not involved in this delivery as it was thought that the risk factor was too high.

3 Results

The time of writing of the paper is early during the second term of the academic year. Thus these results are an interim indication as of that time.

The delivery method from an academic point of view has generally been successful. As at time of writing, the students are further through with their learning of new material than it was thought that they would be at the start of the year. Tutors involved in the program have found

process engaging, and other tutors not involved in the program have noted that the students involved in the process seem to be more highly motivated and more capable of independent work than they expected. As the tutor for most of the work day is acting as a learning resource, there has been the opportunity to multitask, and tutor work load has been at times more intense, but overall less working hours have been required to achieve the same outcomes.

Student satisfaction surveys have been run. Because numbers are so small, it is not possible to statistically prove anything, but satisfaction levels are higher for this tutor delivering these courses than in previous years.

There has been a problem with students and staff wanting to commence new material before completing projects. This has had to be dealt with by setting aside some weeks with no new material. It should have been dealt with by having some sessions with no new learning, and some more formal oral presentations.

There has had to be a need to give small formative assessments to show that the students can apply knowledge. This has led to multiple projects being worked on at once. This number has been kept to a maximum of three.

There has been less of an issue of students handing in work late. This is because they have less projects due in at once, and these projects have tighter deadlines. The fact that students do not have to be thinking about as many disparate subjects and assessments than in previous times is also thought to have contributed to student success as the students spend less time each day reminding themselves where they were up to in their work than previously.

As none of the clients who have been involved in the process have previously been customers for capstone projects, it is difficult to make a formal comparison of their satisfaction levels. However, the main first term client enjoyed having multiple possible implementations to select features from, and was very happy to provide strict deadlines and scope creep. The internal client who wanted what they thought was “a small database” has been happy to have their problem proved to be larger than they first thought, without having to liaise with students. From the main tutor’s perspective there has been more work dealing with clients.

Administrative problems have been less difficult to solve than it was first though they would be. This has been achieved through using achievement based learning, and clear marking templates that are written during the daily requirements meetings. At this point in time there has been no external moderation of the assessments, which may bring up further points for discussion.

4 Future Possibilities and Modifications

There are a variety of ways that the methodology can be expanded further.

As has been stated, there is currently one main tutor delivering this part of the program. Other tutors have expressed an interest in being involved in the process, and

this will be implemented with another tutor later in the 2008 academic year.

This methodology could also be tried on the school’s Level 4 program, but as the students are entry level, there are reservations about student motivation and buy in in this case.

As the projects get more complex during the year, there may be the desire to introduce group work. This is currently under investigation, along with the changes in the student’s enrolments that this may entail.

Currently none of the School’s international students are involved in the process. The international students that enrol in the school are not generally those interested in software engineering, so this modification will probably not be tested in the foreseeable future. However, giving these students experience in this environment before requiring clients to liaise with them could help them to realise the work required in “real-world” situations. On the other hand, cultural differences often lead to international students expecting tutors to know all answers to all questions instantly, and it is not possible to show this using this delivery methodology.

The question of whether the approach would work in a larger institution is an interesting one. While the approach could work, it is less likely to be considered by a larger institution as it has a lower fixed cost in terms of staff workload and a higher variable cost than more traditional approaches to delivering such courses. This is consistent with one of the drivers for the introduction of the approach at Aoraki Polytechnic being the low numbers of students. Larger institutions would be more likely to have degree students seeking capstone projects which would mean that the industry demand for this type of work would be met by them instead. There would be the possibility of trying this methodology as a precursor to capstone projects to make students more fully aware of the work involved in capstone projects.

5 Comparison With Capstone Projects

The key concepts of capstone projects were described by Nesbit et al (2005) in citing the work of Fincher et al (2001) as being to “make the learning real, by integrating theory and practice through authentic problems, processes and deliverables.” Mann and Smith (2006) cite the work of Bruhn and Camp (2004) who identified the “win-win-win” situation that capstone projects can provide in that:

- The students gain real professional skills;
- The industry receives useful products; and
- The faculty successfully engages students in meaningful education that prepares them for transitions from academic theory to industrial practice.”

The approach of the case study based learning described in this paper addresses many of the same aims, in particular by having the students working on real life problems to gain real experience, the industry gaining useful products and learning becoming more meaningful.

Such an approach would also deal with some of the issues faced when finding industry based capstone projects for international students as described in Baker and Nesbit (2006) and Chard and Wempe (2004). The case study approach under the supervision would provide much better support for the international students described. If this approach was followed for capstone projects it would reduce some of the potential value, but would reduce some of the difficulties experienced.

6 Conclusions

At the time of writing the delivery methodology has generally been successful. Students are achieving to a high level and have a strong engagement with the process. It is felt that the engagement level would not have been as high if the students were doing cases, rather than real projects with actual deadlines which involve responsibilities to people other than themselves.

The process has worked due to the following factors:

- Student engagement, teamwork and ability.
- Academic management approving the process and being satisfied with the academic rigour of the assessments and documentation
- Tutor interest and engagement.

The challenges to implementing such an approach include the agility and adaptability of staff to integrate learning and identify opportunities for case studies at reasonably short notice.

In spite of such challenges this case study approach is successful both in terms of the learning for students and the financial viability of programmes when numbers of students are declining. It will be continued in the next semester, when Level 5 students with six months of study will be involved in the process.

References

- Baker, A. and Nesbit, T. (2006) "Transnational Education the Students Coming Onshore: A Case Study". Proceedings of the 19th Annual Conference of the National Advisory Committee on Computing Qualifications, pp 11-16, 2006.
- Bruhn, R. E. and Camp, J., (2004). Capstone course creates useful business products and corporateready students. SIGCSE Bulletin 36(2), 87-92.
- Chard, S. and Wempe, N. (2004) The Development Lab Experience: Dancing With Wolves. Proceedings of the Seventeenth Annual Conference of the National Advisory Committee on Computing Qualifications, Christchurch July, 2004.
- Fincher, S. Petre, M. and Clark, M Eds. (2001) Computer Science Project Work: Principles and Pragmatics. London, Springer.
- Grant, M. (2002) Getting a grip on project-based learning: Theory, cases and recommendations Meridian: A Middle School Computer Technologies Journal, 2002

Mann, S. and Smith, L. (2006) A Value Proposition Model for Capstone Projects. Proceedings of the 19th Annual Conference of the National Advisory Committee on Computing Qualifications. July 2006, Wellington.

Nesbit T., Oliver R., Hancock M. and Nesbit G. (2005) Developing and Running a Photographic Website. Proceedings of the 18th Annual Conference of the National Advisory Committee on Computing Qualifications. July 2005, Tauranga.