36th **Annual Conference** for

BOND UNIVERSITY
INSTITUTE OF SUSTAINABLE DEVELOPMENT & ARCHITECTURE

Australasian University Building Educators Association

27 - 29 April 2011 ✸ Bond University, Gold Coast, Australia

AUBEA

RICS

AIB THE AUSTRALIAN INSTITUTE OF BUILDING

CIOB THE CHARTERED INSTITUTE OF BUILDING

AIBS Australian Institute of Building Surveyors

THE AUSTRALIAN INSTITUTE OF QUANTITY SURVEYORS

36th Annual Conference for Australasian University Building Educators Association

27-29 April 2011

Bond University, Gold Coast, Australia

Conference Convenors:

Associate Professor Rick Best

Professor Craig Langston

Conference Secretariat:

Ms Kristy Anderson

Cover Design:

Miss Keanne Langston

Refereeing Process

This year's conference is titled **Getting a Building Degree – The End of the Beginning**.

All papers included in these proceedings have gone through a formal and rigorous review process, involving at least two referees external to the author's home institution. Full papers were exposed to a two-stage peer review process of double blind refereeing. A refereeing form appended to the papers was provided to the referees to complete, and included additional space for comments to the authors. If the referees agreed to the paper, their advice was accepted, and if referees did not agree the conference convenors independently reviewed the paper and the substance of the comments. In those cases a determination was made on the basis of evidence available.

The conference secretariat received 51 papers, of which 43 were accepted following amendments, and published herein. This represented a 16% rejection rate.

All papers forming part of the proceedings were discussed at the conference.

Technical Committee

The conference convenors would like to thank the following people for their assistance in refereeing papers:

Alan Patching	Bond University
David Baccarini	Curtin University
Michael Regan	Bond University
Roger Birchmore	Unitec Institute of Technology
Paolo Tombesi	The University of Melbourne
Andrew Wilford	Bond University
Peter Smith	University of Technology, Sydney
Mary Hardie	University of Western Sydney
Peter Davis	Curtin University
Swapan Saha	University of Western Sydney
Hemanta Doloi	The University of Melbourne
Goran Runeson	University of Technology, Sydney
Peter Love	Curtin University
Ajibade Aibinu	The University of Melbourne
Gerard De Valence	University of Technology, Sydney
Phil Love	University of Western Sydney
Ron Wakefield	RMIT University
Daniel O'Hare	Bond University
Tim O'Leary	University of South Australia
Amy White	Bond University
Benson Lim	University of New South Wales
John Twyford	University of Technology, Sydney
Sidney Newton	University of New South Wales
Geoff Outhred	RMIT University
Paul Tilley	Queensland University of Technology
Anthony Mills	RMIT University
Ron Best	University of Roehampton
Hilary Davies	Deakin University
Josua Pienaar	Central Queensland University
Linda Too	Bond University
George Zillante	University of South Australia
Tony Williams	The University of Newcastle
Stephen Kajewski	Queensland University of Technology

Jim Smith	Bond University
Anil Sawhney	University of Technology, Sydney
Graham Brewer	The University of Newcastle
Adrian Bridge	Queensland University of Technology
Perry Forsythe	University of Technology, Sydney
Kerry London	RMIT University
Martin Skitmore	Queensland University of Technology
Vasantha Abeysekera	University of Southern Queensland
Albert Chan	The Hong Kong Polytechnic University
Chunlu Liu	Deakin University
Patricia McLaughlin	RMIT University
Spike Boydell	University of Technology, Sydney
Craig Langston	Bond University
Brian Purdey	Bond University
Imriyas Kamardeen	University of New South Wales
Thayaparan Gajendra	The University of Newcastle
Valerie Francis	The University of Melbourne
Tony Ma	University of South Australia
Linda Kestle	Unitec Institute of Technology
Willy Sher	The University of Newcastle
Stephen Pullen	University of South Australia
Lynne Armitage	Bond University
Angelo Karantonis	University of Technology, Sydney
Peter Lawrence	Central Queensland University
Dell McStay	Bond University
David Copray	Bond University
Sara Wilkinson	Deakin University
Patrick Zou	University of New South Wales
Lynn Crawford	Bond University
Sam Baroudi	University of South Australia
David Higgins	RMIT University
Yvonne Maher	Bond University
Kevan Heathcote	Bond University
Janet Xin Ge	University of Technology, Sydney
Stephen Gruneberg	University of Westminster
Allan Ashworth	University of Salford
Charles Kibert	University of Florida
Jeremy Coggins	University of South Australia
Gulasekaran Rajaguru	Bond University

Table of Contents

Do Australian Project Managers Working in the UAE Need Cross-cultural Training?

Sabina Cerimagic
Mirvac School of Sustainable Development
Bond University, Gold Coast, Australia

ABSTRACT

Western corporations have extended their operations to the United Arab Emirates (UAE). Consequently, some problems can arise because many expatriate managers cannot adjust to such a foreign environment. Hence, many projects are likely to fail. However, adequate expatriate preparation can reduce or even prevent expatriate failure. Cross-cultural training intends to assist expatriates enhance their knowledge and skills, which in turn can help the expatriate practise in an unfamiliar host country and to be more productive.

Most Australian project managers working in the Middle East in places such as the UAE have not been adequately prepared for their overseas assignment. This research set out to find out if Australian project managers would like to receive and be thought cross-cultural training.

This research uncovered that cultural training is of utmost importance if the expatriates are to be successful in the UAE. Language study, a preliminary site visit, discussions with local managers and discussions with the team they are going to work with, meeting with anyone who has returned from the same posting are all necessary for their success. However, more importantly, making sure the expatriate is the right person for the position is the most important indicator for success. All these factors must be controlled by the companies to help expatriates adjust and come with the new environment and the challenges which come with it.

KEYWORDS

cross-cultural training, Australian project managers and recruitment

INTRODUCTION

Buildings are major assets and form a significant part of facility management operations. Although buildings are long lasting they require continual maintenance and restoration. Eventually, buildings can become inappropriate for their original purpose due to obsolescence, or can become redundant due to change in demand for their service (Johnson, 1996). It is at these times that change is likely: demolition to make way for new

construction or some form of refurbishment or reuse (Langston and Lauge-Kristensen, 2002).

Making better decisions about built assets will significantly improve our sustainability performance and deliver economic, social and environmental benefits to property owners and investors. In particular, the reuse of valuable resources will offset the need to destroy existing buildings and will contribute positively to climate change adaption initiatives that are increasingly urgent. An understanding of how long buildings last contributes to this discussion.

The aim of this paper is to develop a new method for predicting a building's useful life based on an assessment of its physical life and its annual rate of obsolescence. This forecast can be determined initially during design and periodically re-evaluated or monitored as actual events unfold. A unique physical life calculator is employed to arrive at a baseline value. This value is then discounted by a derived obsolescence rate per annum to predict useful life and calculate the ratio of useful to physical life. The approach adopts a large number of adaptive reuse case studies to evaluate retrospectively whether the proposed framework has real world validity. The paper indeed demonstrates that the method is robust. The ability to effectively model useful life enables more sustainable decisions to be made, in the context of both new construction and existing building interventions.

BACKGROUND

The literature strongly advises that cross-cultural training should be provided to expatriates before they are sent overseas to work. Adequate and appropriate cross cultural training will prepare expatriates to deal better with the new and unfamiliar environment. Additionally, proper pre-departure preparation will give the expatriates an idea of what to expect in the new location to reduce the effects of *culture shock*.

There is also the non-financial effect of failure. These effects include loss of business opportunities and damage to the company's reputation. There are also psychological issues associated with failure. The expatriate will, most likely, have lower self-confidence and damaged self-esteem.

Any cross-cultural program should focus exclusively on the UAE culture, religion, and on how to practice project management in the UAE. This program would have to cover laws in the UAE, leadership and ethics. Emiratis take business personally, so it makes sense to learn as much as possible about the host country's culture in order to be able to avoid misunderstandings and conflict. This research (part of the author's PhD work) has uncovered three stages of expatriate training; the pre-departure stage, on-site stage and the repetition stage.

Project management is a leadership role in which the individual needs to plan, budget, co-ordinate, monitor and control the operation of the entire project from the beginning to the end. This is done by using various techniques in a broad range of activities in order to meet the requirements of the particular project (Bass and Stogdill, 1990). A good project manager has all those skills, however, many companies believe that because their project manager has the technical competency he/she will be successful regardless of the location and hence they do not offer cross-cultural training. Those companies forget that the Arab and Australian cultures are very different and those cultural differences are very real and those differences will affect the project manager. Hence cross cultural training and preparation are the keys to success.

The purpose of this paper is to highlight the importance of cross-cultural training. As well as, to look into the types of cross-cultural training that should be provided and how the training should be delivered to Australian project managers who are being sent to work in the UAE.

It would be risky to assume that the same expatriate managerial behaviours, positive or negative, are going to affect foreign nationals in the same way as in the expatriates home country. Expatriates need to know what behaviours that should be avoided and which they should engage in and this will differ from country to country.

Researchers such as Porter et al., (1999) have indicated that just because an employee is successful in his/her come country it is not a predictor that the employee will be successful in a foreign environment. Unless those potential expatriates are aware about the significance the culture differences play this means they need to be trained on cross-cultural awareness. It takes a long time to learn about a new culture and how to conduct business and behave socially in the new environment. Goodman (1994:41) pointed out a very significant element of culture:

> *"In many respects, one can think of culture as being analogous to an iceberg. As with an iceberg there is the part of the culture that is clearly in sight and there is a larger part of culture (the most dangerous) that is submerged, out of sight, below the waterline, waiting to destroy any business venture if people are unaware of its hidden dangers".*

The obvious parts of a culture such as language, clothing and architecture are easy to detect. However, the subtle and important elements may be more difficult to detect and these may be the ones *"under the water"*. These are much harder to recognise and may include; business ethics, employee loyalty and morality, motivation. This is why every potential expatriate needs to be equipped with adequate and appropriate cross-cultural training to appreciate the obvious and more subtle aspects of a new environment and different culture.

Cross cultural training

Vance and Ensher (2002) claim that training for expatriate staff will help expatriates to adjust faster to their new environment. However, Vance et al. (2002) like many other researchers in this field have discovered in their research that many companies do not train their expatriate staff for overseas assignments. They believe that the absence of cross-cultural training is due to the fact that some organisations assume that if the manager has proven him/herself in the home country or previously overseas they do not require additional training. Bird (2001) argues that cross-cultural training is necessary to succeed abroad and that effectiveness of expatriate training can be improved by asking former expatriates for their input and advice. The experience the previous expatriates have should not be ignored since it has the potential to improve the cross-cultural training (Selmer, et al., 2007).

More than 20 years ago Black and Mendenhall (1989) two of the best known researchers in this field reviewed 29 studies on cross-cultural training and they stated that cross-cultural training has an positive impact on cross-cultural effectiveness and that it should be offered to potential expatriates. However, according to Brewster and Pickard (1994) many companies still claim that the benefits of cross-cultural training are minimal. Their employees on the other hand believe that the training is very helpful in terms of dealing with culture shock and adjustment issues. Forster (2000) stated that many companies either do not offer any type of training or the training which is offered has a very low quality. Forster (2000) points out that pre-departure training which focuses on cultural briefings is very beneficial for both the potential expatriate and his/her dependants.

Research conducted by Caligiuri, et al. (2001), suggests that companies should develop more tailored, relevant and realistic pre-departure cross cultural training programs. Cross-cultural training has the potential of assisting expatriates to adjust to the host country successfully and this in turn promotes successful overseas alignment which is indispensable to the companies. Mentors can help new expatriates make appropriate decisions related to the host country nationals, which in turn will maintain positive relations with the host nationals. Mentors can also provide the new expatriates with critical feedback in a constructive manner, as well as provide emotional support, coaching, friendship, give them the feeling of acceptance and if necessary provide them with counselling.

Bird (2001) believes that the use of case studies and reality-based role playing can enhance the depth of learning. The training should also encompass simulation training with realistic situations which the expatriates my encounter while overseas.

Cross Cultural training and its effects on cross-cultural adjustment

Cross-cultural adjustment is the degree of psychological comfort felt by an individual with several aspects of a new environment (Black, et al., 1990; Parker and McEvoy, 1993; Caligiuri, 2000). In 1988 Black came up with three (3) facets of cross-cultural adjustment:

1. Work adjustment
    - Performance;
    - Responsibility, and
    - Supervision
2. Relational adjustment
    - Interaction with members of the host country
3. General Adjustment
    - Host country life conditions

These three facets of cross-cultural adjustment have been confirmed by many researchers (Black and Stephens, 1989; Black et al., 1991; Parker, et al., 1993; Waxin, 2000). Waxin (2000) studied the different effects of cross cultural training on the three facets and believes that the expatriate's country of origin has a direct and significant effect on the three facets of adjustment.

Selection Criteria of Expatriates for International Assignments

The factors for choosing expatriates for the overseas assignment should be based on international selection criteria. These selection criteria differ from country to country and from company to company. Usually the selection is influenced by the company's experience and is more often than not, culture-based (Luthans, et al., 2009). Companies also need to consider both technical and human criteria when selecting expatriates.

Expatriates that are sent overseas must be able to adapt to change and according to Luthans, et al. (2009). They also need a degree of cultural toughness. Most research shows that most expatriates seem to suffer from a culture shock after the initial arrival as the honeymoon *period* wears off (Ratiu, 1983). However, a culture shock might be also a good sign as it can indicate that the expatriates are getting involved with the new host culture.

Other criteria that should be considered when selecting expatriates are their age, experience and education. Heller (1980) also points out younger managers are more eager for international assignments. However, more often than not younger managers are often the least developed in management experience and technical skills. In the past companies have made their selections based on the technical competence of the expatriate. Technical competence is important, but it is only one of a number of skills that

an expatriate will need to succeed in a host country. If the company only selects an expatriate based on his/her technical skills the company is setting the expatriate up to fail, because the expatriate will go overseas believing that he/she is ready and they will not be able to deal adequately with the challenges awaiting them, and hence is more likely to fail. In addition, companies usually want the expatriates to be well qualified and have an academic degree as well as the desire to work abroad. Over the years companies have realized that a balance is important and this is why they send both younger as well as seasoned expatriates overseas (Luthans et al 2009).

According to Tu and Sullivan (1994) expatriates that are planning to go overseas should carry out a self-assessment. This can be done in three (3) phases:

- *Phase one (1) Self-evaluation and general awareness*
    - In this phase the individual asks him/herself is this international assignment really for me?
- *Phase two (2) Technical and cultural training*
    - Learn about the costumes, language, and etiquette, develop cultural awareness
- *Phase three (3) Activities that one needs after being selected*
    - If possible visit the host country before moving there as well as talk to people who have worked in the region and ask for advice

RESEARCH METHODOLOGY

When both a quantitative as well as a qualitative approach are combined these two methods are known as the mixed-methods approach (Tung, 1988). By using two types of data collecting approaches to conduct the data collection the limitation that the research methods have as individual approaches are diminished.

First, an online survey was used to collect both quantitative and qualitative data. The sample size of the survey was 100 Australian (western) project managers. The survey had a 72% respondent's rate which made the survey answers both reliable and valid. The survey was very helpful in providing rich information on cross cultural project management as well as helping the researcher develop questions for the case study interviews.

After the survey data was collected the questions were analysed with the help of the *SurveyMonkey* software which collects and analyses all the data. The survey results provided the researcher with areas that need to be researched in more depth. This in-depth research was achieved by conducting a number of follow-up case studies.

The data collection started off by using an online questionnaire, which was based on a literature review. Australian project managers were the primary target for the

questionnaire survey. Since only Australian project managers were targeted the survey was in English and there was no need to translate it into Arabic. The questionnaire was designed to find out if Australian project managers working in the UAE were receiving any training prior to their departure or on site. In addition, the survey asked questions about culture, about basic demographics of the participants and about their experiences and advice.

The Survey consisted of 34 quantitative questions and 13 qualitative questions. The quantitative questions mainly focused on the demographic questions such as age, gender, nationality, and the survey also asked *yes* and *no* questions about cross-cultural training.

Examples of quantitative questions:

- *Does your company prepare Expatriates to work in the UAE before they start work?*
- *Do you think it would be beneficial to prepare Expatriates for the UAE business climate?*

The qualitative questions were simple questions and the respondent expatriates were asked to write a couple of paragraphs. Examples of qualitative questions:

- *What methods are used to train the Expatriates?*
- *If cross-cultural training were to be provided to you; what do you think should the training encompass?*

After the survey data of the 100 Australian project managers was collected and analysed it was followed up by 6 case studies. First of all the researcher had to research Australian international companies that also operate in the UAE. After the potential companies had been selected the researcher emailed the company's directors and CEOs of the companies for permission to contact employees of their companies. Then emails were sent out to company contacts, which introduced the researcher and the research and it asked if the individuals would be willing to participate in the study. The emails were received favourably and most companies and individuals were willing to be part of the research.

In some cases the directors and CEOs were the ones interviewed and in other cases the directors and CEOs recommended employees who were best suitable to answer the questions as accurately as possible. The *snowballing* technique was used to extend the sample, this involved asking each interviewee if there is anyone they know off who would be useful for this research, so that the researcher could then interview the identified individual too (Green, Kao and Larsen, 2010).

The case studies were collected by using semi-structured in-depth interviews. Once the interviews were transcribed and analysed any area that needed more information or explanation was collected by contacting the participants by email and asking them the relevant questions. This provided a clear statement of the answers and sound

documentation for each study. The case studies were similarly structured, and below are a list of a few of the questions that were asked during the interview. The questions included:

- *What do you think is important to learn about the UAE and the Emirates before starting to do business in the UAE?*
- *In your opinion what are the 5 most critical facts for being successful in business in the UAE?*
- *Does your company prepare Expatriates to work in the UAE before they start work?*
- *How do you recruit, who and why?*

The survey data was analysed with the help of *SurveyMonkey*. The case studies were firstly transcribed and then coded with the help of NVivo8.

RESULTS

The results will be represented in three different stages; the pre-departure stage, the on-site stage, the repetition stage. In the end the result section will also take a look at expatriate recruitment and its influence on expatriate's learning willingness and adjustment ability.

The pre-departure stage

The training should cover; geography, some history, a review of the Islamic religion, some Arabic, a summary of Arabic body language, workplace communication culture and lifestyle. Arabic mannerisms and cultural awareness of specific items that could easily offend the Muslims should also be included. These issues are given in more detail below. Cultural as well as business etiquette needs to be learned before starting to do business in the UAE. The information provided must be relevant and useful. Most of the challenges are due to the lack of knowledge on how things are done in the UAE compared to Australia. Those mental challenges could be avoided or minimised with appropriate training and preparation of expatriates. A social network and access to support groups would be helpful as well. Expatriates need to be provided with all the relevant and up-to-date information in order to be able to make an informed decision on if he/she wants to work and live in the UAE before they leave their home base. All six case studies agree that cross-cultural training is important. The literature review, the surveys and the cases studies reveal that a *Starter Pack* would be useful and should be offered to the expatriates at the pre-departure stage. A *Starter Pack* needs to be provided to all fresh expatriates and to be specific on the UAE and it needs to cover the following (in no particular order):

- A company overview – with some information on the key people, their contact details and their photos.
- Some information on the UAE Geography and more specific information including maps on the Emirate where the expatriate will live and work.
- Brief history on the UAE and its Population.
- UAE Local Time, Climate, Useful Phrases.
- UAE Public Holidays for the year, with a brief explanation on what the holiday represents.
- Customs and Etiquette.
- A list of international relocation companies.
- Visa information for the UAE - this should be country specific. For example if an Australian is moving to the UAE he/she needs to be provided with information regarding tax and working visas.
- Accommodation information – is the company providing the accommodation if not how much does accommodation cast to rent? Which areas are good to rent in, how much an average rent is, rental agreement contracts what to look out for. If accommodation is provided by the company then the location needs to be given. Otherwise accommodation information in the form of property advice is needed.
- Property bond and up-front payments (Those can be onerous in the UAE).
- Official documents - have the correct and valid documents. For example, valid passport, get children their own passports, visa and work permits need to be approved, driving licence(s) needs to be valid for at least the next six months.
- Appoint a power of attorney in Australia for any legal or financial administration.
- Inform your solicitor of your move.
- Speak to a financial advisor or accountant regarding taxes, investment portfolio and pension.
- Notify all relevant persons and institution about the move. For example, the bank needs to know about any address change and so does the doctor and schools, if the children are going to school, and so on.
- Arrange for copies of medical and dental records to be transferred as well as having all the appropriate heath checks and vaccinations before moving to the UAE.
- After arriving in the UAE, meet and greet with a representative of the company.
- Transfer to hotel or local accommodation – is the company sending someone to pick the expatriate up or is the expatriate getting a taxi?
- Office location (map).

- Office induction – this should be done on the first day of work. The expatriate should be introduced to his her mentor on the first day too.
- Transportation. For example, if a company car was not part of the package then car hire or rental information needs to be provided.
- Utilities.
- Money and tax.
- Education information for expatriates with children.
- Healthcare.
- Useful tips, books, web sites.

All this information that is provided in the pack needs to be relevant and up-to-date. One more advantage of having a Starter Pack is that all relevant information such as phone numbers and who to contact is in one booklet. Once on site the expatriates need to be provided with cross-cultural training workshops. Additionally, it was recommended in the survey that expatriates need to know what they are getting themselves into. It is recommended that, if possible, expatriates should visit the UAE before they move over there. The new expatriates can help themselves by talking to other expats currently living and working in the country which would help manage expectations and prepare them for their work.

The on-site stage

Cross-cultural training intends to assist expatriates enhance their knowledge and skills, which in turn would help the expatriate practice in the unfamiliar host country and to be happier and more productive. Training can help expatriates to better understand the culture, customs and work ethics of their host country. For developmental and functional reasons successful expatriate assignments are invaluable to companies. It is no surprise that the expatriate management literature has paid a great deal of attention to the management of cross cultural adjustment of expatriates. The case studies in this research indicated that on-site training was desirable. However, for most expatriates it is almost non-existent.

Newly arrived expatriates should be given induction workshops. The induction is similar to a refresher course for what was done in the pre-departure training workshops. The exception is that the induction should be spread over two half-days. The reason for this being that a whole day is considered too long and people cannot concentrate and absorb everything if they have to spend a whole day listening to it. Hence, having the training for only half a day over two days would be much more effective. The program needs to be a specific culture preparation program, which would include a review of the construction industry in the UAE and how and if the technical side of work is any different in the UAE

compared to Australia. Additionally, expatriates need to think about how to keep out of trouble when they get to the UAE and some of the specific technical skills required. Once they are over in the UAE there is a need to reinforce the cultural environment information and after they have been there for a while, they need a refresher course about 3 months after arrival, then 6 months and then once a year.

The repetition stage

After the induction is over every new expatriate should get a mentor through a mentoring, coaching and development system. According to the six case studies a mentoring, coaching and development system was recommended. The mentoring, coaching development system would work in the company as a policy where before one can get promoted to the next job (go one level to the next level) the expatriate needs to have completed around fifty hours of coaching or mentoring. They would need to have successfully coached or mentored somewhere between seven to ten new expatriates before they can get promoted. Essentially this is the *buddy system*, but for branding and selling purposes it should be called the mentoring, coaching and development system.

The mentoring, coaching and development system has a couple of very useful advantages. Firstly, it will make sure that there is someone the new expatriate can approach and talk to, or if he/she has a problem or does not understand something there would be someone who can help. Secondly, this type of training acts as a reinforcement phase for the mentor; and this is why a mentoring program is of utmost importance. Additionally, having this type of support base and network is very important because the expatriate knows that he/she is not alone and there is someone who can help.

After completing the refresher workshop (three (3) months after arriving) this is followed by a workshop six months after that, and then another refresher course after one year. It is strongly advisable to take into consideration feedback from the nationals on what can be improved in the workshops and to try and implement it.

Research shows that many host country nationals would like to see changes and improvements in some styles of expatriate managers. Those changes include the expatriate manager's leadership, decision making, communication and group work (Luthans, et al., 2009). In terms of leadership, the following changes would be desirable; expatriate managers need to be friendlier, available and respect subordinates and their suggestions. In terms of decision making, the host county nations would like to be involved in the decision making process by those who will be affected by the decisions made and have a clear definition of goals. In terms of communication; the expatriate managers should adopt more group problem solving with more teamwork as well as encouraging the exchange of opinions and ideas between managers and subordinates.

This indicates that the training approaches used need to reflect both the industrial, professional, personal and the cultural environments.

Testing the post training experience

The survey revealed that most (61.1%) participants agree that testing for post-training experience would be beneficial. Figure 1 shows the survey results.

Figure 1 – Post-training experience

The testing of the post-training experience can indicate if the training is working. If the training is not working then the training should be modified. Additionally, the training can provide feedback and suggested improvements and in this way the training can be revised on a regular basis. In return this helps the company save money by having well trained workers who are able to deliver successful projects.

The post training experience can be conducted by the either the mentor who is mentoring the expatriate or by the expatriate's manager. The expatriate would not be asked to do a self-assessment as most individuals are unable to be objective when conducting self-assessments. Professionals in the field agreed that the post training experience is important and it should be carried out by someone who works with the expatriate and not by the expatriate alone as people see themselves differently to how they are perceived by others.

Figure 2 shows a structural concept map of the whole cross-cultural training program with all the stages indicated together with the form of workshops and mentoring required.

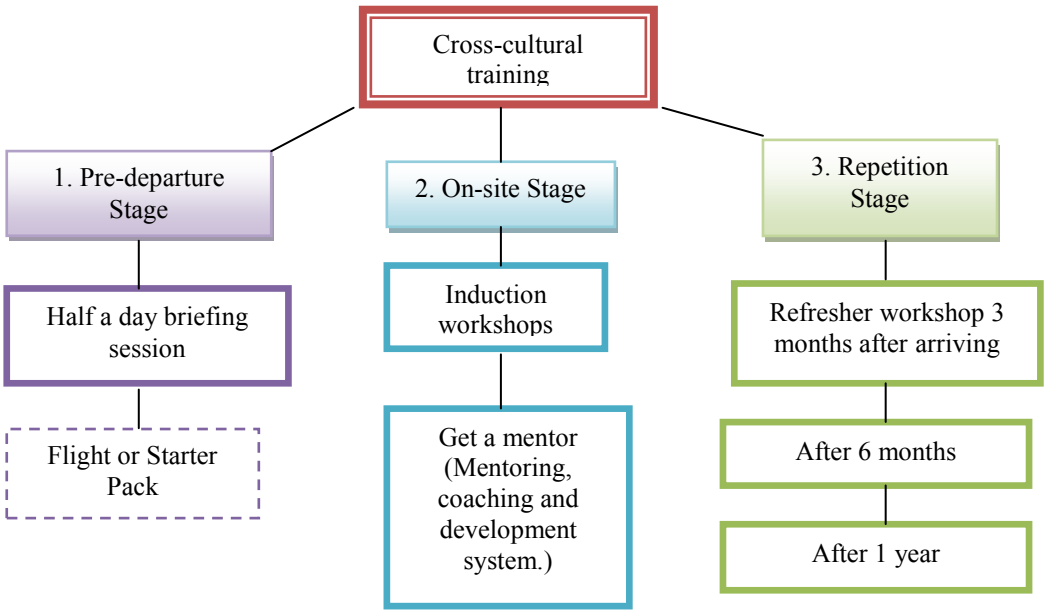


Figure 2 – Cross-cultural training blueprint

Recruitment

Many researchers argue that companies have failed to pay attention to *"screening, selection and training of potential expatriate staff and the non-technical skills they should possess."* (Forster, 2000:63). The way the *"right"* people can be chosen for the overseas assignment is by pre-testing the employees. It is important that they are able to adapt to new and unfamiliar situations, Porter et al., (1990) believe that these characteristic is very important to success.

The expatriates in those case studies have all been recruited in different ways. Most had a phone interview while still in their home country. One of the case study companies has been in the UAE for the last 30 years and only carries out an initial phone interview where they run through most of the difficulties that will come with working in the UAE. They look for people who have the skills set that are required to do the job. In addition, people who are known by the company's staff or who have worked previously on project with staff from the company have priority. In addition, they look at the age of the person and maturity level of the people that they are employing. All of their senior managers do a personality profile, specially carried out by a consulting company to make sure that the person will fit the job.

CONCLUSION

There are a vast number of reasons why cross-cultural training is important. From a company perspective, if their expatriates are adequately trained for the overseas assignment they will be more successful by increasing the overall efficiency and profitability and the company. Cross cultural training also helps expatriates to improve and be able to interact effectively with local people and co-workers and it helps expatriates to adjust to an unfamiliar environment faster than if they had no training at all. The lack of training or no training at all, is associated with higher expatriate failure rates This research has uncovered that cross-cultural training is positively linked to improving the relationships between expatriates and host nationals.

REFERENCES

Adler, N.J. (2001) *International Dimensions of Organizational Behavior*, 4th edition. Cincinnati: South-Western College Publishing.

Bass, B.M. and Stogdill, R.M. (1990) *Bass & Stogdill's Handbook of Leadership: Theory, Research, and Managerial Applications*.3rd ed.New York Free Press; Collier Macmillan.

Bird, A. (2001) International assignments and career as repositories of knowledge. In Mendenhall, M.E., Kuhlmann, T.M., and Stall, G.K. (Eds.), Developing global business leaders: Policies, processes and innovations (pp. 19-36). Westport, CT: Quorum Books.

Black, J.S. (1988) "Work-role transition: a study of American expatriate managers in Japan", *Journal of International Business Studies*, **19**(2)274-291.

Black, J.S. and Mendenhall, M. (1989) "A practical but theory-based framework for selecting cross-cultural training methods", Human Resource Management, **28**(4)511-539.

Black, J.S. and Mendenhall, M. (1990) "Cross-cultural effectiveness: a review and a theoretical framework for future research", *Academy of Management Review*, **15**(1), 113-36.

Black, J.S. and Stephens, G.K. (1989) "Expatriate adjustment and intent to stay in Pacific Rim overseas assignments", *Journal of Management*, **15**(2), 529-544.

Black, J.S., Mendenhall, M. and Oddou, G. (1991) "Toward a comprehensive model of international adjustment: an integration of multiple theoretical perspectives", *Academy of Management Review*, **16**(2), 291-317.

Brewster, C. and Pickard, J. (1994) „Evaluating expatriate training', *International Studies of Management and Organization*, **24**(3):18-35.

Caligiuri, P. (2000) "Selecting expatriates for personality characteristics: a moderating effect of personality on the relationship between host national contact and cross-cultural adjustment", *Management International Review*, **40**(1), 61-80.

Caligiuri, P., Phillips, J., Lazarova, M., Tarique, I. and Bürgi, P. (2001) "The Theory of Met Expectations Applied to Expatriate Adjustment: The Role of Cross-Cultural Training." *International Journal of Human Resource Management* **12**(3): 357–372.

Cerimagic, S. (2010) Cross cultural project management characteristics between Australia and the United Arab Emirates. COBRA conference, RICS, September 2-3, 2010, Paris.

Forster, N. (2000) Expatriates and the impact of cross-cultural training. *Human Resource Management Journal*, **10**(3):63-78.

Green, S.D., Kao, C.C. and Larsen, G.D. (2010) "Contextualising Research: Iterating Between Methods While Following on Empirically Grounded Approach", ASCE Journal of Construction Engineering and Management, 136(1):117-126.

Goodman, N. (1994) "Cross-cultural training for the global executive" *in Improving Intercultural Interactions: Modules for Cross-Cultural training Programs*. Sage Publications, London.

Heller, J.E. (1980) Criteria for Selecting an International Manager. Personnel, May-June, p. 50.

Luthans, F. and Doh, J.P. (2009) International Management. Culture, strategy and behaviour, 7th edition. McGraw-Hill Irwin, New York. *Management Journal*, **10**(3):63-78.

Mendenhall, M. and Oddou, G. (1991) "Toward a comprehensive model of international adjustment: an integration of multiple theoretical perspectives", *Academy of Management. Review*, **16**(2), 291-317.

Parker, B. and McEvoy, G.M. (1993) "Initial examination of a model of intercultural adjustment", *International Journal of Intercultural Relations*, **17**(3), 355-379.

Porter, G., and Tansky, J.W. (1999) Expatriate Success May Depend on a "Learning Orientation": considerations for Selecting and Training. *Human Resource Management* **38**(1):47-60.

Ratiu, I. (1983) „Thinking internationally: a comparison of how international executives learn', *International Studies of Management and Organization*, **13**(1-2), 139-150.

Selmer, J., Chiu, R.K. and Shenkar, O. (2007) Cultural distance asymmetry in expatriate adjustment. *Cross Cultural Management: An International Journal,* **14**(2):150-160.

Tu, H. and Sullivan, S. (1994) "Preparing yourself for an international assignment", *Business Horizons*, **XXXVII**(1):67-70.

Tung, R.L. (1988) The new expatriates: Managing human resources abroad. Cambridge, MA: Ballinger.

Vance, C.M. and Ensher, E.A. (2002) "The Voice of the Host Country Workforce: A Key Source for Improving the Effectiveness of Expatriate Training and Performance", *International Journal of Intercultural Relations* 26:447–61.

Waxin, M.F. (2000) *L'adaptation des cadres expatriés en Inde: ses déterminants et l'effet de laculture d'origine.* Unpublished doctoral dissertation, University of Aix-Marseille III, France.

A Project Management Approach to Disaster Response and Recovery Operations

Dr. Bassam Baroudi
School of Natural & Built Environments
University of South Australia, Adelaide, Australia

Dr. Randy R. Rapp
College of Technology
Purdue University, West Lafayette, Indiana, USA

ABSTRACT

In the last decade the world has seen some of the most devastating natural and manmade disasters on record. These include the 2004 Asian tsunami, Hurricane Katrina, 9/11, the Haiti earthquake, the 2009 Victorian bushfires and more recently the Pakistan floods, the Christchurch earthquake and the Japanese earthquake, tsunami and radiological contamination. These disasters require substantial relief and recovery efforts that are in many cases beyond the capabilities of the countries concerned. The discipline of project management is continually gathering interest from varied sectors. Such interest has seen its body of knowledge applied to many diverse fields such as construction, defence, information technology, health, etc. In fact supporters of project management ideology advocate that all management situations should adopt a "management by projects" philosophy. This paper presents a preliminary study in respect to disaster management. It reviews disaster management literature and follows on to provide a commentary on the topic using a project management approach that examines project stakeholders, organisation, lifecycles, processes and the knowledge areas. The intention of the study is to provide a foundation for upcoming collaborative research into the management of disaster related operations. Disaster management efforts have attracted significant criticism in recent times. It is believed that viewing disaster response and recovery operations from a project management perspective could provide a useful approach that may lead to improved outcomes within this very challenging area.

KEYWORDS

project management, disaster relief and reconstruction

INTRODUCTION

The world has witnessed many devastating disasters with recent events still creating massive challenges in this area. Shaluf (2007) contends that disasters can be classified into three types namely natural, man-made and hybrid varieties. The natural types are

created by natural forces such as tsunami, hurricanes and earthquakes and flooding. Man made types result from human decisions such as building collapses, transport accidents and war. The hybrid types are a combination of both. Many believe that the occurrence of disasters is on the increase (Ofori , 2004; Whybark 2007; Kovacs and Spens, 2007). Hence further research seems worthwhile.

The aim of disaster relief, restoration and reconstruction operations is to mitigate human suffering and return regions to normality. This is usually a complex undertaking requiring high levels of management capability and resources availability. Ofori (2004) points out that disaster situations have a great impact on the built environment and this is particularly compounded in the case of developing countries. This creates a situation where economic and social recovery in those regions takes many years with the consequence being the prolonged suffering of inhabitants.

The application of project management has seen its body of knowledge applied to many diverse fields including construction, defence, information technology and health. Publications such as the Project Management Body of Knowledge (PMBoK®) (PMI, 2008) espouse concepts within project lifecycles, techniques, processes and the various knowledge areas. Many systems exist to manage projects but the underlying concepts remain the same. A good way to think of project management is in terms of "achieving project goals with resources available" (Lock, 1994 p. 3). Also, projects typically have scheduled start and completion points. Furthermore project management dictates that there should always be a single point of responsibility catering to the many stakeholders that are involved. Project management is increasingly extending its knowledge to place greater emphasis on other areas such as soft skills, strategy and sustainability. It is thought that using a structured project management approach that looks at the concepts within project stakeholders, organisation, lifecycles, processes and knowledge areas could be at this time useful to disaster management.

It would appear that there is ample literature regarding disaster management operations, however, there is little written on the topic that takes a more holistic project management approach. Hence, the following will review disaster management and then follow on to provide a project management commentary as applied to disaster situations.

DISASTER MANAGEMENT REVIEW

The following sections review the published literature in respect to disaster management. The sections cover disaster management concepts in the chronological order of disaster readiness, disaster relief and disaster recovery.

Disaster readiness

In recent times increased attention has been paid to pre-disaster preparations. Paton and Jackson (2002) contend that fundamental to disaster readiness or preparedness is the planning and developing of appropriate training arrangements. They suggest that there are limited opportunities to actually acquire the experience to deal with disasters so this option can help prepare emergency workers for the challenge.

Moe and Pathranarakul's (2006) investigations of the 2004 Asian tsunami as it affected Thailand revealed that the country was ill prepared for such an event. It was thought that a disaster management plan would have helped. Such a plan could include the elements of prediction, warning, mitigation and preparedness, clear lines of authority, effective collaboration, education of communities in potential disaster areas and an adequate information base to work from. Furthermore Athukorala and Resosudarmo (2005) studies of the 2004 Asian tsunami as it affected Indonesia and Sri Lanka found response systems to be inadequate. Their assessment of the disaster management process led them to conclude that the public should be better educated about simple safety measures that can be taken during a disaster.

Following the September 11 terrorist attacks in the United States, Perry (2003) suggests that much attention was given to the area of Incident Management Systems (IMS). These systems are basically a way of predicting possible disasters and then planning for the required resources that might be needed in preparation for identified disaster emergencies. Whybark (2007) also looked at how communities can be better prepared. He sees it in two ways. One which highlights the need for required items to be acquired and stored in preparation for when a disaster strikes. The other focuses on planning for the sourcing and distribution of items during the relief operations.

Disaster readiness is believed to be an imperative part of any disaster or emergency management system. This would include planned measures to be taken during and after a disaster event. It should also include preparing the built environment for the possible consequences of disaster via building codes and regulations.

Disaster relief

Disaster relief is the first response during or after a disaster incident. Klein and Weigelt (1991) suggest that once a disaster has struck we cannot expect everything to be seen in its normal context. In fact, they puts forth that the best we could hope for is some form of "controlled chaos". They also argue that we cannot allow the ethos of goodwill and good intentions to pull us through disaster relief situations. These events must have appropriate planning and management.

Yi and Kumar (2007) contend that there are the two major activities that feature in a disaster response. These are evacuation of the affected and logistics support. Their view is that evacuations are the initial response to remove people from a place of harm or danger. Logistics support is that what is required in the time after the initial disaster incident to help survivors that are still within the disaster zone. This help can be in the form of food, shelter, medicine and getting the wounded to hospital. Kovacs and Spens (2007) describe logistic support in terms of humanitarian logistics. They see it as an umbrella term for various disaster relief operations. They say it covers the initial response as well as continuous support for affected regions.

Schneider (2005) suggests that the U.S. government's initial disaster response to Hurricane Katrina in 2004 attracted widespread criticism. She views natural disasters such as these as extremely challenging management problems and puts forth that such events are enormous in scale, quite complex and can affect large populations. She believes the poor management of Hurricane Katrina's disaster relief response was due to bureaucratic government systems and an emergency plan that did not cope well with the situation. Moreover, Sobel and Leeson (2007) question why private sector businesses that supply good and services during disaster relief are much quicker to respond than government agencies such as the U.S.'s Federal Emergency Management Agency (FEMA). It could be argued that the profit motive is stronger than motivations of public sector administrators. However it could quite simply be that FEMA has more issues to manage. Meissner et al. (2002) add that disasters pose great challenges to a region's public emergency services. Government agencies including police, fire departments, hospitals and military forces are needed as well as the assistance of a myriad of private organisations. These all need to be able to react quickly and in a coordinated manner. Thus they say there is a need for both intra and inter organisation coordination for an effective response to be mounted. Furthermore, it would seem that exercises to train the players in their respective roles and resource planning are critical.

Disaster relief efforts require a region's government to manage required operations. This management should be inclusive of their agencies, the private sector and the public.

Disaster recovery

Rapp (2010) views disaster recovery as a combination of restoration and reconstruction. Restoration refers to repairing existing structures to their pre-disaster state whilst reconstruction is rebuilding from new. It is the sum of these two activities that place affected regions on the road to recovery. Coles and Buckle (2004) suggest that effective recovery can only take place if the whole community works in behind the effort. However, the community must have the capacity and knowledge to undertake the works.

They go on to say that in recent times disaster management is not seen as much as managing the hazard but as managing the risks involved.

Moe (2010) makes mention on how Hurricane Katrina scattered a large amount of debris from manmade structures and vegetation over a wide area. This amounted to an estimated 85 million cubic metres of debris which had to be cleaned up. The clearing of the debris needs to precede any construction related activities. It was also pointed out that this work accounted for as much as 40 percent of the total disaster rectification cost. The government departments and agencies involved included Defence, Homeland Security and FEMA, Health and Human Services, Environmental Protection Agency, U.S. Army Engineers, U.S. Coast Guard as well as local authorities.

Building restorations would seem the preferred option ahead of reconstruction. Peacock et al. (2007) see it as "restoration of the restorable". This is basically the repairing and restoring of buildings which have only suffered partial damage. Facilities that do not qualify for restoration must be rebuilt. Armstrong (2000) looks to the U.S.A. for approaches to disaster restoration and suggests that they are more advanced in the area than the U.K. He points out that the U.S.A has organisations that are specifically set up to deal with this sort of remedial work. It is surmised that the market place would govern the viability of these types of organisations within a country or region.

Where restoration is not possible reconstruction activities need to take place. These are deemed much more extensive and time consuming in nature. Baradan (2006) indicates that overall reconstruction periods after a disaster can take anywhere between two and four years. This would likely be dependent on the developed status of the region in question. She states *"post-disaster housing reconstruction is a process that is the interaction of complex social, technological and economic factors and actions"* (p. 1). Rehabilitation efforts require decision making on what is to be done and how and an implementation plan is needed. Then the building work can be assessed, quantified and executed as necessary to see recovery in motion. As indicated these stages can take some time. Furthermore, Alexander (2004) puts forth that reconstruction that occurs too quickly after a disaster possibly indicates a lack of conformity and consultation with stakeholders.

Boen and Jigyasuii (2005) contend that with reconstruction projects the cultural background of the affected region should demand significant attention. They argue that all too often money can flow in for disaster recovery operations with the emphasis being on rebuilding structures rather than communities. Therefore they say it important when redeveloping disaster affected areas that professionals take a cultural perspective. Aldrich (2008) demonstrates that the social capital of a stricken area can affect the speed of recovery. Neighbourhoods that are closely knit before the disaster and maintain contact with each other after evacuation will reconstitute themselves quicker. For example, two

years after Hurricane Katrina, ninety percent of the inhabitants of New Orleans' closely knit Village de L'Est returned and ninety percent of businesses reopened. The remainder of the city only witnessed a fifty percent return. Furthermore, Rotimi et al. (2006) suggest that disaster recovery requires facilitation for capacity building and community sustainability with the potential of mitigating risk and vulnerability to future disasters.
Disaster recovery requires the integration and coordination of many services to ensure an orderly progression back to a region's pre-disaster condition.

PROJECT MANAGEMENT COMMENTARY

The following sections discuss various project management principles as applied to disaster management operations. Project stakeholders, organisation, lifecycles, processes and knowledge areas are covered. The intention is to highlight how a project management approach can provide a useful perspective on disaster situations.

Project stakeholders and organisation

A project stakeholder refers to any organisation or person that is influenced or affected by a situation. With disaster situations the spectrum of stakeholders is seen to be vast. That is particularly more so in the affected regions. The range of stakeholders that would be affected by a disaster from a leadership and management perspective would include government authorities, emergency services, hospitals, utilities, building regulators, etc. Then there would be other stakeholders that could assist in the efforts and these people would include engineers, contractors, suppliers, charity, groups, private businesses, insurers, etc. The largest stakeholder group is the actual affected community at large. One other stakeholder group worthy of note are the various national and international contributors from outside the affected area. As can be seen project management on this scale involves many more stakeholders than most conventional project types.
The various parties referred to above should be seen as the project stakeholders. They all have a role to play in the course of disaster readiness, relief and recovery. Their actions are critical to any successful operation within these challenging situations. However, project management principles dictate that there should only be one single point of responsibility for all activities associated with managing projects. The project leadership should undoubtedly come from the government authority charged with dealing with emergency situations such as FEMA in the U.S. Within disaster management these people could be seen as the "project managers". Their responsibilities would include preparing the project plan inclusive of information in respect to emergency operations aimed at reducing human suffering, logistics support, coordination of other public and private organisations pre and post disaster, disaster awareness promotion, community

engagement and various other tasks. However, lessons learned indicate that whilst centralised planning can be effective, success can come only with decentralised execution. That is "power down" as much as possible to get the work done. In the U.S., federal authorities have learnt to resource, facilitate and support local and state efforts rather than to direct them. As such, project planning should adopt this approach and the designated disaster emergency authority needs to ensure that their role is well communicated to all stakeholders.

Post emergency the restoration and reconstruction of damaged property commences. This sub-project should be a government facilitated endeavour using local building authorities assisted by the private sector. Recovery of public buildings, private dwellings and infrastructure would need significant input from regulators and this should include planning for repeat occurrences. Then the nature of market forces would see designers, engineers, contractors, subcontractors and suppliers quickly vie for construction related work.

Project lifecycle and processes

All projects contain many interrelated activities. These activities or processes make up the project lifecycle. Viewing disaster management in terms of a project lifecycles could be useful. Examining project lifecycles offers the possibility of dividing the required processes into phases or stages within any project. Each of these phases has many processes that must be undertaken. Their durations are estimated then a sequencing exercise sets out the order of events. Once executed the outputs must match the objectives and associated deliverables as set out within the project plan. These phases are typically described as the project initiation, project planning, project execution and project closure phases.

The project initiation phase consists of instigating the necessary processes. Within disaster management this should occur prior to any events occurring such as establishing the responsible emergency management agency and employing qualified personnel. In project management terms that is establishing the project team. Project planning entails establishing how activities are to be managed in a general sense. For example, in this phase the emergency management project team would need to formulate and document emergency plans and analyse logistical scenarios. The planned deliverables would include reduce human suffering, mitigate after affects, provide essential services and facilitating for work to damaged structures. Project initiation and planning stages are basically the disaster readiness or preparedness aspect of disaster management.

The project execution phase is the implementation stage. Hence, this only occurs when a disaster strikes and a disaster relief response is required. This is quite different to

conventional projects where the intention is that the execution stage almost always needs to take place. In disaster management the execution involves the emergency plan moving into action. The project team then manage, monitor and control activities against documented baselines. The execution phase also extends to the restoration and reconstruction period although various responsibilities may transfer to other agencies for this phase. Note these agencies could possibly fall under the authority of the emergency management project team. Finally, the closure phase marks the finalisation of all processes and activities. For example, final inspections, commissioning facilities, building handovers, documenting outcomes and addressing lessons learned are typical of what should be carried at the end of a "disaster lifecycle". The project execution and closure stages essentially cover the disaster relief and recovery operations.

With disasters the project lifecycle can be significantly different in approach to other more conventional projects. For example the initiating and planning phases for a disaster can go on indefinitely without an execution or close out phase ever taking place. Furthermore, some processes such as scope planning or work breakdown structures cannot properly occur until the actual disaster event is known. However, comprehensive generic formats could be produced based on previous experience. Then the elements that are needed for the current scope of work can be selected to comprise the project effort. The timeline associated with disaster management activities can also be viewed in many ways. This is dependent on the type of disaster encountered and the level of development within the affected region. It is thought that a project management approach to disaster situations provides a way of defining phases and required activities within a disaster lifecycle.

Project management knowledge areas

Generic project management has many knowledge areas to draw from. For example, PMBoK® (2008) outlines nine knowledge areas dealing with scope, integration, time, cost, quality, human resources, communications, risk and procurement. These and other knowledge areas provide a framework for project managers to assemble their project requirements. Within disaster management the concepts involved could be of assistance.

In project scope management the emphasis is on discovering what is included in the project but also what is excluded. In standard projects this would wholly occur in the initiation phase however, this would not work for disasters. Hence, as previously indicated generic scoping formats could be developed at an early stage and then finalised on the cusp of the execution phase. For example, if a hurricane strikes, in the first instance the prepared scoping formats could determine the regions that have been significantly affected. Hence, this is where the greater relief and recovery efforts need to

be concentrated. Then the generically identified activities could be checked off so as to foster the desired project deliverables.

Time, cost and quality management are often thought of as core objectives within project management. Within disaster management the scale and complexity of operations can have a great impact within these areas. Time management would seem to be of the essence. The response time to mobilise the execution phase into effective operation could be the difference between life and death during disaster relief. Extended timelines during the recovery period could prolong suffering. Cost could possibly be seen as inconsequential during the disaster relief period but then poorer underdeveloped nations would need to source funding to limit harm from disasters. Cost management during restoration and reconstruction requires due diligence with limited resources and tight timelines likely to have significant impact within this area. Quality management is important in the delivery of the required assistance and services to people in need. It is also seen in terms of the restored or reconstructed product being "fit for purpose". This should also allow improved structures for future disaster challenges. Stringent project control methods are required within time, cost and quality management to achieve desired project outcomes.

Being disaster ready requires human resources and communications management to be adequately considered. Effective human resources management identifies qualified leaders with response teams needing to be acquired and developed. These people need to understand their mission and what resources are available to them to execute their tasks in a time of emergency. Project communications is two dimensional within project management. In one dimension it is the use of appropriate personal communications, e.g. well directed orders, discussion, negotiation. The other dimension takes the form of documented communications, e.g. emergency plans, maps, drawings, reports. Both are required in approaching disaster situations appropriately.

The area of risk analysis within project management seeks to identify, assess, mitigate and control uncertainties. The area is highly relevant to disaster situations carrying dire consequences if mismanaged. For example, could better risk analysis have foreseen the possibility of New Orleans levees failing as occurred during Hurricane Katrina? As such, the processes within risk management are particularly important during the disaster readiness stage. The project team needs to be able to identify possible disaster scenarios and effective response strategies to alleviate potential suffering and damage. Risk management is also critical during the disaster relief stage to ensure challenging situations are kept under control. For example the recent Japanese situation of controlling radiological contamination due to damage by the tsunami is evidence of how critical risk management is in this area. Risk in other more conventional fields pale in comparison.

Risk management during the recovery stage is thought of in terms of that similar to general business risk management.

Project procurement is basically the external sourcing of all goods and services required to carry out the work within a project. In disasters this would essentially involve government agencies such as an emergency response project team procuring contractors and suppliers to assist with disaster relief operations. It would also include sourcing of requirements for restoration and reconstruction activities by the various stakeholders. The procurement area could include anything from medicines, food supplies, and temporary shelters to transport, machine hire, consulting engineers, building contractors and suppliers.

Other broader areas such as soft skills, safety management, human ethics, cultural management and sustainability are also of possible interest in disaster situations. These areas could influence the style of project management applied to disaster response and recovery operations.

CONCLUSIONS

The above review and commentary provides for a preliminary study into disaster response and recovery operations using a project management approach. The study essentially looked at various disaster management findings from around the world and then used project management concepts as a lens to examine various aspects.

Current disaster management concepts can be broadly placed into the areas of disaster readiness, relief and recovery. Disaster readiness was found to be an important part of disaster management. Planning for the potential effects of a disaster at least provides a strategy if such an event occurs. This planning flows into the disaster relief operations possibly allowing for better outcomes than might have otherwise been experienced. The recovery stage allows for reconstruction activities to take place and is inclusive of restoration work where possible.

Project management knowledge provides many industries and fields with a framework to deliver desired outcomes from complex and challenging situations. It is thought the same could apply to disaster situations. Having understandings in the workings of projects and the application of associated concepts can prove useful. This could be in the form of identifying stakeholders, mapping lifecycles, driving processes or applying knowledge areas. It is thought that project management best practice has many tried and proven techniques which could assist within disaster situations.

In concluding, natural and manmade disasters do present enormous challenges. This is evident within recent events where disasters have caused harm to people, the natural environment and the built environment. Hence, it is important that investigations continue

to discover improved ways to manage the effects of disasters. This preliminary study provides a base for upcoming collaborative research integrating disaster situations and project management.

REFERENCES

Aldrich, D. (2008) Social, Not Physical, Infrastructure: The Critical Role of Civil Society in Disaster Recovery, Annual Meeting of the American Political Science Association, August 28-31, 2008.

Alexander, D. (2004) Planning for Post-disaster Reconstruction, I-Rec International Conference, Improving Post-Disaster Reconstruction in Developing Countries, Coventry, UK, 22-23 April 2004..

Armstrong, B. (2000) Small company "champions" IiP: disaster restoration firm finds training pays off, *Industrial and Commercial Training*, Volume 32, Number 4, pp. 135-138.

Athukorala, P. and Resosudarmo, B.P. (2005) The Indian Ocean Tsunami: Economic Impact, Disaster Management, and Lessons, *Asian Economic Papers*, Volume 4, Number 1, pp. 1-39.

Baradan , B. (2006) Analysis of the Post-disaster Reconstruction Process following Turkish Earthquakes, 1999, Third International Conference on Post-Disaster Reconstruction: Meeting Stakeholder Interests, I-Rec, Florence, Italy, 17-18 May, 2006.

Boeni, T. and Jigyasuii, R. (2005) Cultural Considerations for Post Disaster Reconstruction Post-Tsunami Challenges, UNDP Conference.

Coles, E. and Buckle, P. (2004) Developing community resilience as a foundation for effective disaster recovery, *The Australian Journal of Emergency Management*, Volume 19, Number 4, pp. 6-15.

Klein, J.S. and Weigelt, J.A. (1991) Disaster Management. Lessons learned. U.S. National Library of Medicine, National Institutes of Health, *Surgical Clinics of North America*, Volume 71, Issue 2, pp. 257-266.

Kovacs, G. and Spens, K.M. (2007) Humanitarian logistics in disaster relief operations, *International Journal of Physical Distribution & Logistics Management*, Volume 37, Number 2, pp. 99-114.

Lock, D. (1994) *Gower Handbook of Project Management*, Second Edition, Gower Press.

Meissner, A., Luckenbach, T., Risse, T., Kirste, T. and Kirchner, H. (2002) Design Challenges for an Integrated Disaster Management Communication and Information System, The First IEEE Workshop on Disaster Recovery Networks (DIREN 2002) New York City, June 24, 2002.

Moe. (2010) Cleanup after Katrina: an analysis on policy, process, priorities, problems, and politics, *Disaster Prevention and Management*, Volume 19 Number: 3 pp: 314-332

Moe, T.L. and Pathranarakul, P. (2006) An integrated approach to natural disaster management: Public project management and its critical success factors, *Disaster Prevention and Management*, Volume 15, Issue 3, pp. 396 – 413.

Paton, D. and Jackson, D. (2002) Developing disaster management capability: an assessment centre approach, *Disaster Prevention and Management*, Volume 11 Issue 2, pp.115 – 122.

Peacock, W.G., Dash, N. and Zhang Y. (2007) Sheltering and Housing Recovery Following Disaster, *Handbook of Disaster Research*, Editors: Rodriguez, H., Quarantelli, E.L., Dynes, R.R. and Springer.

Perry, R.W. (2003) Incident management systems in disaster management, *Disaster Prevention and Management*, Volume 12, Issue 5, pp. 405 – 412.

Project Management Institute, P*roject Management Body of Knowledge Guide (PMBOK Guide)*, 4th Edition, 2008.

Ofori, G. (2004) Construction Industry Development for Disaster Prevention and Response. 2nd International Conference on Post-Disaster Reconstruction: Planning for Reconstruction, Coventry, UK, 22 - 23 April 2004.

Rapp, R.. (2011) *Disaster Recovery Project Management: Bringing Order from Chaos*. Unpublished book manuscript, West Lafayette, Indiana: Purdue University.

Rotimi, J.O.B., Le Masurier, J. and Wilkinson ,S. (2006) The Regulatory Framework for Effective Post Disaster Reconstruction in New Zealand, Third International Conference on Post-Disaster Reconstruction: Meeting Stakeholder Interests, I-Rec, Florence, Italy, 17 - 18 May, 2006.

Schneider, S.K. (2005) Administrative Breakdowns in the Governmental Response to Hurricane Katrina, *Public Administration Review*, Vol. 65, No. 5, pp. 515-516.

Shaluf, I. M. (2007) An overview on disasters, *Disaster Prevention and Management*, Volume 15, Issue 5 pp. 687-703.

Sobel, R.S. and Leeson, P.T. (2007) The Use of Knowledge in Natural-Disaster Relief Management, *The Independent Review*, Volume 11, Number 4, pp. 519-532.

Whybark, D.C. (2007) Issues in managing disaster relief inventories, *International Journal of Production Economics*, Volume 108, Issues 1-2, pp. 228-235.

Yi, W. and Kumar, A. (2007) Ant colony optimization for disaster relief operations, *Transportation Research Part E: Logistics and Transportation Review*, Volume 43, Issue 6, Pages 660-672.

Risks in Green Building Development: A Supply Chain Perspective

Patrick X.W. Zou
Faculty of the Built Environment
University of New South Wales, Sydney Australia

Paul Couani
University of New South Wales, Sydney Australia
Brookfield Multiplex Construction, Sydney Australia

ABSTRACT

This research aims to identify the major risks in green building development from a supply chain perspective and develop strategies to manage these risks. Data was collected through questionnaire surveys and analysed using relevant software. It is found that the risks in green building vary throughout the supply chain, with ‚lack of commitment in the supply chain to go green' and ‚higher investment costs' being ranked as the most important risks overall. The strategies to manage these risks are through research and development, training and education, co-ordination, knowledge and information management, experience sharing and technology application. As the green building market continues to develop, construction supply chains must collaboratively and collectively responses to the risks to improve their green building performance. This research provides a basis for understanding the key risks and management strategies in green building development from a supply chain perspective.

KEYWORDS

risk management, green building development, supply chain

INTRODUCTION AND RESEARCH AIMS

The construction industries worldwide are responsible for adversely impacting on the environment during the extraction, processing and transportation of raw materials and the construction and operation of a building facility. This realisation has resulted in the recent development of ‚green building', which can be defined as "building with an ecologically sustainable focus" (GBCA 2006a:4). Today there is a strong demand for green building for reasons of ‚being part of an industry that values the environment' and ‚achieving lower lifecycle costs', with these reasons triggered by ‚rising energy costs' and ‚government regulations' (GBCA 2006a).

The first step to creating a ‚green building' is the client's request to do so and this request is then relayed downstream to designers, contractors, subcontractors, suppliers and manufacturers. It is this network of professionals that form the construction industry supply chain (Wang, Lin & Lin 2007). Despite a strong trend towards green building, there is a lack in the supply chain's response to market demand causing a bottleneck for green building expansion (GBCA 2006b). It is therefore necessary to address the reasons for inefficiencies in the supply chain to further the expansion of green building development.

In 2006, the Green Building Council of Australia (GBCA) published the first-ever survey of the green building market in Australia. The Green Building Market Report found that 91% of construction industry participants believe that "current information sources don't fulfill green building information needs" and that information on ‚green products' serves as the prime information need for green building in Australia (GBCA 2006a:39). While 69% of the construction industry's employment is based in trade services (ABS 2008), the GBCA's report does not consider the green building market from the perspective of a subcontractor. Therefore, the impact of ‚green building' is yet to be understood from a supply chain perspective and particularly, downstream links to subcontractors, suppliers and manufacturers have been disregarded from consideration in green building literature.

The construction industry's overall performance depends on the performance of its supply chains; hence strategies aimed at greening the construction industry are to be implemented through the industry's supply chain networks/members. Divergent goals, short-term objectives and fragmented approaches are characteristic of construction supply chains therefore extending green initiatives across the supply chain involves risk and uncertainty. Although risks have been explored in the literature, for example, Ballabin (2008) discussed sustainable design risk, Bowers and Leah (2009) studied legal risks, and Gibbons (2010) investigated contractual risks, such exploration has not ventured into the green building market from supply chain perspective. Specifically, no previous research has been conducted to identify and manage the risks in green building development from supply chain perspective.

The impact of previous experience

This research aims to identify the key risks in green building development from the perspective of the construction supply chain. The objectives are to

1. Investigate the trends and barriers to green building development and the implications.
2. Identify the major risks in green building development.

3. Develop risk management strategies for improving the green performance of the construction industry's supply chains.

Research methodology

Survey method is the most popular form of data collection in supply chain management and logistics research (Sachan & Datta 2005) and serves as a broad approach for obtaining raw data, when compared to case study and interview technique. In this research, survey method served as the means for identifying the key risks in green building development throughout the supply chain.

Survey design

The prime feature of the survey involved respondents classifying the risk factors identified in Table 1 by their level of importance in green building. Risks listed in Table 1 is derived based on the review of several literature (such as Ballobin (2008), Bowers and Leah (2009), Choi and Krause (2006), Finch, (2004), Gibbons (2010), Khan and Burnes (2007), Neiger, Rotaru, and Churilov (2008), Peck (2006), and Zou et al. 2007).

The survey comprised 3 parts: Part 1: Respondent Information: this section comprised „background' or „demographic' questions (Creswell 2004:405), serving to categorise the respondents by their professional experience, organisation size and nature of organisation. Part 2: Familiarity with Green Building: this section also sought „background' information of respondents, with respect to their familiarity with green building. The purpose of this section was to understand and furthermore ensure the suitability of respondents to the survey questionnaire. Indirectly, this section also enabled comparative analysis of responses by Green Star Accredited Professionals. Part 3: Risks in Green Building: the final section of the questionnaire utilised an itemised rating scale, similarly illustrated by Tull and Albaum (1973:110). Part 3 directly sought after attaining the first aim of the research by identifying the risks in green building from a supply chain perspective. This section listed 40 risk factors related to green building and supply chain management and prompted respondents indicate the level of importance of the various risk factors in green building via a five-point summated scale ("very unimportant = 1", "unimportant = 2", "neither important nor unimportant = 3", "important = 4" or "very important = 5"), and at the survey's end, space was made for respondents to add any comments they felt necessary.

Survey population and sample

The survey population included an array of professionals from the construction industry supply chain – clients, consultants, contractors, subcontractors, suppliers and manufacturers. Organisations and individuals were selected from a major building

contractor's project management database. This enabled sample selection to be representative of a construction supply chain. Sample selection was further identified by the GBCA's *Green Building Market Report 2006*. The majority of surveys were sent to professional organisations in 3 States in Australia including New South Wales, Victoria and Queensland. In total 250 industry professionals were sent the survey questionnaire (about 80% via post and 20% via email). A total of 93 surveys were returned, of which 91 were considered acceptable for data analysis. This constituted a 37.2% response rate.

Data analysis

All collated statistical data was entered into a Microsoft Excel spreadsheet, with mode, mean and standard deviation calculated accordingly. These results were analysed individually and illustrated in tables and graphs in the result section. Statistical results were grouped according to where the respondents' organisation was positioned in the construction supply chain. This was carried out to enable an assessment of the risks in green building, as perceived throughout the supply chain. Presentation of all results was tabled to identify the degree to which risks in green building are common throughout the construction supply chain.

RESULTS AND DISCUSSION

Respondent's profiles

The respondents included designers/consultants (24.2%), subcontractors (19.8%), contractors (18.7%), clients and manufacturers (each 13.2%), and suppliers (11.0%). No respondent was employed by an organisation outside the six nominated professions. A key necessity for the validity of this research was the distribution of survey responses across the construction supply chain, and the fulfilment of this requirement.

Of the respondents surveyed, 68.2% had more than 10 years experience in the construction industry and 31.9% had more than 20 years experience. The wealth of experience possessed by the respondents is evenly dispersed throughout the supply chain. Hence there is no case where the results are prejudicially reflective of survey participants with minimal industry experience.

"Green Star accredited" respondents

Of the 91 analysed surveys, Green Star accredited professionals counted for 18.7%. When the distribution of these results are analysed across the supply chain it becomes evident that the dispersal of Accredited Green Star Professionals is more common upstream in the supply chain where 40.9% were designer/consultant; 17.6% were contractors and 16.7% were clients. Downstream of these parties, no manufacturers who completed the survey

were Green-Star accredited and only 10% of suppliers and 11.1% of subcontractors were accredited.

Organisation's involvement in green building development

The results show that over 50% of the organisations surveyed were involved in green building projects in most cases. The most common percentage of construction projects that respondents' were involved in fell between 51 to 75%, with 76 to 100% being the second most common. However, 18.7% of respondents were involved in green building on 26 to 50% of their projects. Only one respondent didn't know the percentage of projects his or her organisation was involved in that had a green building rating.

Risks in green building development

Table 1 presents the survey results of risks in green building development identified by the respondents. These results are reflective of the responses of all participants, thus the perspectives of clients, consultant/designers, contractors, subcontractors, suppliers and manufacturers are amalgamated into the one table. The most important risk factor identified was „lack of commitment in the supply chain to go green' followed by „higher investment costs to go green'. The other important risk factors were „costs of investment in skills development', „lack of shared information on green building', „lack of expertise', „poor management of green-related information', poor interrelationships between supply chain partners', „non-complying products and materials' and „change in technologies due to green building'. The risk factors considered to be least important were „downtime in operations', „reworking stock and penalties for non-delivered goods', „over-ordering and under-ordering of materials' and „suppliers' financial instability'.

Noticeably there is a high degree of consistency in these results across the construction supply chain members, which indicates that the risks in green building development are prevalent throughout the supply chain. Such prevalence is further supported by the primary risk in green building development – „a lack of commitment in the supply chain to go green'. The fact that this is typically considered „very important' by all supply chain members presents the dependence of green building performance on the performance and commitment of the entire construction supply chain. The high ranking of „poor interrelationships amongst supply chain partners' further supports this suggestion.

The second and third ranked risks were „higher investment costs to go green' and „costs of investment in skills development' respectively, identify that added costs to „go green' serve as very important risks in green building development. The GBCA identified similar results, acknowledging the perception "green building goes hand-in-hand with higher upfront costs" as an impression "deeply ingrained in the [construction] industry"

(2006a:28). As the GBCA contend that this perception exists despite studies that have indicated otherwise, it is unsurprising that a „lack of shared information on green building' and „lack of expertise' rank as highly important risks in green building development. These results identified a lack of information sharing across the supply chain, particularly in the contractor, subcontractor, supplier and manufacturer case, and the reliance on designers to provide the industry with green building information. It is also fitting to note that designers identified a lack of shared information as the most important risk in green building development.

Interestingly, „slow approval processes due to green building' was considered the most important risk by contractors. This result is perhaps due to the high emphasis that contractors place on time and programming to avoid such risks as liquidated damages and poor reputation. In the case of the client, „project is no longer financially viable' ranked as the most important risk in green building development, and this was also not identified elsewhere in the supply chain. This finding implies that the added costs in green building can risk the envisaged profit returns at the top of the supply chain.

This result is alarming considering that "the first step to creating a green building is the client's request to do so" (GBCA 2006a:25). Other high-ranking risks not reflected across the supply chain were „non-complying products and materials', „costs of re-testing products and materials' and „change in technologies due to green building'. These risks were considered more important downstream in the supply chain – to subcontractors, suppliers and manufacturers.

Table 2 summarises the major risks (i.e. risks averaging above 4 = important) identified in green building development by the various parties across the supply chain. Clearly, a high number of risks in green building are perceived by the contractor and many of these risks are identified by both upstream in the client case, and downstream in the manufacturer, supplier and subcontractor cases. The client respondents on the other hand did not identify as many risks in green building, perhaps suggesting a degree of risk transfer from the client to the contractor (subsequently passed down to subcontractors).

Evidently, the contractor serves as a focal party in the supply chain, sharing the risks of their downstream and upstream supply chain links. A reason for this could be the development of common procurement methods such as "Design and Construct", where the contractor is responsible for both design and construction of the building project to meet objectives set by the client. The second highest number of risks identified in the survey was perceived by subcontractors, which could also be due to downstream risk transfer, in this case from the contractor.

Table 1 – Risks in green building development: overall results across the supply chain

	Supply Chain Risks		Total Perspective		Client Perspective		Designer/Consultant Perspective		Contractor Perspective		Subcontractor Perspective		Supplier Perspective		Manufacturer Perspective	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Lack of commitment in the supply chain to go green	Most Important Risks	4.23	0.99	4.17	1.19	4.23	1.02	4.29	0.99	4.28	0.83	4.25	0.92	4.17	1.19
2	Higher investment costs to go green		4.22	0.85	4.33	0.65	3.73	0.94	4.41	0.80	4.22	0.81	4.40	0.84	4.58	0.79
3	Costs of investment in skills development		4.14	0.85	3.92	0.67	4.05	1.05	4.25	0.86	4.22	0.65	4.40	0.52	3.92	1.08
4	Lack of shared information on green building		4.10	0.84	4.08	0.90	4.32	0.72	4.12	0.80	4.00	1.03	4.06	0.82	3.92	1.08
5	Lack of expertise		4.10	0.88	3.92	0.67	4.27	0.88	4.06	0.83	3.89	0.90	4.10	1.20	4.33	0.89
6	Poor management of green-related information		4.08	0.82	4.00	0.83	4.09	0.97	4.24	0.56	4.28	0.96	4.00	0.84	3.83	0.39
7	Poor interrelationships between supply chain partners		4.07	1.06	4.17	0.72	3.73	1.20	4.12	1.17	4.22	0.81	4.10	1.20	4.25	1.22
8	Non-complying products and materials		4.05	1.04	3.25	1.22	3.45	1.01	4.18	0.73	4.61	0.78	4.50	0.97	4.58	0.67
9	Change in technologies due to green building		4.00	0.94	3.50	0.67	3.68	1.04	4.06	0.66	4.22	0.73	4.40	1.26	4.33	1.07
10	Slow approval processes due to green building		3.99	1.04	3.83	1.59	3.86	0.83	4.65	0.61	4.11	1.02	3.80	0.84	3.58	1.08
11	Slow response to meet design changes		3.95	0.92	3.75	0.62	4.09	0.68	4.12	1.17	4.17	0.92	3.90	0.88	3.33	0.98
12	Poor product quality		3.91	1.01	3.42	1.00	3.82	1.10	4.88	0.99	4.22	0.94	4.10	0.88	4.00	1.04
13	Uncertainty over green building performance		3.87	0.95	4.25	0.75	4.14	0.94	4.18	0.81	3.88	0.83	3.70	0.67	3.58	1.24
14	Delays in resolving issues and problems		3.81	0.91	4.25	0.62	3.73	0.94	4.24	0.56	3.78	0.81	4.50	0.97	3.25	1.22
15	Costs of re-testing products and materials		3.79	1.15	2.83	0.83	3.14	0.99	4.59	1.06	4.44	0.78	4.50	1.27	4.67	0.65
16	Poor availability of green building supply		3.75	0.78	3.67	0.89	3.55	0.91	3.82	0.64	4.00	0.91	3.80	0.63	3.67	0.49
17	Inability to conform to new specifications		3.70	1.07	3.00	0.85	3.09	0.92	3.94	0.97	4.28	0.67	4.10	1.20	4.25	0.97
18	Limited creativity and innovation		3.68	1.04	3.17	1.03	4.27	0.88	2.88	1.05	3.56	0.98	4.00	0.67	4.17	0.39
19	Long product lead times for green products/materials		3.67	1.11	3.42	1.00	2.88	0.64	3.82	1.19	4.11	0.68	4.30	0.95	4.33	0.98
20	Limited number of green suppliers to choose from		3.65	1.10	3.42	1.08	3.50	1.14	3.59	0.94	4.22	0.88	3.90	0.99	3.17	1.40
21	Project is no longer financially viable		3.63	1.09	4.42	0.79	3.50	1.19	4.18	1.01	3.50	0.99	3.00	0.67	3.00	1.04
22	Lack of knowledge of green building costs		3.59	0.97	4.08	0.90	3.09	0.92	4.06	0.90	3.67	0.84	3.30	0.95	3.50	1.00
23	Short product life		3.59	1.12	3.00	1.13	3.32	1.32	3.47	1.12	3.89	1.02	4.00	0.67	4.08	0.79
24	Contractor's poor management ability		3.58	1.16	3.83	1.03	3.64	1.09	3.71	0.99	4.11	1.08	2.90	0.74	2.83	1.59
25	Price inflation of construction materials		3.57	0.91	3.92	0.79	3.00	0.82	4.12	0.70	3.39	0.85	3.90	0.99	3.50	0.90
26	Uncertainty over "what is green"		3.54	0.99	3.17	0.83	3.91	0.97	3.82	0.81	3.61	0.98	2.70	0.95	3.42	1.00
27	Non-standard workflows in communication		3.52	1.10	3.92	1.08	3.95	0.95	4.18	1.01	3.06	0.80	3.00	1.05	2.50	0.80
28	Unfamiliarity with green building responsibilities		3.49	1.09	3.00	0.95	3.36	1.29	4.06	0.75	4.06	0.94	3.10	0.74	2.92	1.08
29	Excessive time-to-market		3.41	1.09	3.25	1.06	3.32	0.99	2.82	0.81	2.94	1.00	4.40	0.84	4.42	0.79
30	Uncertainty over market supply and demand		3.34	0.95	3.75	0.87	3.32	0.89	3.06	0.90	2.67	0.69	3.30	0.67	4.42	0.67
31	Lack of responsiveness to market conditions		3.29	1.06	3.67	0.98	3.09	1.06	3.00	1.06	3.06	1.06	3.30	1.06	4.00	0.85
32	Government regulations		3.22	1.15	4.00	0.85	3.27	1.20	2.88	1.11	2.89	1.08	3.00	1.05	3.92	1.08
33	Inaccurate quotations	Least Important Risks	3.22	0.94	4.25	0.75	2.68	0.78	3.65	0.70	3.83	0.77	3.00	0.82	2.58	0.90
34	Relationships with new suppliers		3.13	1.04	2.25	0.97	2.86	1.08	2.94	0.83	3.83	0.79	3.10	0.99	3.75	0.75
35	Dependence on offshore suppliers (globalisation)		3.11	1.16	2.42	0.79	2.27	0.98	3.76	0.66	3.67	0.91	3.90	1.42	3.42	1.31
36	Increased time required for quotations		3.05	0.98	4.00	0.74	2.55	0.80	3.53	0.72	3.17	0.99	2.80	0.92	2.42	0.90
37	Suppliers' financial instability		2.85	1.14	2.42	1.00	2.00	0.93	3.53	1.01	3.67	0.84	3.30	1.16	3.67	0.78
38	Over-ordering and under-ordering of materials		2.73	1.16	2.17	0.72	1.95	0.84	3.41	1.18	3.11	1.08	3.50	0.71	3.92	0.90
39	Reworking stock and penalties for non-delivered goods		2.71	1.13	1.92	0.90	2.09	0.75	3.53	1.33	2.94	0.87	3.50	0.85	3.92	0.67
40	Downtime in operations (risk of being unproductive)		2.70	1.11	2.25	0.75	2.09	0.87	3.53	1.19	2.83	0.90	3.30	1.06	3.75	0.97

Table 2 – Key risk factors across the supply chain

	Risk Factors (In Order of Importance)	Mean
Client Perspective *(10 risks)*	Project is no longer financially viable	4.42
	Higher investment costs to go green	4.33
	Uncertainty over green building performance	4.25
	Delays in resolving issues and problems	4.25
	Inaccurate quotations	4.25
	Lack of commitment in the supply chain to go green	4.17
	Poor interrelationships between supply chain partners	4.17
	Lack of shared information on green building	4.08
	Lack of knowledge of green building costs	4.08
	Poor management of green-related information	4.00
Consultant/ Designer Perspective *(8 risks)*	Lack of shared information on green building	4.32
	Lack of expertise	4.27
	Limited creativity and innovation	4.27
	Lack of commitment in the supply chain to go green	4.23
	Uncertainty over green building performance	4.14
	Poor management of green-related information	4.09
	Slow response to meet design changes	4.09
	Costs of investment in skills development	4.05
Contractor Perspective *(18 risks)*	Slow approval processes due to green building	4.65
	Higher investment costs to go green	4.41
	Costs of investment in skills development	4.35
	Lack of commitment in the supply chain to go green	4.29
	Poor management of green-related information	4.24
	Delays in resolving issues and problems	4.24
	Non-complying products and materials	4.18
	Uncertainty over green building performance	4.18
	Project is no longer financially viable	4.18
	Non-standard workflows in communication	4.18
	Lack of shared information on green building	4.12
	Poor interrelationships between supply chain partners	4.12
	Slow response to meet design changes	4.12
	Price inflation of construction materials	4.12
	Lack of expertise	4.06
	Change in technologies due to green building	4.06
	Lack of knowledge of green building costs	4.06
	Unfamiliarity with green building responsibilities	4.06
Subcontractor Perspective *(15 risks)*	Non-complying products and materials	4.61
	Costs of re-testing products and materials	4.44
	Lack of commitment in the supply chain to go green	4.28
	Poor management of green-related information	4.28
	Inability to conform to new specifications	4.28
	Higher investment costs to go green	4.22
	Costs of investment in skills development	4.22
	Poor interrelationships between supply chain partners	4.22
	Change in technologies due to green building	4.22
	Poor product quality	4.22
	Limited number of green suppliers to choose from	4.17
	Slow response to meet design changes	4.11
	Slow approval processes due to green building	4.11

	Risk Factors (In Order of Importance)	Mean
	Long product lead times for green products/materials	4.11
	Contractor's poor management ability	4.06
Supplier Perspective *(12 risks)*	Non-complying products and materials	4.50
	Costs of re-testing products and materials	4.50
	Higher investment costs to go green	4.40
	Costs of investment in skills development	4.40
	Change in technologies due to green building	4.40
	Excessive time-to-market	4.40
	Long product lead times for green products/materials	4.30
	Lack of commitment in the supply chain to go green	4.20
	Lack of expertise	4.10
	Poor interrelationships between supply chain partners	4.10
	Poor product quality	4.10
	Inability to conform to new specifications	4.10
Manufacturer Perspective *(11 risks)*	Costs of re-testing products and materials	4.67
	Higher investment costs to go green	4.58
	Non-complying products and materials	4.58
	Excessive time-to-market	4.42
	Uncertainty over market supply and demand	4.42
	Lack of expertise	4.33
	Change in technologies due to green building	4.33
	Long product lead times for green products/materials	4.33
	Poor interrelationships between supply chain partners	4.25
	Inability to conform to new specifications	4.25
	Lack of commitment in the supply chain to go green	4.17

Interestingly, consultant/designers viewed the fewest number of risks as important, and the risks identified were typically informational and innovation. These results suggest that consultant and designers bear very few financial risks in green building development, especially when comparing the results to others in the supply chain. The only financial risk borne by consultant/designers in green building is „cost of investment in skills development'. Additionally, whilst only one major risk identified by designer/consultants was not reflected in the contractor case („limited creativity and innovation'), many of the risks identified by contractors were not mirrored by designer/consultants. This result further suggests that the contractor bears a great deal of risk in green building development, sharing many of the risks faced by consultant/designers as well as the client. Table 2 also shows that subcontractors, suppliers and manufacturers perceive similar risks in green building development. These risks are typically material and product-based and related to financial risks. In the manufacturer case, respondents identified many of their major risks as „very important', with „costs of re-testing products and materials', „higher investment costs to go green' and „non-complying products and materials' scoring above 4.50 on average. Suppliers similarly identified these risks as very important. This suggests that despite having to bear fewer risks than others in the supply chain, the risks

relating to suppliers and manufacturers are exceedingly important, relating to the costs and compliance of their products and materials.

Managing the risks in the green building development supply chain

Green building development certainly involves many risks throughout the construction supply chain, and the research findings indicated a number of means by which these risks can be managed. These means were primarily identified in the open-ended response to the survey questionnaire.

The survey results identified *research and development (R&D)* as key to improving green building performance. Such solutions were being recorded by designers in a central database for future reference, to expedite approval processes and alleviate the risk of inadequate green building information. These findings are comparable to recommendations by Shiers et al. (2006) who suggested that green building information be embedded within commonly used specification databases. The GBCA (2006b:15) also identify this need due to a lack of "comprehensive, authoritative and accessible source of information on green standards, products and services". The challenge here is for downstream and upstream supply chain members to collaborate in developing an ongoing register of green-complying standards, products and materials. Such an endeavour must overcome the divergent goals and fragmented approaches that are deemed characteristic of construction supply chains (Love et al. 2004).

The research results highlighted the importance of ongoing efforts implemented to train and educate the supply chain, alleviating important risks such as „costs of investment in skills development' and „lack of expertise'. These efforts were identified in the form of Green Star Accreditation with the GBCA, subcontractor training, „green' cadet rotation and supply chain co-ordination (e.g. client and building manager learning from each other). Where the GBCA (2006a) identified „lack of education' as a major hindrance to green building development, it is fitting that training and education be adopted. Furthermore, respondents to the survey identified „training and education' (25%) as a means for improving their organisation's green building performance. Eventually, this training could reduce the tendency in the supply chain to rely on outsourcing such practices as specification writing and compliance monitoring. This was the case in the green building case study.

Further to reducing the risks in green building development, the research identified attempts to motivate supply chain commitment towards fulfilling green building objectives. These attempts were particularly evident in the contractor case, but also found to be executed by clients and designers. Examples included the incorporation of green building as an agenda item in client, design and subcontractor meetings, consultation with

suppliers and manufacturers on performance objectives; and appointment of independent green building specialists to ensure that objectives are fulfilled. These commitments made throughout the supply chain respond to the foremost risk in green building development, „lack of commitment in the supply chain to go green'. As risks are invariably linked to opportunities (AS/NZS4360, 2004 and ISO31000, 2009), these commitments are perhaps the key to greening the supply chain towards competitiveness and economic performance (Rao & Holt 2005).

CONCLUSIONS

This paper has presented the results of the survey questionnaire on risks and performance in green building development across the supply chain. The respondents were well suited to this survey for reasons of being dispersed across the supply chains, well experienced in the construction industry and employed by organisations involved in green building projects. The majority of survey respondents (59%) worked for organisations that employed more than 50 people.

Concerning the risks in green building development, the survey illustrated that a „lack of commitment in the supply chain to go green' is the most important and common risk. Other important risks included „higher investment costs to go green' and „costs of investment in skills development', which also ranked highly throughout the supply chain. Additionally, variations were identified in the risks perceived throughout the construction supply chain. Financial risks were identified as more important upstream to clients, compared to material-related risks „non-complying products and materials' and „costs of re-testing products and materials' considered more important downstream in the construction supply chain. In the consultant/designer perspective, „lack of shared information' was identified as the most important risk followed by innovation risks „lack of expertise' and „limited creativity and innovation'. The contractors identified „slow approval processes due to green building' as the most important risk in green building development. Also, the survey identified that contractors and subcontractors viewed the most number of risks in green building development as important or very important. Consultant/designers on the other hand identified the fewest number of risks as important or very important. Just over half of respondents (51%) felt that their organisation's performance in relation to green building development was „sufficient', and this perception was more recognised upstream in the supply chain to the client, consultants and contractors. 26% of respondents regarded their organisation's performance as „insufficient', particularly those downstream in the supply chain. Less dispersed in the results was the typical consensus that respondents' organisations could improve their green building performance (74%) and manage the risks through research and

development, training and education, co-ordination, knowledge and information management, experience sharing; and technology application.

REFERENCES

Akintoye, A. and Black, C. (1999) „Operational risks associated with partnering for construction', in *Profitable Partnering in Construction Procurement*, E&FN Spon, London, pp. 25-37.

AS/NZS 4360. (2004) *Risk Management*., Standards Australia and Standards New Zealand.

Australian Bureau of Statistics. (2008) „Construction Industry', in *Year Book Australia*, Cat. No. 1301.0, ABS, Canberra.

Ballobin K. (2008), *Sustainable design risk management*, Victor O. Schnnerer& Company.

Bedard, J. and Grahem, L. (2002) „The Effects of Decision Aid Orientation on Risk Factor Identification and Audit Test Planning', *Auditing: A Journal of Practice and Theory*, 21(2), pp. 39-56.

Bowers, K. and Leah, C (2009) *the green building revolution, addressing and managing legal risks and liabilities*. Environmental law and policy clinic, Harvard Law School.

Choi, T. and Krause, D. (2006) „The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation', *Journal of Operations Management*, 24(5) pp. 617-652.

Creswell. (2004) *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*., Prentice Hall, USA, pp. 395-427.

Finch, P. (2004) „Supply chain risk management', *Supply Chain Management: An International Journal*, 9(2), pp. 183-196.

Gibbons, M.R. (2010) Building green without losing green: managing risks in sustainable design and construction contracts. *The real Estate Finance Journal* 25, 25.

Green Building Council of Australia. (2006a) *Green Building Market Report 2006*., GBCA, Australia., pp. 12-43.

Green Building Council of Australia. (2006b) *Sustainable Building Pathway: Accelerating Transformation in the Commercial Building Sector*., GBCA, Australia., pp. 1-36.

Khan, O. and Burnes, B. (2007) „Risk and supply chain management: creating a research agenda", *International Journal of Logistics Management*, 18(2), pp. 197-216.

Kohler, U. (2007) „Surveys from inside: An assessment of unit non-response bias with internal criteria', *Survey Research Methods*, 1(2), pp. 55-67.

Love, P., Irani, Z. and Edwards, D. (2004) „A seamless supply chain management model for construction', *Supply Chain Management: An International Journal*, 9(1) pp. 43-56.

Neiger, D., Rotaru, K. and Churilov, L. (2008) „Supply chain risk identification with value-focused process engineering', *Journal of Operations Management.,* (website publication), pp. 1-15.

Peck, H. (2006) „Reconciling supply chain vulnerability, risk and supply chain management', *International Journal of Logistics: Research and Applications*, 9(2), pp. 127-142.

Rahman, M. and Kumaraswamy, M. (2005) „Assembling integrated project teams for joint risk management', *Construction Management and Economics*, 23(5), pp. 365-375.

Rao, P. and Holt, D. (2005) „Do green supply chains lead to competitiveness and economic performance?', *International Journal of Operations & Production Management*, 25(9), pp. 898-916.

Sachan, A. and Datta, S. (2005) „Review of supply chain management and logistics research', *International Journal of Physical Distribution & Logistics Management*, 35(9), pp. 664-705.

Tull, D. and Albaum. G. (1973) *Survey Research: A Decisional Approach*, International Textbook Company Limited, USA, pp. 103-132, 165.

Wang, L., Lin, Y. and Lin, P. (2007) „Dynamic mobile RFID-based supply chain control and management system in construction', *Advanced Engineering Informatics*, 21(4) pp. 377-390.

Zou, P.X.W., Zhang, G. and Wang, J. (2007) „Understanding the key risks in construction projects in China', *International Journal of Project Management*, 25(6), pp. 601-614.

Engaging Project Management Postgraduate Students in Online Environments – A Qualitative Study

Anthony Wood, Jian Zuo and George Zillante
School of Natural and Built Environments
University of South Australia

ABSTRACT

Participation in teaching and learning plays a critical role for students' better understanding of course principles and contents. A number of studies have been undertaken to investigate ways to better engage students through conventional course delivery modes in the classroom. Purely online course delivery is an emerging approach in contemporary education. This research adopted a qualitative approach to explore student engagement issues in an online project management postgraduate course. Students enrolled in the course were asked to comment on their perceptions of student engagement in online environments. The results showed that there are substantial differences between student engagement in classrooms and that in online environments. Implications are discussed.

KEYWORDS

student engagement, online environment, project management, postgraduate course

INTRODUCTION

The ultimate goal of education is that students gain the necessary understanding of knowledge and skills. Normally a set of objectives are set for each course from the very beginning of the delivery. Assessments are designed to measure students' learning outcomes. There have been a large number of studies that have investigated ways to improve students' understanding of course objectives and hence the improvement of their academic performance. It is well recognized that students' participation in the classroom is one of the most significant factors that contribute towards the academic standing of students. A number of researchers have conducted empirical studies in different contexts on the effectiveness of various tools and techniques to motivate student engagement in the classroom. The aim of this research is to investigate students' perceptions of engagement in online environments.

The Australian Council for Educational Research defined student engagement as "students' involvement with activities and conditions likely to generate high-quality learning… provides a practical lens for assessing and responding to the significant

dynamics, constraints and opportunities facing higher education institutions" (ACER 2010, p.3). Järvelä (2008, p. 318) argued that student engagement is associated with "the antecedents and consequences of how students behave, how they feel, and how they think". This particularly highlighted the critical role student engagement plays in contemporary higher education that is featured with student centred teaching and learning.

Student engagement has attracted an increasing level of attention, both in school education and higher education. Appleton et al. (2006) developed an instrument to measure the cognitive and psychological engagement of students with school. Their large scale survey with 2577 responses returned a six-factor model to assess student engagement, i.e. teacher-student relationships, control/relevance, peer support, aspirations, family support and extrinsic motivation. Their study also found that students' learning outcomes (such as GPA and suspension) are associated with the level of engagement. Fredricks et al. (2004) pointed out that school engagement is influenced by both the individual trait and the general context. Leithwood and Jantzi (2000) argued that transformational leadership, school conditions and family educational culture contribute towards high levels of student engagement with the school.

At the higher education level, Schaufeli et al. (2002) conducted a cross-national survey in Spain, Portugal and the Netherlands on student engagement issues. Their study with 1661 responses showed that engagement is negatively associated with burnout, whereas the level of student engagement partially explains the students' academic performance. Ahlfeldt et al. (2005)'s study found that the incorporation of problem-based learning components helps to improve the level of student participation in university classes. Their study also showed that the level of student engagement is negatively associated with the size of the class. Loftin et al. (2010) noted that the instructor plays a critical role to set up an appropriate classroom environment which encourages students to participate in class, e.g. asking questions or making comments. Bentley et al. (2009) pinpointed that the hot seat teaching methodology is an effective approach to motivate students' engagement such as preparing for class and participating in classroom discussions, particularly in large size classes.

In terms of measurement of student engagement, the Australian Council for Educational Research has developed an instrument (the Australasian Survey of Student Engagement) to be used in Australian universities. There are three versions of instruments, i.e. Student Engagement Questionnaire (SEQ), Postgraduate Student Engagement Questionnaire (PSEQ) and Staff Student Engagement Questionnaire (SSEQ). These instruments are developed based on the instruments developed by the Indiana University Center for Postsecondary Research.

There is a comparatively small number of studies investigating student engagement issues in online environments. This gap needs to be addressed as there is an increasing number of university courses that are taught online. Bradford and Wyatt (2010) surveyed more than 1300 students in two universities in the Unites States as to the factors that motivate students to engage in asynchronous learning environments. Their study indicated that students with high levels of engagement generally perform better academically in online courses. According to Richardson and Newby (2006), the experience gained during online learning motivates students to take more responsibility for their own learning. They subsequently recommended that a number of factors, such as profile of students, focus of the program, and students' prior online experience should be taken into consideration during the design of online courses.

Online delivery mode presents a significant challenge to teaching project management postgraduate courses online. The theory of topics such as project management is not difficult to teach through electronic media; however it is much more difficult to teach the practice. Conflict arises because the value of the theory is compromised when not supported by competent practice skills. For example, a course delivered face-to-face may be deliberately structured so that most of the students' learning comes from active engagement in collaborative activities. Transposing this course into an online structure would immediately present challenges because asynchronous discussion forums would replace real-time discussion.

RESEARCH METHODOLOGY

A qualitative approach was employed in this research to explore student engagement issues in online environments for project management postgraduate courses. The aims of this research were to investigate: (1) perceptions of students on engagement in online environments; and (2) factors to promote student engagement in online environments. A large university in South Australia was selected to satisfy this purpose. This university offers postgraduate project management courses purely online. One first-year course, Principles of Project Management was selected. This is a foundation course which aims to provide students with an overview of the principles, skills and techniques required for management of projects throughout the project life cycle from inception to completion.

This research was undertaken throughout the delivery period July – November 2010. The cohort contained 75 students, all of whom were either Australian or held Permanent Resident status. Two questions were posted to an online discussion forum for students' comments:

1. What does student engagement mean to you in online studying environment?
2. What factors promote the student engagement in online studying environment?

A total of 23 responses were received; the response rate of 30.7% was considered acceptable in view of the voluntary nature of the inquiry.

RESULTS AND CONCLUSIONS

Perceptions of students on engagement in online environments

As shown in Table 1, a majority of students perceived engagement in online environments as the interaction between students and staff. Some sample comments made by students were:

- "To engage the lecturer and the student in two way dialogue."
- "I believe engaged learning has a lot to do with being motivated and enthused to undertake learning by your own admission. It also means learning in a collaborative way with others."
- "Participate in all topic activities and share knowledge / experience with fellow students."
- "To me engagement in learning means that you are both learning from others doing the course and also contributing your opinions to aid other peoples learning."
- "Engagement refers to the time, energy and resources that I put into the learning process while interacting with and sharing ideas & experiences with other students."

Table 1 – Students' perceptions on engagement in an online environment

Students' Perceptions on Engagement	Number of Responses	Response Percentage
Interaction between students and staff	15	65%
Interest in learning	6	26%
Others	2	9%
Total	23	100%

One student particularly highlighted the critical role of interactions between students and staff by stating "Nowadays I hate reading a textbook only, I like variety in the way stimulus hit the back of my brain, cause we all learn differently, and have sixth senses and are social creatures, why not use this to increase our learning capability?" (sic).

22% of students regarded interest in learning as key characteristics of student engagement in online environments, with comments such as:

- "Being involved and interested in learning."

- "Engagement to me means that it got my attention, and made me part of the learning process. I think that this may have to do with the multi-directional nature of the work in relation to this course and how it aims to engage us in our own learning."

It is interesting to note that a few students perceived student engagement as "a commitment to further study or extracurricular activities". This does not appear to be reported in the literature, and therefore is worthwhile considering for further investigation.

Factors to promote student engagement in online environments

As shown in Table 2, a majority of students responded that real time cases and contribution to each other's learning helps to facilitate student engagement in online environments.

Table 2 – Students' perceptions on factors promoting engagement in an online environment

Students' Perceptions on Factors Promoting Engagement	Number of Responses	Response Percentage
Real time scenarios	10	43%
Contribute to each other's learning	8	35%
Online facilities for interactions	3	13%
Others	2	9%
Total	23	100%

Students made some comments on the role of the adoption of real time scenarios in online teaching and learning, as below:

- "Speaking with those working in the industry is interesting and shows how principals (sic) are applied in practice. I am also more engaged if I can apply some of what I am learning in my day to day work."
- "Relevance to everyday situations."
- "Having to do „real life' exercises."
- "One with practical examples rather than just questions, e.g. project program - rather than ask us to create one, it is helpful to first have a collection of examples to review first. Too often courses are simply a textbook read and answer process."
- "Working with REAL LIFE case studies and receiving acknowledgement in some way that confirms I am on the right track with my understanding."

In terms of the contribution to each other's learning, students made comments such as:

- "Being able to see other students' viewpoint and learning new and unthought-of ideas from students and lecturers."

- "Having to contribute to a final solution and correct others."

Students recognized that there are various types of assessments, e.g. the essays, the quizzes, and the assignments, that will influence the level of student engagement in online environments. In particular, one student stated that regular smaller assessments are more engaging than larger assessments as it forces more online discussion and also means regular feedback is being received. Another student perceived a study plan as critical for engagement by stating "a well laid out study plan so I do not feel lost in an overload of information".

The level of students' participation during class helps to facilitate their learning and contributes towards their achieving courses objectives. Indeed, it has become a challenge for educators to engage students actively in higher education; this is in particular a case in online environments. This research adopted a qualitative approach to investigate the students' perceptions of engagement in online project management postgraduate courses. Results showed that students perceived engagement in online environments similarly to that in conventional delivery mode (i.e. in the classroom). The most common characteristics of student engagement in online environments are interaction between students and staffs and interest in learning.

Face-to-face interaction is not an option due to the online delivery of the course; therefore technologies need to be in place to assist the instructor to facilitate the interactions. Similarly, students rated the inclusion of real life cases in teaching and contribution to each other's learning as the most significant factors contributing towards higher level of student engagement in online environments. The comments made by students on the impacts of different types of assessments on student engagement are very interesting and warrant further investigation.

Limitations of this study are owing to the small sample involved. Future research opportunities exist to further investigate this issue with a large scale survey.

REFERENCES

ACER. (2010) Doing more for learning: Enhancing engagement and outcomes Australasian Survey of Student Engagement Australasian Student Engagement Report, Australian Council for Educational Research, Camberwell, Victoria, 3124, Australia.

Ahlfeldt, S., Mehta, S. and Sellnow, T. (2005) Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction were in use. *Higher Education Research and Development* 24(1) , pp. 5-20.

Appleton, J.J., Christenson, S.L., Kim, D. and Reschly, A.L. (2006) Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology*, 44, pp. 427-445.

Bentley, K.A., Brewer, P.C. and Eaton, T.V. (2009) Motivating students to prepare for class and engage in discussion using the hot seat, *Journal of Accounting Education*, 27(3), pp. 155-167.

Bradford, G. and Wyatt, S. (2010) Online learning and student satisfaction: Academic standing, ethnicity and their influence on facilitated learning, engagement, and information fluency, *The Internet and Higher Education*, 13(3), pp. 108-114.

Dixon, M.D. (2010) Creating effective student engagement in online courses: What do students find engaging? *Journal of the Scholarship of Teaching and Learning*, 10(2), pp. 1-13.

Fredricks, J.A., Blumenfeld,P.C. and Paris, A.H. (2004) School Engagement: Potential of the Concept, State of the Evidence, *Review of Educational Research*, 74(1), 59-109.

Järvelä, S., Veermans, M. and Leinonen, P. (2008) Investigating student engagement in computer-supported inquiry: a process-oriented analysis, *Soc Psychol Educ*, 11, pp.299-322.

Leithwood, K. and Jantzi, D. (2000) The effects of transformation leadership on student engagement with school, *Journal of Educational Administration*, 38(2), pp. 112–129.

Loftin, C., Davis, L.A. and Hartin, V. (2010) Classroom participation: A student perspective, *Teaching and Learning in Nursing*, 5(3), pp. 119-124.

Richardson, J.C. and Newby, T. (2006) 'The Role of Students' Cognitive Engagement in Online Learning', *American Journal of Distance Education*, 20(1), 23 -37.

Schaufeli, W.B., Martínez, I.M., Pinto, A.M., Salanova, M. and Bakker, A.B. (2002) Burnout and Engagement in University Students : A Cross-National Study, *Journal of Cross-Cultural Psychology* ,33(5), 464-481.

Enhancing University-Industry Collaboration via Teaching Company Scheme: A Case Study on Research Partnerships in Hong Kong

Ken T.K. Chan and Albert P.C. Chan
Department of Building and Real Estate
The Hong Kong Polytechnic University, Hong Kong, PRC

John F.Y. Yeung
College of International Education, School of Continuing Education
Hong Kong Baptist University, Hong Kong, PRC

ABSTRACT

The concept of partnering has gained growing attention in the research community in the past two decades. Various issues associated with partnering have been widely investigated in the prevailing literature. These research efforts have built up a solid theoretical foundation for partnering development. A review of prevailing literature indicates that case study, survey and interview are the common research approaches employed for partnering research. Close collaboration between the industry and university can facilitate the research process, especially on soliciting information and insights from practitioners in partnering. To facilitate collaboration between industry and university, the Hong Kong Polytechnic University (PolyU) introduced a collaborative platform, termed as Teaching Company Scheme (TCS), which enables companies to take on university's research expertise to conduct business-specific research projects. At the same time, universities can put the research deliverables into real business world to increase practical values of research. This paper aims to introduce the organization and operation of TCS by a case study on a successful TCS between a utility company in Hong Kong and PolyU. This paper concludes that the TCS is an effective means to foster collaboration between industry and university, resulting enhancement of both theoretical and empirical development of partnering research.

KEY WORDS

Teaching Company Scheme, TCS, partnering, Hong Kong

INTRODUCTION

Partnering, being a member under the umbrella of Relational Contracting (Chan et al., 2009), has drawn attentions from academia and the construction industry in the past decades in view of its claimed benefits of better time and cost control resulted by improved relationship and communication among project participants. (Cowan et al.,

1992, Abudayyeh, 1994, Thompson and Sanders, 1998, Gransberg et al., 1999, Chan et al., 2003, Black et al., 2000, Li et al., 2001). Partnering has been evolving since its early development in the UK (Bennett and Jayes, 1998) and US (Cowan et al., 1992) in the 1980s. It can be seen from the prevailing literature that partnering has gained more and more attention in the construction industry. Various issues associated with partnering, such as critical success factors, benefits, barriers of implementation, contractual arrangement and partnering performance measurement, have been widely investigated in the prevailing literature. These research efforts have built up a solid theoretical foundation for partnering development. However, empirical evidences supporting the partnering concept are still scanty in the prevailing literature, resulting an imbalance between theory development and empirical support. Development of partnering requires support from empirical evidences as Li et al (2000) pointed out that "the lack of rigorous empirical research in partnering has resulted in minimal improvements in our understanding of the concept". Although certain amount of empirical partnering studies have been conducted in the last two decades (Cowan et al., 1992, Weston and Gibson, 1993, Gransberg et al., 1999, Chan et al., 2008, Black, 2004, Chan et al., 2004), the scope and amount of these empirical evidence are relatively insufficient. Tang (2006) asserted that lack of deeper understanding on the underlying principles of partnering and how to realize the partnering mechanisms in practice have hindered the development and wide spread of partnering in the construction industry

Most of the empirical research about partnering employs either case study approach or survey and interview approach. Bygballe et al. (2010) conducted a review on 87 papers about partnering from 4 top-rated journals, among which 31 papers adopted case study approach while the other 32 papers adopted survey or interview approach.

The success of case study and survey approaches for partnering research primarily depends on the support from the industry, especially in providing necessary practical information and insights on partnering or completing survey. However, it is not uncommon that response rate to survey of practitioners in the construction industry is below 30% (Ogunlana, 1999). The common low response rate to survey implies that support from the industry on partnering research is insufficient, which hinders the empirical development of partnering.

A NEW PLATFORM FOR PARTNERING RESEARCH

This paper aims at promoting an alternative approach for partnering research, termed as Teaching Company Scheme (TCS) and sharing the experience of a TCS in Hong Kong. TCS can enhance collaboration between industry and universities for more insightful

partnering research by setting up a platform facilitating knowledge and technology transfer from universities to the industry and vice versa.

BACKGROUND OF TCS

The history of TCS can be dated back to the 1970's. Jones and Craven (2001) stated that the UK government have supported the TCS between universities and the industry since 1975, aiming at facilitating technology transfer between academia and the industry. The development of TCS was originated from the arrangement of Teaching Hospitals for training up medical professionals. Peattie (1993 P.60) stated the primary objectives of Teaching Hospitals are:

1. *Raise the level of industrial performance by effective use of academic resources*
2. *Improve industrial methods by the effective implementation of advanced technology and new ideas*
3. *Help graduates with careers for industry*
4. *Give academic staff broad and direct involvement with industry in order to benefit research and enhance the relevance of teaching*

The development of TCS has realized the above objectives and resulted in a win-win-win situation, in which company, researcher and university under the TCS would be benefited. In Hong Kong, TCS has been strongly supported by the Innovation and Technology Commission of the Hong Kong Government, which has established a University-Industry Collaboration Program (UICP) with a clear objective of:

> *UICP aims to stimulate private sector interest in R&D through leveraging the knowledge and resources of universities. The emphasis is on close collaboration between private companies and universities in Hong Kong.* (ITF, 2010)

ORGANIZATION OF TCS

Each TCS is typically funded by both the involved company and the university. Governmental funding may also be available such as in the UK and Hong Kong. The TCS employs a graduate as a Research Associate, who carries out daily research activities with supervision from a TCS management committee comprising of senior management of the company and the academic staff from the university. Alternatively, the involved company can also nominate its staff as the Research Associate.

To fulfill the expectation of academia and industry, TCS requires the management committee to develop a set of mutually agreed objectives for the research project. This arrangement provides an effective platform for enhancing collaboration and exchanging ideas between universities and the industry. Designing an academically and practically viable research has been a challenge to academia as it requires collaboration and

significant inputs from both academics and practitioners. Under the TCS, the involved company provides practical insights on the research projects while the university provides academic and consulting advice. Their consolidated inputs can create a research project with both academic and practical values. The TCS research project can also be viewed as a bridge for exchanging ideas and experiences of the industry and university, resulting in a high level of synergy.

The appointed Research Associate implements the agreed research activities under the joint supervision from both industrial and academic supervisors, by which the Research Associate can gain real-life exposures in the business world and practical research experiences. The organization and inputs from the involved parties are shown in Figure 1.

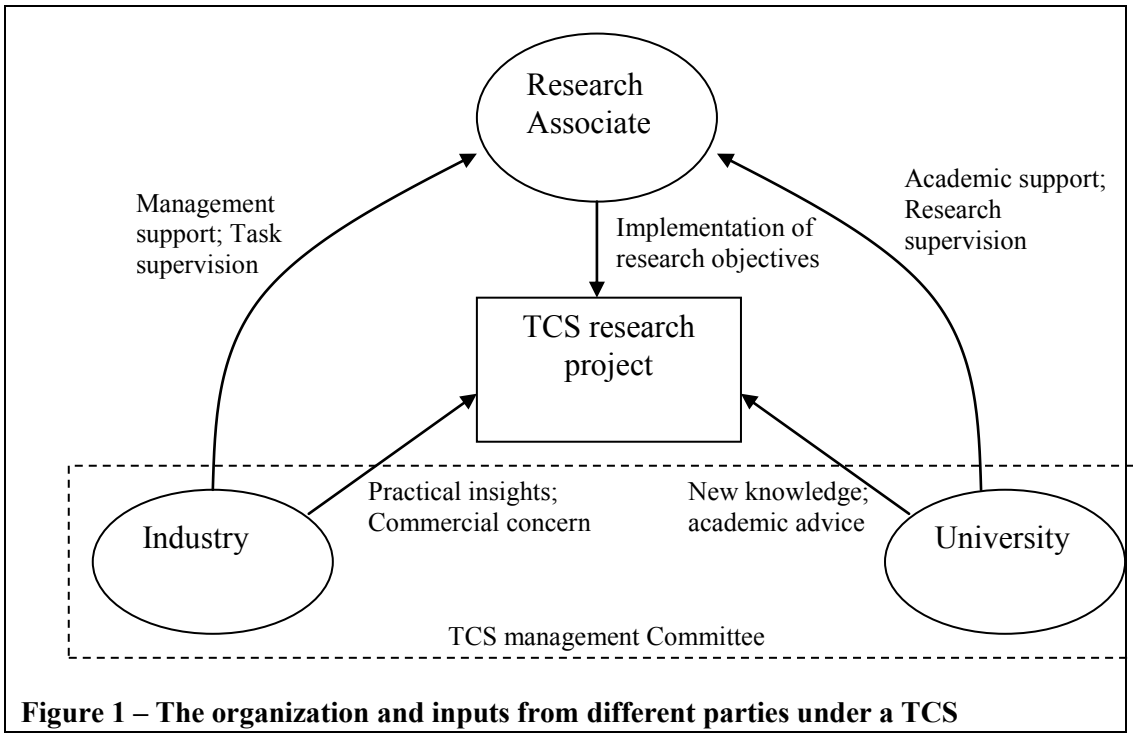


Figure 1 – The organization and inputs from different parties under a TCS

CASE STUDY

A TCS has been established in 2009 between a utility company (Company X) in Hong Kong and the Hong Kong Polytechnic University (PolyU) for a partnering related research. The organization, operation and progress of the TCS are presented in the following sections.

Company X has adopted non-contractual partnering for its projects. After implementing partnering for 5 years, Company X would like to capture the partnering experiences and enhance its partnering performance for their future projects. With consideration on the unique operating regime and business environment of utility business in Hong Kong,

Company X initiated a TCS for developing a practical management framework to enhance its partnering performance.

TCS Management Committee

A management committee was formed under the TCS. Company X has appointed three staff as the TCS chairman, Industrial Supervisor and Research Associate respectively. PolyU has also appointed two academic staff as Principal Investigator and project coordinator. Figure 2 shows the composition of the management committee.

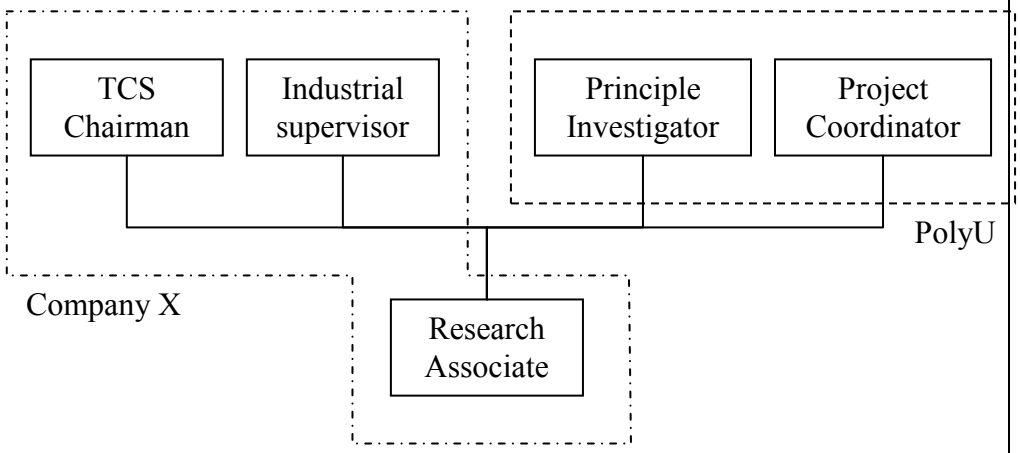


Figure 2 – The composition of the management committee under the TCS

Operation of the TCS

Regular meetings have been conducted within the TCS management committee and the Research Associate. This interactive process allows Company X to express their concerns over the partnering projects, while the Principal Investigator and the Project Coordinator can fine tune and derive specific research objectives with the Research Associate for the best interest of both parties. Throughout the course of the research project, the regular meetings within the TCS management committee serve the purpose of monitoring and reporting the research progress.

Outcomes of the TCS

The progress of the TCS is encouraging. Two partnering review workshops have been successfully conducted with engineers from Company X and those consultants, contractors and sub-contractors involved in the partnering projects. The Research Associate was the facilitator of the two workshops under supervision from the TCS management committee. The review workshops offered valuable insights to the research

projects, particularly in refining the research objectives. The key insights captured form the review workshops include:

- The existing KPIs cannot effectively reflect the actual performance. It was found that the contractors have got high KPIs scores but the clients were not satisfied with the contractors' performance.
- The scores of KPIs are sometimes arguable as it mainly depends on subjective judgments, and the client and the contractors have different views on the scores of KPIs.
- The contractors were underperformed due to lack of motivations
- The diverse stakeholder objectives have been aligned in the senior management level through the partnering processes but the alignment is weakened in the middle and frontline level, resulting traditional adversarial situation.

These specific practical insights from practitioners are hard to obtain otherwise. The insights from the review workshops have refined and validated the practicality of the research objectives, which include development of a set of company specific Key Performance Indicators (KPIs) for measuring partnering projects; exploring an optimal contract strategy; review and development of incentive scheme for a partnering contract and identification of critical success factors for implementation of partnering in the utility business context.

The TCS established an effective platform for knowledge transfer between university and the industry. The development of KPIs for partnering projects is an example. Yeung et al. (2007) from the PolyU have developed an objective and reliable Partnering Performance Index (PPI), employing the Delphi survey method, for assessing partnering performance of construction projects in Hong Kong. The established methodology, with improved objectivity and reliability, has been adopted for the Company X under the TCS for developing a set of company-specific KPIs for partnering projects. The university can be benefited from a higher application rate of its research outcomes in practice, which can in turn increase the credibility of the research outcomes. The Company is also benefited from applying some well established and state-of-the-art research outcomes for resolving business problems in a cost-effective manner through the TCS.

In addition, the TCS has facilitated relationship building and communication between the university and the industry. It not only fosters the application of research outcomes from university into practice, but also provides an effective channel for industry's feedback regarding the practicality of research.

CONCLUSIONS

TCS has been adopted for different technology related research with proven effectiveness and synergy. This paper shows that TCS can also be applied for partnering research, by which collaboration between academia and industry can be fostered. It also shows that all parties under the TCS can be benefited in different perspectives. For participating companies, they can benefit from applying the state-of-the-art research deliverables according to their business needs. The Research Associate can acquire practical research experience in a genuine business environment, while the university can benefit from establishing close links with the industry.

Under the TCS, the Research Associate has been received full support from Company X in conducting the research, including allowing access to data of pervious partnering projects and conducting survey and interview to the relevant staff with a guarantee 100% response rate. These supports can facilitate the whole research project and increase efficiency of conducting empirical research. More importantly, practical insights from practitioners can be captured and fed back to the research community for identifying future research direction, which are essential to the empirical research development of partnering research in particular.

For the community as a whole, the TCS not only enhances the practicability of research but also helps develop a group of high caliber, young, technically and managerially sound researchers and professionals for the future of the construction industry. This alternative research approach is recommended for partnering research in the construction industry such that more empirical research evidences can be obtained for advancing the development of partnering in the construction industry.

ACKNOWLEDGEMENTS

The authors sincerely acknowledge PolyU and the hosting company for establishing the TCS. Gratitude is also extended to the TCS Management Committee for their continuous support and advice throughout the research process.

REFERENCES

Abudayyeh, O. (1994) Partnering: *A Team Building Approach To Quality Construction Management,* Journal Of Management In Engineering, 10**,** 36-44.

Bennett, J. and Jayes, S. (1998) *The Seven Pillars Of Partnering: A Guide To Second Generation Partnering*, Thomas Telford.

Black, C., Akintoye, A. and Fitzgerald, E. (2000) *Analysis Of Success Factors And Benefits Of Partnering In Construction,* International Journal Of Project Management, 18**,** 423-434.

Black, R. (2004) *MTR Partnering- A Work In Progress* In Chan, A. P. C. & Chan, D. W. M. (Eds.) Proceedings Of The CII–HK Conference 2004 On *Construction Partnering: Our Partnering Journey–Where Are We Now, And Where Are We Heading?* Hong Kong Construction Industry Institute

Bygballe, L.E., Marianne, J.B. and Sward, A. (2010) *Partnering Relationships In Construction: A Literature Review*, Journal Of Purchasing And Supply Management.

Chan, A.P., Chan, D.W. and Yeung, J.F. (2009) *Relational Contracting For Construction Excellence: Principles, Practices And Case Studies*, Spon Press.

Chan, A.P.C., Chan, D.W.M., Fan, L.C.N., Lam, P.T.I. and Yeung, J.F.Y. (2004) *A Comparative Study Of Project Partnering Practices In Hong Kong*. In Chan, A.P.C. & Chan, D.W.M. (Eds.) *Proceedings Of The* CII–HK *Conference 2004 On Construction Partnering: Our Partnering Journey–Where Are We Now, And Where Are We Heading?* Hong Kong Construction Industry Institute Hong Kong

Chan, A.P.C., Chan, D.W.M., Fan, L.C.N., Lam, P.T.I. and Yeung, J.F.Y. (2008) *Achieving Partnering Success Through An Incentive Agreement: Lessons Learned From An Underground Railway Extension Project In Hong Kong,* Journal Of Management In Engineering, 24**,** 128-137.

Chan, A.P.C., Chan, D.W.M. and Ho, K.S.K. (2003) *An Empirical Study Of The Benefits Of Construction Partnering In Hong Kong,* Construction Management And Economics, 21**,** 523-533.

Cowan, C., Gray, C. and Larson, E. (1992) *Project Partnering*, Project Management Journal, 23.

Gransberg, D.D., Dillon, W.D., Reynolds, L. and Boyd, J. (1999) *Quantitative Analysis Of Partnered Project Performance,* Journal Of Construction Engineering And Management, 125**,** 161-166.

ITF (2010) *University-Industry Collaboration Programme (UICP) In Innovation And Technology Commission*, H.K.G. (Ed., Web Page: http://Www.Itf.Gov.Hk/L-Eng/Uicp.Asp.

Jones, O. and Craven, M. (2001) *Beyond The Routine: Innovation Management And The Teaching Company Scheme*, Technovation, 21**,** 267-279.

Li, H., Cheng, E.W.L. and Love, P.E.D. (2000) *Partnering Research In Construction,* Engineering Construction & Architectural Management (Blackwell Publishing Limited), 7**,** 76-92.

Li, H., Cheng, E.W.L., Love, P.E.D. and Irani, Z. (2001) *Co-Operative Benchmarking: A Tool For Partnering Excellence In Construction,* International Journal Of Project Management, 19**,** 171-179.

Ogunlana, S.O. (1999) *Profitable Partnering In Construction Procurement: CIB W92 (Procurement Systems),* London, Routledge.

Peattie, K. (1993) *The Teaching Company Scheme: Effecting Organizational Change Through Academic/Practitioner Collaboration,* Journal Of Management Development, 12**,** 59.

Tang, W., Duffield, C.F. and Young, D.M. (2006) *Partnering Mechanism In Construction: An Empirical Study On The Chinese Construction Industry,* Journal Of Construction Engineering And Management, 132.

Thompson, P.J. and Sanders, S.R. (1998) *Partnering Continuum,* Journal Of Management In Engineering, 14**,** 73.

Weston, D.C. and Gibson, G.E. (1993) *Partnering-Project Performance In U.S. Army Corps Of Engineers*, Journal Of Management In Engineering, 9**,** 410-425.

Reflections on the Implementation and Effective use of Commercially Available Online Videos and Quizzes as an e-learning Aid for Delivery and Assessment of a Mixed Mode Construction Management OHS University Course

Peter Ward
School of Architecture and Built Environment
University of Newcastle, Australia

ABSTRACT

Most Construction related University programmes recognise the need for the inclusion of some form of Occupational Health and Safety (OHS) element to their courses. The forthcoming implementation of nationally applicable OHS legislation in Australia is likely to increase this recognition on Australian construction programmes. The delivery of OHS as a subject that reflects the realities of OHS construction industry issues in a classroom environment is difficult to achieve. More so when the course is delivered to both on campus and distance learning students as part of a "mixed mode" programme. Commercially produced OHS materials in an E-learning format are widely available and are often seen as a means of recreating the realism of real life OHS scenarios. One option for the application and use of such technology is the use of online videos and related online quizzes targeting the video content. This research consists of a case study examining the perceived effectiveness of the implementation and use of one such commercially produced OH&S package consisting of videos and related quizzes, delivered in an E-learning format, as an aid to the delivery and teaching of a "mixed mode" University OH&S course on a construction related programme. The research reports the opinions and feedback of the students of the course as to the suitability and effectiveness of the use and application of the materials. Results indicate that students considered the use of online videos and online assessed quizzes as an E-learning tutorial and assessment method as being overall beneficial to their learning experience.

KEYWORDS

e-learning, OHS, quizzes, videos

INTRODUCTION

It has been reported that construction undergraduates have a poor level of knowledge of, and a poor attitude towards, occupational health and safety (OHS) risk management in construction (Carpenter et al., 2001), and that all construction professionals should have

an adequate education in OHS risk management, in addition to their academic studies, for there to be an overall improvement in the management of OHS risks within the construction industry (DETR, 2000). In Australia currently, there is statewide legislation (national legislation superseding these will be introduced in January 2012) requiring that construction workers undertake three levels of OHS of induction training (Australian Safety and Compensation Council, 2007):

- General induction;
- Site induction;
- Task-specific.

The coverage of these induction courses vary from "general" safety identification of hazard and risks, site specific safety identification of hazards and risks, and specific task related identification of hazards and risks, and can be delivered in a number of formats, such as verbal instructions, video presentations, and custom made computer packages (Wagener and Zou, 2009) and is considered to be more of a practical approach to the issues. Other resources that can be used to effectively support teaching and learning of built environment OHS education are student activity packages (Daw, 2003) and textbooks (Griffith and Howarth, 2001). The effective delivery of what is normally perceived to be a vocational subject such as OHS in a classroom situation to undergraduate students is considered to be difficult and unrealistic, in that it may not be possible to fully communicate and portray the realities of the risks and hazards present on a construction site in the confines of a classroom situation. This research considers a number of innovations, i.e. the use of commercially produced videos and related quizzes as a teaching and assessment mechanism, together with the delivery of the materials via online means, as an effective and efficient "enabler" of teaching, assessing, and delivering the subject matter (EDUCAUSE, 2005).

Although this research was primarily seeking the opinions and reflections of students on the use of videos and accompanying quizzes as a learning and assessment aid, it is acknowledged that the use of online delivery in this case also ensured that the students benefitted from the recognized advantages and positive features of E-learning:

- Flexibility for learners to access the course from remote locations and the ability to progress through the course at their own speed;
- The course is always available (outside of work hours);
- Easy quality control of the course content;
- Once the course is in place it can be used over and over, and can be used as a refresher tool;
- Provide an economical delivery of OHS training (Wagener and Zou, 2009).

The increased availability of information and communication technologies (IT) at work is considered to be one of the most significant factors that may lead to changes in education (Condie and Livingston, 2007) and transformative innovations for higher education in the 21st century (Garrison and Kanuka, 2004). Increasing financial stress (Sher et al., 2008), and increasing levels of student engagement in the workplace (Mills and Ashford, 2004) has also resulted in a change in student profile and expectations regarding course quality and flexibility as to the availability and use of online technologies within their studies (Spender and Stewart, 2002). Despite the recognized advantages however, the uptake and application of E-learning strategies and technologies for safety training and instruction by the construction industry has been limited (Bloom, 2003, Wagener and Zou, 2009). High implementation costs and limited IT familiarity are thought to be influencing factors that are considered to be an industry wide problem (Wagener and Zou, 2009), whilst the availability of appropriate internet access, the need for computer literacy, and the willingness to accept E-learning are considered to be issues for the learners themselves (Wagener and Zou, 2009). Studies into the effectiveness of E-learning suggest that students with a positive attitude towards web based learning perform better in an E-learning environment than a face to face course (Pan et al., 2003).

Wagener and Zou (2009) state that E-learning has many positive features not found in traditional face to face teaching and suggest that research into trainee's attitudes and perceptions into the use of such technology be carried out. As most University degree programs today are either supported, or have available to them some form of online delivery facility, that if used and implemented effectively could assist in the positive adoption of such technology, the opportunity to implement and assess the use of online OHS videos and online quizzes as a teaching and assessment aid for the delivery of an OHS course as part of the Bachelor of Construction Management course at the University of Newcastle was undertaken.

This case study reports students' reflections and opinions of the use and application of one such professionally produced E-learning package consisting of OHS videos and related quizzes, as a teaching aid for the support, delivery, and assessment of a construction related OHS course to a "mixed mode" (Sher et al., 2008) cohort of University degree students. Online videos and online assessed quizzes were introduced as an aid to the delivery of the Occupational Health and Safety for the Built Environment course. The course is intended to be undertaken in the second semester during the second year of the Bachelor of Construction Management programme, however, the flexible modular format of the programme enables it to be studied at any time throughout the students' period of study, either as an on campus or as a distance learning student. It is

also available as an elective to students of other Faculties and Schools within the University.

Student opinion and reflection of the effectiveness of the use of the online OHS videos and quizzes was sought and analysed. Technical issues relating to the use of such E-learning materials, together with an assessment of the "quality" of the content of the professionally produced materials is not directly addressed in this research, but may be touched upon in some of the reflections and discussions.

One of the major concerns resulting from the delivery of the course as a "mixed mode" format to both on campus and distance learning students was the possibility of breaching the rules of "natural justice", where each cohort of students would be expected to receive exactly the same information, materials, quality of learning experience, and equal opportunity to successfully complete the course. The traditional course design strategy illustrated in Table 1 reflected this concern. Each cohort received the same "lectures", with the opportunity to hear each others questions, and also ask their own individual questions, thereby adhering to the rules of natural justice.

It is acknowledged that even though the same tutorial questions and tutorial exercises were presented to each cohort, attendance at the tutorials by on campus students, and involvement in the distance learning tutorials by distance learning students was at times sporadic and left a lot to be desired. It is also acknowledged that the direction of each tutorial per tutorial group and cohort could also vary depending on the questions and issued raised during the tutorial, thereby possibly breaching the rules of natural justice. The design, application, and implementation of the E-learning strategy was intended to overcome these potential issues by ensuring uniformity of delivery of the same materials to both cohorts during the tutorials.

The "Traditional" Approach

The "traditional" strategy for delivery of the course to both cohorts was as outlined in Table 1.

Table 1 – Traditional course delivery strategy

Facility/Cohort	On Campus Students	Distance Learning Students
Lecture	One two hour lecture per week (the live lecture was recorded using the University's central recording system and made available for download to al students on the course).	A recording of the one two hour lecture per week made available for download using the University's Intranet system.
Opportunity to ask questions and receive feedback on issues emanating from the lecture.	Students were able to ask questions and receive feedback during the lecture. Students were also able to post questions and receive feedback using the University's Intranet system (these were responded to on a daily basis).	Students were able to hear questions asked, and the given responses, recorded on the live lecture recording. Students were also able to post questions and receive feedback using the University's Intranet system (these were responded to on a daily basis).
Tutorials	A one hour traditional tutorial per tutorial group using structured tutorial questions and exercises based on the lecture material was given. Feedback on the tutorials was given during the tutorial sessions.	The same tutorial questions as given to the on campus students were available to the distance learning students via the University Intranet system. Distance learning students had the opportunity to post responses to the tutorial questions used using the University's Intranet system. Feedback on the posted responses was given on a daily basis.
Opportunity to ask questions and receive feedback on further issues emanating from the tutorials.	Students had the opportunity to ask questions and make comments addressing further issues emanating from the tutorials during the tutorials. Student's also had the opportunity to post further questions and make comments addressing issues emanating from the tutorials using the University's Intranet system. These questions and comments were addressed on a daily basis.	Student's had the opportunity to post further questions and comments addressing issues emanating from the tutorials using the University's Intranet system. These questions and comments were addressed on a daily basis.

Opportunity to ask questions and make comments concerning the assignments.	Students had the opportunity to ask questions and make comments concerning the assignments during the lectures and during the tutorials. Responses were given to these questions and comments during the lectures and tutorials. Students also had the opportunity to post questions and make comments on the University's Intranet system. These questions and comments were responded to on a daily basis.	Students could listen to the questions, comments, and responses given concerning the assignments on the live lecture recording. Students also had the opportunity to post questions and make comments on the University's Intranet system. These questions and comments were responded to on a daily basis.

Means of Assessment

Assessment for the traditional course consisted of two submissions, each contributing up to fifty percent of the student's potential total marks for the course. The tutorials and posted comments were not assessed.

The "E-learning" Approach

The "E-learning" strategy for delivery of the course to both cohorts is outlined in Table 2.

Table 2 – E-learning course delivery strategy

Facility/Cohort	On Campus Students	Distance Learning Students
Lecture	One two hour lecture per week (the live lecture was recorded using the University's central recording system and made available for download using the University's Intranet system).	A recording of the one two hour lecture per week made available for download using the University's Intranet system.
Opportunity to ask questions and receive feedback on issues emanating from the lecture.	Students were able to ask questions and receive feedback during the lecture. Students were also able to post questions and receive feedback using the University's Intranet system (these were attended to on a daily basis).	Students were able to hear questions asked, and the given responses, recorded on the live lecture recording. Students were also able to post questions and receive feedback using the University's Intranet system (these were attended to on a daily basis).

Online videos as replacement to traditional tutorials	All students were emailed an online link enabling them to watch an online video addressing an OHS issue. Once activated the online link remained active for a period of three days to enable the student to re-watch and re-study the online videos, and raise questions and post comments prior to undertaking the assessed online quiz.	
Opportunity to ask questions concerning the online videos.	All students had the opportunity to post questions and make comment concerning the online videos using the University's Intranet system (these were responded to on a daily basis). Technical issues were addressed to and responded by the system provider.	
Assessed online quizzes	The online quizzes were made available to the students via the online video link previously emailed to them.	
Opportunity to ask questions concerning the assessed online quizzes.	All students had the opportunity to post questions and comments on the University's Intranet system (these were responded to on a daily basis).	
Traditional tutorials and tutorial questions as an additional learning aid.	The traditional tutorial questions were re-packaged and described as Self Assessment Questions (SAQ's) and made available to students for them to attempt as a self learning exercise using the University's Intranet system (these were not assessed). Student's had the opportunity to post responses to the SAQ's on the University's Intranet system. These responses would have been addressed on a daily basis, however no student made use of this facility.	
Opportunity to ask questions and receive feedback on further issues emanating from the SAQ's.	Student's had the opportunity to ask questions and make comments addressing issues emanating from the SAQ's using the University's Intranet system. These responses, questions, and comments would have been addressed on a daily basis, however, no student posted a response for comment to any of the SAQ's.	
Opportunity to ask questions and make comments concerning the assignments.	Students had the opportunity to ask questions and make comments concerning the assignments during the lectures and during the tutorials. Responses were given to these questions and comments during the lectures and tutorials. Students also had the opportunity to post questions and make comments on the University's Intranet system. These questions and comments were responded to on a daily basis.	Students could listen to the questions, comments, and responses given concerning the assignments on the live lecture recording. Students also had the opportunity to post questions and make comments on the University's Intranet system. These questions and comments were responded to on a daily basis.

The major change with this method of delivery was the use of E-learning tutorials and related online assessed quizzes. Rather than hold a number of the same tutorials using the

same questions and exercises to on campus students, and making the same tutorial questions and exercises available to distance learning students via the University's Intranet system, use was made of the professionally produced OHS online video's, together with their supporting online quizzes. Instead of attending in class tutorials, or attempting the tutorial questions via the University's Intranet system, email links were sent out to all students on the course on a weekly basis. The email link enabled the student to watch a safety video online, and then attempt an associated quiz.

In total eight different online OHS videos and their associated online assessed quizzes (as listed in Table 3) were made available to all students of both cohorts. The videos typically lasted between 30 and 45 minutes, with the time required to complete the quizzes being left to the individual student. As the online quizzes were assessed and contributing towards the students final mark the majority of students enrolled on the course watched the online videos and undertook the assessed online quizzes.

Table 3 – E-learning video and assessed quiz titles

1	Safety Awareness
2	Understanding Safety at Work
3	Construction Fundamentals
4	Slips Trips and Falls
5	Height Safety
6	PPE Essentials
7	Hazardous Substances Safety Essentials
8	Risk Management Safety Essentials

Means of assessment

The "E-learning" approach to assessment for the course consisted of two traditional submissions, contributing up to forty percent each of the student's potential total marks for the course, together with the student's average mark for seven of the eight assessed online quizzes (the first quiz was marked but not included in the students results. This was to enable the student to become familiar with the online quiz format and give them an opportunity to have a "dry run" at undertaking a quiz) contributing up to twenty percent of the students overall mark for the course (the University has a policy of limiting the amount of marks available from online quizzes to a maximum of twenty percent of the marks available for the course).

RESEARCH METHODOLOGY AND PURPOSE

The research methodology consisted of a case study of the students on the course. A statistical analysis of the course results for this period of study, an analysis and

comparison with the two previous years' results, and the administration and analysis of a questionnaire voluntarily undertaken by students of the course.

The purpose of the research was to reflect on the student's opinions concerning the delivery strategy, and the effectiveness of the use of videos and assessed online quizzes as a learning aid to their studies. The effectiveness of online delivery was not an issue directly investigated, but recognition of some of its benefits are incumbent and evidenced within the results and discussion of the research.

RESULTS AND DISCUSSION

Of the 130 students enrolled on the course 31 responded to the survey giving a total response rate of 24%.

Table 4 illustrates a comparison of the E-learning strategy course results with those of the previous two years. It is suggested that the divergence from the 2008 results was caused by the use of a new assignment, assignment assessment schedule, and marker being employed in 2009. The 2009 and 2010 results show a closer correlation, indicating that the E-learning strategy did not alter the overall assessment results in either a positive or negative way, but maintained a constant standard within the assessment results.

Table 4 – Comparison of results with previous two years courses

Year	N	Range	Min	Max	Mean	Std. Dev.	Var.	Coeff. of Var.
2008	102	51	41	92	76	9.767	95.389	12.851
2009	121	78	13	91	74.49	13.988	195.664	18.778
2010	130	79	6	85	68.88	13.802	190.482	18.902

The statements the participants were asked to respond to, and their responses are tabulated and discussed below:

Table 5 – Student responses

Statement/Response	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
The videos enabled me to gain an appreciation of the OHS issues in a "realistic" context	7	16	6	1	1

Table 5 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion of how effective and realistic the content of the videos was considered to be. The responses indicated that of the 31 students who responded a total of 23 either strongly agreed (7) or agreed (16)

with the statement. Six students neither agreed nor disagreed with the statement, whilst two student either disagreed (1) or strongly disagreed (1) with the statement, indicating that 74% of those who responded were of the opinion that the videos enabled them to gain an appreciation of the OHS issues in a realistic context, whilst 19% neither agreed or disagreed with the statement, and a further 3% either disagreed or strongly disagreed with the statement.

Table 6 – Student responses

Statement/Response	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
The videos enabled me to gain an appreciation of the OHS issues in a "realistic" context that couldn't be replicated in a classroom situation	8	16	5	1	1

Table 6 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion of the effectiveness of the videos as a teaching aid in a classroom situation. The responses indicated that of the 31 students who responded a total of 24 either strongly agreed (8) or agreed (16) with the statement. Six students neither agreed nor disagreed with the statement, whilst one respondent disagreed with the statement, indicating that 78% of those who responded were of the opinion that the videos enabled them to gain an appreciation of the OHS issues in a realistic context that couldn't be replicated in a classroom situation, whilst 16% neither agreed or disagreed with the statement, and a further 6% either disagreed or strongly disagreed with the statement.

Table 7 – Student responses

Statement/Response	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
The information contained in the videos enabled me to answer the quizzes.	3	11	5	10	2

Table 7 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion of how relevant and effective the information contained in the videos was for answering the quiz questions. The responses indicated that of the 31 students who responded a total of 14

either strongly agreed (3) or agreed (11) with the statement. Five students neither agreed nor disagreed with the statement, whilst 12 respondents either disagreed (10) or strongly disagreed (2) with the statement, indicating that 45% of those who responded were of the opinion that the information contained in the videos enabled them to answer the online quizzes, whilst 16% neither agreed or disagreed with the statement, a further 39% either disagreed or strongly disagreed with the statement. This result indicated no clear distinction either in favor of or against the statement between the respondents. This is considered to reflect some of the criticisms received about the technical content of the videos, in that some of the materials and questions were considered to be ambiguous in the possible interpretation of the meanings and possible answers.

Table 8 – Student responses

Statement/Response	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
Completing the quizzes increased my understanding of the subject matter.	6	13	8	3	1

Table 8 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion of how effective undertaking the quizzes as a learning experience was. The responses indicated that of the 31 students who responded a total of 19 either strongly agreed (6) or agreed (13) with the statement. Eight respondents neither agreed nor disagreed with the statement, whilst four respondents either disagreed (3) or strongly disagreed (1) with the statement, indicating that 61% of those who responded were of the opinion that completing the quizzes increased their understanding of the subject matter, whilst 26% neither agreed or disagreed with the statement, a further 13% either disagreed or strongly disagreed with the statement.

Table 9 – Student responses

Statement/Response	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
The number of quizzes undertaken as part of the course was about right.	2	21	4	3	1

Table 9 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion as to the ideal number of assessed quizzes to be undertaken. The responses indicated that of the 31 students who responded a total of 23 either strongly agreed (2) or agreed (21) with the statement. Four respondents neither agreed nor disagreed with the statement, whilst four respondents either disagreed (3) or strongly disagreed (1) with the statement, indicating that 74% of those who responded were of the opinion that the number of quizzes undertaken as part of the course was about right., whilst 13% neither agreed or disagreed with the statement, a further 13% either disagreed or strongly disagreed with the statement.

Table 10 – Student responses

Question/Response	0	1 - 3	4 - 6	7 - 9	1 per Week
How many quizzes do you think should have been undertaken as part of the course?	0	4	8	13	6

Table 10 contains the responses of the whole student cohort concerning the above statement. The question was intended to determine the respondents preferred number of assessed online quizzes to be undertaken. The responses indicated that of the 31 students who responded, 13% would have preferred to undertake between 1 and 3 assessed quizzes for the course, 26% would have preferred to undertake between 4 and 6 assessed quizzes for the course, 46% would have preferred to undertake between 7 and 9 assessed quizzes for the course, and a further 19% would have preferred to undertake one assessed quiz per each week of the course. This result corresponds with the previous result.

Table 11 – Student responses

Statement/Response	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
The 20% weighting of the quizzes towards my final mark for the course was about right.	6	14	6	5	0

Table 11 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion of the most suitable weighting towards the overall course mark the assessed online quizzes should

have contributed. The responses indicated that of the 31 students who responded a total of 20 either strongly agreed (6) or agreed (14) with the statement. Six respondents neither agreed nor disagreed with the statement, whilst five respondents disagreed with the statement, indicating that 65% of those who responded were of the opinion that the 20% weighting of the quizzes towards the final mark for the course was about right, whilst 19% neither agreed or disagreed with the statement, a further 16% disagreed with the statement.

Table 12 – Student responses

Question/Response	0	5%	10%	15%	20%	>20%
What percentage weighting should the assessed quizzes contribute to your final mark for the course?	0	0	6	2	14	9

Table 12 contains the responses of the whole student cohort concerning the above statement. The question was intended to gauge the respondents' opinion of the most suitable weighting towards the overall course mark the assessed online quizzes should contribute. The respondents were required to indicate a number category and the responses indicated that of the 31 students who responded, 19% would have preferred the assessed quizzes to contribute 10% towards their total mark for the course, for the course, 7% would have preferred the assessed quizzes to contribute 15% towards their total mark for the course, 45% would have preferred the assessed quizzes to contribute 20% towards their total mark for the course, and a further 29% would have preferred the assessed quizzes to contribute over 20% towards their total mark for the course. This result corresponds with the previous result.

Table 13 – Student responses

Statement/Response	Watching the videos and undertaking the quizzes was worthwhile.	Watching the videos was worthwhile but undertaking the quizzes was not.	Watching the videos was not worthwhile but undertaking the quizzes was.	Watching the videos and undertaking the quizzes was not worthwhile.
My overall opinion of the online videos and quizzes was:	19	4	4	4

Table 13 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion of the benefits

of watching the videos and undertaking the online quizzes. Respondents were required to choose one of a number of stated responses. The responses indicated that of the 31 students who responded, 61% expressed the opinion that watching the videos and undertaking the assessed online quizzes was worthwhile. Of the remaining responses, 13% expressed the opinion watching the videos was worthwhile but undertaking the quizzes was not, 13% expressed the opinion that watching the videos was not worthwhile but undertaking the quizzes was, and the remaining 13% expressed the opinion that watching the videos and undertaking the quizzes was not worthwhile.

Table 14 – Student responses

Statement/Response	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree
My learning experience would have benefited more by undertaking traditional tutorials and tutorial questions rather than watching the online videos and undertaking the online quizzes	1	6	7	14	3

Table 14 contains the responses of the whole student cohort concerning the above statement. The statement was intended to gauge the respondents' opinion of whether traditional lectures and tutorials would have been a more effective learning experience. The responses indicated that of the 31 students who responded, 56% either strongly disagreed (3) or disagreed (14) with the statement. Of the remaining responses, 22% neither agreed or disagreed with the statement, and 22% either agreed (6) or strongly agreed (1) with the statement.

Table 15 contains the responses of the whole student cohort concerning the included statement. The statement was intended to identify the respondents preferred approach to the use of videos and online quizzes as an effective learning experience. Respondents were required to choose one of a number of possible responses. Responses indicated that 7% of respondents considered that the use of lectures, traditional tutorials, and tutorial questions only would have been more beneficial. A further 35% of respondents considered that the use of lectures, traditional tutorials and tutorial questions, combined with online videos and online quizzes would have been more beneficial. Of the remaining responses, 45% considered the use of lectures, online videos, and online quizzes only would have been the most beneficial. A further 13% expressed an opinion that none of these approaches were considered to be beneficial. Overall, some 80% of the responses

indicated that the use of online videos and assessed online quizzes, combined with traditional lectures and tutorials, or just traditional lectures, would have been beneficial to their learning experience.

Table 15 – Student responses

Statement/Response	Lectures, traditional tutorials, and tutorial questions only.	Lectures, traditional tutorials and tutorial questions, combined with online videos and online quizzes.	Lectures, online videos, and online quizzes only.	None of these.
My learning experience would have benefited more by the use of:	2	11	14	4

The respondents were then asked a number of qualitative questions in an attempt to obtain constructive comment as to how their learning experience could have been improved. The questions, together with selected responses have been tabulated in tables 16 and 17 respectively.

Table 16 – Student responses

Question: How could the online videos and assessed online quizzes be used to improve your learning experience?
I think their use was appropriate and justified. Exposure to these types of quizzes gives a realistic experience of what is happening in the construction industry safety inductions etc... Overall very worthwhile and suitable for the course.
I think the online tutorials were fine… The number of tutorial videos may have been a bit too much.
Overall I think they are a great tool for introducing OHS to people that are going to be greatly affected by it for the rest of their careers.
They were interesting and were able to obtain my attention immediately. They were easy to follow and comprehend and easy to apply to the quiz itself.
I don't feel the use of the videos or quizzes could be changed to improve my learning anymore than they already did. The online videos were very informative and helpful.
I think the online quizzes were great… Great quizzes', really enjoyed them and they definitely helped me understand more about OHS in the workplace.
The videos and quizzes were used in an adequate context.
One every week of the course would be beneficial, other than that I found the videos very informative.
The online videos are a fantastic way to learn the course. I strongly recommend too continue to use this method.

The online videos contained good shock value with their illustrations. The online videos and quizzes were good. It would be good possibly to have a quiz every week. They help create realistic life scenarios. I think it was a great way of learning the material. It gave you information regarding all the work you should know with video explanation. Great way of learning. I think the way the course was delivered was different to traditional ways (just lectures and tutorials). I believe the online videos' was a good idea and I personally prefer this approach. I thought this form of learning was beneficial. Use of online videos was helpful in demonstrating simulated scenario's that couldn't be achieved in a traditional lecture setting. The use of the online videos and quizzes was a good alternative to traditional tutorials… Overall very satisfied with the delivery and information provided. Keeping the video tutorial but giving out weekly short answer questions for students to fill or maybe finals test where we need to fill out the answers. Have one quiz with a video or images, the amount of quizzes offered was too many and I lost track of how many quizzes there were and where we were up to. Great idea and teaching tool. Online videos and quizzes, lectures and tutorial questions.

Table 17 – Student responses Statement: Suggest how you think this course could be delivered that would improve your assessment experience:
40%, 40%, 20% was suitable for weighting. Less quizzes. Maybe 1-3. Average of those marks should go no more than 10% of final marks. I'm happy as is. Happy overall. I found that the assessments were very appropriate for the course and they were weighted fittingly. I believe the current format to be effective as it provides multiple forms of assessment. Slightly more weighting towards the online quizzes would be good given they are delivered throughout the duration of the course. The assessment criteria, including online quizzes and formal submissions, were adequate. One assessment worth 100%. More assignments with less weightings. Online quizzes assessed in conjunction with tutorial questions and assignments. Happy with assessment. I think the quizzes should be worth more than 20%. More quizzes and less assessments.

CONCLUSIONS

Overall the students who responded gave a favorable opinion as to the use of online videos and online quizzes as an effective means undertaking tutorials and assessment.

The majority of those students who responded were of the opinion that the use of online videos enabled them to gain an appreciation of the OHS issues in a "realistic" context, that ordinarily couldn't be replicated in a classroom situation.

Although there was no clear opinion as to the effectiveness of watching the online videos as a learning exercise, there was a majority of those who responded who considered that undertaking the online quizzes increased their understanding of the subject matter.

Overall the majority of students who responded were of the opinion that the number of online assessed quizzes undertaken was about right for the course, and the allocated weighting of the marks of 20% contribution to their overall course mark was appropriate.

The majority of students who responded were of the opinion that watching the online videos and undertaking the online assessed quizzes was worthwhile. There was some indication that combining them with traditional lectures and tutorials may be worthwhile.

Overall the majority of students who responded were of the opinion that the use of online videos and online assessed quizzes benefitted their learning experience more than the use of traditional lectures and tutorials alone would have done.

The qualitative answers reflect an overall positive response to the use and implementation of online videos and online assed quizzes as a suitable aid to the delivery and assessment of a construction related OHS course.

Tutorial participation by those students enrolled on the course increased to almost 100% involvement as a result of the application, implementation, and utilization of the assessed online quizzes (some students attempted at least enough quizzes to obtain a pass mark for this element of the course, whilst the majority of students of the course completed all of the quizzes).

Although there was an overall positive response to the use of online videos and quizzes as an effective teaching, learning, and assessment media, comment should be made as to the importance of the quality (both production wise and technical accuracy) of the materials used. Although the production quality of this particular product was excellent, there were several criticisms of the technical content contained in some of the videos, as a number of students commented on what they perceived to be the ambiguity of interpretation of some of the materials in relation to the online quizzes. Although not reported in detail in the results in this paper, the effective adoption of such technologies must be dependent upon the quality of the materials used.

REFERENCES

Australia Safety and Ccompensation Council (2007) *National code of Practice for Induction for Construction Work*. Australian Government.

Bloom, M. (2003) E-Learning in Canada Findings from 2003 E-Survey.

Carpenter, J., Williams, P. and Smith, N.C. (2001) Identification and management of risk in undergraduate construction courses. Norwich, UK.

Condie, R. and Livingston, K. (2007) Blending online learning with traditional approaches: changing practices. *British Journal of Educational Technology,* Vol. 38**,** pp 337 - 348.

Daw, R. (2003) Health and Safety, Student-centred Learning in Construction Education. University of Plymouth.

DETR (2000) Rethinking health and safety strategy statement. London, UK.

EDUCAUSE (2005) The Myth about e-Learning "We Don't Need to Worry about E-learning Anymore". *EDUCAUSE REVIEW,* 40.

Garrison, D.R. and Kanuka, H. (2004) Blended learning: Uncovering its transformative potential in higher education. *Internet and Higher Education,* Vol. 7**,** pp 95 - 105.

Griffith, A. and Howarth, T. (2001) *Construction Health and Safety Management,* Harlow, Pearson Longman.

Mills, A. and Ashford, P. (2004) Full time student and part-time worker: employment practices of undergraduate students in built environment courses in Austyralia. *Proceedings of the 29th Annual Conference of the Australian Universities' Building Educateors Association.* University of Newcastle, NSW, Australia.

Pan, C., Sivo, S. and Brophy (2003) Students Attitude in a Web-enhanced Hybrid Course: A Structural Equation Modeling Enquiry. *Journal of Educational Media & Library Sciences,* 412.

Sher, W., Brewer, G., Gajendran, T. and Williams, A. (2008) Mixed-mode delivery of construction management degree programs. in Haigh, R. & Amaratunga, D. (Eds.) *CIB International Conference on Building Education and Research: Building Resilience.* Heritance Kandalama, Sri Lanka, The University of Salford.

Spender, D. and Stewart, F. (2002) Embracing e-Learning in Australian Schools., Commonwealth Bank, Australia.

Wagener, E. and Zou, P.X.W. (2009) E-Learning for Construction Safety Training in the Australian Construction Industry. In Linguard, H., Cooke, T. & Turner, M. (Eds.) *CIB W099 Conference 2009 - Working Together: Planning, Designing and Building a Healthy and safe Industry.* Melbourne, Australia, RMIT University.

Early Contractor Involvement – South Australian Experience

Dr Tony Ma and Hee Heng Xin
School of Natural and Built Environments
University of South Australia, Adelaide, Australia

ABSTRACT

Construction contractors are usually not invited in design stage before design is being finalized. Therefore, it reduces their ability to influence the project's specification. Early Contractor Involvement (ECI) is a form of project delivery which provides efficient use of resources; allows innovation in projects and provides for a value outcome. The aim of this paper is to review the circumstances when ECI will be implemented and to determine the strength and issues of this form of procurement. It also attempts to identify the critical success factors of ECI. A case study is conducted. The results reveal that the ECI approach had allowed all parties to work together to provide early innovations and cost savings, and to integrate greater constructability into the design. Overall, the findings from the case studies provide a valuable insight and understanding of the current practices of ECI projects in the South Australian construction industry.

KEYWORDS

early contractor involvement, constructability, South Australia

INTRODUCTION

In traditional procurement system, the process itself does not invite any design contribution from the contractor, as design aspects in this system are the domain of the architect or engineer. Even though construction knowledge is considered as a vital design input, its impact on design is restricted by the designer's lack of construction experience and limited understanding of construction requirements (Song et al., 2009). Many contractors also argue that designers do not have enough practical experience of on-site construction and construction knowledge to assess designs as to constructability in most cases (Ndekugri & Turner, 1994). As a result constructability problems may occur.

Saghatforoush et al. (2009) stated that "*the integration of experienced construction personnel into the earliest stages of project planning as full-fledged members of the project team will greatly improve the chances of achieving a better quality project, completed in a safe manner, on schedule, for the least cost*." Contractors make use of their construction experience to assist designers to better designs and increase the

flexibility of the project will help to avoid any later design modifications that require extra cost to the project Early Contractor Involvement (ECI) was first established in 2001 by the Highways Agency for the A500 Stoke Pathfinder Project in UK to overcome problems in delivering major infrastructure projects. According to UK Highway Agency (2009), the project saved two years over the conventional contracting approach. Early Contractor involvement reduces the time taken through planning opportunities for overall project cost, and that reductions through value engineering are maximised where implemented at an early stage of the project (Matheson Ormsby Prentice, 2005).

In Australia, Queensland's Department of Main Roads (DMR) and Department of Public Works (DPW) both use ECI models. DMR reports success with its model contract introduced in 2005 including early completion of projects, improved design, simplified construction and reduced costs. It has used this approach on Maroochy River Bridge, Townsville Ring Road, and North Ward Road in Townsville. DPW released its new Managing Contractor Contract in 2007. It has also been used for the delivery of major public buildings (Whitehead 2008). In South Australia, there has been an increasing use of ECI by the Government in the development of public infrastructure projects (e.g. The Bakewell Underpass in Adelaide, and Tramline Extension).

In order to understand more about the use of ECI contracting, this paper aims to review the circumstances when ECI will be implemented and to determine the strength and issues of this form of procurement. It also attempts to identify the critical success factors of ECI. A case study has been collected through face-to-face interview. The findings shall provide a valuable insight of the current practice of ECI projects in South Australia.

REVIEW OF EARLY CONTRACTOR INVOLVEMENT

In Australia, the concept of Early Contractor Involvement under the principle of constructability is not new. In the year of 1993, the Construction Industry Institute Australia (CIIA) has developed 12 principles of constructability based on the CII constructability concepts (Trigunarsyah, 2004). The 12 principles developed emphasize on the commitment of the project team particularly from the very beginning of the project. Construction personnel are also encouraged to be involved. The best way is to include the actual constructor to the project team from the feasibility stage (Francis & Sidwell, 1996).

Song et al. (2009) define early contractor involvement as a relationship between a contractor and an owner or a designer that engages the contractor from the early design stage and allows the contractor to contribute its construction knowledge and experience to design. Early Contractor Involvement involves contractor to assist in the development of design for the project in the early phases of a project. According to the Main Roads of

Queensland Government (January 2009), ECI is best described as a negotiated Design and Construct (D&C) contract. The contractor, together with the contractor's designer, can be engaged as early as immediately after a project business case has been prepared. ECI was developed for current market conditions (increased infrastructure programs across transport, water and mining sectors in particular, and a very tight technical skills market). This was done principally to gain the benefits of a D&C approach, and to reduce the significant resource requirement of D&C projects during the tender phase. ECI takes a two-stage approach, the first being the selection of contractors through a non-price selection process based on the capability of the proposed team. It finishes with the contractor submitting a stage 2 offer. In stage-2, the successful contractor works under a service agreement with the government.

Strength of ECI

Early Contractor Involvement contracting has a number of benefits compare to traditional contracting procurement. These benefits include (Whitehead, 2009):

1. *Reduced tender costs and time*

   Mosey (2009) suggested that ‚*ECI potentially reduces preparation time for projects by 30-40%, by carrying out some parts of the development process simultaneously rather than consecutively*.' An organization typically has a one in three chance of winning in a traditional tender. Therefore, it would be a waste to spend large sums of their own money on investigation or design being awarded the contract (Edwards, 2009). However, for an Early Contractor Involvement contract, detailed project design and scope of works are not required during tendering process. In an overheated market, this helps to reduce the resources needed during tendering process.

2. *Better team approach*

   ECI provides the benefits from client and supplier to work as a team (Mosey, 2009).With the utilization of Early Contractor Involvement**,** the contractor is involved in the design phase**.** Whitehead (2009) outlined that the benefits on relationship contracting will therefore be gained through the close relationship between the owner, contractor and designer. Through relationship contracting, there will be a better understanding of the project through improved communication and an improved work environment.

3. *Increased opportunity for innovation*

   Early involvement increases innovation which was being lost on Design and Construct contracts as detailed design and scope of works is not required to set

out at the beginning of the project. Thus, the design of the project is more flexible and hence allow for options for innovation to be discovered.

4. *Fast decision-making*

   The early involvement and collaboration between contractor, client and designer allow for decision-making and approvals. Moreover, decisions can be made very quickly as senior personnel are accessible (Edwards, 2009).

5. *Shortened delivery time*

   As Early Contractor Involvement allows work to commence at the early stages of construction while the design and documentation of later trade packages are being finalized, the time and cost restraints associated with traditional tendering methods can be reduced.

6. *Better integration of construction methods/ Constructability*

   Through Early Contractor Involvement, the contractor contributes more input in the design process which in turn leads to increased constructability. Besides, the close collaboration and input between all parties assists for better integration of construction methods in the design of the works.

7. *Reduced risk of surprise*

   The risk of surprises is reduced during the progression of project because of good communications, good understanding of the project among the contractor, client and designer on the scheme requirements and the associated costs.

8. *Fewer variations during construction*

   There will be fewer variations during construction as all parties have a good understanding of the cost required for the project.

9. *Realistic price*

   Through ECI contracts, the real costs are highlighted early as a team or alliancing spirit which leads to an open and honest process is provided. The price provided will be much more realistic compare to traditional contract procurement (Whitehead, 2009).

Issues of ECI

Ever since Early Contractor Involvement was being introduced in the year of 2001, there have been only a few problems identified. However, there are some issues have to be concerned (Whitehead, 2009):

1. *Involvement of senior staff*

   The early stages of the project tie up senior staff for a longer period than traditional form of contracts. This additional involvement occurs particularly in

the design phase when the contractor's margins are traditionally low. Though, this will have to be reasonable against the cost saved during the tender processes.

2. *Potential loss of innovation*

   For project where construction price can be negotiated, it may be hard to find out when the design has progressed sufficiently as the contractor may want to continue to refine the design to reduce their risk (Edwards, 2009). The designers may then „step back' from design innovation as the contractor pursues constructability and cost savings at early schematic design stage.

3. *Going too early*

   When the contractor is appointed too early, there is a risk that the contractor may not be motivated to provide its best staff. Therefore, the earlier is not necessarily the better.

4. *Potentially higher prices*

   Due to the fact that Risk Adjusted Price is built up in the absence of competitive tension, this may lead to a higher Risk Adjusted Price. Hence, appropriate measures need to be taken into account.

5. *Finance*

   Finance may be not easy to obtain in the circumstances where the project total costs are not confirmed.

6. *Uncertainty*

   The contract (New Engineering Contract) used in the United Kingdom is being criticized due to the fact that it is an entirely new contract which does not have the benefit of years of judicial interpretation (in the case of standard form of contracts). Thus, Whitehead (2009) suggested that Early Contractor Involvement could be used in conjunction with traditional contracts. On the other hand, the Australian models utilize contract that is consistent with the existing standard contracts where the Australian standard contracts have been used as the base for stage 2 contract. It is vital to ensure certainty wherever possible as the existing contracts may simply not appropriate.

ECI EXPERIENCE IN SOUTH AUSTRALIA – A CASE STUDY

The road works projects have traditionally used construct only or Design and Construct, which have largely been successful in meeting the project time, cost and quality. However, it is recognised that these strategies are unlikely to meet the delivery timeframes now expected by government, particularly in complex projects. According to Edwards (2009), there are a number of contracting strategies developed in the road

construction industry that encourage collaboration between the principal, designer and the constructor. These include alliance contract and early contractor involvement. ECI has been selected as the contract delivery strategy for a number of major transport infrastructure projects in South Australia. These projects include:

- The Bakewell underpass
- The South Road Anzac Highway Underpass
- The Air Warfare Destroyer Shiplift,
- Coast to Coast Tramline extension, and the
- Reconstruction of part of the Adelaide metropolitan passenger rail network.

In order to fulfil the research objectives, a project case has been studied in details. Table 1 indicates its brief summary.

Table 1 – Summary of the Tramline Project

Nature of Project	Contract Price	Year	Interviewee
The construction of 2.8 kilometres of double tram track, with substation, overhead catenary system and associated structures, necessary road and bridge works and traffic management measures, an additional four tram stops, and new park and ride facility (SA Government project)	Approximately $100 million	May 2009-March 2010	Project Manager

The aim of this case study is to facilitate the following objectives:

- To understand the reasons for this procurement strategy
- To identify the issues and risks involved when ECI is being chosen.
- To examine the impacts of ECI to the project outcome.

This project is about the extension of tramline in Adelaide. It incorporated the construction of 2.8 kilometres of double tram track, with substation, overhead catenary system and associated structures, necessary road and bridge works and traffic management measures, an additional four tram stops, and new park and ride facility. The extension of tramline was to expand light rail services into the wider metropolitan transport network.

It was quickly recognized in the early planning study that there would be difficulties to construct the tramline. The construction works affected the use of the road network, the rail corridor and the river. During construction, there were temporary impacts on kerbside use. The impact of the tramline on the kerbside activities comprised some minor relocation of bus stops to suit the road widening. Besides, there was some loss of parking on some of the roads. The rail corridor was contaminated and required management during construction.

The project delivery team had to be aware of the requirement to minimise disruption to the city from the construction works due to the fact that the scope of work consisted of various range of activities such as civil, electrical, track engineering, traffic management and urban design. These works were required throughout the whole extension. Therefore, the project delivery team had to complete these works in as short a time as is practical in order to minimise any impact on traffic and events held in the city.

The client recognized the complexity of the project and it required an innovative approach to the project delivery method. With the previous successful experience of adopting ECI in delivering the required infrastructure asset within the budget and on time, the client decided that the project was an ideal candidate for the ECI strategy. By adopting the ECI method, the client engaged a team to collaborate with in order to develop an approved design from conceptual stage, that was then subsequently procured by the conventional design and construct method. All tenders in stage-1 were assessed according to the following criteria:

- Experience in similar works
- Management team qualities
- Appreciation of and approach to tasks
- Financial viability and insurance

Under the ECI agreement, the client was committed to establishing and maintaining a close and cooperative relationship throughout the life of the project. A joint leadership team comprising senior people from the contracting organization and from the client was established. This high level team was responsible for providing the strategic direction of the project and creating, guiding and supporting a culture of cooperation and high performance. The team had also provided organizational support to the project. The whole process is very similar to the alliance contracting but with a smaller scale and it does not have the pain and gain share provision.

In November 2007, the contractor and designer were engaged under an ECI agreement. The contractor and designer were invited to enter into an agreement to undertake Design Development. A project management team consisting of staff from the client, the contractor and designer was formed under the agreement. The agreement had also included the provision for design work to continue up to award of the design and construct contract. The team worked closely with the client for seven months, sharing its engineering design and constructability expertise. The outcome of this process was a design that defined the scope of the works, identified the risks and mitigation requirements, and contained sufficient information for the construction work to be accurately priced.

The client recognized the importance of high quality design development and the project cost savings that can result from high standard design. Therefore, some of the client's staffs were appointed to the design team during the period of the design development phase. Through the collaboration among the team members, the teamwork was established and it provided joint commitment, integrated approach and innovative thinking for the project.

The contractor had to develop the cost estimate which include the proposed construction activities and cost against other similar projects on a confidential open book basis. An estimator had been engaged by the client to calculate an estimated cost without referring to any of the contractor's calculations. The parties could negotiate the design and construct contract cost once the cost estimates had completed. The client had the right to seek for other proponent if the parties cannot agree with the price and risk allocation. However, in the case of this project, the same team was awarded the stage-2 contract for this project.

The collaborative approach taken by the parties delivered a number of benefits. The ECI approach had provided the maximum opportunity for the contractor to manage the key areas for innovation and value for money such as track design, construction staging and traffic management. This process provides the maximum opportunity for the contractor to manage this. The client dictated that through the understanding, skill and experience, it enabled the team to deliver a value-for-money project whilst giving proper consideration to the needs of community groups and road users.

During the interview, the project manager indicated that ECI might not contribute huge savings for the project as a whole, but it certainly created huge savings in the tendering process. Calling tenders for a design and construct for high risk projects would result in very high prices and tedious evaluation process. During the stage-1 process, the establishment of teamwork is at risk as it can be very challenging to select the most appropriate approach or solution for the project due to the fact that each team member may have different opinion towards the project. On the other hand, before finalising the stag-2 contract, there will always be tension in the process of negotiating a price for the design and construction. With the lack of traditional competitive approach, the client will never know if value for money tender has been obtained from the stage-1 contractor.

CONCLUSIONS

ECI contracts were seen relatively successful in South Australia in road works projects. However, not every project would be suitable to adopt the ECI approach. Generally, it is not worth to call tender for projects with high risk and uncertainty of scope. It will result in very high tender prices to reflect the uncertainty involved in project delivery. Thus,

traditional contract types are more favourable for straightforward projects. Meanwhile, if the project is very complex or high in risk and there is an ongoing need for collaboration between the designer, contractor and client during construction, the project is better suited to an alliance contract. From the results of the case study through interview, it shows that projects with high risk and uncertainty scope but smaller than a typical alliance project are more suited to an ECI approach.

It is found out that the transition of the first stage to the second stage is the most difficult part of the ECI contract. In the client perspective, termination would only be done as the last resort as there are significant barriers to terminating the relationship with the design contractor. Besides, there would be significant disruption to the momentum of project team and loss of knowledge about the project if another company takes over. To ensure a realistic price is offered by the contractor, the client would usually engage an independent cost consultant to prepare a separate estimate before reviewing the price offered by the contractor. If there is a case where the price could not be agreed, the client would try to negotiate with the contractor in order to get to an agreed price and solution.

REFERENCES

Edwards, R. (2009) Early Contractor Involvement (ECI) Contracts – The Experience of the South Australian Department of Transport, Energy and Infrastructure with ECI Contracts, Department of Transport Energy and Infrastructure

Francis, V.E. and Sidwell, A.C. (1996) *The Development of Constructability Principles for The Australian Construction Industry*, Construction Industry Institute, Australia

Mainroads of Queensland Government (2009), Early Contractor Involvement, Main Roads- Connecting Queensland, viewed 30 January 2011, <www.mainroads.qld.gov.au>

Matheson Ormsby Prentice. (2005) Early Contractor Involvement in Ireland, viewed on 30 January 2011, www.mop.ie/.../ProjectsGroup-EarlyContractorInvolvementContractsIn Ireland-RS-June2005.pdf

Mosey, D. (2009) Early Contractor Involvement in Building Procurement- Contracts, Partnering and Project Management, Wiley-Blackwell, United Kingdom

Ndekugri. I. and Turner, A. (1994) „Building Procurement By Design and Build Approach', *Journal of Construction Engineering and Management*, vol. 120 pp 243-256

Saghatforoush, E., Hasim, S., Jaafar, M.S. and Kadir, M.R.A. (2009) **'**Constructability Implementation Among Malaysian Building Contractors', *European Journal of Scientific Research,* vol. 29, pp 518-532

Song, L., Mohamed, Y. and Abourizk, S.M. (2009) „Early Contractor Involvement in Design and Its Impact on Construction Schedule Performance' *Journal of Management in Engineering,* vol. 25, pp 12-20

Trigunarsyah, B. (2004) „Constructability Practices among Construction Contractors in Indonesia', *Journal of Construction Engineering and Management*, vol. 130, pp 656-669

Whitehead, J. (2009) Early Contractor Involvement – The Australian Experience, Construction Law International, vol 4 No.1, viewed 29th August 2009 <http://www.minterellison.com/public/connect/resources/file/ebe40105f11cc62/ConstructionLawInternational.pdf>

Guaranteed Maximum Price Contracting – A Qualitative Study in South Australia

Dr Tony Ma and Phoebe Hooi Wen Beh
School of Natural and Built Environments
University of South Australia, Adelaide, Australia

ABSTRACT

The South Australian construction industry is experiencing high demand for new construction and meanwhile increasing project complexities in terms of schedules and budgets. These pressures are driving the need for changes in contracting procedures. The Guaranteed maximum price (GMP) approach to contracting has recently become popular in Australia with a strategy of pre-determining the agreed final contract sum of a project. This study aims to review the current practice and the major components of GMP contracting within the South Australian construction industry. A detailed case study highlights the pitfall of this type of contracting and shows that the standard form of contract is considered necessary for GMP projects as it would provide consistency, in contrast to the current situation with a myriad of hybrid and custom contracts in use.

KEYWORDS

guaranteed maximum price, standard form of contract, South Australia

INTRODUCTION

Various types of contracts are available for the construction industry to best procure a construction project. A strategy which is becoming quite popular in Australia is the use of Guaranteed Maximum Price (GMP) to pre-determine the agreed final contract sum of a project. GMP contract is usually used when the scope of work cannot be defined as clearly as in a lump-sum contract. The contractor and the owner agree that the contractor will perform an agreed scope of work which is defined as best as possible at a price not to exceed an agreed-on amount, the GMP (Kaplanogu and Arditi 2009). The typical way of understanding these different types of construction contracts is to view them from the perspective of the amount of risk involved and methods for sharing the risk between parties. The range of risk runs from a fixed-price contract at one end of the spectrum to a totally non risk cost reimbursable contract at the other end of the spectrum (Perkin, 2008). Although GMP contracting has been used for many projects, there is still lacking a standard form of contract for this arrangement. In contrast to the current situation with a numerous of hybrid and custom contracts in use, a proper GMP standard form is an

obvious solution to provide consistency. Some thought it would be difficult to have a standard form as each project and method of pricing was unique. Another issue is that the contract was generally drafted and administered by the client's representative and what they thought the contract said may not be what it actually said (Davis and Stevenson 2004). The aim of this paper is to review the current practice and the major components of GMP contracting within the South Australian construction industry. A case study has been collected through face-to-face interview. It also attempts to make recommendations for possible standard form for GMP contract.

PROBLEMS ASSOCIATED WITH GMP CONTRACTING

Gander and Hemsley (1997) defined GMP as: "*The intention of the Guaranteed Maximum Price contract is to provide a lump sum contract under which there will be no adjustment of the tender price unless the scope required by the client changes*".

The term GMP when applied to a construction contract provides the client a nice feeling of security. The contractor entering into a contract of this nature is convinced that no matter what happens the final cost will not be above the maximum and there is a fair chance it could be lower (Chan et al. 2004). Any design changes which result from the specific instructions of the client would understandably fall outside the guaranteed price. As mentioned above, this is because GMP contract is considered as a hybrid arrangement consisting of a cost reimbursement contract and a GMP clause implies that the contractor is entitled to be paid an agreed upon fee, reimbursed for his actual cost such that, added to the agreed upon fee, the total amount does not exceed the GMP amount, and compensated for the option accorded through the GMP clause (Boukendour and Bah 2001). With risk transfer being at the moment very much in vogue the guaranteed maximum price contract has seen resurgence. The intention of this procurement route is to transfer all risks to the contractor and allow for no increases in price whatsoever other than costs which result from client changes. Therefore it is always been recommended that a fixed fee is paid and the reimbursable cost includes only the direct cost involved in the work carried out. Hence, the fixed fee is made up of the indirect cost and the contractor's profit, both of which are determined as a function of the scope of work (Boukendour and Bah 2001).

According to Tay et al. (2000) and Lim (2001), the major problem encountered whilst using a GMP was the definition of a „scope change'. If the definition is not well defined, it will certainly fall into the loop hole for disputes and contractual claims. Therefore a well written contract document is of upmost important by describing how the GMP is formulated and under what circumstances that it can be adjusted for scope changes. Davis and Stevenson (2004) noted another problem associated with the use of GMP is no standard form of contract with the myriad of custom contracts that likely causing

confusion and conflict. The other problems may also include who should be responsible for the errors and omissions in documentations, latent conditions, and disruption due to industrial actions, delays (beyond the control of the contractor) and changes to statutory regulations. Therefore it is recommended that a standard list of items should be developed to ensure that the parties consider them before entering into a GMP contract.

MAJOR COMPONENTS OF A GMP CONTRACT

GMP contract

The basis of administering a GMP contract is usually stated in the contract documents. Due to the absence of detailed and complete tender documents such as a complete set of drawings during the tendering process, negotiation of the contract becomes the primary mechanism between the client and the contractor to form the contract. GMP contract is therefore unique as the various documents transmitted during the derivation of GMP form the part of the Contract Documents. The basic documents of a GMP contract shall include (Lee 1995):

- Letter and Award
- Breakdown of GMP sum
- Summary of Inclusions and Exclusions
- Summary of Scope of Works
- Preliminary Architectural, Structural and Landscape Drawings
- Structural Investigation Report
- M&E Performance Specifications

GMP is estimated based on preliminary design documentation provided by client and his team of consultants (Chan, et al., 2007). The pricing of GMP contracts usually comprises:

- Cost for main contractor's direct works (e.g. substructure works, reinforced concrete superstructure works, finishes works, etc)
- Domestic subcontractor's works packages
- Provisional quantities
- Provisional sum
- Contingency for design development

The information provided in the tender documents is not sufficient for construction and completion of the works. The contractor is thus allowed in his tender pricing for design development. Further design information will be provided by the client and his team of consultants after the GMP is agreed and issued to the contractor (Turner, 2002). GMP contract generally comprised two basic components; they are "Non Adjustable Cost Portion" and "Adjustable Cost Portion".

Non adjustable cost portion

Although the project brief and the design drawings were incomplete or insufficient for construction and completion of the whole works, the basic scope of the proposed works and their requirements shall be adequately described and defined. The Non Adjustable Cost portion is not subject to any adjustments for any increase or reduction in cost irrespective of actual cost for the works unless there are variations to GMP that were termed as scope changes (Lee, 1995). It is similar to fixed price lump sum contracts without quantity and it comprises components such as preliminaries, cost studies design fees, method statement fees, coordination fees and so on.

As the design is yet to be fully developed by the project team, the contractor is significantly required to make sufficient provisions for design development with the knowledge that after the agreement and award of the GMP The Non Adjustable Cost also included the Contractor's compliance with the stringent planning requirement and fire safety regulations (DLS, 2004).

Adjustable cost portion

Adjustable Cost Portion is for works that are not fully defined during the tender stage. These are typically subcontract works that fixed prices are not readily available during the formulation of GMP. These specialist works, under the control of the head contractor, are to be packaged and tendered to trade contractors. The savings, if any, will be returned to the client and contractor at the end of the project as GMP contracts may provide for sharing in any savings from the GMP allocation (DLS, 2004). However, the methodology to adjust the adjustable cost sum is subject to reduction only. It means that the total actual cost within the Adjustable Cost Portion is less than the sum allocated in the GMP. As indicated by several researchers, the saving sharing mechanism will accrue to the client because it may be argued that if the contractor intends to earn a share in the saving, the GMP that he/she first set may be high in an attempt to have a share in the saving at the end of the project. As a result, the client pays the maximum sum subject to any additional requirement which can only be modified by scope change initiated by the client. If the maximum threshold is unfortunately reached, the contractor has to bear the entire cost.

Variations

The major problem being encountered is the definition of „variations'. In fact, the definition of variations is tremendously difficult to manage. It sometimes leads to disputes due to the variations that have a noticeable impact on the final sum of the project.

There are mainly two types of variations in a GMP contract. The first type of variations is arisen from the design development for which Contractor is deemed to have made provision for within the design risk allowance. Architect's instructions normally will not affect the GMP as it has been included in the provision which is pre-estimated regarding the detail of scope of work is given to the Contractor. On the other hand, the second type of variations to the GMP is scope change. It only occurs when the architect's instruction fall into the situations of materially changes the overall floor plan area or building volume; materially changes the use of an area, and materially changes the level of quality of an area to a higher level of specification from the standard reference (Tay et al. 2000).

Costs components in GMP

The contractor not only has to provide the total fixed costs and provisional costs, but also has to include the profits and overhead in a reasonable percentage. It also shall include costs associated with:

- Performance and payment bonds
- Liability insurance
- "Risk Premium" (Optional)
- Contractor Permit Allowance
- Construction contingency
- Professional fees

On the other hand, the exclusions are also need to be specified. Below are some of the examples of exclusions:

- Permanent diversion of services
- Utilities connection fees
- Furniture, fittings and equipment items other than those specifically highlighted in the contract.

In the *General Conditions* of a sample construction contract in Adelaide, South Australia, the client does not expect any change order for an increase in costs as GMP only introduced into the contract when the works were 80% completed. Management Contracting has been adopted where the client employs the contractor to coordinate the work packages and to subsequently enter into works contracts with the trade contractors. It is limited to the sums of preliminaries and profit to be quoted throughout the project. Therefore, overhead will be included but are not limited to the followings:

- Mobilization
- All indirect salaries for all Construction Manager's employees or consultants who will be involved in the Project

- All expenses establishing and running the field office, including telephone, copier, two-way radios, travel, etc
- Any miscellaneous tools or materials required for the job
- All reproduction of documents, surveyor services, testing/inspections, and safety programs/equipment
- All cleanup of site and adjacent areas, including final clean up
- Allowance for additional temporary protection/concealment of construction activities if required
- As-built drawings on paper
- Demobilization
- Indirect expenses required for operation of the Contractor's business and all indirect expenses that may be incurred as a result of the performance of the work under Project

IS THERE A NEED FOR A GMP STANDARD FORM?

Currently there is no standard form of contract classified as GMP. In fact, GMP is a method of project delivery rather than a type of lump sum contract (Haley and Shaw, 2002). The current practice of setting up a contract for GMP is to adapt a traditional standard form with amendments and special requirements to the general conditions of contract (Haley and Shaw, 2002). Another alternative to the client is to produce a bespoke contract. For contractors who market themselves on the fundamental of GMP normally produce their own contract form (Longworth, 2008). A typical example of this is when a Design and Construct contract (AS4000) is used, special conditions related to the formulation of GMP will be added. Any additional risks are then included into the contract scope (Perkin, 2008).

Davis and Stevenson (2004) stated the reason of not having a standard form of GMP is that the contract was generally drafted and administered by the client's representative. It is thought what the contract said may not be what it was actually asked by the client. Nevertheless, there is one which comes the nearest is the FIDIC 4th Edition Red Book, 1999 for use on international projects and although it is not titled as a GMP contract and this is an obvious intention (Longworth, 2008).

Regardless of which standard form is to be used, the fundamental principle remains the same. Both client and contractor must fully understand what risks they are assuming. Open discussion about these points should be held so that the components and price in the contract is clarified and understood (Haley and Shaw, 2002).

From the literature, the Australian Construction Department is increasingly being asked by contractors and clients to set up a GMP standard form which includes the option to use cost reimbursable pricing mechanisms. The standard form should be drafted on a partnering ethos of contracting based on pre-agreed charter of good faith between the parties to effectively cooperate to achieve project's goals. Generally, the agreement is based on trust, respect, open and regular communication and procedures to deal with implementing contract mechanisms include dispute resolution.

Therefore, a standard form of contract is considered necessary for GMP projects as it would provide consistency, in contrast to the current situation with a myriad of hybrid and custom contracts in use (Davis and Stevenson, 2004). Moreover, standard forms have been tried in the courts and thus the meaning of the clauses has been tested, and thus solutions will be clearer if things go wrong. In other words, a standard form normally states risk and responsibility allocations clearly hence they must be accepted by the entire contracting parties (Haley and Shaw, 2002).

RESEARCH METHODOLOGY – A CASE STUDY IN SOUTH AUSTRALIA

In order to understand the real issues of a GMP contract in practice, a detailed case study of a recent completed project was conducted through a face-to-face interview with a building procurement manager of a major contractor in Adelaide. The interviewee has 20 years of working experience in the construction industry and came across 7 projects that used the GMP approach. It was a project of Conversion of Former Government Building into Flats. The project particulars are given in Table 1:

Table 1 – Project particulars

Procurement Method	GMP by Design and Construct through selective tendering and based on amended AS 4000 - 1997
Partnering Process	Nil
Pain/gain-share	50/50 gain-share arrangement
Reason of Disputation	Confusion over the definition of the term "Works"

Nature of project

This case study was conducted on a unique and landmark type project involving participants with a reasonable level of previous experience with GMP projects. The method of tendering was selective, in which no partnering was adopted. The procurement mechanism of this project adopted Design and Construct tender approach. It was an arrangement for a 50/50 gain-share agreement incorporated into the procurement process. No pain-share arrangement was stipulated on this project, with any overrun of budget

solely taken on by the contractor. Time was a major factor on this project as construction had to be undertaken within certain dates in the year.

Methods of setting up the GMP contract form

This case will illustrate the difficulties which can befall a contractor who enters into a GMP contract. The parties entered into a contract for the conversion of a former government building into flats, including parking and commercial units on the ground floor. The contract was extensively amended based on the AS4000-1997. In particular, an Article A had been added, which provided for a GMP for the carrying out of the contractor's obligations under the contract. Article A also stated the additional risks and responsibilities of the contractor which were to be contained within the GMP at a considerable length.

This included that the contractor had satisfied himself as to all risks which might influence or affect the carrying out of the works. These embraced incorrect or insufficient information having been provided to the contractor, any inadequacy or inaccuracy in drawings or specifications, and any other matter irrespective of whether it was foreseeable at the time of entering into the contract. This represented a high level of risk in view of the fact that the work involved the conversion of a building which was almost 100 years old.

One of the primary motives for using GMP procurement method was to secure that the contractor would be responsible for the entire construction activities and accordingly that the incidence of contractor's claims would be greatly reduced.

Issues of disputation

The problem came up once the contractor was issued by the employer’s agent of an instruction to carry out the repairs of the concrete perimeter beams within the existing building. In the beginning, it was intended prior to the execution of the contract that tests should be carried out on the structural components, especially with such an old building, to determine their integrity and load bearing capacities. However, no actual investigations had been carried out and no provisions had been prepared for such investigations in the contractor’s Proposal. It is not surprising that such a problem gave rise to delay and additional costs incurred by the contractor on such a large and complex refurbishment project. It was argued on behalf of the contractor that there was no specific reference in the Employers Requirement or the Contractor Proposal to the concrete repairs which he was entitled to pay for the work over and above the guaranteed price.

Mutual discussion

A special session had been held for the entire parties involved in this project to discuss who should be responsible for the delay and additional costs incurred. The contractor spelt out that there was no knowing what the contractor might have encountered. The existing structures and foundations, despite a proper pre-contract survey, might have proved to be insufficiently robust to carry the load and to have required strengthening. Commercial organizations who purchased this old property could not sensibly expect to transfer all the risk of the suitability of the property for conversion on to the contractor. On the other hand, the client reckoned that Article A which placed all risks onto the contractor deprived them of any right to additional payment. Furthermore, in finding against the contractor that within the schedule of the guaranteed maximum price, there was nothing to displace the ordinary and unambiguous meaning of Article A that the risk of unforeseen defects in the existing building was the responsibility of the contractor. Without an agreement at the end of the meeting, both parties agreed to refer this matter to arbitration.

Arbitration

After reviewing the entire contract documents especially the Article A and the hearing of both parties, the arbitrator concluded that it was irrelevant to assume the contract made no specific reference to concrete repairs. In his opinion, the contract contained clear terms for the risk allocation for such unforeseen conditions. He held that all the direct and consequential delay and costs arising from the concrete repairs should be borne by the contractor in his GMP contract. However the contactor did not agree and put forward an appeal to the court for justice.

Appeal

The contractor argued that the risks they had accepted by reference to one of the clauses and elsewhere in the contract were to be contained within risks arising in connection with the Works. The term 'Works' was clearly defined in the contract and the contractor contended that the repair works to the existing concrete perimeter beams should not form part of his 'Works' under the contract. The contractor also argued that Article A entailed acceptance by it of additional risks and responsibility to that accepted under the other provisions of the contract, but not the risk of rectifying at its own expense any unforeseen defects in the existing building adapted by him.

Implication

Since there was no pain-share arrangement in this project; it meant the cost overrun had to be solely taken by the contractor. Therefore, the contractor appealed the matter to court. The Judge however did not accept this proposition. In his judgment, he indicated that the provisions of Article A clearly allocated the scope of unforeseen or unknown risks to the contractor. Before tendering, the contractor should have considered the information available about the existing building. Moreover, the tendering contractor was to be expected to ascertain the building conditions and to take-up a commercial risk as to the extent of the limited information available.

The judge further noted that in any contract with a significant design element at the interface of a building into the ground or on to an existing structure, it was important to allocate the risk of the unforeseen or to ascertain any degree of risk arising out of the ground conditions or existing structure. Consequently, the contractor's appeal failed and he had to solely bear the additional costs incurred by the concrete repair works.

Lessons learnt

From the commencement to the end of the lawsuit, both parties had spent approximately three years to come to the conclusion, it was time consuming and expensive. In general, the court will not interfere with risk allocation clauses unambiguously written into construction contracts by which the risk of unforeseen events is transferred to one party. However, it is not uncommon for a contract to include in its heading „Guaranteed Maximum Price'. The fact that this heading exists does not in itself mean that the contractor, except for scope changes, has taken on all risks. Since there is no standard form of GMP contract, clients on domestic projects that require a GMP are left with either amending an existing standard form or having a bespoke contract specially drafted. The one which comes the nearest is the FIDIC Silver Book for use on international projects and AS4000-1997 or AS2124-1992 for domestic projects. Contractors who market themselves on the basis of GMP usually produce their own form of contract.

The interviewees suggested that contractor tendering for a GMP contract should be very cautious about the wordings of the contract and to check if the client has transferred all risks to the contractor. It is not unusual to find that matters such as increases in cost due to changes in legislation fall outside the guaranteed price and will be paid for as an extra. Therefore it is time for a standard form of contract for GMP projects to be produced as it would provide consistency and allocations of risk to both parties.

CONCLUSIONS

This research has completed an analysis on the current GMP practice in the South Australian construction industry via a case study approach. As the use of GMP contracts becoming popular, this study provides industry professionals, academics and construction students with a greater understanding of the problems and risks associated with GMP contracts. The current practice of setting up a contract for GMP is adapting a traditional standard form with amendments and special requirements to the general conditions of contract. In order to obtain consistency and minimize the risks for contract administration, a standard form of GMP has become necessary.

The fundamental principle remains the same. Both client and contractor must fully understand what risks they are assuming. Open discussion about these points should be held so that the components and price in the contract is clarified and understood before signing the contract.

REFERENCES

Boukendour, B. and Bah, R. (2001) „The guaranteed maximum price contract as call option', *Construction Management and Economics*, vol. 19, pp. 563 – 567.

Chan, D.M., James, M. and Wong. (2007) „Evaluating guaranteed maximum price and target cost contracting strategies in Hong Kong construction industry', *Journal of Financial Management of Property and Construction*, vol. 12, pp. 139-150.

Chan, D.W.M., Chan, A.P.C., Lam, P.T.I., Lam, E.W.M. and Wong, J.M.W. (2007) „Research Monograph: *An investigation of Guaranteed Maximum Price (GMP) and Target Cost Contracting (TCC) procurement strategies in Hong Kong construction industry.*' The Hong Kong Polytechnic University, October.

Davis Langdon & Seah Singapore (DLS). (2004), „Guaranteed Maximum Price Contracts', *Executive Summaries for the practitioner,* vol. 4(1), MITA (P) No 051/01/2004.

Davis, P.R. and Stevenson, D. (2004) „Understanding and Applying Guaranteed Maximum Price contracts in Western Australia', *in proceedings of Australian Institute of Project Management 2004 National Conference*, Perth, 10-12th October 2004, Australian Institute of Project Management, Perth.

Gander, A. and Hemsley, A. (1997) Guaranteed maximum price contracts. *CSM*, pp38-39.

Haley, G. and Shaw, G. (2002) *Is "Guaranteed Maximum Price" The Way To Go?*, Cannonway Consultants Ltd., Hong Kong.

Kaplanogu, S.B. and Arditi, D. (2009) „Pre-project peer reviews in GMP/lump sum contracts', *Engineering, Construction and Architectural Management*, vol.16, pp.175-185.

Lee, D. (1995) „Guaranteed maximum price contract: the Singapore experience', Singapore Institute of Surveyors and Valuers, Singapore, pp 1-7.

Lim, H.K. (2001) Perspective of the construction industry on Guaranteed Maximum Price (GMP) contracting, unpublished thesis, University of South Australia, Australia.

Longworth Consulting Worldwide Limited, "Guaranteed maximum price construction contract form for contractor.' accessed 02/08/2009 http://www.longworthconsulting.co.uk/news%20construction%20contract%204.htm.

Mills, R.S. and Harris, E.C. (1995) Guaranteed maximum price contracts. *Construction Law*, no. 573/95, 28-31.

Perkin, T.S. (2008) *An evaluation of Guaranteed Maximum Price (GMP) procurement strategies and performance in the South Australian construction industry*, unpublished thesis, University of South Australia, Australia.

Tay, P., MCauley, G. and Bell, B. (2000) „Meeting client's needs with GMP', *The Building Economist*, June, 4-5.

Turner, J.R. (2002) Farsighted project contract management: incomplete in its entirety, *Construction Management and Economics*, vol. 22, pp75–83.

Developing Teaching Models for Teaching in Larger Group Master Programs

Dr Janet Xin Ge and Dr Perry Forsythe
Faculty of Design, Architecture and Building
University of Technology, Sydney, Australia

ABSTRACT

Students enrolled in the Master Programs at the School of the Built Environment, University of Technology have vastly different cultural background and come from diverse contexts and experiences. A significant and substantial increased in the number of students in the Master programs over the previous years have raised issues of teaching quality, students satisfaction and administrative problems. Many existing literatures have discussed issues of large class teaching for undergraduate students. This study concerns teaching models of large class for Master students in Australia. The investigation begins with exploring good practices of Master Programs teaching in large class size from NSW universities through CEQ score. Questionnaire is developed and interviews are conducted to the selected participants. Collected data are then analysed for developing teaching models for the Master Programs. The findings suggest that students' satisfaction can be maintained with large classes teaching when large group lectures followed by small group of tutorials, tailored-making teaching methods are used and timely assessment feedback are provided.

KEYWORDS

large class teaching, student satisfaction, CEQ, Master Programs, Australia

INTRODUCTION

The demand for Higher Education has increased worldwide accompanying a change in political and social environments in nowadays (Trow, 2005). An outcome of the increased demand is large class teaching which is more complex than teaching in small class. The problems associated with large classes vary with the discipline, the nature of the class such as lecture, tutorial, lab work or workshop, and perception of the lecturers and students (Ramsden, 2008). Academics have to deal with more diverse population of the students, difficult to engage and communicate with other staff and students and have greater administrative issues for a large class (Eccles, et al 2008).

The Master Programs, namely, Master of Planning, Master of Project Management and Master of Property Development, is housed within the School of the Built Environment

(SBE), University of Technology Sydney (UTS). The courses are unique and well received because the courses are practical orientated. There were large student numbers, i.e., more than 120 students in a class for the first year Master classes. Students enrolled in the Master Programs have vastly different cultural backgrounds and come from diverse contexts and experiences.

The large class teaching has highlighted a number of issues and concerns for the teaching staff to manage their teaching. Some of the feedbacks from lecturers highlight issues in large class teaching:

- An appropriate teaching and learning environment is difficult created;
- Little opportunity for arranging student interaction in large class lecture;
- Time consuming and effort needed for providing in time assessment feedbacks to students;
- Resources required and timetable difficulties for arranging independent learning activities such as tutorials;
- Difficult to support English as second-language students and help with their special needs.

The identified issues are consistent with problem findings from other universities (Tolhurst and Baker, 2003; Eccles, et al., 2008). Large class teaching could discourage students' learning activities and result in lower student satisfactions on their learning. In addition, some administrative issues, such as additional involvement of resources, reconstruction of course and teaching team, balance of costs and benefits of revenues, effective management system and staff training requirements must be faced in large class teaching. Developing appropriate teaching models that enhance student learning in large class environment and maintain student satisfactions are challenges.

This paper explores the successful strategies that can be adopted for large class teaching in the Master courses at the School of the Built Environment. The paper is organised in the following sequence: a) reviewing literature with regards to the problems and effectiveness of learning and teaching in large classes; b) discussing research methodology to address the problems; c) developing teaching models for the Master Programs and then concluded.

LITERATURE REVIEW

The central theme of the literature over the last decades focuses on students' expectations of their educational experience (Gibbs, Lucas and Simonite, 1996; Biggs and Tang, 2007). Larger student population and diversity has changed the idea of set goals and single experience (Ramsden, 2008). There are benefits of teaching large classes, such as plenty of students for interaction and a rich variety of human resources. However,

problems of control and management are challenges built in with the large classes (Hess, 2001). Myron-Wilson and Smith (1998) identified the influence of class size on teaching and learning and the effects that class sizes have on student satisfaction, self-esteem or attitudes to study. According to the research findings of Teaching and Educational Development Institute (2001), large classes lead inevitably to increased diversity and complexity, in particularly, the problems associated with a greater administrative burden, difficulties in communicating, promoting active participation and monitoring student progress. Thus, large classes undermine the quality of teaching and detract from the learning experience of the students. Stork (2003) advised that lecturers often found difficulty in creating a teaching environment that meets students' needs in large classes. The contextual difficulties such as divergent instructor personalities and teaching styles often reduce effective teaching results in classes where each student prefers a different learning approach (Schlee, 2005; Cope and Staehr, 2005). Athiyaman (1997) identified class size, level and difficulty of subject content, and student workload are the main determinants of student satisfaction.

Students' preferences of class size and concerns about the impact of class sizes on their learning depends entirely on his/her previous experiences (Myron-Wilson and Smith, 1998). Feigenbaum and Friend (1992) suggested that first year psychology students usually favour the greater interaction involved with small classes and more experienced students tend to prefer large class teaching. The findings was confirmed by the research of Papo (1999), who conducted a survey to 246 undergraduate second to fourth year students from various faculties and investigated learning problems associated with class size.

Herington and Weaven (2008) encourage a student-centred approach which enhances student learning experiences in classes. A student-centred approach is focused on the student's needs, abilities, interests, and learning styles with the lecturers as a facilitator of learning (Barr and Tagg, 1995). A multiple-models approach to teaching students was suggested by Joyce et al (2000) as large classes usually mean a wide range of student backgrounds and abilities. Some teaching methods such as tutorials and laboratories are impossible to implement in large classes; unless the large classes are broken up into small groups.

The relationship between learning approaches, student satisfaction and student results were analysed by Biggs (2003) (Refer to Figure 1) and investigated commonly by opinion surveys and student ratings of teaching efficacy (Crittenden, et al. 1975; Feldman, 1984). Gibbs, et al. (1996) argued that these measuring tools provide information on student satisfaction and rating of teaching only. There are also fundamental biases inherent in the

interpretation of students' ratings of their classes because many students express satisfaction for variables unrelated to those being measured.

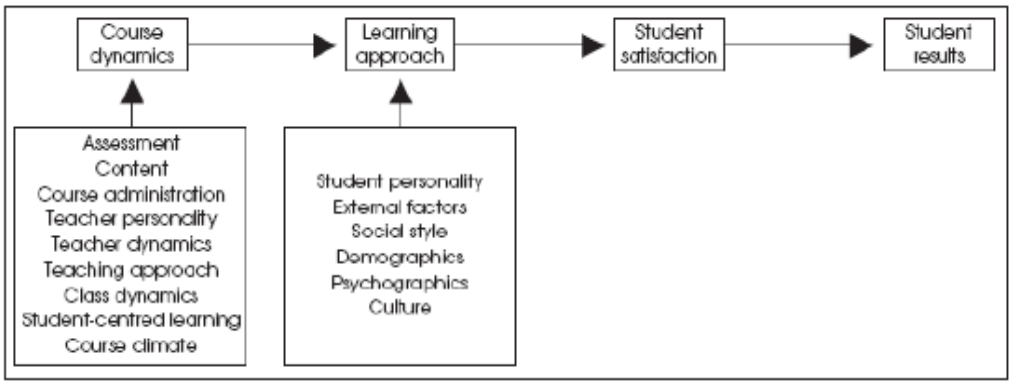


Figure 1 – Factors impacting student approaches to learning (source: Biggs, 2003)

Gibbs, et al. (1996) and Kelly (2001) suggested that a major problem faced by students in large classes is the scarcity of learning resources included both material and human. Examples of scarcity of material are the over-crowded computer and science laboratories and limited access resources. Students' performances in large classes are affected by difficult access to tutors and slow and minimal feedback on assessment. To improve teaching efficacy, the utilising of internet could be one of the innovative technologies to support large classes learning and teaching. Freeman (1996) reported the outcomes of an internet trial for enhancing the learning environment on various university stakeholders, i.e., academic managers, staff and students. He found that utilising the internet would improve staff-student interactions, student access to learning resources and assessment in large classes. Housego and Freeman (2000) presented five fictional case studies for undergraduate business courses and concluded that technology supported teaching i.e., employing web based learning (WBL) tools into the teaching environment, can be effective and improve student learning outcomes.

The continued provision of quality teaching in large classes and the maintenance of student satisfaction are important because student performance is linked to influences, such as feelings of inclusion and value (TEDI, 2001). Much of the research in this area is dated and focused on undergraduate rather than Master studies or the higher education system in the USA and UK, rather than Australia. In Australia, Master students are often mature, have a few years working experiences and expect to learn relevant knowledge in depth through reasoning and discussions. In particular, Master students in the disciplines of built environment tend to focus on practical applications rather than theory in nature, such as feasibilities studies, Case analysis, modelling and methods of risk mitigations on

projects. The teaching models for large undergraduate classes may not be appropriate to the Master students. This paper will address large class teaching of the Master Courses in Australia. The research and findings could contribute to existing knowledge by filling a 'gap' in knowledge of large class teaching at Master level students in Australia.

RESEARCH DESIGN

This research is designed to learn experiences and practices in large class teaching within UTS and the universities around Sydney. The findings are then studied and analysed. The strategies that can be applied in the Master Programs at School of the Built Environment UTS are drawn for testing. The rationale for the research design is that lecturers face the same challenges in large class teaching and students' satisfactions on learning experiences are influenced by class sizes. This research methodology is consistent with targeted sampling followed by a case study methodology (Yin, 1984, p.23). Empirical inquiry is used in a contemporary and real-life setting to provide the basis for the application of ideas that bring an improved understanding of complex issues (Utexas, 2009). Accordingly, the research involves identifying similarly large class teaching in Master Programs within UTS and other universities. Questionnaire for interviewing academic lecturers involved in large class teaching is then developed. The responses of questionnaire and interview are studied in-depth. Models adopted in the Master Programs at the School of Built Environment UTS thus can be developed. Figure 2 depicts the research framework.

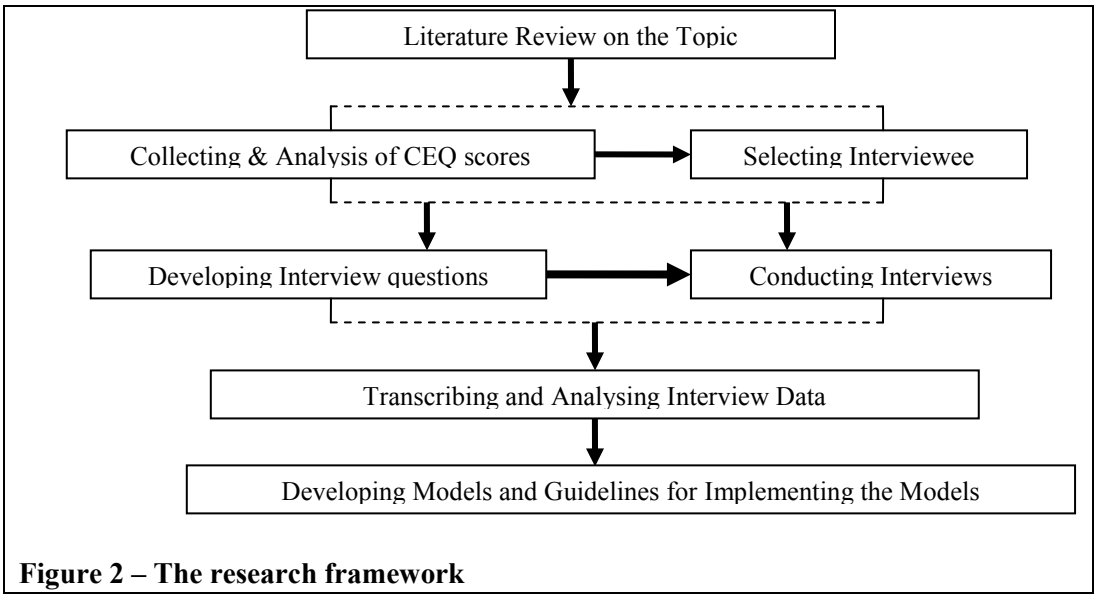


Figure 2 – The research framework

Selecting participants and interviewees

Published Course Experience Questionnaire (CEQ) scores are used as criteria for selecting the Master Programs and Universities to participate the research. The CEQ is the national survey of all university graduates conducted annually by the Graduate Careers Council of Australia (GCCA) that provides a national performance indicator of the quality of teaching and the major source of comparative data on student satisfaction with the overall course experience (Mclnnis, et al., 2001). The higher the CEQ scores are, the higher the student satisfaction; the better the teaching practice and stronger the management support to students. Forsythe and Zou (2005) used the CEQ scores to study on improving student satisfaction in undergraduate construction management studies. By analysing the CEQ results, the best teaching and learning Master Programs which have the strongest conceptual similarity with the professional and management oriented degrees' Master programs in the School of the Built Environment (SBE) can be identified and selected for this study. The 2008 published CEQ scores from NSW universities were collected and used for this study.

The 2008 CEQ scores of overall student satisfaction for universities in the New South Wales Australia are shown in the Table 1. This research concerns large classes for Master students undertaking Built Environment courses. Thus, three principles are considered for selecting the interviewees, i.e., (1) Large class teaching; (2) Relevant or similar field of study; and (3) the higher CEQ score. Seven members from the University of Wollongong (UOW) and the University of New South Wales (UNSW) were selected as the universities received the higher student satisfaction level for both undergraduate and postgraduate programs. In addition, six UTS members from the large programs in the School of Business and Engineering were also selected for the study.

Table 1 – Overall CEQ scores in 2008 in Australia (source: UTS database)

Name of the university	CEQ UG	CEQ PG	CEQ Programs with large class teaching
Uni of New England	59	55	
University of Wollongong	**53**	**51**	Business, Admin & Economics (47) Law (54), Engineering, surveying (50)
Southern Cross University	34	40	
Charles Stuart University	35	39	
Uni of New South Wales	**42**	**39**	Civil engineering (39) Business (40)
The Macquarie University	38	37	Architecture (50)
University of Newcastle	30	34	
Uni of Technology Sydney	**34**	**34**	Engineering, surveying (42) Business, Admin & Economics (35)
University of Sydney	36	33	
Uni of Western Sydney	36	32	Building (50)

The data collected for research is considered valid because the interviewees include all level of academic staff such as Dean, Head of School, Associate Professors, Senior Lecturers, Lectures and Casual Lectures, who have experience in large class teaching. Also, the interviewees are represented in variety discipline areas, crossing business, engineering, property, law, planning and project management in the respected and reputable Master Programs of NSW universities.

Developing questionnaire

Interview questionnaire was developed in accordance with literatures. There are two parts of questions in the developed questionnaire. The first part of the questionnaire constitutes eleven generic questions included general information of the participants and program involvement. Examples of the questions are:

- Name of respondent and position
- Name of educational program
- Name of university
- How many full time lecturers in the program?
- How many part time lecturers in the program?
- How many administrative staff in the program?
- With your best knowledge, what is student/staff ratio in the program?
- What is average coordinating and marking role for each staff?
- What are the roles of a course director?

The second part of the questionnaire contains forty one questions including quantitative and qualitative inquiry what teaching methods and strategies they have adopted in the large class teaching. Questions on student numbers, student to staff ratio, staffing combination, creative use of digital and other innovative forms of learning are included. Some sample questions are:

- What is name of the subject/unit and code number?
- How many students in the subject?
- What is the mode of teaching?
- Are you used to and comfortable in teaching large classes?
- How the subject is delivered?
- Do the students need extra attention and how do you support them?
- What help do you have to teach your large class?
- How do you assess your students?
- What do you rank as the most important thing to assess?
- Do you do all the marking?

- How do you provide feedback?
- What major problems are experienced in teaching large classes?
- What support is provided to you?
- Has student performance diminished with teaching large classes?
- What strategies have you adopted to assist you when teaching your large class?
- What is the relationship between class size and student feedback rating, such as Student Feedback Survey?

Unstructured interviews were also undertaken during August to November 2009. The answers from interviews were recorded both on the questionnaire sheet and voice recorders. Both these sources of data were organised into a coherent set of answers for each respondent. The answers then were sorted, compared and analysed.

A detailed contextual study of collected information from the selected Masters programs is analysed and then expressed in terms of strengths and weaknesses as well as relationships among the strategies used – as compared to the SBE Masters programs. Models and the guidelines for implementing these models of teaching and learning for large classes that concurrently maintain high levels of student satisfaction will be developed.

RESEARCH FINDINGS AND DISCUSSIONS

Five questions are selected for discussing and analysing as examples of the entire research in this paper.

What size of students is constituted a large class for your subject?

A large class constitutes 40 to 120 students were advised by the participants. This is consistent with the literature which indicated more than 50 students constitute a large class (UNESCO, 2006. p.01). The findings suggest that the perception of what is a large class depends on lecturers' prior teaching experiences. Lecturers who began their career teaching from small classes may find it difficult to adapt teaching in large classes in the later years. Conversely, lecturers who began teaching large classes would progress to adapt easily to teaching even larger classes.

According to Biggs and Tang (2007), the major factors associated with the large class teaching are:

a) Planning and teaching
b) Planning and conducting assessment
c) Administration and management
d) Tutoring and demonstrating

Each of these factors needs serious consideration while designing strategies for teaching in the large classes. Lecturers are required to adapt their teaching and instructional practices to suit a variety of learning profiles and learning outcomes (Subban, 2006) in large diverse classes because individuals do not learn in the same way (Fischer and Rose, 2001). However, lecturers can generally perform their core duty of knowledge delivery if they are supported with the workload such as preparation of laboratory equipment and uploading documents on systems by others (Biggs and Tang, 2007).

How do you deliver your lectures and in what way are they supported?

Tutorial, small group work, problem-based learning and online support through WebCT, discussion board and emails are identified by all the interviewees. Other identified methods include demonstration, online quizzes, computer labs and case studies.

Learning styles can be caused by diversity of culture background (Garger and Guild, 1998). Herington and Weaven (2008) studies methods of improving the learning styles and outcomes of first year university students within large class environments using action research approach. They found that a more student-centred (self-regulated) teaching style can lead to re-engagement of students and maintain student satisfaction with courses regardless of the employed learning style. They also found that tutorial session may encourage students to be more engaged in class activities, but it does not necessarily promote deeper approaches to learning.

Universal Design for Learning (UDL) and Differentiated Instruction (DI) are the two contemporary education practices addressed the diverse learners. According to CAST (2006), the UDL is ‚a framework for designing curricula that enable all individuals to gain knowledge, skills, and enthusiasm for learning'. A universally designed curriculum has been specifically designed, developed, and validated to meet the needs of the full range of students (Hitchcock and Stahl 2003).

Differentiated instruction was suggested by some researchers as positive outcomes that can be produced. Differentiated instruction refers to ‚teaching that is adapted to take into account the range of individual differences and needs of students in any one classroom' (van Kraayenoord 1997). Under this teaching method, the curriculum, teaching structures, and teaching practices can be modified to ensure that instruction is relevant, flexible, and responsive, leading to successful achievement, and the development of students. Johnsen (2003) studied the effects of using differentiating instruction to suit students with different ability levels and found that the use of differentiated techniques proved to be engaging, stimulated student interest and provide a gratifying experience for the undergraduate teachers.

Assessment tasks in the taught postgraduate courses

A major factor that contributes towards the satisfaction of students and lecturers is the assessment of grades for the students (Biggs and Tang, 2007, p.232). Individual assignments, group projects and final examination are commonly mixed mode assessments in the Master courses.

Assessment is a central element in the overall quality of teaching and learning in higher education and an integral component of a coherent educational experience (CSHE, 2011). Well designed assessments are usually included, clear expectations, established, reasonable workload, and provided opportunities for students to self-monitor, rehearse, practise and receive feedback. Essays, group projects and presentations had become to dominate the pattern of student assessments, instead of examination. This is because lecturers believe that the assessment methods stimulate students to more effective learning. However, lecturers are stressed out from the volume of marking required with large classes (Ward and Jenkins, 1992). Marking becomes an enormous task and some lecturers need to spend their weekend marking students over 100 scripts.

Students expect to see a clear relationship between lectures, tutorials and other resources; and how grades are determined, as well as timely feedback. Students would be satisfied when the feedbacks have explained the grade they have received and suggestions for how they can improve (CSHE, 2011). Lecturers usually found it difficult to provide timely feedback to individual students in large classes.

Do large classes make you feel that some students need extra support?

Large class teaching has limited lecturer's ability to interact with students in their class. Ten out of thirteen interviewees assume that some students need extra support. The identified points of needing extra support are: (a) students with language difficulty; (b) individual learning ability and learning style; and (c) different in previous skills and experiences. It is obviously difficult for lecturers to provide additional support for all students in a large class. Techniques of how do lecturers support students in need in large classes are thus required for further investigation.

Student performance has diminished with larger class sizes

Table 2 shows that eight out of thirteen interviewees (61.5%) agreed that student performance has diminished with large class teaching, two of the interviewees said „No', two answered "Depends" and one showed "Neutral'. A similar question was asked „Student grades and grade distribution have changed with larger class sizes'. Seven out of thirteen ticked "Yes" and another six responded "No". However, there were eleven out of thirteen (84.6%) answer "Yes" on a question „The quantity, duration and cognitive level

of interaction among students and lectures have declined as class size increased' and only two rejected the claim.

Table 2 – Student performance has diminished with larger class sizes

	YES	NO	OTHERS (Depends)	NEUTRAL (Maybe)
E1	✓			
E2	✓			
E3			✓	
E4	✓			
E5	✓			
E6	✓			
I7				✓
I8	✓			
I9			✓	
I10	✓			
I11		✓		
I12	✓			
E13		✓		

In term of a question on „whether a negative relationship between class size and student ratings', among the 13 responses, seven indicated „Yes', four showed „No' and two ticked „Depends'. The results are consistence with findings of Feldman (1984), who conducted meta-analysis of literature and found 22 studies showing a negative relationship between class size and student ratings, 11 with curvilinear relationship, 2 studies reporting no significant differences, and 2 reporting a positive relationship. Feldman concluded that large class size has a significantly negative influence on student ratings of teaching.

TEACHING MODELS FOR MASTER STUDENTS IN THE BUILT ENVIRONMENT COURSES

Learning and teaching quality can be maintained by (a) selecting appropriate lecturing facilities and technology support; and (b) personal contact with and effective feedback to students which is crucial in maintaining students' satisfaction. Based on the findings from respected universities, a new model has been derived for enhancing learning and teaching in the Master Programs for the School of Built Environment.

Large classes followed by small group tutorials

The Master Programs in the School of the Built Environment were usually run by block mode of teaching, i.e., each course runs in twice weekends includes Thursday evening, Friday and Saturday full day. The teaching mode is selected to meet students who are willing to study but they have fulltime jobs. With large number of students in a class,

lecture and tutorial cannot be run together. Thus, large classes followed by small group tutorials have been suggested as the most appropriate teaching structure. Through the tutorials, students are able to interact with lecturers for questions. Principle of relevancy-oriented and practical (Lieb, 1991) can be applied in teaching and learning in Built Environment students because significant learning depends on the perceived relevance to the learner's own purposes (Biddulph & Carr, 1999).

Selecting appropriate teaching methods for relevant topics

Lecturers are advised to select appropriate teaching methods in accordance with relevant topics and adopt the technological tools such as computer modelling, and facilities within UTSOnline as a learning platform. Variety of teaching methods reveals a significant way to enhance students learning for preventing students' boredom (Knox, 1986). Using experiential techniques such as simulations, role plays, case studies, critical incidents, and inquiry teams allows them to filter their perceptions through their own experiences, needs and developmental changes (Galbraith, 1991).

Improving communication and feedback with students

Improved communication and feedback enhance lecturer-students' relationships and contribute to maintain students' satisfaction. Lecturers are also encouraged to provide timely feedback on assessments and build up personal contacts with students. Feedback is most effective if given immediately after a certain action and if it specifically describes a behaviour (Renner, 1999). Feedback is seen as an essential element in the process of learning, not separate from it (Rogers, 1989). Effective, instant and positive feedbacks on their progress (Bassano, 1986) provide students encouragement and direction (Knox, 1986). Most students have limited time to study as they are working in full/part time jobs. To facilitate their learning, positive, and instant response on their assessment and performance enhances their gain from the time constraint.

Improving management support on teaching and learning

Teaching quality cannot be maintained without administrative and management support. There are tensions between increasing class size and preparation time. Appropriateness of facilities to support lecturers is critical, such as software for computer lab tutorial, technology support and tutorial assistance.

SUMMARY AND CONCLUSION

This paper has studied teaching and learning experiences of large classes from selected universities. Teaching models that can be applied to enhance student learning experiences in the Master Programs at the Built Environment have been developed. The paper has

also addressed issues of managing effective teams in order to produce quality of teaching, reducing lecturers' stress and establishing a management system to balance costs and benefits of using resources.

Teaching in a large class involves addressing many of the requirements of good teaching however large class is more complex. Thus this study has identified the crucial issues related to teaching, administration and assessment. Academics have to learn to deal with diverse population of the students in large classes and adopt appropriate teaching models relevant to the subject matter that meet expectation of Master students.

Teaching modes of Master Programs in the School of the Built Environment are much flexible now and have been restructured. For example, core subjects are scheduled to teach twice a year. Large class size can be reduced by separating one group students into two semesters. Lecturers can design teaching mode to suit the subject requirements and students backgrounds. Lecturers are also encouraged to use digital teaching aid for attracting students learning interest.

Models that can be adopted for Master Programs in the School of Built Environment have been developed. The conclusions are that students' satisfaction can be maintained with large classes when (a) the teaching structure is changed to lectures followed by tutorials; (b) appropriate teaching methods are tailored to relevant topics; (c) timely assessment feedback are provided; and (d) administrative support is provided. In fact, some of the subjects have begun to apply the model into large class teaching. The effects of implementing the developed models require further study.

The study is considered timely and significant because it primarily focuses on students' learning and will inform subsequent curriculum renewal. In addition, the findings of the proposed investigation could be a useful reference for extending the experiences to benefit other programs within and outside UTS with similar situations.

ACKNOWLEDGEMENT

The research was supported by the UTS the Vice-Chancellor's Learning and Teaching Grants: Small learning and teaching improvements grant 2009.

REFERENCES

Athiyaman, A. (1997) Linking student satisfaction and service quality perceptions: The case of university education, *European Journal of Marketing*, 31(7), 528-540.

Barr, R.B. and Tagg, J. (1995) From learning to teaching: a new paradigm for undergraduate education, *Change*, 27 (6), 13-25.

Bassano, S. (1986) Helping learners adapt to unfamiliar methods. ELT Journal, 40(1), pp.13-19 in *EEB703 Workplace Learning and Development: Module 1*, Holliday, R. (2000) (ed), Charles Sturt University.

Biddulph, F. and Carr, K. (1999) Learning theories and curriculum, *Teachers and Curriculum*, 3, 31-35.

Biggs, J. and Tang, C. (2007) *Teaching for Quality learning at University*, 3rd ed., Open University Press, Berkshire, United Kingdom.

CAST: Centre for Applied Special Technology (2006) [Online] Accessed 11 July 2007, http://www.cast.org.

Cope, C. and Staehr, L. (2005) Improving students' learning approaches through intervention in an information systems learning environment. *Studies in Higher Education*, 30 (2), 181-197.

Crittenden, K., Norr, J. and LeBailly, R. (1975) Size of university classes and student evaluations of teaching, *Journal of Higher Education*, 46, 461-470.

CSHE: Centre for the Study of Higher Education (2011) Core principles of effective assessment, Australian Universities Teaching Committee, Accessed on 20 Jan 2011 on http://www.cshe.unimelb.edu.au/assessinglearning/05/index.html.

Eccles, M., Pym, J. and Johnston, K. (2008) Initiating a new information systems course: a case study in educational innovation, *The African Journal of Information Systems*, 1 (1), 77-91.

Feldman, K. (1984) Class size and college students' evaluations of teachers and courses: A closer look, *Research in Higher Education*, 21, 45-116.

Feigenbaum, E. and Friend, R. (1992) A comparison of freshman and upper division students' preferences for small and large psychology classes, *Teaching of Psychology*, 19, 12-16.

Fischer, K.W. and Ross, L.T. (2001) Webs of skill: how students learn. *Educational Leadership*, 59 (3), 6-123.

Forsythe, P. and Zou, X.W.P. (2005) Improving student satisfaction in undergraduate construction management studies, Proceedings of AUBEA 2005, QUT, Brisbane, Australia, 4-5th July 2005.

Feldman, K. (1984) Class size and college students' evaluations of teachers and courses: a closer look, *Research in Higher Education*, 21, 45-116.

Freeman, M. (1996) Innovations in teaching & learning: the role of the Internet in teaching large undergraduate classes, Discussion Paper No. 2, Faculty of Business, University of Technology, Sydney.

Gibbs, G. and Jenkins, A. (1992) An introduction: the context of changes in class size, In Gibbs, G. and Jenkins, A. (1992) (eds.) *Teaching large classes in higher education: how to maintain quality with reduced resources*, Kogan Page.

Gibbs, G., Lucas, L. and Simonite, V. (1996) Class size and student performance: 1984-94, *Studies in Higher Education*, 21, 261-273.

Garger, S. and Guild, P. B. (1998) *Marching to different drummers*, 2nd Edition. ASCD Book.

Knox, A.B. (1986) Helping adults learn: a guide to planning, implementing and conducting programmes, Jossey-Bass: San Francisco, in *EEB703 Workplace Learning and Development: Module 1*, Holliday, R. (2000) (ed), Charles Sturt University.

Herington, C. and Weaven, S. (2008) Action research and reflection on student approaches to learning in large first year university classes. *The Australian Educational Researcher*, 35 (3), 111-134.

Hess, N. (2001) *Teaching large multilevel classes*. Cambridge University Press.

Hitchcock, C. and Stahl, S. (2003) Assistive Technology, Universal Design, Universal Design for Learning: Improved Learning Opportunities, *Journal of Special Education Technology*, (18) 4: 45-52.

Housego, S. and Freeman, M. (2000) Case studies: integrating the use of web based learning systems into student learning, *Australian Journal of Educational Technology*, 16, 258-282.

Johnsen, S. (2003) Adapting instruction with heterogeneous groups. *Gifted Child Today*, 26 (3), 5-6.

Joyce, B., Weil, M. and Calhoun, E. (2000) *Models of Teaching*. Boston: Allyn and Bacon.

Kelly, B. (2001) Personal communication, University of Queensland.

Lieb, S. (1991) Principles of Adult Learning, Accessed on 12 Dec 2005. http://honolulu.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/adults-2.htm.

Mclnnis, C.; Griffin, P.; James, R. and Coates, H. (2001) Development of the course experience questionnaire (CEQ), Centre for the Study of Higher Education and Assessment Research Centre, Faculty of Education, The University of Melbourne, Department of Education, Training and Youth Affairs.

Myron-Wilson, R. and Smith, P.K. (1998) A matter of degrees, *The Psychologist*, 11, 535-538.

TEDI: Teaching and Educational Development Institute (2001) Teaching large classes, The University of Queensland Australia, Accessed at 10 Jan 11 on http://www.tedi.uq.edu.au/largeclasses/pdfs/LitReview_1_Diff.pdf.

Papo, W. (1999) Large class teaching: is it a problem to students? *College Student Journal*, 33, 354-357.

Ramsden, P. (2008) *The future of higher education – teaching and the student experience*, The Higher Education Academy, UK.

Renner, P. (1999) *The art of teaching adults – How to become an exceptional instructor & facilitator*, Canada: Training Associates Ltd.

Rogers, A. (1989) *Teaching adults*, Philadelphia: Open University Press.

Schlee, R. (2005) Social styles of students and professors: Do students' social styles influence their preferences for professors? *Journal of Marking Education*, 27(2), 130-142.

Stork, D. (2003) Teaching statistics with student survey data: A pedagogical innovation in support of student learning. *Journal of Education for Business*, 78 (6), 335-339.

Subban, P. (2006) Differentiated instruction: a research basis. *International Education Journal*, 7 (7), 935-947.

Tolhurst, D. and Baker, B. (2003) A new approach to a first year undergraduate information systems, Australian Computing Education Conference (ACE 2008), Adelaide, Australia.

Trow, M. (2005) Reflections on the transition from Elite to Mass to Universal access: forms and phases of higher education in modern societies since WWII. In Altbach P. (Ed.), *International Handbook on Higher Education*. Berkeley, California: Kluwer Academic Publishers.

UNESCO: United Nations Educational, Scientific and Cultural Organisation (2006) Practical Tips for Teaching Large Classes: A Teacher's Guide, UNESCO Asia and Pacific Regional Bureau for Education, Bangkok, Thailand, viewed on 28 August 2009, <http://unesdoc.unesco.org/images/0014/001488/148867e.pdf>

Utexas (2009) The case study s a research method, Retrieved on 19 March 2009 at http://www.ischool.utexas.edu/~ssoy/usesusers/1391d1b.htm.

van Kraayenoord, C.E. (1997) Differentiated instruction, Embracing diversity: proceedings of the 21st national conference of the Australian association of Special Education Inc held at Brisbane 20-28 September 1997 Australian Association of Special Education, Brisbane.

Ward, A. and Jenkins, A. (1992) The problems of learning and teaching in large classes, in Gibbs, G and Jenkins, A. (1992) (eds.), *Teaching Large Classes in Higher Education: How to maintain quality with reduced resources*, Kogan Page.

Yin, R.K. (1984) *Case study research: Design and methods*. Newbury Park, CA: Sage.

Developing a Program Manual for Master Property Courses

Dr Janet Xin Ge
Faculty of Design, Architecture and Building
University of Technology, Sydney, Australia

ABSTRACT

There are increased numbers of sessional staff involved in teaching activities in universities. A Program Director is an academic member who is responsible for teaching and research activities in a university. At the same time, the Program Director has responsibilities to manage staff members and ensure the quality of teaching and students satisfactions on their learning. Exercising leadership with little formal power and limited resource is a challenge for a Program Director where traditional leadership theories may not be appropriate for using. A Program Manual is developed based on a role of Developer, one of the leadership roles in the ICFV model in this study. This paper discusses a need for a Developer role of leadership and illustrates the process which a Program Manual is developed. The study described in this paper contributes to a body of knowledge to inform practice in the area of academic leadership and the application of Developer role of leadership for developing of academic coordinators.

KEYWORDS

program manual, master courses, developer role of leadership, ICFV model, UTS

INTRODUCTION

The Master of Property Development course is one of the largest programs in the School of the Built Environment, University of Technology Sydney (UTS). There has been a significant and substantial increase in the number of students enrolled in these courses over the previous years. The original classes were small groups of 20-30 students but they now have evolved into larger group sizes of 50-100 students or more. The increase in student number has reflected positively on the program's offerings but on the other hand has raised a number of administrative issues and concerns for the teaching staff. These issues include the overall operating efficiency, resistance to the change brought upon the incurred student numbers, logistic issues and also reduced level of support services provided leading to possibly lower student satisfaction. Also, more than half of the subjects are taught by sessional lecturers who are not familiar with academic and operating procedures in UTS. Sessional lecturers are external people from industry or

professions who work part-time as lecturers and are regularly employed on a subject-by subject basis, but not in tenured or permanent positions at UTS. Their performances affect the quality of the learning experiences of students and a successful leadership will contribute higher level of student satisfactions (Davis, 1998). A Program Director provides strategic direction and ongoing coordination (Bennis, 2009), as well as engages in activities that encompass logistics and support are required for the program in maintaining the quality of teaching and sustaining student satisfaction during a period of rapid growth. A Developer role, one of the leadership roles in the ICFV model has been identified and a Program Manual, which provides vital information on policies, teaching and administrative procedures that assists lecturers, in particular sessional lecturers, has been suggested.

This paper discusses a need for a Developer role of leadership and describes how the Program Manual has been compiled and developed to provide guidelines and resource information related to UTS policies, DAB strategic plans, learning and teaching related information for the lecturers. Additional information such as safety procedures and emergency related matters are also addressed. The Manual also provides information on links to websites and lists publications that are relevant to the courses. The paper will be presented in the following sequence. First, a literature review on leadership and a Developer role for providing direction and coordination to lecturers; Second, describing the content of the Program Manual, and finally discussions on implementation. This research was supported by the UTS Teaching and Learning leadership program in 2009.

LITERATURE REVIEW

Organisational leadership theory and practice have been well researched (Browning and Van Velsor (1999); Abolio, et al. (2000); Boal and Hooijberg (2000); Zaccaro and Horn, 2003). The early theories tend to focus upon the characteristics and behaviours of successful leaders, whereas later theories begin to consider the role of followers and the contextual nature of leadership (Bolden, et al., 2003). Table 1 is a summary of the evolution of leadership theories.

Table 1 – Eight leadership theories (source: Bolden, et al., 2003 and Cherry, 2011)

Great Man Theories	Based on the belief that leaders are exceptional people, born with innate qualities, destined to lead. The use of the term „man' was international since until the latter part of the twentieth century leadership was thought of as a concept which is primarily male, military and Western. This led to the next school of Trait Theories.
Trait Theories	The lists of traits or qualities associated with leadership exist in abundance and continue to be produced. They draw on virtually all the adjectives in the dictionary which describe some positive or virtuous human attribute, from ambition to zest for life.
Behaviourist Theories	These concentrate on what leaders actually do rather than on their qualities. Different patterns of behaviour are observed and categorised as „styles of leadership'. This area has probably attracted the most attention from practising managers.
Situational Leadership	This approach sees leadership as specific to the situation in which it is being exercised. For example, whilst some situations may require an autocratic style, others may need a more participative approach. It also proposes that there may be differences in required leadership styles at different levels in the same organisation.
Contingency Theory	This is a refinement of the situational viewpoint and focuses on identifying the situational variables which best predict the most appropriate or effective leadership style to fit the particular circumstances.
Participative Theories	The ideal leadership style is one that takes the input of others into account. These leaders encourage participation and contributions from group members and help group members feel more relevant and committed to the decision-making process. In participative theories, however, the leader retains the right to allow the input of others.
Transactional (Management) Theory	This approach emphasises the importance of the relationship between leader and followers, focusing on the mutual benefits derived from a form of „contract' through which the leader delivers such things as rewards or recognition in return for the commitment or loyalty of the followers.
Transformational (Relationship) Theory	The central concept here is change and the role of leadership in envisioning and implementing the transformation of organisational performance.

A transformational approach has been commonly adopted in educational leadership research (Leithwood and Jantzi, 1990; Sheppard, 1996; Turan and Sny, 1996; West, et al., 2000) as the approach is critical to meeting educational challenges in a changing environment (Cheng, 1997). The issues of higher education leadership are important in the sense that academic leaders who now manage institutions with increased numbers of students in many programs (Altbach, 2010). Leadership in higher education includes directions and requirements set by federal and state governments, institutional governance and management and the roles of positional, teaching and learning, research and other leaders within institutions (Devlin, et al., 2010). There is a consistent relationship between a style of leadership and higher levels of student outcomes (Hopkins, 2010).

Many researches provide evidences and models that the educational leadership affects student achievements (Mulford and Silins, 2003; Bishop, 2004).

Leadership in higher education were investigated by Kouzes and Posner (1987); Middlehurst (1989); Knight and Trowler (2001) and Davies, et al. (2001). According to Vilkinas, et al (2007), the leadership in learning and teaching literature is currently under-theorised. Research on academic development has traditionally focussed on aspects of teaching and learning rather than management and leadership (Vilkinas, et al., 2007). Davies, et al. (2001) pointed out a need for studying leadership in universities that have been run in a more business-like manner. This is because higher education faces an unprecedented period of accelerating change that is driven by shifts in public attitudes, reductions in the level of public support, questions regarding higher education's priorities, and demands for greater accountability (Wisniewski, 2004). The European Foundation for Quality Management's Excellence Model was examined as a possible vehicle for improving leadership in higher education. Their research conducted a case study to demonstrate how a change in leadership style has generated improvement in a higher education faculty. Knight and Trowler (2001) examined the ways that mainstream leadership thinking does and does not apply to departments and teams and suggested a way of looking at the practice of leading in higher education institutions. Many leadership program models have been developed that integrate knowledge about the structure and culture of the organization; a study of different theories of leadership; the opportunity for participants to develop and demonstrate key leadership competencies; the development of a personal philosophy of leadership and a variety of active learning experiences (Conger, 1996; Nevins and Stumpf, 1999, Wisniewski, 1999 & 2004).

According to Zaccaro and Klimoski (2001), much of the existing research on leadership has focused at the level of direct supervision and the relationship between the leader and followers, characteristics of the leader and followers and characteristics of their relationship. Zaccaro and Horn (2003) further suggested that leadership research should not only conduct theoretic study, but provide the platform for understanding and resolving practical leadership problems. Research on educational leadership tends to focus on academic leadership which is a function of the academic staff who undertake the academic coordination of significant courses or programs in a faculty (Vilkinas, et al., 2007, p3). The coordinators are responsible for the practical and everyday process of supporting, managing, developing and inspiring academic colleagues (Ramsden, 1998, p4); designing and delivering of programs, as well as involved teaching, with little if any formal power (Vilkinas, et al., 2007, p3) within universities. Vilkinas, et al. (2007) also suggested that the roles of the coordinators are thus critical in all discipline areas because their direct and indirect impact on the learning outcomes of large numbers of students.

Leadership in higher education is likely to be more dispersed and less hierarchical and positional, shared and located more in the work of teams (Timberlake, 2010). One of roles of the academic coordinator is to act as supervisors of lecturers and sessional lectures who contribute significantly to the core teaching of higher education. Timberlake (2010) conducted a survey of sessional teachers at Deakin University and discovered that academics understand the needs of sessionals but they do not have time to commit to providing substantial academic development opportunities for their sessional teachers. He claimed that the challenge for higher education institutions is to build models of leadership that adequately acknowledge and support the needs of teaching staff. A tripartite model of academic development (Timberlake, 2010) was suggested for the strategic direction of Deakin University, i.e., the central academic development unit taking on the „broker' role, as identified in the Integrated Competing Values Framework (ICVF) (Vilkinas et al., 2007).

The ICVF model has two dimensions (a people-task and an external-internal focus) and a four quadrant model (Vilkinas and Cartan, 2006), which is a development of an earlier framework by Quinn and his colleagues (Quinn, 1984, 1988; Quinn, et al., 2003; Quinn and Rohrbaugh, 1983). In the model, five operational roles for the academic coordinators, i.e., innovator, broker, deliverer, monitor, and developer, were identified within the quadrants. Figure 1 illustrates the roles and relationship of ICVF model and a brief description of the behaviours associated with each of these roles and those roles displayed by academic coordinators are showed in Table 2.

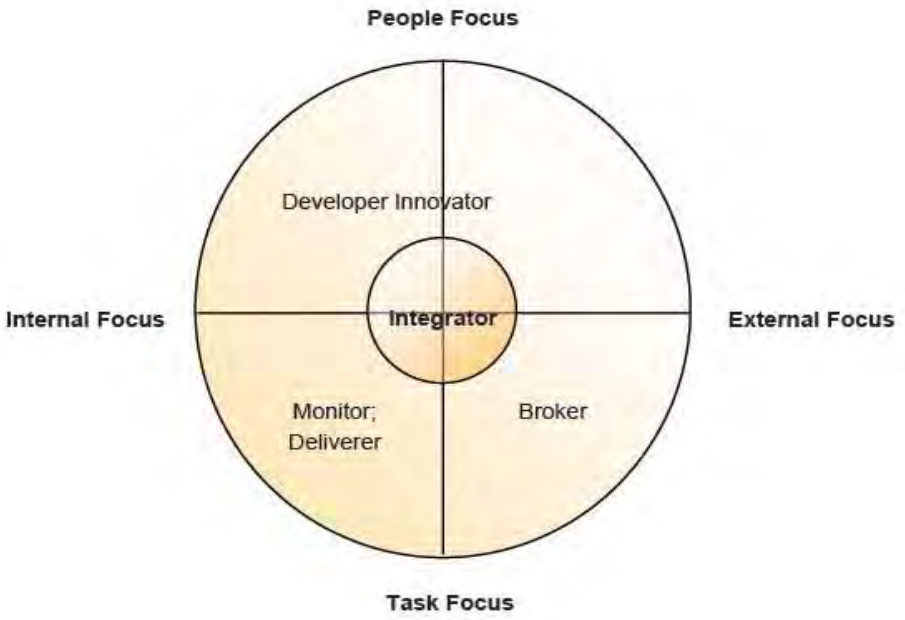


Figure 1 – Integrated competing values framework (source: Vilkinas, et al., 2007)

Table 2 – Five operational roles and their application to academic coordinators in the ICVF model (source: Vilkinas, et al., 2007)

Role	Academic coordinators application
Innovator	Sees need for new courses/delivery approach Innovative in teaching approach
Broker	Maintains necessary networks within and outside of the university Secures necessary teaching resources
Deliver	Ensures courses are designed and delivered Motivates teaching staff Sets clear and achievable teaching and learning goals for the team Communicates and clarifies goals with teaching staff Schedules, coordinates and solves teaching issues
Monitor	Regularly collects and distributes information on teaching performance Monitors own and others' teaching performance
Developer	Develops teaching staff Participates in mentoring and peer coaching sessions as a mentor and coach Is aware of strengths and weaknesses of teaching team Develops and maintains teaching teams Arranges for appropriate development activities for teaching team

Vilkinas and Cartan (2001, 2006) suggested that the five operational roles are paradoxical in nature under the ICVF model. How and when to apply a given role, and to what extent as each role competes with others are decisions made by the program coordinator. An investigation of leadership roles and predictors of leadership effectiveness for Chinese managers were taken by Vilkinas, et al. (2009). They found that cultural and institutional differences do significantly affect variability in leadership behaviour associated with leadership effectiveness.

Central of the ICFV model is the Integrator role which includes two aspects of critical observer and reflective learner. The „critical observer' describes the operational roles required at any particular time in response to any environmental changes; whereas „reflective learner' is to reflect on past and current usage of the operational roles and to learn from those experiences (Vilkinas and Cartan, 2001). This sixth role involves critical thinking and reflective practice in order to monitor movement and application of the five operational roles. A well developed integrator will have the ability to move between the five roles with ease and to be able to deliver any of the five roles depending on which are most appropriate (Denison, et al., 1995; Hooijberg, et al., 1992).

As discussed, many leadership theories study the relationship between the leader and followers (Zaccaro and Klimoski, 2001). However, the relationship between a Program Director and his/her team is unique in universities and not the same as other types of organisations. A Program Director, also called Program Leader or Course Director, is a leader of a program and plays a coordinator role within a School or Department. As shown in Figure 2, the Program Director reports to the Head of School and takes care of all activities that are related to the program. The activities include course development

and renewal; organising professional accreditation; time tabling; budgeting; recruiting staff to teach; contracting for sessional lecturers; enrolling students; handling students enquiries, request for exemption and course transferring/deferring, and complaints; reporting of examination; marketing, and even little things like order book vouchers for showing appreciation to the guest speakers. The problem is that a Program Director him/herself is also an academic member who is responsible for teaching and conducts researches and projects. A Program Director does not usually have formal power and the role is undoubtedly complex. On the other hand, teaching at universities is a second job for many sessional lecturers. Thus, a Program Director may not commit enough to provide support to sessional staff for their teaching activities.

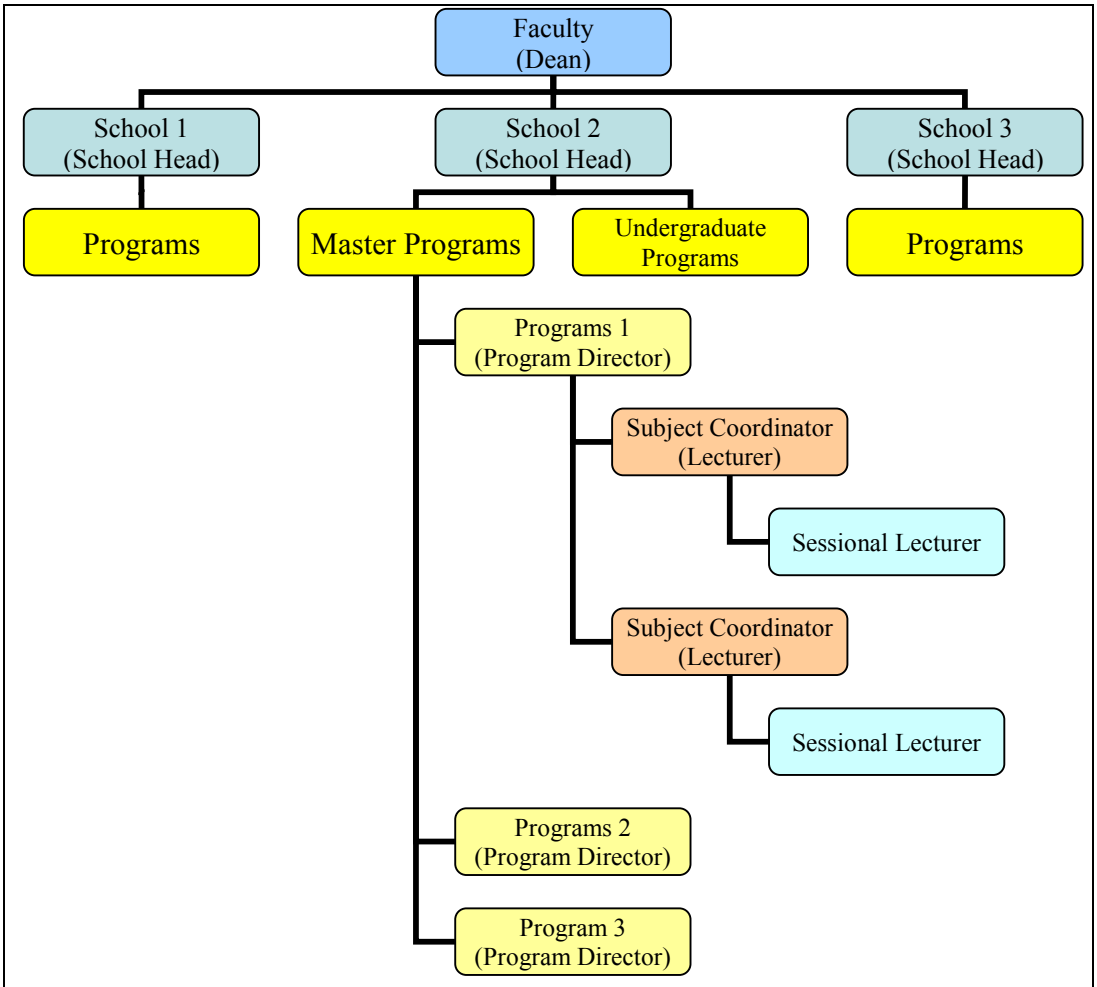


Figure 2 – A hierarchy of a school/department in a university

Given the multi-task roles and special position, the traditional leadership skills may be inappropriate for using in the academic leadership position. How the Program Director leads his/her team to enhance the quality and teaching and maintain students' satisfaction is an area for exploring.

METHODOLOGY

A Developer role, one of the leadership roles for academic leaders under the ICVF model (Vilkinas & Cartan 2006) is applied for this study as traditional leadership theories may be considered inappropriate for academic leadership (Zaccaro and Horn, 2003). One of the main tasks of Developer role is to provide appropriate opportunities and resources for staff members developing the skills and knowledge they need to succeed.

With increased student numbers, lecturers are required to provide additional efforts for maintaining student satisfactions. In addition, staff members are now required to present online teaching documents that allow students to access online handouts and teaching material. It takes time for lecturers, in particular sessional lecturers to learn setting up online discussion forum, online marking and grading, online approval process, and so on. According to Freeman (1996), utilising the internet would improve staff-student interactions, student access to learning resources and assessment in large classes. A Program Director thus is needed to act in a role as a „Developer' to provide information and train the lecturers to use online information for their teaching activities. Developing a Program Manual that provides information and the direction for accessing information are needed. The Manual is specifically designed to and caters for the Master Property Programs at UTS. Figure 3 depicts the research method and how the Program Manual is developed.

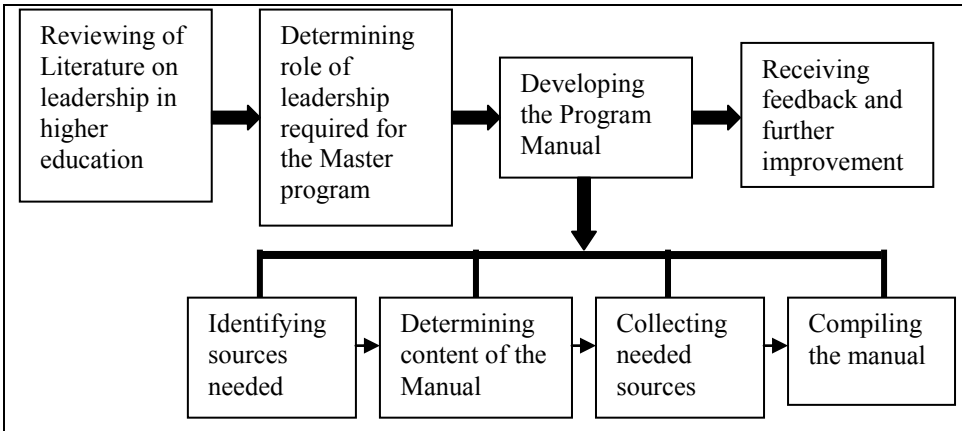


Figure 3 – Method of the research

Five steps are taken when designing the Manual as follows:

a) Identifying and investigating main support and sources needed for Lecturers/sessional lecturers undertaking their teaching and development activities;
b) Determining the content of the Program Manual for the Master Property Program;

c) Collecting and seeking the required information and sources;

d) Compiling and distributing the Program Manual;

e) Receiving feedback.

The content of the Program Manual is based on everyday working process for lecturers conducting teaching activities within the program. Sources of information were collected from UTS documents, websites and literature. The resources consist of different types in the Program Manual. Some of them are summary such as teaching methods and advantages/disadvantages of each of the methods. In some cases, there are internal and external links (e.g., UTS vision statement, IT support), location (e.g., library source locations) or contacts (fire procedures and emergency handling). Some of them are Journal or articles (e.g., teaching and learning in higher education, subject development). Figure 4 shows a sample of contents of the Manual.

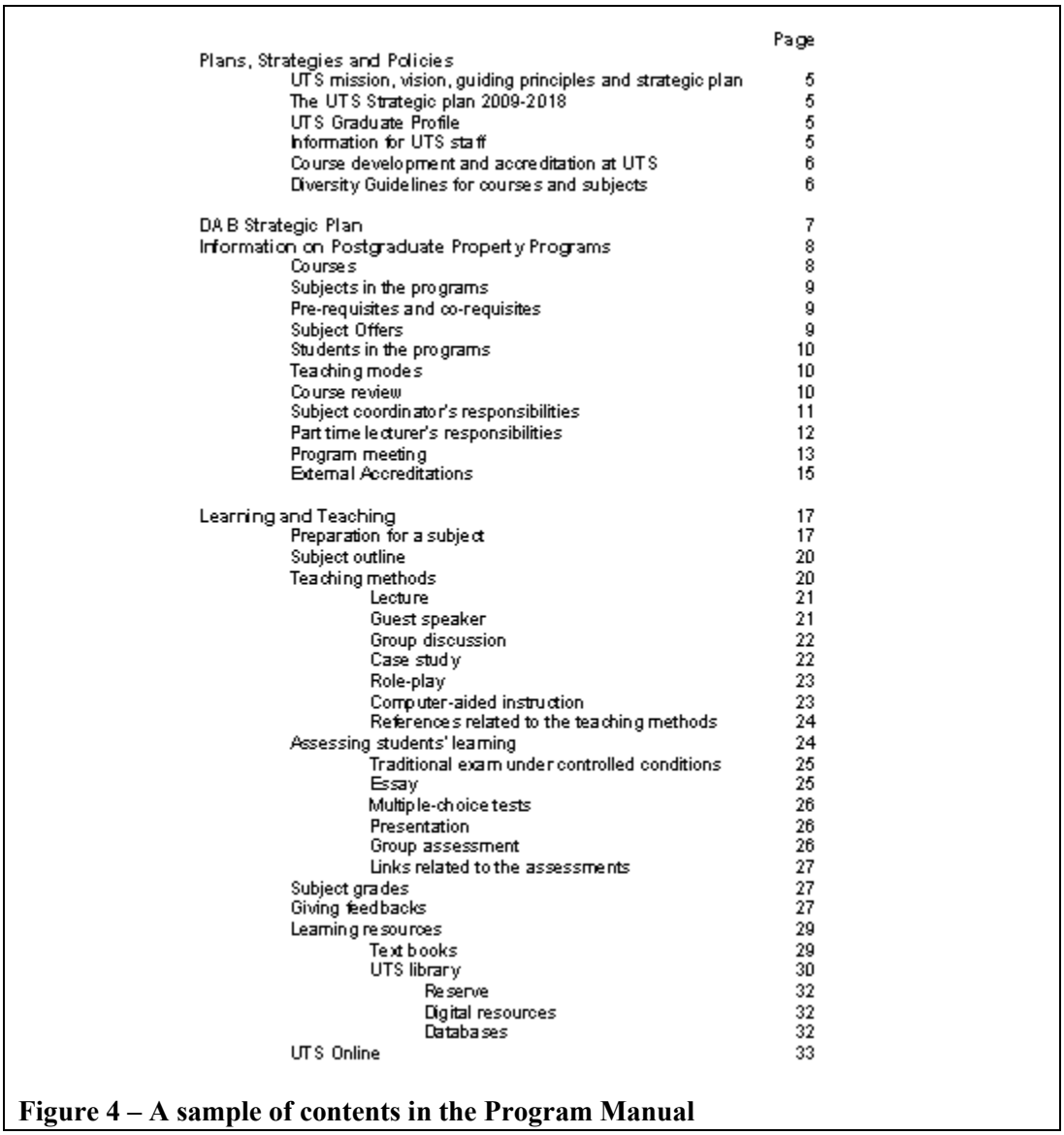


Figure 4 – A sample of contents in the Program Manual

DEVELOPMENT OF THE PROGRAM MANUAL

Literature on developer role of leadership were reviewed that provide a theoretical base for developing a Program Manual, which is needed to support lectures when they prepare their teachings activities catering for enhancing quality learning and the requirement of course review and renewal for the Master Property Programs in UTS. There are similar products (TEDI, 2010; IML, 2010) developed that support lecturers at university level providing information on teaching and learning, assessment methods and other support facilities (Chalmers, et al., 2003). There is no tailor-made Program Manual that integrates all supporting information on teaching and learning activities at program level. This Program Manual is thus developed to include all of the aspects concerning teaching activities, which consists of UTS, Faculty and program level information that lecturers must be aware of during their teaching activities in the program. The Program Manual is a list that includes mainly summaries and links that can be located for detailed information. Eight main areas are covered as follows.

Plans, strategies and policies at UTS level

Lecturers teaching at UTS should know the mission and vision statement, university strategic plan and policies, as well as graduate profile to guide their teaching activities. They must also know their employment conditions, entitlements, responsibilities and requirements at UTS. By understanding a range of information and processes that relate to the development, changes and approval of award courses at UTS, lecturers can develop teaching activities in such ways to meet accreditation for course development and renewal. With increasingly diverse student profiles in classrooms, Diversity Guidelines for Courses and Subjects is a valuable source for supporting lecturers to understand different cultures and perspectives in their teaching activities. Based on the guidelines, lecturers can formulate strategies for working with culturally diverse students (Burnette, 1999; Kea, 1998), thus to maintain student satisfactions on their learning.

Faculty strategic plan

The Strategic plan at the Faculty level is more specific and applicable because the subject matter and professional development are more relevant. The information is contained in the Program Manual for helping lecturers/sessional lecturers to understand the direction of the Faculty, required learning outcomes of students, professional leadership to be met and targets and standards to be achieved.

Information on postgraduate property programs

This section consists of detailed information related to the program, such as provided courses, required subjects for completing a course, pre-requisites/co-requisites of subjects

(Figure 5), teaching modes, and when subjects are offered. The section also includes the responsibilities of subject coordinators and sessional lecturers, a summary of student background, and course evaluation processes, student feedback survey, program meeting, and accreditation by external professional body have also been included.

Pre-requisites and Co-requisites

Subject Code	Subject	Subject Code	Prerequisites/Co-requisites
15143	Group Project A: Urban Renewal	15142	Introduction to Property and Planning
		15144	Sustainable Urban Development
17704	Property Development Finance	15142	Introduction to Property and Planning
		12535	Valuation Application
15312	Team Leadership Principles and Communications	15315	Project Management Principles
15313	Project Procurement and Risk Management		
15316	Project Time, Cost and Quality Management		
15144	Group Project B: Greenfield Development	15143	Group Project A: Urban Renewal
12535	Valuation Application	15142	Introduction to Property and Planning
17518	Advanced Property Development	15142	

Figure 5 – A sample of program information

Providing such information is important because sessional lecturers can obtain first-hand the program overview easily and understand context among subjects and their relationships within the program. Hence, they can refer to the information needed at anytime and use the information to prepare their teaching material for students.

Learning and teaching

This section contains information on „Preparation for a subject' that consists of student profile analysis and approaches of understanding diverse cultural students. An example of writing a lesson plan and a list of questions that guide to develop a lesson plan are also suggested. Requirements on developing a Subject Outline, its template and the links are provided.

The advantages, disadvantages and suggested strategies for the success of several common teaching methods, such as lecture, tutorial, guest speaker, group discussion, case study, role play and computer-aided instruction are listed. The UTS coursework assessment policy and procedure manual, types and numbers of assessments were included in the Manual. Applications of each assessment methods and their advantages and disadvantages are discussed. Polices on Grades and the link of how assignments are graded, as well as links on evaluation and giving feedback are provided.

Learning resources

This section lists resources such as text book order from Co-op bookshop, library and UTSOnline, are used for developing lectures:

- *Text book order*. How and when do lecturers order text books are described. Books are commonly used in the program for new students are listed.
- *Library*. This section covers location of UTS library and how UTS library can be accessed outside the UTS. Procedures of placing and accessing books at the library Closed Reserve, Digital Resources and various Databases on Built Environment related topics, as well as forms and links are given.
- *UTSOnline*. UTSOnline is a WebCT based online learning and teaching media. How UTSOnline is used and the ways of uploading material are illustrated by graphs. The use of Turnitin online plagiarism detection software, Digital Dropbox for student submitting their assignment, and other common used tools are also included. Figure 6 is a sample.

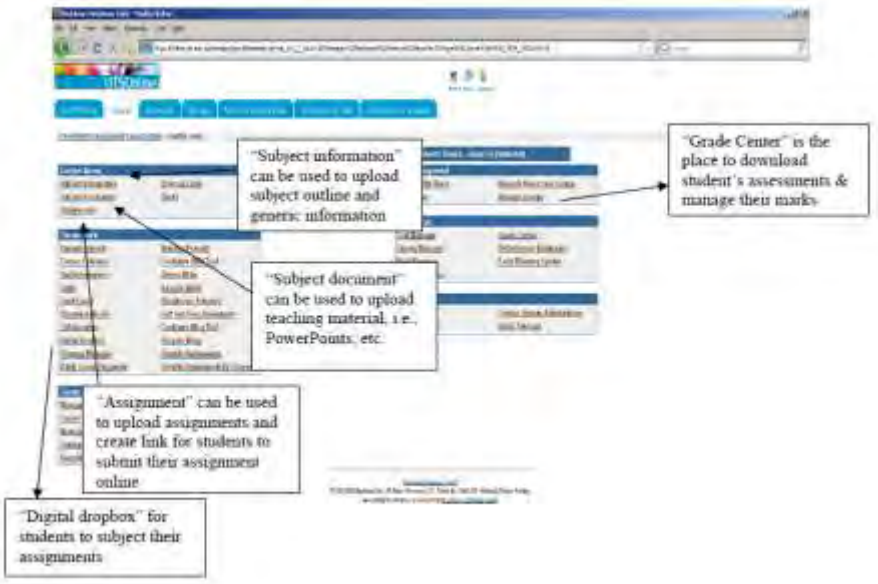


Figure 6 – A sample of using UTSOnline

Handling student issues

This section includes principles of handling student issues and processes of student conflict management such as mediation, dialogue, facilitation, conflict coaching, and training (Bodine and Grawford, 1998). Examples are: approval of subject exemptions; responses to student discipline and appeals; evaluations of special consideration, absences and course work extensions; preparations of alternative examinations; and management of student conflict.

Other information

This section briefly indicates information and links lecturers need to know during their teaching. UTS is an open campus and the classrooms are located at centres from Broadway to Chinatown, thus locations of classrooms and their maps are provided. Safety and security issues, emergency contacts and fire evacuation procedures are presented.
Lecturers are also responsible to provide direction to help first year students. Information needed to support new students, such as skills of lifelong learning; assignment writing, oral presentation, English as second language; mathematics, statistics and computer skills; accessing computer laboratory; skills of organising study and self motivation; and subject enrolment and enquiries are also provided.

Appendix

The Appendix includes Frequently Asked Questions for sessional lecturers and forms (Subject Outline template, Faculty genetic information booklet, text book order form) are attached.
The developed Program Manual is a pamphlet that contains source and directions for accessing information for lecturers/sessional lecturers involved in the Master Property Programs. The Manual has been distributed to all involved lecturers for feedback and also uploaded to the UTSOnline so that lecturers can access it at anywhere and anytime. "The Manual provides useful information in which some of them I was not aware of…" (Phillips, -- a sessional lecturer 2009). The Manual is expected to be updated every year by the Program Director.
Learning and teaching activities are everyday jobs performed by lecturers. The developed Program Manual provides one-stop platform for lectures to access required information anytime and anywhere.

CONCLUSION AND REMARKING

This research establishes a key role of a Program Director, i.e., to provide the teaching staff with the relevant information and guidelines. The information provided in the Program Manual aligns with the educational regulation set by the UTS Academic Board and other similar deliverable documents. Once the lecturers have the Manual, they can make their decisions regarding the most effective and efficient way to prepare their teaching to enhance students' satisfaction.
The Program Director performs the Developer role providing the lecturers with all of the information and ideas concerning the subject activities which is the essential sector of the educational quality. Formally recognised achievement of leaders who provide a clear vision and direction and monitor progress (Bolden, et al., 2009) of program development

and quality of learning and teaching is necessary. The Program Director needs to improve leadership skills and demonstrate a heightened and accurate self-awareness, as well as the ability to learn from their previous experiences and to inform future behaviours. They need to be able to critically assess their own performance, reflect on their assessment and learn from it (Ash & Clayton, 2004), thus constantly improving their academic leadership capability.

This paper contributes to a body of knowledge to inform practice and the application of Developer role of leadership for developing of academic coordinators. The leadership approach and ideas adopted in this paper can be also extended beyond the Property Master Program to other programs and the University-wide. There are challenges for a Program Director implementing effective leadership in higher education, provided that the Program Director his/herself is an academic staff member who must fulfil teaching and research roles with little power of resource allocation and authorisation. Developing a comprehensive Program Manual and the effectiveness of the Developer role of leadership that enhances teaching and learning and maintains student satisfaction can be further studied.

REFERENCES

Altbach, P.G. (2010) *Leadership for Higher Education*, New York and London: Routledge.

Ash, S. and Clayton, P. (2004) The articulate and learning: an approach to guided reflection and assessment. *Innovative Higher Education*, 29(2), 137-154.

Avolio, B.J., Kahai, S. and Dodge, G.E. (2000) E-leadership: implications for theory, research, and practice, *The Leadership Quarterly*, 11(4), 615-668.

Bishop, P. (2004) Stories from within: leadership, learning and lives in a high poverty school, paper presented at the Australian Association for Research in Education Annual Conference, Melbourne, December.

Blair, J.D. and Hunt, J.G. (1985) A research agenda for leadership on the future battlefield. In J.G. Hunt, J.D. Blair (Eds.), *Leadership on the future battlefield* (pp. 271-317). Washington, DC: Pergamo Brassey's.

Browning, H. and Van Velsor, E. (1999) *Three keys to development: using assessment, challenge, and support to drive your leadership*. Greesboro, NC: Center for Creative Leadership.

Boal, K.B. and Hooijberg, R. (2000) Strategic leadership research: moving on. *The leadership Quarterly*, 11(4), 515-549.

Bodine, R. and Grawford, D. (1998) *The handbook of conflict resolution education: a guide to building quality programs in schools*, San Francisco: Jossey-Bass.

Bolden, R., Petrov, G. and Gosling, J. (2009) Distributed leadership in higher education: rhetoric and reality. *Educational Management Administration and Leadership*, 37(2), 257-277.

Bolden, R., Gosling, J., Marturano, A. and Dennison, P. (2003) A review of leadership theory and competency frameworks: edited version of a report for Chase Consulting and the Management Standards Centre, Centre for Leadership Studies, University of Exeter, Crossmead Barley Lane, Dunsford Hill, United Kingdom. http://www.leadership-studies.com.

Burnette, J. (1999) Critical Behaviors and Strategies for Teaching Culturally Diverse Students. ERIC/OSEP Digest E584, ERIC Clearinghouse on Disabilities and Gifted Education Reston VA. http://www.ericdigests.org/2000-3/critical.htm. Viewed 12 Dec 10.

Chalmers, D., Herbert, D., Hannam, R., Smeal, G. and Whelan, K. (2003) Guidelines for managing, supporting and training sessional teaching staff at university, AUTC project, viewed on 12 Dec 0 at www.tedi.uq.edu.au/sessionalteaching.

Cheng, Y.C. (1997) The transformational leadership for school effectiveness and development in the new century. Paper read at International Symposium of Quality Training of Primary and Secondary Principals toward the 21st Century, January 20-24, at Nanjing, China.

Cherry, K. (2011) Leadership Theories – 8 Major leadership theories, Accessed on 29 Jan 11. http://psychology.about.com/od/leadership/p/leadtheories.htm.

Conger, J. (1996) Can We Really Train Leadership? *Strategy, Management, Competition. Winter*, 52-65.

Conger, J. (1993) Training leaders for the twenty-first century, *Human Resource Management Review*, 3(3), 203-218.

Davies, J., Hides, M.T. and Casey, S. (2001) Leadership in higher education, *Total Quality Management and Business Excellence*, 12 (7), 1025-1030.

Davis, C. (1998) Professional development of leaders of a large teaching team: a dual role. *International Journal for Academic Development*, 3(1), 12-17.

Denison, D., Hooijberg, R. and Quinn, R. (1995) Paradox and performance: toward a theory of behavioural complexity in managerial leadership. *Organisational Science*, 6, 524-540.

Devlin, M., Nagy, J. and Lichtenberg, A. (2010) Research and Development in Higher Education: Reshaping Higher Education, Melbourne, 6-9 July, 2010. Conference 6-9 July 2010 Melbourne http://conference.herdsa.org.au/2010/index.html

Hooijberg, R. and Quinn, R.E. (1992) Behavioural complexity and the development of effective managers. In R. J. Philips and J.G. Hunt (Eds.), *Strategic Management: A Multiorganisational-level perspective*. NY: Quorum.

Hopkins, D. (2002) Instructional leadership and school improvement, National College for School Leadership, Viewed on 20 Jan 2011 at http://mt.educarchile.cl/mt/jjbrunner/archives/Instructional_leadership.pdf.

IML: Institute for Interactive Media & Learning (2010), University of Technology Sydney, Viewed 10 Dec 2010 at http://www.iml.uts.edu.au/.

Kea, C. (1998) *Focus on ethnic and minority concerns: critical teaching behaviours and instructional strategies for working with culturally diverse students*. CCBD Newsletter. Reston, VA: The Council for Exceptional Children.

Knight, P.T. and Trowler, P.R. (2001) *Departmental Leadership in Higher Education*. Open University Press.

Kouzes, J.M. and Posner, B.Z. (1987) *The Leadership challenge: how to get extraordinary things done in organizations*, San Francisco: Jossey Bass, 362

Leithwood, K. and Jantzi, D. (1990) Transformational Leadership: how principals can help reform school cultures, *School Effectiveness and School Improvement*, 1(4), 249-280.

Middlehurst, R. (1989) Leadership and higher education, *Higher Education* 18: 353-360.

Mulford, B. and Silins, H. (2003) Leadership for organisational learning and improved student outcomes, *Cambridge Journal of Education*, 33(2), 175-195.

Nevins, M. and Stumpf, S. (1999) 21st Century Leadership: Redefining Management Education. *Strategy, Management, Competition*, 3rd quarter. 41-51.

Quinn, R. (1984) Applying the competing values approach to leadership: toward an integrative framework. In J.G. Hunt, D. Hosking, C. Schriessheim and R. Stewart (Eds.), *Leaders and Managers; International Perspectives on Managerial Behaviour and Leadership* (pp. 10-27). NY: Pergamon press.

Quinn, R. (1988) *Beyond Rational Management: mastering the paradoxes and competing demands of high performance*. San Francisco, CA: Jossey-Bass.

Quinn, R. and Rohrbaugh, J. (1983) A spatial model of effectiveness criteria: toward a competing values approach to organisational analysis. *Management Science*, 29, 363-377.

Quinn, R.E., Faerman, S.R., Thompson, M.P. and McGrath, M.R. (1996) *Becoming a master manager: a competency framework*, (2nd ed). NY: John Wiley & Sons Inc.

Quinn, R., Faerman, S., Thompson, M. and McGrath, M. (2003) *Becoming a master manager* (3rd ed.). NY: John Wiley and Sons.

Phillis, P. (2009) An email of response on the Program Manual.

Ramsden, P. (1998) *Learning to lead in higher education*. London: Routledge.

Sheppard, B. (1996) Exploring the transformational nature of instructional leadership. *Alberta Journal of Educational Research*, XLII(4), 325-344.

TEDI: Teaching & Educational Development Institute, The University of Queensland, at http://www.tedi.uq.edu.au/aboutTEDI/index.html, Viewed on 12 Dec. 2010.

Timberlake, T. (2010) Developing leaders of sessional teachers in higher education. In M. Devlin, J. Nagy and A. Lichtenberg (Eds.) *Research and Development in Higher Education: Reshaping Higher Education*, 33, 597-608. Melbourne, 6-9 July, 2010.

Turan, S. and Sny, C. (1996) An exploration of transformational leadership and its role in strategic planning: a conceptual framework. Paper read at Annual Meeting of the International Society for Educational Planning, September 19-21 at New Orleans, LA.

Vilkinas, T., Shen, J. Cartan, G. (2009) Predictors of leadership effectiveness for Chinese managers, *Leadership & Organization Development Journ*al, 30(6), 577 – 590.

Vilkinas, T. and Cartan, G. (2006) The integrated competing values framework: its spatial configuration. *Journal of Management Development*, 25(6), 505-521.

Vilkinas, T., Leask, B. and Rogers, T. (2007) Developing leadership capability of academic coordinators. Paper presented at Enhancing Higher Education, Theory and Scholarship, Proceedings of the 30th HERDSA Annual Conference, Adelaide, 8-11 July, 2007.

West, M., Jackson, D., Harris, A. and Hopkins, D. (2000) Learning through leadership, leadership through learning. In *Leadership for Learning*, K Riley and K Seashore Louis (eds.), San Francisco, Jossey-Bass.

Wisniewski, M.A. (2004) Leadership in higher education: Implications for leadership development programs, Leadership In *Higher Education*, 2(1). http://www.academicleadership.org/article/LEADERSHIP_IN_HIGHER_EDUCATION.

Wisniewski, M.A. (1999) Leadership Competencies in Continuing Higher Education: Implications for Leadership Education. *The Journal of Continuing Higher Education*. Winter, 14-23.

Zaccaro, S.J. and Horn, Z.N.J. (2003) Leadership theory and practice: fostering an effective symbiosis, *The Leadership Quarterly*, 14, 769-806.

Zaccaro, S.J. and Klimoski, R. (2001) The nature of organizational leadership. In S.J. Zaccaro, and R. Klimoski (Eds.), *The nature of organizational leadership: Understanding the performance imperatives confronting today's leaders* (pp. 3-41). San Francisco: Jossey-Bass.

Comparative Analysis of University Websites for Indicators of Sustainability Practices: Australia and Malaysia

Mohamad Sufian Hasim, Dr Stephen Pullen and Dr Alpana Sivam
School of Natural & Built Environments
University of South Australia, Adelaide, Australia

ABSTRACT

Globally, sustainability practices are becoming more important as the need increases to respond to the impact of development. However, there are differences on the level of sustainability practices between developed and developing countries. Furthermore, the achievement of sustainable development goals needs participation, integration and collective efforts from both types of country. This study reviewed university websites to explore the sustainability commitment in 39 Australian and 20 Malaysian universities as examples of higher education institutions from developed and developing countries. Content analysis was used to analyse data. The definition for ‚commitment' used was that universities provided information in their website that demonstrated initiatives towards sustainability. Generally, the extent of commitment among Australian universities is higher than Malaysian universities and shows that sustainability issues are well established in the former country. Most universities in Malaysia met only one theme which is ‚sustainability research and education'. The preliminary results of the study show a significant gap and differences between both countries regarding sustainability commitments. Furthermore, this study gives insights into questions of the level of awareness in Australia and Malaysia regarding sustainability practices. The results provide initial indicators which may assist Malaysian universities in minimising the sustainability commitment gap compared with Australian universities.

KEYWORDS

sustainability, sustainable development, Australia, content analysis, universities

INTRODUCTION

Strong ties between sustainability practices and physical development are key factors in achieving sustainable goals in the built environment. The relationship is a key factor in minimising the negative impact of development. Originally, the sustainability concept emerged from the term ‚sustainable development' derived from the Latin ‚sustenere'

which means „to hold up', „maintain' and „tolerate' linked with the triple bottom line (Wojcikiewicz 2008), consisting of the environment, economy and social factors.

At present, sustainability themes have received broad attention in the built environment (Shah 2006; Elmualim et al. 2009) where this concept was recognised as a framework for encouraging a sustainable development approach (Forsberg & von Malmborg 2004; Proctor & Straton 2009). However, most of these studies have been carried out in Western, economically developed contexts. In the West, studies began in the 1970s (Plessis 2007) whereas in developing countries, discussion only began in the early 1990s. Therefore, gaps of practice still exist between developed and developing countries which can lead to different approaches in the implementation of sustainability agendas.

The achievement of sustainability needs participation and integration from the government and private sector to generate sustainable development. Ideally, to derive the maximum benefit for the sustainability approach, a combined effort from both parties has to be realised. To provide a manageable scope to the research described in this paper, universities as one of the key institution in the government sector were chosen as a focus as these will provide leadership for others in sustainability practices. Furthermore, universities can set an example to the community by influencing the way forward to enhance the sustainable development agenda through education, research and operation.

This study is part of a larger PhD project and utilises a case study approach using Australia and Malaysia to represent developed and developing countries respectively. One developed and one developing country has been selected as a case study to undertake comparative analysis. Therefore, the findings are limited to the above countries only.

To contribute to knowledge about how sustainability practices are embedded within university management, this study uses manual content analysis of internet websites to determine sustainability commitments. The definition for „commitment' used was that universities provided information in their website that demonstrated initiatives towards sustainability which are relevant to the „Triple Bottom Line' whether undertaken, currently undertaking or intending to undertake in future management activities. Hence, in the context of this research, it was website evidence and indicators that were identified.

This research contributes to the body of knowledge on sustainability in higher education as the websites for all universities in Australia (39) and Malaysia (20) were analysed. Undoubtedly, with all universities across both countries involved, consisting of 59 universities in total, the data is comprehensive and provides a cross-sectional comparison between both countries. Hence, the results may differ from previous studies, for example Bajracharya & Too (2009), with limited samples.

Specifically, the main purpose of this study was to determine the extent of commitment towards sustainability practices within universities across Australia and Malaysia with the

objective of identifying the common and most popular themes that define sustainability practices. To this end, this paper will focus on the sustainability commitments within universities in Australian and Malaysia. The paper is divided into five parts. Starting from this introduction, the literature on the role and significance of universities in relation to sustainability are reviewed. Following an outline of the research methodology, the results of the study are explored. Next, a discussion of the findings and finally, the conclusions are drawn related to the above discussion.

UNIVERSITIES AND SUSTAINABILITY

Universities have a significant role in sustainable development. They are recognised as a role model and play a vital part in the development of societies (Sabir 2008). The importance of the university in sustainable development is reflected in international agreements such as the Copernicus University Charter for Sustainable Development and the Kyoto Declaration on Sustainable Development issued by the International Association of Universities in 1993 and the UNESCO World Declaration on Higher Education in 1998 (Sabir 2008). These agreements promote universities as key institutions in developing sustainable societies. For example in the Kyoto Declaration, universities are encourage to practice sustainable physical operation and, in addition, to embed the environment in education. Therefore, universities have great potential to play a fundamental role in achieving a sustainable global future.

At present, importance has been given to university sustainability in the area of research, education and administration including campus operation (Mcmillin & Dyball 2009). Globally, numerous universities are taking steps to improve management practices to achieve sustainable development (Bajracharya & Too 2009). However, the extent of awareness level is still unknown. Do universities practice sustainability in all aspects? Are entire research management, education and curriculum design and campus operations influenced by sustainability principles? In answering these questions, the practices within university settings need to be measured.

Furthermore, universities are increasing their awareness of the importance of integrating sustainability principles in business by signing the Talloires Declaration, a voluntary environmental agreement for the institutions of higher learning. At present, 350 universities representing forty countries have signed this agreement (Bajracharya & Too 2009). According to University Leaders for a Sustainable Future (1999), in signing this agreement a University signals its willingness and readiness to address the challenges raised in the Talloiries Declaration. In addition to the main business of delivering research and education, universities can maximize their role as a catalyst for achieving a sustainable future by integrating sustainability principles into their entire business

practice. However, according to Mcmillan and Dyball (2009), universities have some poor approaches in managing sustainability initiatives which contribute to the waste of resources and lead to distraction from sustainability goals.

RESEARCH METHODOLOGY

To address the aim of the research, a case study approach was adopted to compare the extent of universities' commitments towards sustainability in Australia (39 universities) and Malaysia (20 universities) respectively. The case study approach is used to answer questions like „how' and „why' as suggested by Yin (1994) and has the benefit of providing extensive information, more analysis and a clearer perspective on the subject of study (Marshall & Rossman 1999). The justification for selecting the above countries was due to familiarity and easy access factors. Currently, the lead author is studying in Australia and previously has been working in Malaysia enabling effective exploration of both countries. Clearly, this has advantages to provide a depth of understanding in both countries.

The study reviewed the websites for Australian and Malaysian universities to investigate the presence of sustainability evidence and used content analysis. Generally, this study reviewed sustainability initiatives in the overall management and operations of universities. This technique was conducted to identify patterns and evidence on the subject of sustainability. It was performed by utilising publicly available data including any additional accessible and relevant PDF documents linked to the universities website.

Traditionally, the information on organizations was communicated to the stakeholders via hard copy published annual reports, brochures and news paper. However, with current technological changes and the general acceptance of the use of the internet as a tool for communication, organisations have started to create websites to post relevant information (Adams & Frost 2008). These changes lead to the richness of information in the website. According to Fleishman and Hillard Communication (2006), websites are one of the main sources of information used by the public to explore organisational commitments towards sustainability. In addition, the web sites are extensively used by business to report on sustainability in North America and the European region (Gill, Dickinson & Scharl 2008). According to Chapple & Moon (2005), the information in web sites can be considered official, representing their institution and governance. Thus, in this context, we assume that as a responsible institution, universities will disclose accurate information which reflects their actual situation and not only for marketing purposes. Therefore, this technique is relevant and the data considered reliable and valid. In addition, as a preliminary data collection method, the website review allows a remote comparison for Australia and Malaysia with advantages to reduce time and cost for the overall study.

According to Jose and Lee (2007), content analysis can be applied to explore the correlation between texts and their possible themes or concepts. It is well accepted in social and environmental responsibility research and this technique is popular in corporate social and environmental research (Gray, Kouhy & Lavers 1995). Moreover, this method has been used by many studies such as Kim and Weaver (2002), Hine (2004), Zhang (2005), Braun and Clarke (2006), Lambert and O'Halloran (2008) and Gill, Dickinson & Scharl (2008). Advantages of using this method, as described by Kolbe and Burnett (1991), are that this technique provides preliminary data and can be used as a support method in multi-method studies.

The systematic review of the websites was undertaken for the content posted within the specific time frame starting 01 August to 15 September 2010. Each website was reviewed manually. The data collection process was conducted in a strict step by step procedure (refer Figure 1). To avoid bias in the data interpretation, each university website was reviewed at least twice. With this independent review, the themes found were matched and adjusted to established refined themes. These procedures omitted any potential misinformation to strengthen the findings. These methods contributed to validity and reliability of the data. Systematically, the review was conducted by typing the specific words to find target themes. Then, by thoroughly reading the possible sources, it was possible to become familiar with the sustainability agenda setting within universities. Next, a detailed thematic analysis was conducted (refer Figure 1).

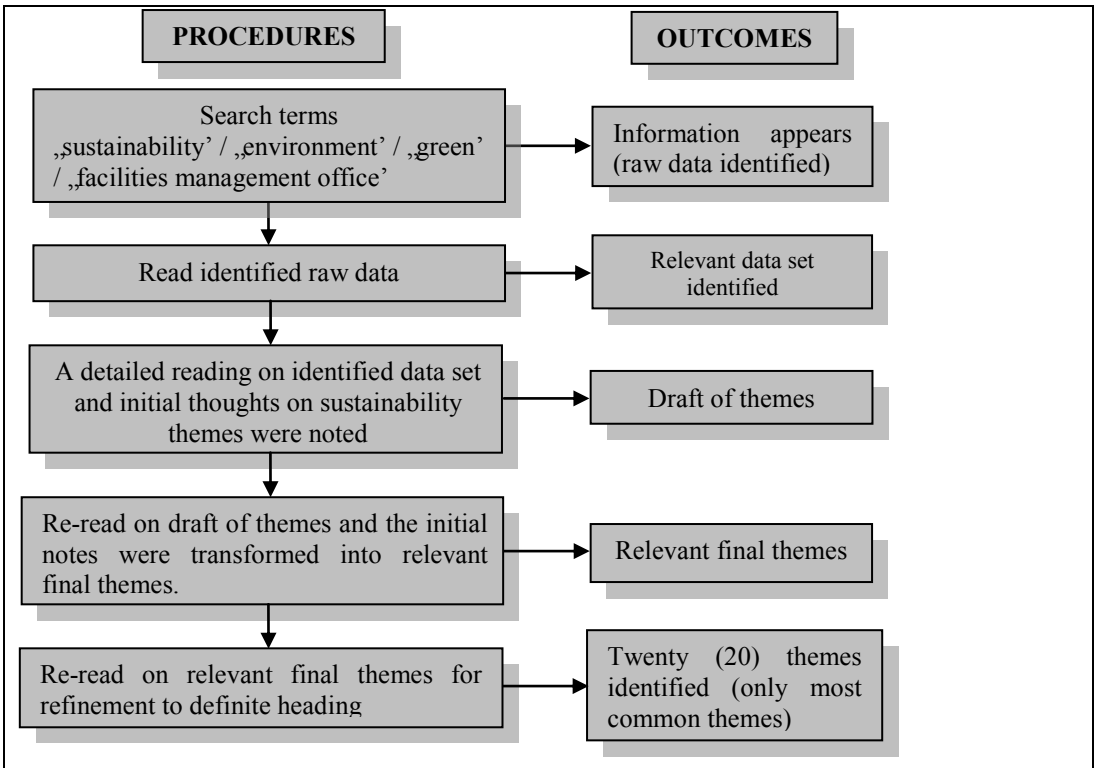


Figure 1 – Flow chart for the research method process

RESULTS

The themes were chosen based on the universities' descriptions of their initiatives towards sustainability practices. This study identified a set of 20 relevant themes as listed in Table 1 which shows the overall findings and the comparison of results between Australia and Malaysia. Each of the above themes is now briefly described to elaborate their actual meaning and to compare the results as follows:-

1) *Statement of commitment to sustainability in its operation.* The statement which expresses the university's concern on sustainability issues. It was documented either in the vision, mission or senior management speeches. For example, the University of Wollongong (UoW) stated their commitment to sustainability in the UoW Strategic Plan year 2008 to 2010. In the Malaysian context, for example, Universiti Sains Malaysia (USM) stated "USM will embrace the protection of the ecosystem, the conservation and restoration of resources as well as the development of human and intellectual capitals...". Four (20%) universities in Malaysia have a „Statement of commitment in its operation', compare to 35 (90%) for Australian universities.
2) *Sustainability policy/plan.* The policy or plan formulated to enhance sustainability achievement, especially environmental sustainability. For example, Australian National University (ANU), created their Environmental Management Plan to fulfill the ANU's environmental policy and other objectives. Thirty-one (79%) Australian universities have a policy or plan to enhance the sustainability agenda in their operation. However, no evidence was found on Malaysian universities' websites.
3) *Sustainability position/co-coordinator.* This is a special position created to handle sustainability matters—for example, various positions such as Project Sustainability Engineer and Environmental Services Manager at University of Wollongong. Twenty-eight (72%) Australian universities have special positions to manage and handle sustainability matters but no data was found for Malaysian universities.
4) *Sustainability committee.* A special committee is established to deal directly with the sustainability. For example, the Environmental Management Planning Committee at ANU advises on the performance of environmental management. For Malaysia, Universiti Malaya (UM) established the Environmental Secretariat to improve environmental awareness such as addressing energy efficiency and pollutant control. Twenty-five (64%) Australian universities have a special committee to deal with sustainability agenda. However, no data was found in Malaysian universities websites.

Table 1 – A list of sustainability themes found in Australian and Malaysian universities

No	List of Themes	Australia		Malaysia	
		No. n=39	%	No. n=20	%
1	Statement of commitment to sustainability in its operation	35	90	4	20
2	Sustainability policy/plan	31	79	0	0
3	Sustainability position/coordinator	28	72	0	0
4	Sustainability committee	25	64	0	0
5	Sustainability department/office	9	23	2	10
6	Sustainability reporting	16	41	0	0
7	Sustainable energy	34	87	0	0
8	Sustainable water supply	35	90	0	0
9	Sustainable waste management	36	92	0	0
10	Sustainable biodiversity / ecological system	15	38	1	5
11	Emission control / pollution prevention	11	28	0	0
12	Sustainable transport	29	74	0	0
13	Sustainable / green facilities, building & infrastructure	25	64	1	5
14	Sustainable / green purchasing / procurement	19	49	0	0
15	Green IT, office & laboratory	19	49	0	0
16	Sustainability research & education	39	100	17	85
17	Community engagement	10	26	0	0
18	Sustainability awareness program / project	23	59	2	10
19	Established/signed commitment with others higher education association	22	56	0	0
20	Partnership / collaborations with other parties	13	33	0	0

5) *Sustainability department/office.* The office or department of sustainability created to coordinate sustainability matters. For example, the Green Office at Charles Sturt University coordinates and monitors sustainability performance. Nine (23%) Australian universities have a unit to coordinate sustainability matters. However, only two (10%) universities in Malaysia represented by UM and USM.

6) *Sustainability reporting.* The reports are produced in relation to sustainability practices. For example, The Southern Cross University reports their sustainability initiatives in education and operational activities. Fifteen (38%) Australian universities produced reports on sustainability practices. However, no data was found in Malaysian universities' websites.

7) *Sustainable energy*. Universities incorporated sustainable energy in their management approach, (whether they have undertaken, are undertaking or will undertake in the future plan). The initiatives concern renewable energy and efficiency. For example, in the University of South Australia, various energy efficient projects are featured such as the intelligent energy management systems, power factor correction and on demand lighting. Thirty-four (87%) Australian

universities showed awareness on sustainable energy. In comparison, no data was found in Malaysian universities websites.

8) *Sustainable water supply.* Universities showed their awareness on sustainable water management such as water conservation and efficiency. For example, The University of Tasmania implemented reuse water consumption by the installation of rainwater tanks. Thirty-five (90%) Australian universities showed awareness on sustainable water system. However, no available data was found in Malaysian universities.
9) *Sustainable waste management* . The awareness on waste management such as waste reduction and recycling. For example, La Trobe University is establishing strategies for recycling of organic waste and e-waste. Thirty-six (92%) Australian universities showed their awareness in sustainable waste management. However, no data was found in Malaysian universities' websites
10) *Sustainable biodiversity / ecological.* The university commitment in practicing sustainable biodiversity like the preservation of native flora and fauna. For example, the University of Queensland, promotes the preservation of birds and possums. For Malaysia, USM introduced the concept of „Garden University' to appreciate the influence of the natural environment in the university campus. Fifteen (38%) Australian universities showed awareness on sustainable biodiversity. In comparison, only USM showed their awareness regarding this theme in Malaysia.
11) *Emission control / pollution prevention* . The university shows awareness to prevent air, water and land pollutions in their practices. For example, Curtin University of Technology conducted an emissions audit of greenhouse gases as part of achieving sustainable operation. Eleven (28%) Australian universities showed awareness on pollution. However, no data was found in Malaysian universities' websites.
12) *Sustainable /green transportation / travelling*. The universities practice or show awareness on sustainable transportation. For example, Flinders University established the Green Transport Office with the aim to minimise vehicle numbers. Twenty-nine (74%) Australian universities show awareness on sustainable transportation management. However, no data was found in Malaysian universities websites.
13) *Sustainable / green facilities, building & infrastructure*. Universities show awareness to adopt sustainability principles in creating facilities and buildings. For example, Griffith University has applied sustainable building principles to all new and refurbishment projects such as the installation of motion detector sensors

for lighting. In Malaysia, the Universiti Malaysia Perlis (UMP) seriously considered to build a „Nature-Campus' taking into account physical, spiritual and environmental factors.. These elements have a close relation to sustainable building and facilities. Twenty-five (64%) Australian universities showed awareness on sustainable facilities. In comparison, only the UMP was found to exhibit this theme in Malaysia.

14) *Sustainable / green purchasing / procurement*. Universities apply a sustainable procurement or purchasing policy. For example, La Trobe University approached sustainable purchasing via supporting energy efficient transport. Nineteen (49%) Australian universities show awareness in adopting sustainable principles in procurement. However, no data was found in Malaysian universities websites.
15) *Green IT, office & laboratory*. Universities introduced sustainability principles in office, laboratory and IT management. For example, the University of Adelaide was embarking on sustainable IT projects such as replacement of outdated data centre and screen saver timing. Nineteen (49%) Australian universities show awareness in practicing sustainability in this area. In comparison, no data was found in Malaysian universities websites.
16) *Sustainability research & education.* Universities involved in sustainability research and education. The adoption of sustainability in research activities in universities lead to the creation of new ideas and improved knowledge towards sustainability. For example, Murdoch University has established centre „Energy for Sustainable Transport' to improve Western Australia's transportation sector. For education, the existence of information on sustainability principles in the courses and curriculum designed to support the sustainability goal. For examples, the University of Southern Queensland offered sustainability program for postgraduate level such as the Master of Sustainability Science. In Malaysia, the UM has established research centres such as the Center for Equatorial Sustainable Design and the Centre for Sustainable Built Environment. All 39 (100%) Australian universities show awareness in sustainability research and education. In comparison, only 17 (85%) was found in Malaysian universities. This is the highest number of themes that was found in both countries.
17) *Community engagement.* Universities involvement with communities regarding sustainability. For example, the University of New South Wales has developed a website „Teach Sustainability' to support local school teachers in promoting sustainability. Ten (26%) Australian universities are involved with communities in moving towards sustainability. However, no data was found in Malaysian universities' websites.

18) *Sustainability awareness program / project.* Universities provide programs to enhance the awareness level among staff and students. For example, the University of Technology Sydney has created „UTS Alumni Sustainability Network' to enhance interest among staff and students. In Malaysia, the UM has created an Environmental Volunteer Group to support the implementation of environmental sustainability all over the campus. Twenty-three (59%) Australian universities show awareness to boost knowledge and alertness among staff and students concerning sustainability. In comparison, only two (10%) universities in Malaysia met these themes.
19) *Established/signed commitment with other higher education associations*. Universities have signed a declaration of commitment with parties concerning sustainability in higher learning education. For example, Macquarie University has commitments with Australasian Campuses Towards Sustainability (ACTS), the body concerned on sustainability in the Australian and New Zealand tertiary sectors. Twenty-two (56%) Australian universities associated with parties supporting the sustainability in higher learning education. However, no data was found in Malaysian universities websites.
20) *Partnership / collaborations with other parties*. Universities have collaborations or partnerships with other parties concerning sustainability such as local and state government or private companies. For example, the University of Ballarat has collaborated with the National Centre for Sustainability (NCS) to support the development of sustainable practices. Thirteen (33%) Australian universities collaborated with other parties concerning sustainability. In comparison, no data was found in Malaysian universities' websites.

Comparative analysis: overall themes

Based on the data presented in the Table 1, the most frequent themes are „Sustainability research & education' articulated by all (100%) of Australian universities and 85% among Malaysian universities. This is followed by „Sustainable waste management' which is 92% and then „Statement of commitment to sustainability in its operation' and „Sustainable water supply' both achieving 90% from total universities in Australia. The three least frequent themes are „Sustainability department/office', „Community engagement and „Emission control / pollution prevention'.

In comparison with the Malaysian universities, out of the 20 themes found in total, only six were identified which are „Statement of commitment to sustainability in its operation' met by four universities, „Sustainability department/office' and „Sustainability awareness program/project' both met by two universities and the rest only met by one university.

A comparison of universities across both countries

Table 3 shows a comparison of the number of sustainability themes for both countries. The segregation is based on 4 scales which are 1 to 4. Each scale was divided by bands of 25%. These ranks were utilised to portray the overall performance between universities and their commitments. These scales are arbitrary in nature, however, they were applied consistently across the countries to provide comparison.

From the tables, the results showed that Australian university websites display more sustainability themes than those of Malaysian universities. Twelve (31%) of the Australian universities are in the top group (75-100) and the majority are under category 2 which is 19 (49%) universities.

However in Malaysia, all universities are at category 4 or at minimal level, except one university in category 3. Overall, most universities in Malaysia only met one theme which is „Sustainability research and education'.

Table 2 – Comparison of overall number of sustainability themes count for both countries

Group	Percentage of Sustainability Themes	Australia		Malaysia	
		No of universities	%	No of universities	%
1	75-100	12	31	0	0
2	50-74	19	49	0	0
3	25-49	5	13	1	5
4	0-24	3	7	19	95

Figure 2 shows the distribution of the number of sustainability themes for Australian universities. It can be seen that the majority of institutions display between 10 and 20 themes in their websites with just a few lower than this.

DISCUSSION

The purpose of this study is to determine the extent of commitment within universities across Australia and Malaysia towards sustainability practices as indicated by a detailed web site survey. The review of 39 university websites in Australia and 20 in Malaysia showed significant differences between the countries. Generally, the results provide preliminary findings that the developed world is more mature than developing countries for the commitment toward sustainability practices. The 20 sustainability themes identified were addressed by Australian universities to a varying extent but only a few were addressed by the Malaysian universities. This result presents evidence that sustainability issues are well established in Australia.

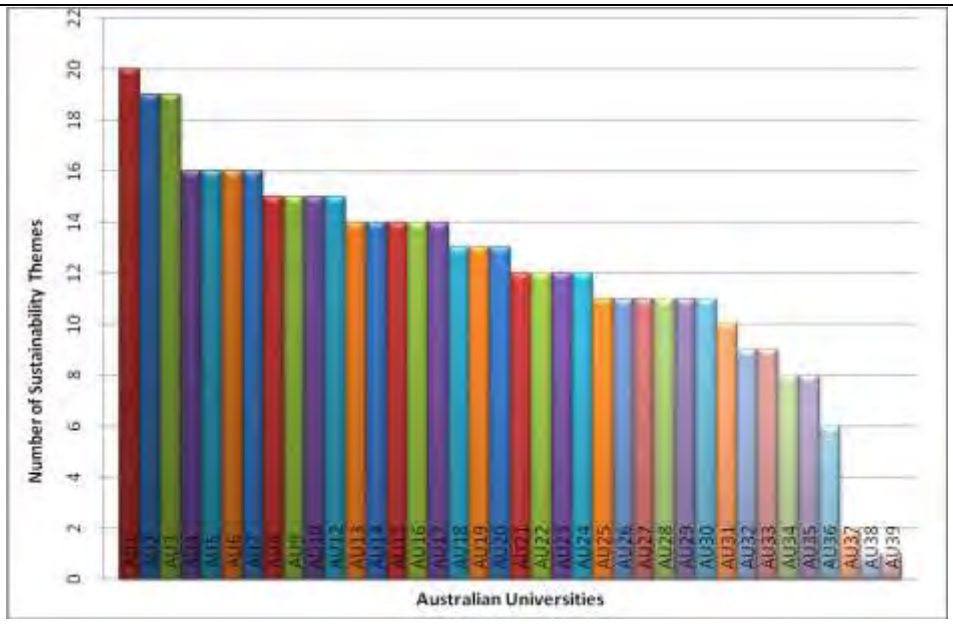


Figure 2 – Distribution of sustainability themes on Australian universities websites

Specifically, the study for both countries shows no strong connection between the particular type of themes met and the universities' overall practices. This means that even when certain universities have adopted a significant theme in their organisation such as „Sustainability policy,' the overall individual university achievement can still be below 50%. These trends are similar with the „Sustainability position' and the „Sustainability committee' themes. In the Australian context, eight universities are below 50% achievement. Clearly, although they have a significant and good governance criterion such as policy, special sustainability coordinator and committee on sustainability, the overall commitment is still debatable. Furthermore, this study shows similarities between both countries on the commitments for certain themes. The „Statement of commitment to sustainability in its operation' and „Sustainability research & education' are the themes most identified in the Australian and Malaysian universities. From the results, most universities have commitments to practices and dedicated teaching and research into sustainability which can lead to determine goals and improve the understanding and knowledge of the respective peoples. This means both countries are committed on these issues. Therefore, for Malaysia, these two themes are potentially beneficial for the long term aim of achieving sustainable development goals.

An interesting aspect of this study is the validity of surveying organisational websites for gauging actual policy. There are a number of researchers supporting the concept and these are referred to earlier in this paper. However, there may be cultural, social or technological reasons which weaken the correlations between policy and website information when comparing developed and developing countries. This possibility is

recognised and for this reason a detailed questionnaire will be distributed to universities in both countries. The results of the questionnaire will be compared with the websites survey to address this issue.

The data provides insights to the research aim of determining the level of sustainability commitments in both countries. Malaysian universities appear to show some of the sustainability themes evident in Australian universities, at least at the level of policy and commitment. It is in the implementation of this commitment that Australian universities differ and appear to have developed further. This observation provides the beginnings of a potential roadmap for Malaysian universities to achieve greater sustainability practices in the future.

CONCLUSION

As a significant conclusion, this preliminary study has confirmed that sustainability practices are on the management agenda of most universities in both Australia and Malaysia, particularly with respect to a commitment to sustainable research and education. The actual implementation of sustainable practices as defined by the 20 sustainability themes derived in this research varies in Australian universities from low to high. By contrast, the study indicates that Malaysian universities are less advanced in this respect.

This study is a part of a larger PhD project and represents an initial step in identifying those factors which may assist universities in Malaysia to achieve sustainable practice. Ultimately, the outcomes will contribute to a draft framework aimed at accelerating the adoption of sustainable performance. Furthermore, the study provides preliminary information to increase the body of knowledge about sustainability in universities.

Further detailed analysis will be carried out by a questionnaire survey to Australian and Malaysian universities followed by interviews with facilities management personnel in selected institutions. The information from the web survey, questionnaires and interviews will be triangulated to confirm those factors which contribute to the successful implementation of sustainable practices in the operation of universities. Particular attention will be paid to the role of the facilities management departments and the acquisition and operation of university buildings.

REFERENCES

Adams, C.A. and Frost, G.R. (2008) Integrating sustainability reporting into management practices. *Accounting Forum*, 32, 288-302.

Bajracharya, B. and Too, L. (2009) Building a sustainable university campus: A case study of Bond University. Bhishna Bajracharya, 15.

Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101.

Chapple, W. and Moon, J. (2005) Corporate Social Responsibility (CSR) in Asia. *Business & Society*, 44, 415-441.

Communications, F.A.H. (2006) Rethinking corporate social responsibility. *Fortune Magazine*.

Elmualim, A., Czwakiel, A., Valle, R., Ludlow, G. and Shah, S. (2009) The Practice of Sustainable Facilities Management: Design Sentiments and the Knowledge Chasm. *Architectural Engineering and Design Management*, 5, 91-102.

Forsberg, A. and Von Malmborg, F. (2004) Tools for environmental assessment of the built environment. *Building and Environment*, 39, 223-228.

Gill, D.L., Dickinson, S.J. and Scharl, A. (2008) Communicating sustainability: A web content analysis of North American, Asian and European firms. *Journal of Communication Management*, 12, 243-262.

Gray, R., Kouhy, R. and Lavers, S. (1995) Corporate social and environmental reporting: a review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing & Accountability Journal*, 8, 47-77.

Hine, C. (2004) Social *Research Methods and the Internet: A Thematic Review*.

Jose, A. and Lee, S. (2007) Environmental reporting of global corporations: A content analysis based on website disclosures. *Journal of Business Ethics*, 72, 307-321.

Kim, S.T. and Weaver, D. (2002) Communication Research About the Internet: a Thematic Meta-analysis. *New Media & Society*, 4, 518-538.

Kolbe, R.H. and Burnett, M.S. (1991) Content-Analysis Research: An Examination of Applications with Directives for Improving Research Reliability and Objectivity. *Journal of Consumer Research*, 18, 243.

Lambert, S. and O'Halloran, E. (2008) Deductive thematic analysis of a female paedophilia website. *Psychiatry, Psychology and Law*, 15, 284-300.

Marshall, C. and Rossman, G.B. (1999) *Design qualitative research*. Sage: Thousand Oaks, California.

Mcmillin, J. and Dyball, R. (2009) Developing a Whole-of-University Approach to Educating for Sustainability. *Journal of Education for Sustainable Development*, 3, 55-64.

Plessis, C.D. (2007) A strategic framework for sustainable construction in developing countries. *Construction Management and Economics*, 25, 67 - 76.

Proctor, W. and Straton, A. (2009) Sustainability assessment: accounting for the triple bottom line. *Ecos*, 29.

Sabir, M. (2008) *The role of universities in sustainable development with special focus on Pakistan*.

Shah, S. (2006) *Sustainable practice for the facilities manager*, Oxford, UK, Blackwell Publ.

Wojcikiewicz, B. (2008) Examining the Triple Bottom Line. *Qualified Remodeler*, 34, 30.

Yin, R.K. (1994) *Case study research: Design and methods*. Thousand Oaks, CA, Sage Publishing.

Zhang, J. (2005) *Content analysis of web sites from 2000 to 2004: a thematic meta-analysis*. Texas A&M University.

Harmonisation of Construction Industry Payment Legislation in Australia – A Survey of Construction Lawyers

Jeremy Coggins
School of Natural and Built Environments
University of South Australia, Adelaide, Australia

ABSTRACT

With parliaments in ACT, Tasmania and South Australia all passing construction industry payment legislation („the legislation') towards the end of 2009, the legislation has now been enacted, in one form or another, in all eight Australian States and Territories. As its stands there is, to varying degrees, disparity between each of the relevant Australian Acts. This disparity is particularly marked between the Western Australian and Northern Territory Acts, on the one hand, and the New South Wales, Victorian, Queensland, Australian Capital Territory, Tasmanian and South Australian Acts on the other. This paper presents the findings of a questionnaire survey aimed to solicit the views of construction lawyers in Australia as to the desirability of legislative harmonisation, the appropriateness of the existing legislative models for various types of payment claim, and the suitability of various proposals for a nationally unified legislative model.

KEYWORDS

security of payment, statutory adjudication, harmonisation

INTRODUCTION

It is now 12 years since the *Building and Construction Industry Security of Payment Act 1999* commenced in New South Wales. During that time, construction industry payment legislation („the legislation') has progressively been enacted throughout all the other Australian jurisdictions,[1] culminating in the Tasmanian Act which received Royal Assent

[1] The relevant Acts, in order of commencement, are: *Building and Construction Industry Security of Payment Act 2002* (Victoria) – the „Victorian Act', *Building and Construction Industry Payments Act 2004* (Qld) – the „Qld Act', *Construction Contracts (Security of Payments) Act 2004* (NT) – the „NT Act', *Construction Contracts Act 2004* (WA) – the „WA Act', *Building and Construction Industry Security of Payment Act 2009* (Tas) – the „Tasmanian Act', *Building and Construction Industry Security of Payment Act 2009 (ACT)* – the „ACT Act', *Building and Construction Industry Security of Payment Act* 2009 (SA) – the „SA Act'. The Acts commenced operation on the following dates: 26 March 2000 (NSW), 31 January 2003 (Vic), 1 October 2004 (Qld), 1 January 2005 (WA), 1 July 2005 (NT), 17 December 2009 (Tas), 1 July 2010 (ACT). Note that the SA Act comes into force on a date which is yet to be proclaimed.

on 17 December 2009.[2] Although the other Australian jurisdictions modelled their legislation, to varying degrees, upon the NSW Act, there is considerable inconsistency between the various Australian Acts. This inconsistency is most marked, with respect to the underlying conceptual frameworks and detail of the drafting, between the Western Australia (WA) and Northern Territory (NT) Acts on the one hand which more closely resemble the United Kingdom (UK)[3] and New Zealand (NZ)[4] Acts, and the other Australian Acts on the other which are more closely modelled on the NSW Act.

Accordingly, the WA and NT Acts have been collectively labelled[5] as the „West Coast' model legislation as opposed to the „East Coast' model tag given to the other Australian Acts.[6]This paper generally refers to the NSW legislation as representative of the East Coast model, and the WA legislation as representative of the West Coast model.

A common objective of all the Australian legislation is the eradication of unfair contractual provisions and practices with regards to payment in order to get cash flowing down the hierarchical contractual chains that exist on most construction projects. All the legislation also provides for rapid and mandatory statutory adjudication of contractual payment disputes in the construction industry designed to facilitate quick and inexpensive resolution of such disputes.

There appears to be a general consensus that the inconsistency in the legislation across Australia is an undesirable state of affairs. As such, in recent times there has been a call from several commentators – echoing the recommendation of the Cole Royal Commission (Cole 2003) nearly a decade ago – that the legislation should be harmonised into a uniform national approach in order to benefit the construction industry (Bailey 2009; Zhang 2009; Bell &Vella 2010). Some of these commentators have put forward proposals and ideas as to the most appropriate conceptual framework for a unified approach (Davenport 2007; Bailey 2009; Brand & Davenport 2010; Coggins 2011).

After initially considering the legislative objective, and key differences between the East and West Coast legislative models, this paper briefly considers three different proposals that have been proffered as the basis for unified national legislation. The results of a pilot

[2] Although the Tasmanian Act commenced operation before the Australian Capital Territory (ACT) and South Australia (SA) Acts, it was actually the last Act to be passed by Parliament in Australia.

[3] *Local Democracy, Economic Development and Construction Act 2009* (formerly the *Housing Grants, Construction and Regeneration Act 1996*).

[4] *Construction Contracts Act 2002* (NZ) – the „NZ Act'.

[5] The author first came across this terminology in a final report prepared by Stenning and Associates for the Minister administering the Building Act 2000 entitled „Security of Payment in the Tasmanian Building and Construction Industry' published in 2006.

[6] Which more closely resemble the NSW Act.

survey of Australian construction lawyers with respect to harmonisation of the legislation, carried out by the authors, are then presented. From the pilot survey, preliminary observations are made as to the respondents' views as to suitability of the existing legislation for resolving payment disputes, and the desirability and form of harmonising legislation.

THE OBJECTIVE OF THE LEGISLATION

Although the overall common objective of the East and West Coast legislative models is the same - to facilitate the flow of cash in a swift manner down the hierarchical contractual chain on construction projects[7] - some differences with respect to legislative parliamentary intent can be detected from the Second Reading Speeches.

Despite the East Coast model's wide ranging scope, affording protection to all parties who carry out work (or supply goods and services) in the construction industry, the focus of the Second Reading Speech for the NSW Bill given by the Minister, Mr Morris Iemma, was very much on protecting the vulnerable small subcontractor. As Mr Iemma (1999: 1594) states:

> *It is all too frequently the case that small subcontractors - such as bricklayers, carpenters, electricians and plumbers - are not paid for their work. Many of them cannot survive financially when that occurs, with severe consequences for themselves and their families.*

Mr Iemma (1999: 1595) continued:

> *Hundreds of subcontractors in New South Wales struggle to survive when they do not receive money owed to them for work undertaken. They do not have the cash flow allowing them to keep on working while waiting for payment. This causes hardship not only to them but also to their families.*

The intent and design of the East Coast model legislation, therefore, would appear to be geared towards the protection of smaller contractors (or suppliers) by ensuring they are entitled to, and are able to recover, progress payment claims for construction work they have undertaken (or related goods and services they have supplied).[8]

The intent of the West Coast model is similarly wide ranging in its scope of coverage, but unlike the East Coast model, would appear to be intended to commensurately cater for a wide range of contractual payment claims, ranging from small to complex. Accordingly,

[7]See the Second Reading Speeches for each of the Acts: ACT (Hargreaves J, 15 October 2009); NSW (Iemma M, 29 June 1999); NT (Toyne P, 14 October 2004); Queensland (R E Schwarten, 18 March 2004); SA (Kenyon T, 5 March 2009); Tasmania (Singh L M, 4 November 2009); Victoria (Thomson M R, 21 March 2002); WA (MacTiernan A J, 3 March 2004.

[8]See, for example, s 3(1) of the NSW Act.

in her Second Reading Speech for the WA Construction Contracts Bill, the Minister, Ms MacTiernan (2004: 274), states that the legislation's:

> *primary aim is to keep the money flowing in the contracting chain by enforcing timely payment and sidelining protracted or complex disputes. The process is kept simple, and therefore cheap and accessible, even for small claims.*

THE KEY DIFFERENCES BETWEEN THE EAST AND WEST COAST MODELS

Several differences exist between the two models with respect to concept and detail. For the purposes of this paper, three of the key differences are discussed below.

Dual payment system versus freedom of contract

The East Coast model operates a „dual payment' system for progress payment claims, creating a statutory payment system which runs alongside any contractual regime.[9] In order to engage the statutory payment system, a claimant must endorse its payment claim as being made under the Act,[10]and serve it upon the respondent.[11]The West Coast model does not operate a dual payment system, but rather payment claims referred to in the Act are those made under the contractual regime.

The East Coast model provides for recovery of progress payments for construction work undertaken or goods and services supplied only and, therefore, by definition only allows contractors or suppliers to recover payment from their principals, i.e., „upstream' claims. The scope of the West Coast model is wider, providing the right for either party to make an adjudication application in relation to any payment disputes[12] falling within the scope of the building contract, including debts and damages claims within the scope of the contract.

Under the East Coast model's statutory payment regime, a respondent has up to 10 business days[13] after the payment claim is served to serve a payment schedule indicating the amount of the payment it proposes to make. If the scheduled amount is less than the claimed amount, the schedule must indicate why the scheduled amount is less with reasons for withholding payment.[14] If the respondent either schedules an amount less

[9] *Beckhaus v Brewarrina Council* [2002] NSWSC 960 per Macready AJ at [60]. Such a dual payment system was described as a "dual railroad track system" by Macready AJ in *Transgrid v Siemens &Anor*[2004] NSWSC 87 at [56].

[10] See s 13(2)(c) of the NSW Act.

[11] See s 13(1) of the NSW Act.

[12] See s 25 of the WA Act.

[13] Except in the SA Act which allows 15 business days – see s 14(4)(b)(ii) of the SA Act.

[14] See s 14(3) of the NSW Act.

than the payment claim or fails to pay the whole or part of the scheduled amount by the due date, the claimant may make an adjudication application under the Act.[15]

In the case where a lesser amount is scheduled and paid, the claimant must serve an adjudication application on an Authorised Nominating Authority (ANA) of their choice,[16] with a copy served on the respondent,[17] within 10 business days[18] after receiving the payment schedule.[19] The respondent then has either a period of 5 business days[20] after receiving a copy of the application or 2 business days[21] after receiving notice of an adjudicator's acceptance of the application, whichever is the later, to lodge an adjudication response with the adjudicator.[22]

If the respondent does not duly provide a payment schedule, it becomes liable to pay the claimed amount to the claimant on the due date for the progress payment.[23] Where no payment schedule is provided, the claimant has two paths available under the Act by which to recover the payment claim.

The first path is for the claimant to seek summary judgment in court for the debt due,[24] in which case the respondent is not entitled to bring any cross-claim against the defendant in the summary judgment proceedings, or raise any defence in relation to matters arising under the construction contract.[25] The second path is for the respondent to apply for the payment claim to be determined in adjudication,[26] in which case the respondent will be disallowed from lodging an adjudication response.[27] This means that a respondent will not then have an opportunity to be heard by the adjudicator, who is essentially limited to a

[15] See s 17(1) of the NSW Act.

[16] See s 17(3)(b) of the NSW Act.

[17] See s 17(5) of the NSW Act.

[18] See s 17(3)(c) of the NSW Act.

[19] Except in the SA Act which allows 15 business days – see s 17(3)(c) of the SA Act.

[20] Except in the Tasmanian Act (7 business days) and ACT Act (10 business days).

[21] Except in the Tasmanian Act (5 business days) and ACT Act (5 business days).

[22] See s 20(1) of the NSW Act.

[23] See s 14(4)(b) of the NSW Act.

[24] See s 15(2)(a)(i) of the NSW Act.

[25] See s 15(4)(b) of the NSW Act.

[26] This second path may be preferable to some claimants in terms of speed of recovery as the claimant may request an adjudication certificate from the relevant ANA stating the adjudicated amount (see s 24 of the NSW Act) and file the adjudication certificate as a judgment for a debt in any court of competent jurisdiction (see s 25 of the NSW Act).

[27] See s 20(2A) of the NSW Act.

consideration of the submissions duly made by the parties[28] when determining the adjudication.[29]

Even in circumstances where the respondent has duly served a payment schedule, it may only include in its adjudication response reasons for withholding payment which have previously been included in the payment schedule.[30] Thus, a respondent may be prevented from being able to present its full case to the adjudicator unless it has previously served a comprehensive payment schedule which covers all the issues it may wish to rely on subsequently.

Unlike the East Coast model, the West Coast model provides no detailed statutory payment system but rather gives primacy to the parties' agreed contractual payment regime.[31] Thus, where no progress payment is certified in response to a payment claim under the contract within the time stipulated in the contract, the claimant has no statutory right to summary judgment (as per the East Coast model) but must apply to the courts for summary judgment.[32] Unlike the East Coast model, the West Coast legislation does not make the serving of a response to the payment claim[33] a condition precedent to the right of a party who is served with an adjudication application[34] to lodge an adjudication response. Additionally, there are no limitations as to the inclusion of reasons for withholding payment in a response to an adjudication application. Thus, providing that a party lodges their response to an adjudication application within the time allowed by the legislation,[35] it will not be deprived of the opportunity to present its full case.

Types of payment claims allowed

The East Coast legislation was only intended to cover ‚purely progress payment claims' (Davenport 2007: 15). Consequently, the East Coast adjudication scheme was designed

[28]I.e., payment claim, payment schedule and all submissions that have been duly made in their support.

[29] See s 22(2) of the NSW Act.

[30]See s 20(2B) of the NSW Act.

[31] If no such payment regime is provided for in the construction contract, then the payment provisions set out in Schedule 1 of the legislation are implied into the contract.

[32] If the courts permit summary judgment this does not guarantee swift and inexpensive recovery of a certified payment. There is still the possibility that a defendant may be able to defeat an application for summary judgment by demonstrating to the court that it can mount a reasonable defence by way of a cross claim based upon the facts and law, in which case the only option left to the contractor will be to pursue its claim in a relatively lengthy and costly court trial or arbitration hearing.

[33]I.e., the equivalent of a "payment schedule" in East Coast terminology. Although under the West Coast legislation a response to a payment claim is a contractual requirement rather than a statutory requirement.

[34]I.e., the equivalent of the "respondent" in East Coast terminology.

[35]Within 14 days (WA Act, s 27(1)) or 10 working days (NT Act, s 29(1)) after the date on which a party to a construction contract is served with an application for adjudication.

solely for the valuation of construction work undertaken or related goods and services supplied. As submitted by Brand and Davenport (2010: 5), the East Coast adjudication scheme was not intended (and, therefore, designed) to accommodate more complex claims for monies due under the contract such as, for example, delay damages claims by a contractor or liquidated damages claims which the principal, or their contract administrator, may set off against a progress claim. Accordingly Davenport (2007: 23) states "adjudication of a progress claim is a fast track process that is not suitable for deciding issues of breach of contract, extensions of time, repudiation and termination, causation, quantification of damages etc.".

The difference in progress payment amount between the statutory entitlement, as determined by the adjudicator under the East Coast legislation, and the contractual entitlement, as determined by the contract administrator, appears to have resulted in some confusion and inconsistency with respect to what amounts should or should not be included in an adjudicator's determination. Accordingly, with respect to set offs under the current East Coast adjudication process, Davenport (2007: 22) states:

> *There are differences in the approach taken by adjudicators. Some take the approach that only a debt (owed to the purchaser) that is admitted by the supplier or has been decided by a court or tribunal or in arbitration or has been created under a dispute resolution clause in the contract, can be set off against progress payments… Other adjudicators decide disputed issues of liability for and quantum of the back charges… Some adjudicators allow a set off of an amount claimed by the purchaser even if liability and quantum have not been proven.*

Furthermore, the NSW judiciary has allowed claimants to recover amounts for delay damages in adjudicated payment claims under the Act.[36] This, as Davenport (2007: 14) puts it, creates an "imbalance"[37] as only one party is allowed to apply for adjudication of payment disputes regarding damages. As claims for damages falling within the scope of the contract have the potential to be made by either contractual party,[38] it is procedurally unfair to allow only one party the right to refer such claims to the Act's dispute resolution processes.

---

[36] See *Coordinated Construction Co Pty Ltd v JM Hargreaves Pty Ltd* [2005] NSWCA 228; *Coordinated Construction Co Pty Ltd v Climatech (Canberra) Pty Ltd &Ors* . [2005] NSWCA 229; *Minister for Commerce (formerly Public Works & Services) v Contrax Plumbing (NSW) Pty Ltd &Ors*[2005] NSWCA 142; and, *John Holland Pty Limited v Roads & Traffic Authority of New South Wales &Ors*[2007] NSWCA 19.

[37] Also see Brand and Davenport (2010: 5).

[38]E.g. contractors' claims for delay and disruption costs caused by principals, and principals' claims for liquidated or general damages for contractor's delay in achieving practical completion.

Permitted approach of adjudicator in making the determination

Under the East Coast model, the adjudicator is limited to a consideration of documents submitted by the parties when making his or her determination.[39] An adjudicator under the West Coast legislation is not restricted to a consideration of documents submitted by the parties when making his or her determination as in the East Coast model. Rather, the legislation encourages a West Coast adjudicator to be more evaluative in their approach to determination by providing that an adjudicator "is not bound by the rules of evidence and may inform himself or herself in any way he or she thinks fit".[40] This has the effect of extending the adjudicator's investigative powers beyond the consideration of the parties' submissions, thus assisting the adjudicator in ascertaining the facts and the law.

OVERVIEW OF EXISTING PROPOSALS FOR HARMONISATION

Three proposals for a unifying model of legislation are summarised below.

Davenport's proposal for a dual process of adjudication

Davenport (2007) has proposed a dual process of adjudication which aims to combine the East Coast and West Coast model statutory adjudication processes[41] in order to „solve many of the perceived problems with adjudication in the building and construction industry' (Davenport 2007: 12). Davenport (2007: 15) states that:

> *The proposed dual process would retain the [East Coast] certification process for purely progress payment claims, i.e. for claims for the value of work, goods or services that have actually been provided, and would adopt the traditional [West Coast] process for other payment disputes.*[42]

Davenport explains that his proposed dual process of adjudication „would be basically the same as now exists but with slightly different rules for dealing with progress claims and ex-contractual claims' (Davenport 2007: 15).

This would, thus, allow an adjudication process which is faster-track, cheaper and significantly more restrictive on the investigative powers of the adjudicator for purely

[39] Which, in practice, means that an adjudicator under the East Coast legislation often makes a determination on documents only.

[40] See s 32(1)(b) of the WA Act, and s34(1)(b) of the NT Act. Note that the NT Act substitutes the word "appropriate" for "fit" in this provision.

[41] For further details of Davenport's proposed dual process, also see Brand and Davenport (2010).

[42] Davenport cites examples of such „other payment disputes', which he terms „ex-contractual claim', including, *inter alia*: a contractor's claim for delay damages for breach of contract by the principal, a contractor's claim for the value of extra work carried out for which the superintendent refuses to direct a variation in writing, a principal's claim for liquidated or general damages for delay in achieving practical completion, and a principal's claim for the costs of having work carried out under the contract, which the contractor disagrees is included in the contract, by another contractor.

progress payment claims, and a quasi-judicial adjudication process for adjudication of ex-contractual claims.[43]

Notably, however, Davenport has proposed some significant procedural modifications with respect to the operation of the „traditional', West Coast, process for adjudication of ex-contractual claims. For example, a statutory system, similar to the current statutory payment system under the East Coast model, is prescribed for the serving of ex-contractual claims by claimants and defences by respondents prior to the lodging of a „traditional' process adjudication application.

Davenport's proposal is a based on a view that the East Coast model in its present form provides an efficient and procedurally fair scheme for resolving purely progress payment disputes, but not for claims for other debts and damages. By providing a West Coast system for such debts and damages claims, Davenport argues that procedural fairness will be restored.

Bailey's Proposal for a Cap on Claim Amounts

Bailey (2009) advocates a cap on claim amounts under rapid mandatory adjudication schemes for payment, thereby confining the benefits of the „short, sharp interim adjudication procedure' to participants in small business. Accordingly, Bailey (2009: 3) states:

> *If the intended small business focus of the reform had been more narrowly defined in the legislation and the process refined for that sector of the construction industry, then the complexities that pervade the process might not have developed as they have.*

The outline conceptual framework of Bailey's proposed scheme essentially involves capping „the value of claims and the amount of main contracts and sub-contracts[44] which are to be subject to the process … with limited or scaled or stepped processes defined' (Bailey 2009:3).

Further, Bailey (2009: 3) proposes that:

> *the scheme should be limited only to claims for payment for the value of work performed. This necessarily will include work outside the contractual scope (i.e., variations).[45] Time-related claims, other than those for which there is established entitlement under contractual regimes, ought be excluded.*

[43] Where, as Davenport points out, an adjudicator „is more likely to call for further submissions or hold a conference or make an inspection.'

[44] This issue was the subject of complex amendment in s.10A of the amendments to the Victorian Act in 2007.

[45] The Victorian amendments to the legislation in 2007 sought to address this issue.

Thus, larger and more complex disputes arising in the construction industry would not be subject to statutory rapid adjudication, instead being „dealt with under procedures that are developed specifically for them including commercial arbitration' (Bailey 200: 3).

Coggins' proposal for a dual process of adjudication according to size of progress payment claim

Using Davenport's concept of a dual process and Bailey's concept of claim capping, Coggins (2011) has proposed a hybrid adjudication scheme for consideration as a harmonised, unifying model.

The proposed scheme would be a dual process according to size or value of payment claim or, alternatively, of contract sum. It would employ the East Coast model process for small progress payment claims which fall below a prescribed cap value. Payment claims which could be adjudicated under the East Coast process would be strictly limited to payment claims for construction work carried out or supply of related goods and services. Payment claims which involve disputes over what Davenport terms as „ex-contractual' claims would not be permitted to be adjudicated under the capped East Coast process, but would be resolved under the West Coast process instead.

Progress payment claims which are greater in amount than the capping value, which it is suggested should initially be $25,000, for the East Coast process would be adjudicated under the West Coast process. Additionally, any payment claims, regardless of size, which involved „ex-contractual' claims (e.g. a delay damages claim within the scope of the contract, or a liquidated damages claim set off against the certified payment amount by the principal or its agent) would be adjudicated under the West Coast process.

Coggins' proposal is based on a view that:

- the restrictive nature of the East Coast adjudication scheme does not afford the required level of procedural justice to be expected from an effective alternative dispute resolution process, and that this level of restriction may only be justified to protect smaller, more vulnerable contractors as per the original parliamentary intent; and, as such,
- a „one-size fits all' approach for the construction industry is inappropriate as several distinct differences exist between the higher and lower ends of the hierarchical contractual chain on construction projects with respect to, *inter alia*: use of balanced standard forms of contract, inclusion of impartial independent certifying mechanisms for progress payment in contracts, imbalance of bargaining power between contractual parties, and commercial vulnerability to cash flow problems of a relatively small amount.

RESEARCH METHODOLOGY

The target population for the pilot survey was Australian construction lawyers. It was felt that, although construction lawyers may not have the most experience as actual adjudicators under the legislation, their legal training, expertise and role as professional legal advisers to construction industry clients meant that they were the most likely to understand the differing legislative frameworks and content of the various Australian Acts, as well as judicial interpretation of the legislation.

The survey sample comprised 66 construction lawyers throughout Australia. The lawyers in the sample were selected by an internet search, browsing the staff profile data on websites of legal firms in Australia with specialist construction law departments. Lawyers who were shown to have expertise in construction law were included in the sample. Additionally, three lawyers who were known to the authors[46] to have specific expertise on the legislation were included in the sample. Of the 66 questionnaires sent out, 10 responses were returned – a response rate of 15%.[47]

It is intended that the responses from the pilot survey form the basis from which to inform a larger subsequent survey to be carried out in mid to late 2011.

The relatively small number of respondents, and sample of lawyers predominantly selected from a limited number of legal firms found via an arbitrary internet search, mean that the findings of this pilot survey *per se* are preliminary in nature; at best, the findings are, therefore, indicative and should be treated with caution. Nevertheless, the views of the respondents are certainly of interest.

The survey was distributed in an online format using the „TellUs2' software application. The questionnaire comprised 30 questions, most of which required respondents to express their views, with respect to ideas or statements, on a Likert scale of 1 to 5. The survey results are presented below.

RESEARCH FINDINGS

In order to gauge the respondents' type and level of experience in relation to the two Australian legislative models, they were asked to check various boxes to indicate their knowledge and experience with respect to the legislation[48] (see Figure 1).

[46] Such lawyers were known to the authors principally due to their publications with respect to the legislation.

[47] The survey was jointly administered by the author and David Delchau (final year undergraduate student, Bachelor of Construction Management & Economics, University of South Australia). David Delchau has presented his own separate analysis of some of the survey results in his 2010 undergraduate thesis.

[48] Note that respondents were permitted to check more than one box when answering this question.

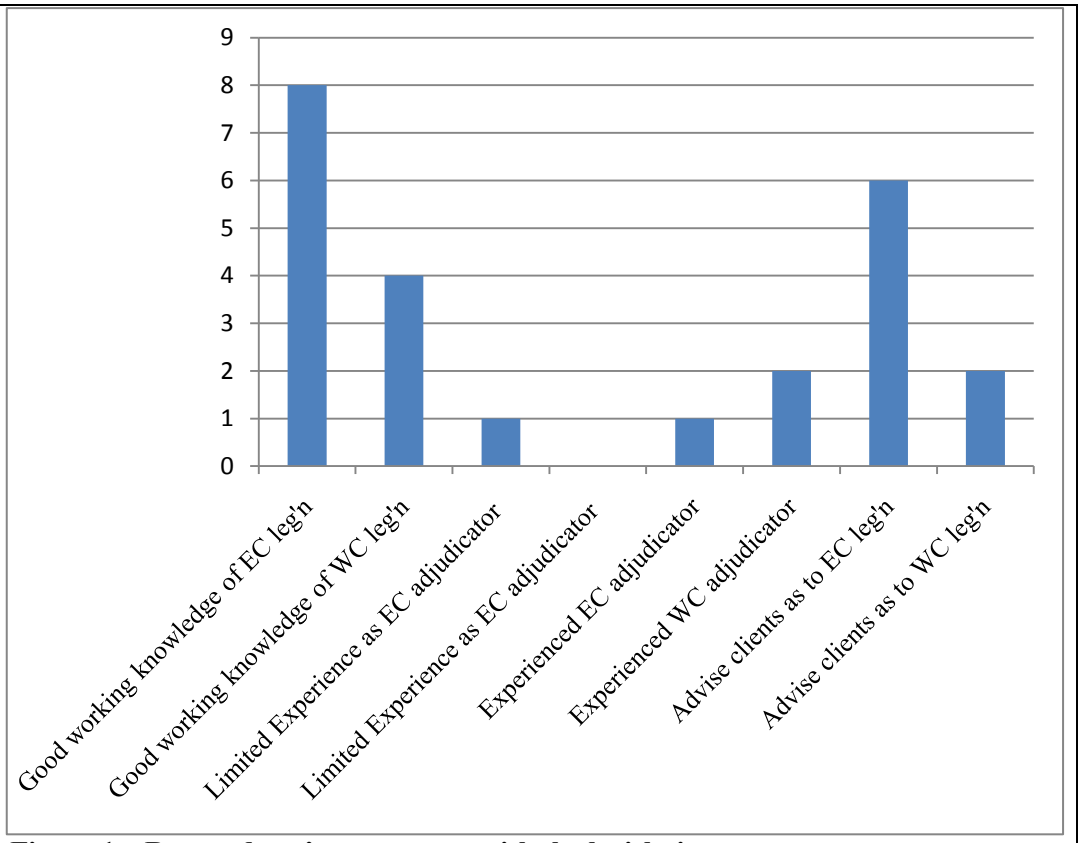


Figure 1 – Respondents' engagement with the legislation

8 out of the 10 respondents had at least a good working knowledge of the East Coast legislation, and 7 of the respondents have advised clients with respect to the East Coast legislation. Only 4 out of the 10 respondents had at least a good working knowledge of the West Coast legislation, and 2 of the respondents have advised clients with respect to the West Coast legislation. For each model, only 2 respondents had any actual experience as an adjudicator.

The respondents were asked to rank on a scale of 1 to 5 (1 = highly undesirable, 5 = highly desirable) how desirable they thought it is for Construction Industry Payment legislation in Australia to be harmonised into a national unified model. The results are shown in Figure 2.

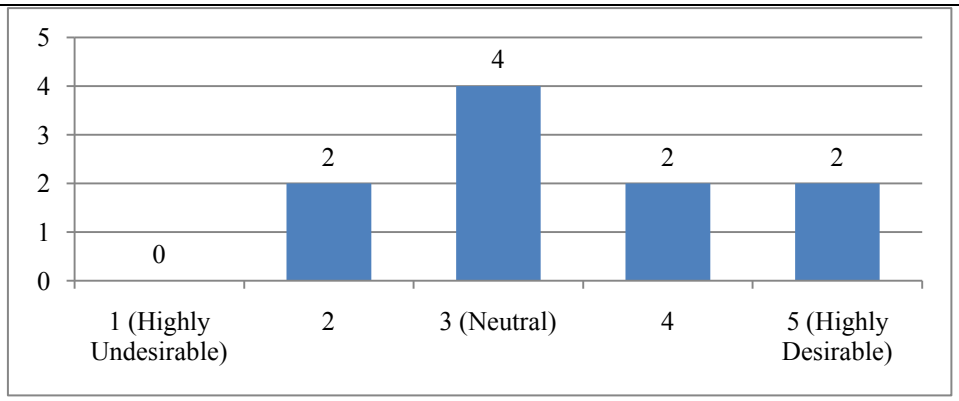


Figure 2 – Desirability of harmonised legislation

4 of the respondents felt that harmonised legislation was either desirable or highly desirable. 4 of the respondents felt neutral towards the proposition. 2 of the respondents felt harmonisation was undesirable.

The respondents were asked to rank on a scale of 1 to 5 (1= not urgent, 5 = very urgent) how urgent they thought it is for Construction Industry Payment Legislation in Australia to be harmonised into a national unified model. The results are shown in Figure 3.

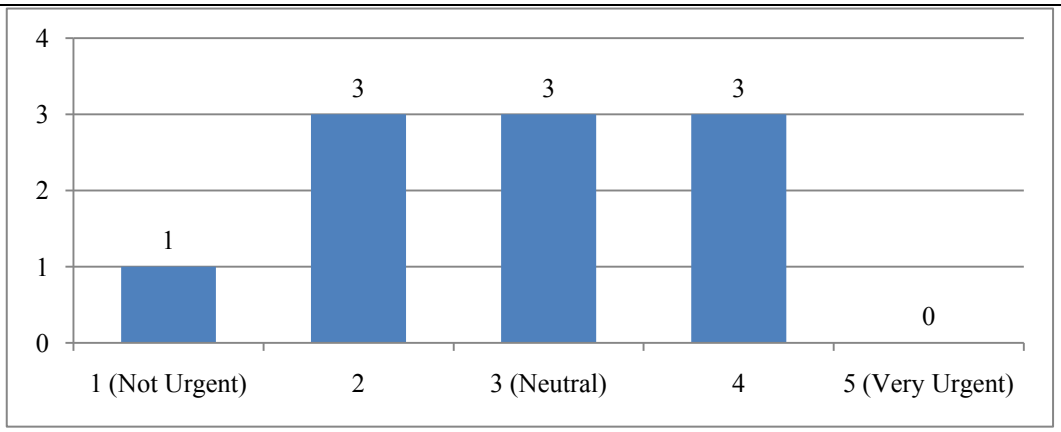


Figure 3 – Urgency of harmonisation

4 of the respondents felt that harmonisation was not urgent. 3 of the respondents felt harmonisation was urgent.

The respondents were asked to indicate the reasons why they thought harmonisation is desirable by checking up to three reasons give to them in the questionnaire. 8 of the respondents felt harmonisation is desirable because it would minimise duplication in, and reduce cost of education campaigns about the legislation. 7 of the respondents felt harmonisation is desirable because it would reduce costs of businesses moving between jurisdictions and operating in different jurisdictions. 2 of the respondents felt harmonisation is desirable because from the principle of equity, it is not right that

subcontractors in some jurisdictions should have more favourable payment rights than in others.

When asked whether there any other reasons why they thought harmonisation is desirable apart from those listed in the questionnaire, the following responses were received:

> *Would allow the creation of a central national adjudication body with one set of rules and a more consistent body of law in the area... It also allows the adjudicators to be focused on one piece of legislation providing greater certainty and confidence in the process.*
>
> *State Government Laws proved unequal to the task of understanding the issues involved.*
>
> *Greater certainty in legal precedent.*
>
> *It would assist contractors. subcontractors, consultants (such as architects, project managers and lawyers to operate with more certainty.*
>
> *I can see no compelling benefits to harmonisation.*
>
> *I think there needs to be a couple of points of clarification: 1 The issue of a need for harmonisation is largely illusory in the circumstances that most small and medium contractors only operate in one jurisdiction. In any event, those operating in multiple jurisdictions are quite used to dealing with different OH & S laws, building certification and permit requirements etc, therefore the Security of Payment (SOP) issue is just a further matter to take into account and is probably not at the forefront of their thinking. From a respondent's point of view they should seek advice from lawyers in the relevant jurisdiction to mitigate this risk. 2 Harmonisation is only desirable if the actual legislative regime is fixed and made more effective and equitable to all industry participants, therefore principals and head contractors should also have a voice in this debate. Too often in the past they have been largely overlooked. Their treatment in NSW and to a lesser extent in Qld and Victoria has been shameful. There is no point in harmonisation if the bad east coast regime is the benchmark.*

When asked about the best way to achieve enactment of uniform legislation, the respondents significantly preferred the option which stated that uniform legislation be developed by the Standing Committee of Attorneys-General, and subsequently enacted in each State and Territory. Their second preference was that Commonwealth legislation be enacted which overrides existing State and Territory legislation. Their third preference was for Commonwealth legislation to be enacted which, by regulation, could exempt States and Territories from the Commonwealth legislation if they enacted legislation which was at least as favourable as the baseline set by the Commonwealth legislation.

The respondents were asked to rank on a scale of 1 to 5 (1= totally disagree, 5 = totally agree) the extent to which they agreed with the following statement: „Construction industry payment legislation should afford greater protection to smaller contractors (and suppliers) than medium or large contractors (and suppliers)'. The results are shown in Figure 4.

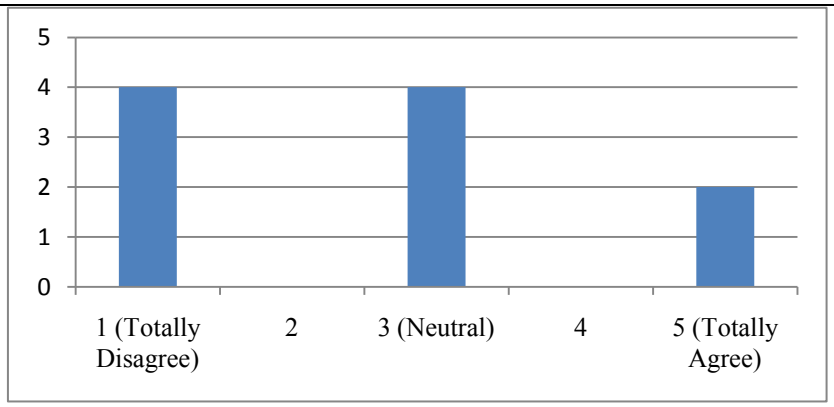


Figure 4 – 'The legislation should protect small contractors more'

4 of the respondents strongly disagreed that small contractors should receive a greater level of protection from the legislation than medium or large contractors. 4 respondents felt neutral to the proposition. 2 respondents strongly agreed with the proposition.

The respondents were asked to rank on a scale of 1 to 5 (1= totally disagree, 5 = totally agree) the extent to which they agreed with the following statement: „Construction industry payment legislation should afford greater protection to smaller and medium contractors (and suppliers) than large contractors (and suppliers)'. The results are shown in Figure 5.

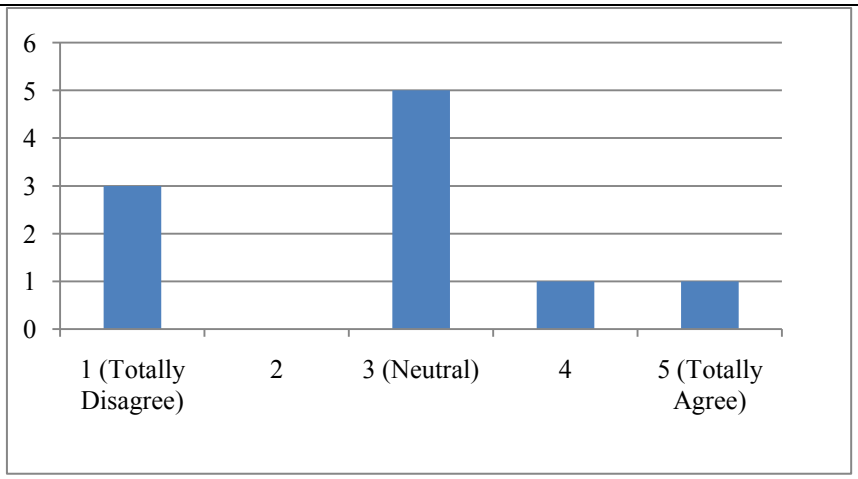


Figure 5 – 'The legislation should protect small and medium contractors more than large contractors'

3 of the respondents strongly disagreed that small and medium contractors should receive a greater level of protection from the legislation than large contractors. 5 respondents felt neutral to the proposition. 1 respondent agreed, and 1 respondent strongly agreed, with the proposition.

The respondents were asked to rank on a scale of 1 to 5 (1= totally disagree, 5 = totally agree) the extent to which they agreed with the following statement: „Construction industry payment legislation should afford the same level of protection to all contractors (and suppliers) regardless of size'. The results are shown in Figure 6.

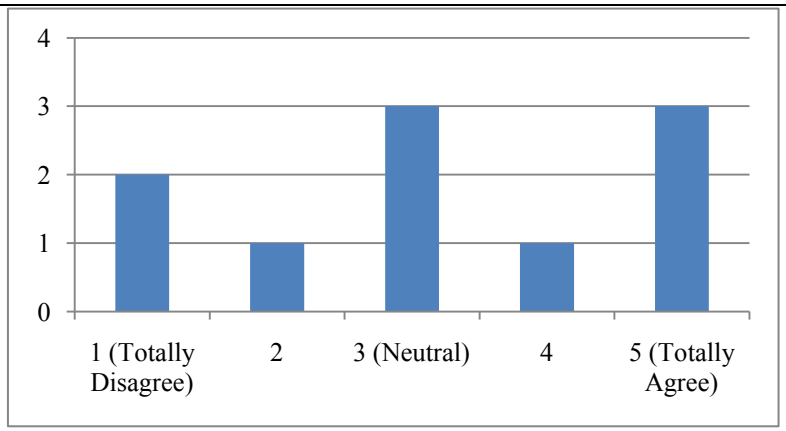


Figure 6 – 'The legislation should protect contractors of all sizes equally'

2 of the respondents strongly disagreed, and 1 disagreed, that the legislation should protect contractors of all sizes equally. 3 respondents felt neutral to the proposition. 1 respondent agreed, and 3 respondents strongly agreed, with the proposition.

The respondents were asked to indicate on a scale of 1 to 5 (1 = Not appropriate, 5 = Very appropriate) how appropriate they thought the East Coast legislative model is in fairly resolving purely progress payment claims under $25,000, between $25,000 and $99,999, and over $100,000. The results are shown in Figure 7.

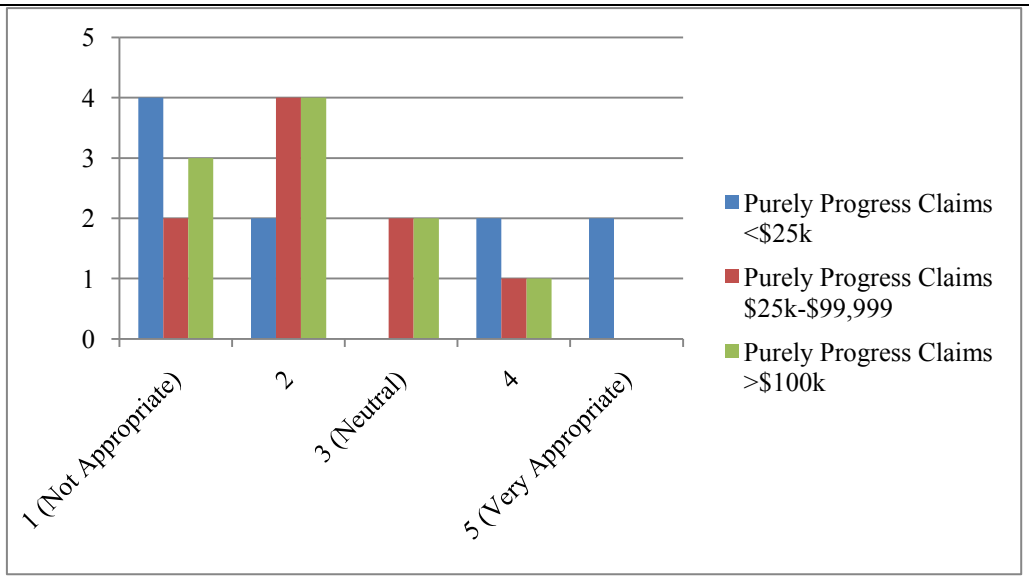


Figure 7 – Appropriateness of East Coast model for resolution of purely progress payment claims

For all size categories, at least 50% of the respondents viewed the East Coast model as, to some degree, inappropriate for resolving purely progress payment claims. For resolution of purely progress payment claims over $100,000, 70% of the respondents viewed the East Coast model as, to some degree, inappropriate. For resolution of purely progress payment claims under $25,000, 40% of the respondents viewed the East Coast model as, to some degree, appropriate.

The respondents were asked to indicate on a scale of 1 to 5 (1 = Not appropriate, 5 = Very appropriate) how appropriate they thought the East Coast legislative model is in fairly resolving other types of payment claims (i.e., claims for damages and debts) under $25,000, between $25,000 and $99,999, and over $100,000. The results are shown in Figure 8. As may be seen, for all size categories, at least 70% of the respondents viewed the East Coast model as, to some degree, inappropriate for resolving other types of payment claims.

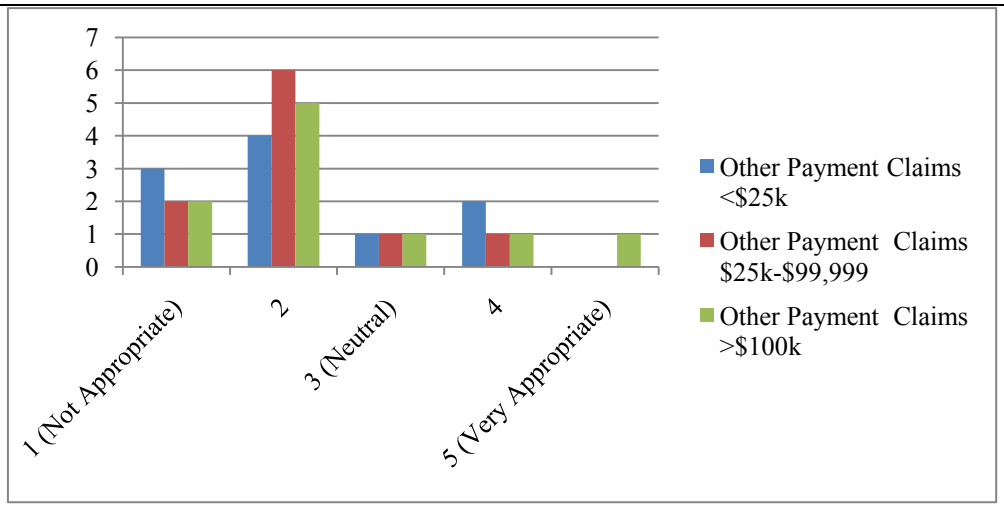


Figure 8 – Appropriateness of East Coast model for resolution of other payment claims

The respondents were asked to indicate on a scale of 1 to 5 (1 = Not appropriate, 5 = Very appropriate) how appropriate they thought the West Coast legislative model is in fairly resolving purely progress payment claims under $25,000, between $25,000 and $99,999, and over $100,000. The results are shown in Figure 9.

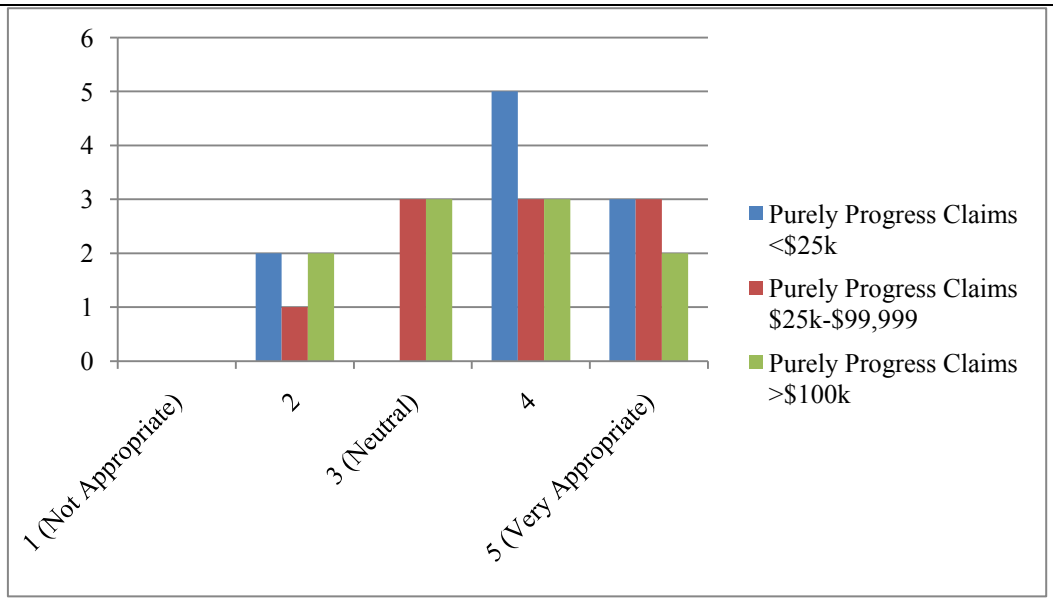


Figure 9 – Appropriateness of West Coast model for resolution of purely progress payment claims

For resolution of purely progress payment claims below $25,000, 80% of the respondents viewed the West Coast model as, to some degree, appropriate. For resolution of purely progress payment claims between $25,000 to $99,999, 60% of the respondents viewed the West Coast model as, to some degree, appropriate. For resolution of purely progress payment over $100,000, 50% of the respondents viewed the West Coast model as, to

some degree, appropriate. For resolution of purely progress payment claims in each size category, no more than 20% of the respondents viewed the West Coast model as, to some degree, inappropriate.

The respondents were asked to indicate on a scale of 1 to 5 (1 = Not appropriate, 5 = Very appropriate) how appropriate they thought the West Coast legislative model is in fairly resolving other types of payment claims (i.e., claims for damages/debts) under $25,000, between $25,000 and $99,999, and over $100,000. The results are shown in Figure 10.

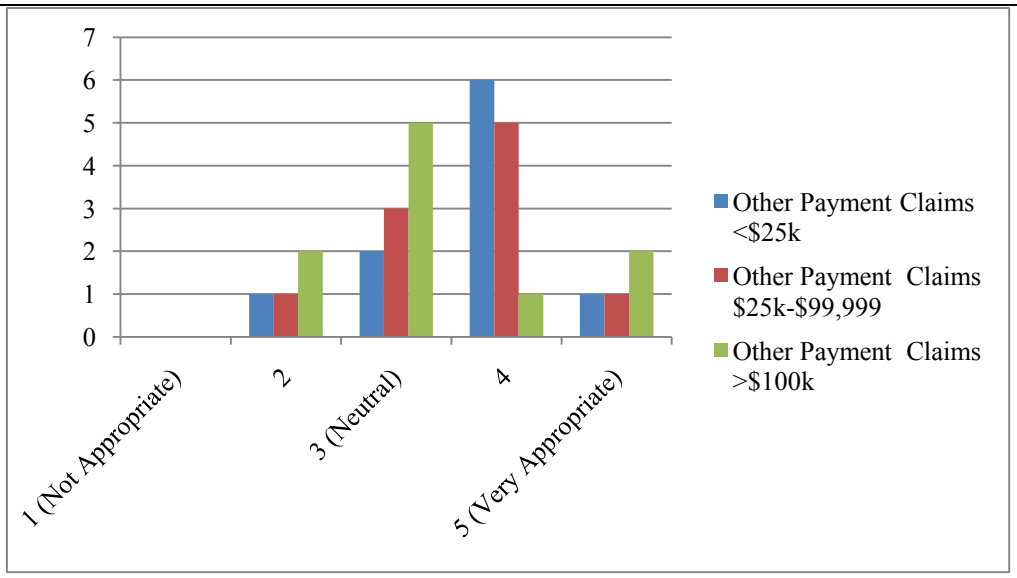


Figure 10 – Appropriateness of West Coast model for resolution of other payment claims

For resolution of other types of payment claim below $100,000, at least 60% of respondents viewed the West Coast legislative model as, to some degree, appropriate. However, for resolution of other types of payment claim above $100,000, only 30% of respondents viewed the West Coast legislative model as, to some degree, appropriate. For resolution of other types of payment claims in each size category, no more than 20% of the respondents viewed the West Coast model as, to some degree, inappropriate.

The respondents were asked to indicate on a scale of 1 to 5 (1 = Not appropriate, 5 = Very appropriate), how appropriate they thought the intended East Coast statutory entitlement to purely progress payment claims (i.e., an entitlement to progress payment claims for construction work carried out or related goods and services supplied which does not take account of any contractually agreed adjustments to progress payment claims for debts and damages) is for purely progress payment claims under $25,000, between $25,000 and $99,999, and over $100,000. This question essentially reflects respondents' views as to progress payment amounts under the East Coast model's payment system differing from contractually agreed progress payment amounts. The results are shown in Figure 11.

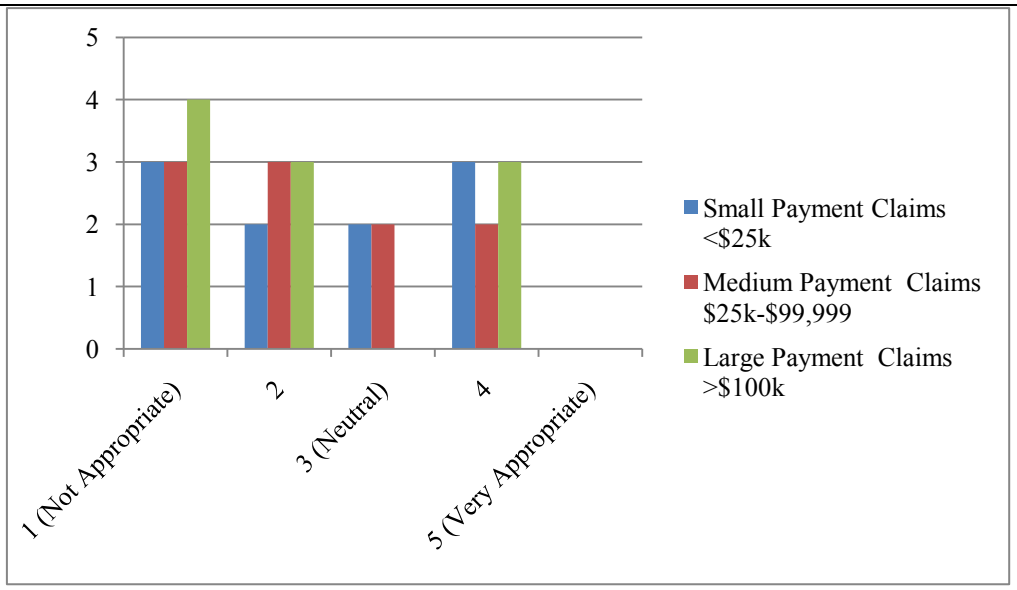


Figure 11 – Appropriateness of East Coast model's statutory entitlement to purely progress payment claims

For progress payment claims below $25,000, 50% of the respondents viewed the East Coast model's statutory entitlement as, to some degree, inappropriate. For progress payment claims between $25,000 to $99,999, 60% of the respondents viewed the East Coast model's statutory entitlement as, to some degree, inappropriate. For progress payment claims above $100,000, 70% of the respondents viewed the East Coast model's statutory entitlement as, to some degree, inappropriate. For progress payment claims in each size category, no more than 30% of the respondents viewed the East Coast model's statutory entitlement as, to some degree, appropriate.

The respondents were asked to indicate on a scale of 1 to 5 (1 = Not suitable or not promising, 5 = Very suitable or very promising), how suitable or promising they thought the following 5 options were as a conceptual framework for a harmonising unified adjudication model in Australia:

1. All payment disputes to be adjudicated under the current East Coast process.
2. All payment disputes to be adjudicated under the current West Coast process.
3. Purely progress payment disputes up to a capped amount to be adjudicated under the East Coast process. Payment disputes above the capped amount to be resolved under traditional dispute resolution methods (e.g., arbitration or litigation).
4. Purely progress payment disputes up to a capped amount to be adjudicated under the East Coast process. All purely progress payment disputes above the capped amount, and all other payment disputes (relating to monetary amounts for damages or debts within the scope of the contract) of any amount, to be resolved under West Coast adjudication process.

5. All purely progress payment disputes of any amount to be adjudicated under the East Coast process. All other payment disputes (relating to monetary amounts for damages or debts within the scope of the contract) of any amount to be resolved under West Coast adjudication process.

Option 3 is akin to the Bailey proposal described above. Option 4 is akin to the Coggins proposal described above. Option 5 is akin to the Davenport proposal described above. The results are shown in Figure 12.

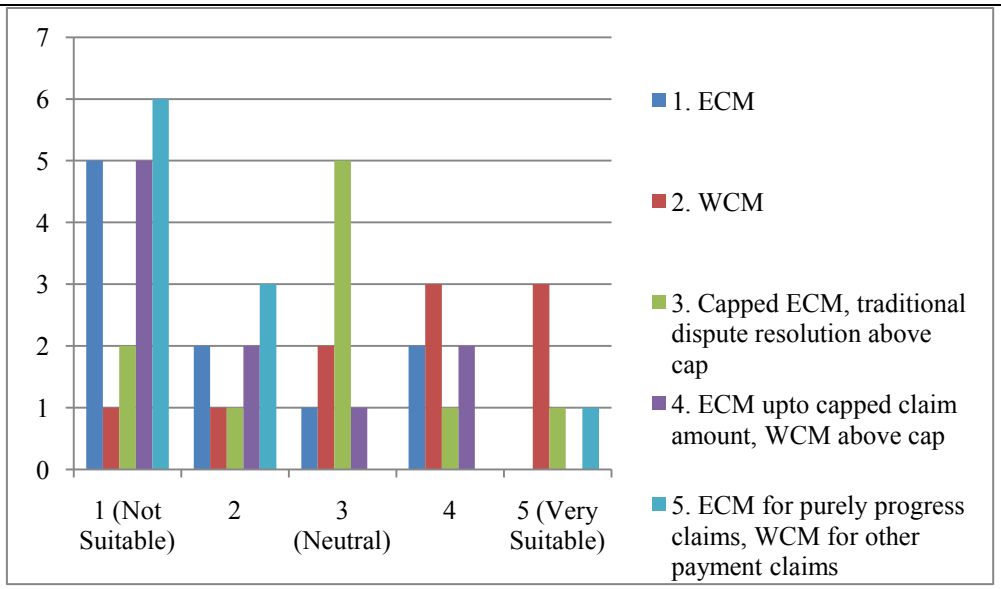


Figure 12 – Suitability of proposed harmonisation models

The option which received most support as a unifying model was that all payment disputes to be adjudicated under the current West Coast process. 60% of the respondents indicated that the West Coast process would, to some degree, be a suitable harmonising model. Only 20% of the respondents viewed that the current East Coast process would be a suitable harmonising model. The East/West Coast hybrid models (options 4 & 5 above) received little support, with 70% viewing that option 4 would be unsuitable and 90% viewing option 5 would be unsuitable. Option 3 was viewed as unsuitable by 30% of respondents, and suitable by 20% of respondents.

When asked to propose a suitable cap amount for payment claims under the East Coast model if a capped model were to be introduced, one respondent suggested $25,000, another $200,000, and two respondents suggested $250,000. Other comments received in response to this question included:

> *In my view the cap amount should be a Total Contract Sum cap. This sum should be approximately $100,000. In that event large contracts are not covered by SOP but smaller contracts are.*

I don't agree a unified system is desirable however I agree all systems should be capped. The contract sum, not the claim should be the determinator of the cap. In my opinion for contracts over $500k the parties should be entitled to negotiate to exclude the Act.

I believe that a capped regime, relating purely to payment disputes and excluding all, non agreed variations, time related claims etc using the East Coast model is appropriate up to a cap of $250,000. However, the legislation also needs to provide that the contractor may only rely upon the Act for the current payment claim. Work not claimed in previous months should go through the standard dispute resolution provisions. Alternatively, once a claim has been rejected with a payment schedule the contractor must take the claim to adjudication at the time of rejection. If it does not do so it loses the right to resubmit the claim or to seek adjudication of that issue in the future. Finally costs of adjudications need to be addressed as adjudicators, once appointed have an open cheque book.

CONCLUSION

All Australian States and Territories have enacted Construction Industry Payment.[49] To varying degrees, all the Australian Acts differ from each other. However, fundamentally the eight Australian Acts may be categorised into one of two distinct models which differ in conceptual framework – the East Coast model and the West Coast model. As such, the issue of harmonisation of the legislation in Australia has become topical.

This paper has presented the results of a pilot survey of Australian construction lawyers as to their views as to: harmonisation, the effectiveness of the two distinct existing Australian models, and various suggested proposals for unifying legislation. Being a pilot survey, a significant limitation of the research findings presented exists in terms of the sample size and response rate. Therefore its findings must be treated as preliminary and, at best, indicative. The key findings of the preliminary research are as follows:

- Perhaps, surprisingly, there was not a majority consensus amongst the respondents that harmonisation was either desirable or urgent;
- Generally, the respondents favoured legislation which protected contractors of all sizes equally, rather than legislation designed to protect smaller contractors more than larger contractors;

[49] Although the SA Act has yet to commence.

- Significantly more respondents viewed the existing East Coast legislative model as inappropriate, rather than appropriate, for resolving both purely progress payment disputes and other types of payment dispute;
- Significantly more respondents viewed the existing West Coast legislative model as appropriate, rather than inappropriate, for resolving both purely progress payment disputes and other types of payment dispute;
- More respondents viewed the East Coast legislative model's statutory entitlement to purely progress payments, which differs from standard form contractual entitlement, as inappropriate rather than appropriate;
- The existing West Coast legislative model was most favoured by respondents as a unifying model; and,
- The hybrid harmonising proposals (i.e., those combining East Coast and West Coast adjudication schemes) did not receive much support.

If the move towards harmonisation is to materialise, there is a need for more extensive research to be carried out in Australia to gauge statistically valid views of stakeholders. The pilot survey has highlighted the need to target a wider population than just construction lawyers. Accordingly, a subsequent full survey is planned in mid to late 2011 which will target all classes of parties who have had the experience of being involved in the statutory adjudication process, potentially including claimants, respondents, adjudicators as well as construction lawyers.

REFERENCES

Bailey, I. (2009) "Harmonisation or Reform of Legislation: Construction Industry and Dispute Resolution" (Paper delivered at Construction Law Seminar, Melbourne Law School, 10 November 2009).

Bell, M. and Vella, D. (2010) "From motley patchwork to security blanket: The challenge of national uniformity in Australian „security of payment' legislation", *84 Australian Law Journal* 565.

Brand, M.C. and Davenport, P. (2010) "A proposal for a „Dual Scheme' of statutory adjudication for the building and construction industry in Australia" *Proceedings of the Royal Institution of Chartered Surveyors COBRA Conference, Paris.*

Coggins, J.K. (2011) "From Disparity to Harmonisation of Construction Industry Payment Legislation in Australia: A Proposal for a Dual Process of Adjudication based upon Size of Progress Payment Claim", unpublished.

Cole, T.R.H. (2003) "Final Report of the Royal Commission into the Building and Construction Industry", Commonwealth of Australia, February 2003.

Davenport, P. (2007) „A Proposal for a Dual Process of Adjudication', *Australian Construction Law Newsletter*, Issue #115, University of Technology Sydney.

Iemma, M. (1999) Building and Construction Industry Security of Payment Bill Second Reading Speech, 29 June 1999, Parliament of NSW Legislative Assembly Hansard Transcript.

MacTiernan, A.J. (2004) *Construction Contract Bill* Second Reading Speech, 3 March 2004, Parliament of Western Australia Legislative Assembly Hansard Transcript.

Zhang, T. (2009) "Why national legislation is required for the effective operation of the security of payment scheme", 25 *Building and Construction Law Journal* 376.

Evaluating Change in Students' Environmental Values: The Impact of Environmental Learning in Undergraduate Design Courses

Graham Brewer, Louise Askew and Tony Williams
School of Architecture and Built Environment
University of Newcastle, Australia

ABSTRACT

Design increasingly matters in the context of climate change. Environmental problem solving across design disciplines is vital to ensure that certain problems of climate change are addressed and that more sustainable ways of living and working are created. However, sustainability is notoriously hard to define and has faced considerable challenges in its inclusion as part of design education, with further problems presented in evaluating any impacts on the environmental attitudes and behaviours of design students. In this practice paper, the "Design and the Environment" course delivered at the University of Newcastle is examined. The course is trans-disciplinary, delivering environmental content to mixed cohorts of design students. Using problem-based learning techniques, the course requires students to evaluate the consequences of their designs by performing a life cycle analysis/audit of their solution. In this research, experiences of the course are examined using a well-evidenced evaluation mechanism – the New Ecological Paradigm (NEP) – in order to observe the effects of this particular subject on the environmental values of a single cohort of students. This practice paper presents the results of this limited intervention, yet provides further issues for discussion and another starting point for future research on the inclusion of environmental awareness and sustainability in design education.

KEYWORDS

Design students, environmental education, New Ecological Paradigm (NEP), attitudinal change.

INTRODUCTION

It is widely noted that environmental concerns have dramatically increased among the public over the last few decades (Dunlap and Scarce, 1991; Thapa, 2001). Increasing awareness of both immediate environmental crises and long-term climatic change has led to changing environmental values and attitudes including the recognition of ecological limits and finite resources. Most agree that education plays a vital role in supporting such

attitudinal changes (Etzioni, 1993; Ikenberry, 1997). Indeed, evidence exists that exposure to just one environmental education course can alter students‘ environmental attitudes (Benton, 1993; McMillan, 2004; Rowe, 2002) and potentially, their behaviours (Benton, 1993; Rickinson, 2001).

With this in mind, design education comes to the fore as a key area in which to support environmental awareness—with designers playing a crucial role in creating sustainable elements and products of our lived environment. Although design education has increasingly incorporated environmental principles over the last 15 years, there remains a need for courses that combine theoretical and practical advice on environmental design. Moreover, there needs to be continued evaluation of the impacts of environmental education on design students‘ attitudes and values, and how this might affect the behaviours of future design professionals (Brezet and van Hemel, 1997; Stevels, 2001a). This is particularly important as sustainable design continues to expand as a profitable activity, with clients increasingly insisting upon environmental design and accountability in their suppliers.

Educating and training the next generation of designers, and their educators, is central to meeting this increasing demand for environmental design. Ultimately, the limits of sustainable urban development are defined by the level of creativity displayed by designers and their educators (Stevels, 2001b). A sustainable future is therefore dependent on a new approach to design education in which environmental thinking is second nature.

At the University of Newcastle, Australia the development of a course entitled "Design and the Environment" has been a response to the increasing demand for environmentally-aware design education. The course is a core component in the Bachelor of Technical Education degree program, and is being increasingly selected as an elective course by both full-time, on-campus students and part-time distance learners, and by students from other disciplines. The course embraces a multidisciplinary approach to sustainability, whereby students from different disciplines can come together to develop a shared understanding of the links between design decisions and their environmental consequences throughout the life of the asset. This flexible and multidisciplinary approach is generally considered to support the most effective sustainable design, and sustainability tools and metrics across diverse design disciplines (Hadorn et al., 2006; Levett-Therivel, 2004; Stauffacher et al., 2006). This approach also represents a paradigm shift; breaking down the traditional demarcation fostered by the ‗professionalism of design‘ framework (Walker, 2006).

This practice paper observes the experiences of a single cohort of design students undertaking the course. Using the widely adopted evaluation metric, the New Ecological

Paradigm (NEP), the change pre- and post-course on these students‘ environmental values and attitudes was measured across one semester. Additional questions were included post-course to assess the students‘ perceived ability to combine ecological awareness into their design practices. From these results, a brief insight into how environmental awareness might be increased as part of design education is provided—offering scope for further, more in-depth assessment of the role of education in building and supporting environmental values as part of design study and practice.

COURSE EVALUATION: THE NEP AND ATTITUDINAL CHANGE

The ―Design and the Environment" course has been informed by several key principles. First, the course design is underpinned by the role of the designer as central to shaping not only the appeal of an artefact but also the long-term costs and consequences of owning and operating it—for the owner, user and the wider community. Second, the course is designed so that members of a specific discipline identify appropriate boundaries to design problems associated with their discipline. This should include the nature of the environmental impacts, their assessment, and the generation of design alternatives that will minimise them. Third, it is accepted that the norms relating to design evaluation for one discipline (e.g. architecture) can reasonably be expected to differ somewhat from those of another discipline (e.g. textiles) in terms of techniques, availability of tools, and predicted rigour.

Student learning then is driven by a flexible approach that can be tailored to the needs of specific disciplines. This approach is supported in the assessment process, devised by way of a negotiated learning contract, which allows the individual student to design their own learning program within the confines of the course objectives. It is refined during the first ten weeks of study and when finalised, is used as the template against which the student‘s assessment items are graded. Therefore, the assessments are tailored to suit specific groups‘ needs, and to avoid the frustration around inappropriate and universal assessment items that are not relevant to students‘ intended professions.

From previous course evaluations, it was found that students appreciate this flexible approach and the improved learning that it facilitates (Brewer et al., 2008). Moreover, students indicated that they value the exposure to life-cycle analysis techniques throughout the course, and their increased awareness of their role as designers of artifacts that have an environmental impact (Brewer et al., 2008).

Overall, the course has been designed to produce environmental generalists who develop a broadly shared understanding of what it means to be an environmentally aware designer. In the following section, the experiences of a single student cohort undertaking the course are discussed. As stated, the New Ecological Paradigm (NEP) is adopted pre-

and post-course to provide an indication of any changes in students' attitudes and values around key environmental issues, together with additional questions specifically addressing the applicability of environmental values to design practice.

The New Ecological Paradigm (NEP) approach

The New Ecological Paradigm (NEP) was first developed in the mid-seventies as a tool to assess the ecological consciousness of the public (Dunlap and Van Liere, 1978). Whilst updated and revised in 2000 (Dunlap et al., 2000), the NEP has been regularly and widely used across diverse studies, demonstrating that the tool is a relatively reliable and valid measure of ecological attitudes and values (Ewert and Baker, 2001). Currently, the NEP contains a set of 15 items designed to ascertain respondents' stance in relation to five hypothesised facets of an ecological worldview: the reality of limits to growth, anti-anthropocentrism, the fragility of nature's balance, rejection of exemptionalism, and the possibility of an eco-crisis (Dunlap et al., 2000). The measurement tool uses a five-point Likert format, ranging from strongly agree (1), to strongly disagree (5).

Across the 15 items, there are eight odd-numbered statements that assert an attitude of environmental concern, such as, "We are approaching the limit of the number of people the earth can support". There are seven even-numbered questions that suggest an opposite environmental attitude, such as, "Humans have the right to modify the natural environment to suit their needs". Essentially, agreement with the eight odd-numbered items and disagreement with the seven even-numbered items indicates a pro-ecological view. This structure allows the aggregation of an individual's responses into a single score by adding the Likert scale scores on the seven "not concerned" questions and subtracting the scores on the eight "concerned questions" (Anderson et al., 2007)[1].

Ultimately the NEP measures a set of beliefs that may be reflected in a range of other environmentally-aware attitudes and behaviours. Whilst supporting caution against a deterministic link between the NEP and behaviour it is likely that:

> *...a pro-ecological orientation or "seeing the world ecologically," reflected by a high score on the NEP Scale, should lead to pro-environmental beliefs and attitudes on a wide range of issues* (Dunlap et al., 2000: 428).

Therefore, the NEP is considered to be a relevant and effective tool for measuring 'worldview' environmental attitudes, and perhaps behavioural change over time (Shephard et al., 2009).

[1] The aggregation of individuals' NEP results was not undertaken in this evaluation due to obvious ethical concerns around maintaining the anonymity of student respondents.

NEP RESULTS FOR "DESIGN AND THE ENVIRONMENT"

The NEP is used as part of a brief and initial observation of student experiences as part of the "Design and the Environment" course at the University of Newcastle. A single cohort of students was asked to complete the NEP questionnaire at the initiation and completion of the course. A total of 25 respondents participated in the pre-course assessment and 24 of these completed the post-course assessment (this represented 83% of the total students enrolled in the course). Additional questions were included in the post-course assessment to gauge the potential influence of the environmental course on students' perceptions of their own future design practice.

The students' responses were grouped into proportions who strongly agreed, agreed, neither agreed/disagreed, disagreed and strongly disagreed for each of the 15 NEP statements (see Table 1). As stated previously, responses that are pro-NEP should agree with the odd-numbered statements and disagree with the even-numbered statements. Table 2 presents a summarised version of these results across the 15 NEP statements and their associated categories (based on the environmental values they represent e.g. anti-anthropocentric, limits, eco-crisis). The table shows those statements which elicited a 'pro-NEP', 'undecided', or 'anti-NEP' response post-course, and also indicates any change in environmental awareness from pre-course results. The results reveal generally pro-NEP responses across the 15 statements, with 3 statements eliciting an increase in environmental awareness from pre- to post-course, 1 statement declining and the remainder generating broadly equivalent results across the duration of the course (including one statement that maintained an anti-NEP response both pre- and post-course).

Two of the statements that elicited increases in environmental awareness from pre- to post-course assessment concerned ecological limits—"we are approaching the limit of the number of people the earth can support", and "the earth is like a spaceship with very limited room and resources". Moreover, there was also some indications of positive change in perceptions of eco-crisis, represented in more strongly held disagreement with the statement "the so-called ecological crisis facing humankind has been greatly exaggerated".

Table 1 – NEP results: proportion of students who agree/disagree with environmental statements[2]

	Strongly Agree		Agree		Agree Total		Neither		Disagree		Strongly Disagree		Disagree Total	
	Pre	Post	Pre	Post	**Pre**	**Post**	Pre	Post	Pre	Post	Pre	Post	**Pre**	**Post**
We are approaching the limit of the number of people the earth can support	16	29	32	33	**48**	**62**	32	24	20	14	0	0	**20**	**14**
Humans have the right to modify the natural environment to suit their needs	4	5	24	29	**28**	**34**	32	48	28	14	12	5	**40**	**19**
When humans interfere with nature it often produces disastrous consequences.	24	14	40	48	**64**	**62**	32	24	4	10	0	5	**4**	**15**
Human ingenuity will insure that we do NOT make the earth unliveable.	0	0	16	19	**16**	**19**	52	52	32	24	0	5	**32**	**29**
Humans are severely abusing the environment	40	38	56	48	**96**	**86**	4	14	0	0	0	0	**0**	**0**
The earth has plenty of natural resources if we just learn how to develop them.	32	29	40	43	**72**	**72**	12	14	16	14	0	0	**16**	**14**
Plants and animals have as much right as humans to exist	52	43	32	43	**84**	**86**	12	14	0	0	4	0	**4**	**0**
The balance of nature is strong enough to cope with the impacts of modern industrial nations	0	0	0	10	**0**	**10**	16	5	60	57	24	29	**84**	**86**
Despite our special abilities humans are still subject to the laws of nature.	56	38	32	52	**88**	**90**	12	10	0	0	0	0	**0**	**0**
The so-called ―ecological crisis" facing humankind has been greatly exaggerated	16	0	36	14	**52**	**14**	28	38	20	38	0	10	**20**	**48**
The earth is like a spaceship with very limited room and resources	20	24	32	38	**52**	**62**	24	5	16	29	8	5	**24**	**34**
Humans were meant to rule over the rest of nature	0	0	4	10	**4**	**10**	24	29	48	33	24	29	**72**	**62**
The balance of nature is very delicate and easily upset.	28	14	48	62	**76**	**76**	20	24	4	0	0	0	**4**	**0**
Humans will eventually learn enough about how nature works to be able to control it.	4	0	24	24	**28**	**24**	16	10	28	48	28	19	**56**	**67**
If things continue on their present course, we will soon experience a major ecological catastrophe.	28	29	40	38	**68**	**67**	28	33	0	0	4	0	**4**	**0**

[2] This table also highlights the totals for those who agree (strongly agree and agree) and disagree (strongly disagree and disagree) so at to highlight those questions that are generally pro-NEP. Responses that are pro-NEP should agree with the odd-numbered statements and disagree with the even-numbered statements.

Table 2 – Environmental awareness post-course

Student Ecological Awareness	Classification	Pro-NEP	Undecided	Anti-NEP	Change in awareness
We are approaching the limit of the number of people the earth can support	*Limits*				**Increased**
Humans have the right to modify the natural environment to suit their needs	*Anti-Anthropocentric*				**Decreased**
When humans interfere with nature it often produces disastrous consequences.	*Balance*				Equivalent
Human ingenuity will insure that we do NOT make the earth unliveable.	*Anti-Exemptionalism*				Equivalent
Humans are severely abusing the environment	*Eco-Crisis*				Equivalent
The earth has plenty of natural resources if we just learn how to develop them.	*Balance*				Equivalent
Plants and animals have as much right as humans to exist	*Anti-Anthropocentric*				Equivalent
The balance of nature is strong enough to cope with the impacts of modern industrial nations	*Balance*				Equivalent
Despite our special abilities humans are still subject to the laws of nature.	*Anti-Exemptionalism*				Equivalent
The so-called –ecological crisis" facing humankind has been greatly exaggerated	*Eco-Crisis*				**Increased**
The earth is like a spaceship with very limited room and resources	*Limits*				**Increased**
Humans were meant to rule over the rest of nature	*Anti-Anthropocentric*				Equivalent
The balance of nature is very delicate and easily upset.	*Balance*				Equivalent
Humans will eventually learn enough about how nature works to be able to control it.	*Anti-Exemptionalism*				Equivalent
If things continue on their present course, we will soon experience a major ecological catastrophe.	*Eco-Crisis*				Equivalent

Interestingly, the categories that declined or displayed anti-NEP sentiments concerned issues of development, including the use of resources and the modification of the natural environment—evident in agreement with the statement —the earth has plenty of natural resources if we just learn how to develop them" and an increase in agreement with —humans have the right to modify the natural environment to suit their needs". Both of these statements imply the ability to manipulate the environment, which may reflect the design and construction focus of the course and the discipline in which the students are based—disciplines that obviously centre on the design and composition of the built environment. This is clearly an area of design education that will need to be addressed in order to more effectively build in environmental awareness around the use of the natural environment and its resources.

Most of the other 15 statements evoked pro-NEP responses equally across pre- and post-course assessment. This may be a result of more generally accessible environmental education, a finding supported by proponents of NEP itself, who acknowledge the growing environmental awareness of the general public (Dunlap and Scarce, 1991; Thapa, 2001). Moreover, similar studies of environmental education courses have found that students do not necessarily become more —green" or —known" as a result of environmental education, but rather develop less ambiguous and more articulate notions of environmental awareness that are much more difficult to measure as part of an overarching NEP framework (Anderson et al., 2007).

In this light, it is useful to examine the additional questions included in the post-course intervention which questioned the applicability of the environmental values and attitudes learnt in the course to practical aspects of their design work. Table 3 reveals that the vast majority of this class of students feel that they could undertake a sustainable house or product design (74% and 90% respectively), and could also justify any additional costs of such sustainable design to clients if required (81%).

Nearly all (90%) of the cohort also felt that they could effectively incorporate the principles learned in the course into their professional design practice. Moreover, the students expressed widespread support (85%) for the Life Cycle Analysis approach, which requires them to think about the outcomes and consequences of their design across a variety of domains, including the environment. The results from these additional questions post-course indicate suggest positive student perceptions of their ability to apply their environmental learning to their professional design practice.

Table 3 – NEP results: additional questions

NEP Survey Results (Extra Questions): IDEA2461 Design and the Environment	Strongly Agree %	Agree %	Neither Agree or Disagree %	Disagree %	Strongly Disagree %
I feel I could undertake a sustainable residential house design, if the situation arose	19	57	14	10	0
I feel I could undertake a product design project utilising sustainable principles, if the situation arose	19	71	5	5	0
I believe that green pressure groups cannot influence environmental issues in product design	0	24	33	38	5
I believe that government legislation is not necessary in order to make society more environmentally sustainable	10	14	24	24	29
If called upon, I feel I have the knowledge to justify the additional cost of sustainable design features to other people	10	71	19	0	0
I feel that knowledge of Life Cycle Analysis should NOT be a required part of my degree	5	0	10	52	33
I will incorporate the principles I have learned in this course into my professional practice	29	62	10	0	0

CONCLUSIONS AND FUTURE RESEARCH QUESTIONS

The analysis presented as part of this research is limited—observing only one design student cohort across a single semester through the self-perceptions of students. Yet it is suggested that these findings offer a useful (if brief) insight into the environmental values and awareness of students enrolled in a design course that incorporates environmental education. The students demonstrated a high level of existing awareness of environmental issues—one that increased post-course across some key areas of the NEP scale. This supports notions of a general expansion in public awareness of, and education in, environmental issues, together with evidence that this course also develops and defines these environmental values through ongoing attention to advancing environmental knowledge. In addition, these findings also identify areas which need to be further addressed in environmentally-oriented design courses; namely, issues of development and resource use. Design and construction courses are predicated on advancing skills in the manipulation/use of the natural and built environment. Further education may be needed for students to develop the knowledge on how to effectively apply these skills in environmentally sensitive and complementary ways.

The findings generated are intended as an initial foray into further, more in-depth investigations on the advantages and limitations of design courses as vehicles for environmental education. It is suggested that assessments such as NEP provide a useful evaluation tool and could be effectively incorporated as a part of regular design course assessments, as a way of measuring change in environmental awareness. Longitudinal investigations may be particularly useful for monitoring student change over the entire duration of a design program. Together, more in-depth and ongoing assessments such as these would provide valuable indicators of the potential of students to produce environmentally-aware designs as part of their future work as design professionals—further reinforcing the benefits of incorporating environmental education as a core element of design programs.

REFERENCES

Anderson, M.W., Teisl, M.F. and Criner, G.K. (2007) Attitude Changes of Undergraduate University Students in General. *The Journal of General Education*, 56(2): 149-168.

Benton, R. (1993) Does an environmental course in the business school make a difference? *Journal of Environmental Education*, 24(4), 37-43.

Brewer, G.J., Gajendran, T., Landorf, C.M. and Williams, A.P. (2008) Educating for urban sustainability: a transdisciplinary approach. *Engineering Sustainability*, 161: 185-193.

Brezet, H. and Van Hemel, C. (1997) *Ecodesign, a promising approach to sustainable production and consumption*. United Nations Environment Programme.

Dunlap, R.E. and Scarce, R. (1991) The polls-poll trends: environmental problems and protection. *Public Opinion Quarterly*, 55(4), pp. 651± 672.

Dunlap, R.E. and Van Liere K.D. (1978) The ―new environmental paradigm": a proposed measuring instrument and preliminary results. *Journal of Environmental Education*, 9: 10-19.

Dunlap. R.E., Van Liere, K.D., Mertig, A.G. and Jones, R.E. (2000) Measuring endorsement of the New Ecological Paradigm: a revised NEP scale. *Journal of Social Issues*, 56: 425-442.

Etzioni, A. (1993) *The spirit of community: The reinvention of American society*. New York: Simon and Schuster.

Ewert, A. and Baker, D. (2001) Standing for where you sit: An exploratory analysis of the relationship between academic major and environment beliefs. *Environment and Behavior*, 33, 687–707.

Hadorn, G.H., Bradley, D., Pohl, C., Rist, S. and Wiesmann, U. (2006) Implications of transdisciplinarity for sustainability research. *Environmental Economics*, 60: 119-128.

Ikenberry, S. (1997) Defining a new agenda: Higher education and the future of America. *NCA Quarterly*, 71(4), 445-450.

Levett-Therivel. (2004) *Report to the SUE-MoT consortium: Sustainable urban environment – metrics, models and toolkits: analysis of sustainability/social tools*. Loughborough, SUE-MoT.

McMillan, E. (2004) Impact of university-level environmental studies class on students‘ values. *Journal of Environmental Education*, 35(3), 19-26.

Rickinson, M. (2001) Learners and learning in environmental education: A critical review of the evidence. *Environmental Education Research*, 7(3), 207-320.

Shephard, K., Mann, S., Smith, N. and Deaker, L. (2009) Benchmarking the environmental values and attitudes of students in New Zealand's post-compulsory education. *Environmental Education Research*, 15: 571-587.

Stauffacher, M., Walter, A.I., Lang, D.J., Wiek, A. and Scholz, R.W. (2006) Learning to research environmental problems from a functional sociocultural constructivism perspective: The transdisciplinary case study approach. *International Journal of Sustainability in Higher Education*, 7: 252-275.

Stevels, A.L.N. (2001a) Applied ecodesign: Ten years of dynamic development. *Ecodesign 2001*. Tokyo.

Stevels, A.L.N. (2001b) Integration of ecodesign to the business. In Hundal, M.S. and Wiley J.W. (Eds.) *The mechanical life cycle handbook: Good environmental design and manufacturing*.

Thapa, B. (2001) Environmental Concern: A comparative analysis between students in Recreation and Park Management and other departments. *Environmental Education Research*, 7(1): 39 – 53.

Walker, S. (2006) *Sustainable by design: Explorations in theory and practice*. London: James and James.

Are Formal Peer Support Programs the Answer for Construction Students Transitioning to University Study?

Mary Hardie, Philip Love and Swapan Saha
School of Engineering
University of Western Sydney, Australia

ABSTRACT

The transition to university life has always been problematic for some students. The self-directed nature of university study comes as an unwelcome surprise to many students who have been used to close supervision from their teachers at high school. Difficulty in adjustment can also be experienced by those students who enter university through pathways other than straight from secondary school. Students transitioning from TAFE programs may have expectations about staff availability, class size, attendance rules and teaching style. The university experience is likely to be quite different and expectations may have to be amended. Similarly, mature age students who have been in the workforce may find university requirements both unfamiliar and frustratingly ill-defined. A great deal of effort has gone into the easing of this transition process, by researchers in many fields, especially in education and the social sciences. Incorporating this cross disciplinary expertise, this paper looks at the design of a peer support study program as a mechanism for bridging the gap between student expectations and university reality, in a construction management program. Later year students in the undergraduate program become mentors to first year students and facilitate scheduled study sessions. Informal social networks may partly fill this role once students are established at university, but it is likely that many students can benefit from an organised peer support program in the early stages of their academic careers.

KEYWORDS

AUBEA, construction management, peer mentoring, articulation

INTRODUCTION

In response to the Bradley Review of Higher Education (Bradley 2008), the current Prime Minister Julia Gillard, when Minister for Education, set the goal that by 2025, 40% of all Australians aged 25 to 34 should hold a bachelor's degree or higher (Gilmore and Narushima 2009). If this is to be achieved, pathways to higher education will need to be established which enable increased participation by groups who are currently under-represented among the student body at many of our universities. These groups include

students classified as Low Socio-Economic Status (LSES); students with a disability; those from non-English speaking backgrounds (NESB); those from rural or isolated areas; and women in non-traditional areas of study. James et al. (2004), in a large scale review of the participation of these equity groups in higher education, described the varying levels of success that have been achieved in this area. Concentrating on the initial university experiences of students in these categories is likely to be a useful strategy for improving participation rates as well as retention percentages.

The transition to university has been widely reported to be a difficult one for many students (Abbott-Chapman 2006; Krause et al. 2005; Moodie 2004; Nelson et al. 2008; Peat et al. 2001; Watson et al. 2001; Watson 2008; Wilcox et al. 2005). The learning environment is often quite different from that of high school, TAFE or even career development training in the workforce. Consequently, many students come to university with expectations which are unlikely to be met. In particular, many students are unused to large lecture-style classes and some find the experience alienating and disorienting. Many students may not have yet acquired the systematic study habits that are crucial for university success. Some students have an expectation of close supervision in a similar manner to school, where teachers act *in loco parentis*. There is also sometimes an expectation that academics will be available to answer student questions at any time during the working day, as well as during scheduled classes. University attitudes to plagiarism and collusion can come as a surprise to some students who have a tendency to see copying from textbooks as ‚the way you learn'. Other students are unwilling to approach staff for assistance, even in fairly straightforward situations which could be easily handled. University policies and administrative procedures can be daunting for some students who tend not to read information provided on these matters until after they have developed a problem. Attendance requirements at university can be problematic for those students in the workforce or with family responsibilities. The traditional university teaching model tends to assume that students are free to spend their time in the full-time study of the chosen discipline. This is less and less likely to be true, as the great majority of students have some form of paid work and many have other conflicting demands on their time. Add to this, the fact that many students travel long distances to their universities, and timetables are not always flexible enough to take account of this circumstance.

The university sector has sought to address these issues in a variety of ways. Some matters are resource-based, while others relate largely to administration. More flexible modes of delivery of teaching programs are another approach that has been tried with varying degrees of success. Self-directed study via online learning resources works very well for highly motivated students, but can increase the sense of alienation for others. It

may solve the time management issues but cannot provide the full „university experience' that some students seek. Some personal contact with staff as well as with other students is beneficial in most cases, but especially for those students who find the transition to university study overwhelmingly difficult. When equity issues are added to the general difficulties which are experienced to some extent by most new university students, problems can be more extreme. Nevertheless, it has been demonstrated that with appropriate support both retention rates and performance of students from these groups can be comparable to those of other students (Levy and Murray 2005).

TRANSITION ISSUES FOR STUDENTS FROM IDENTIFIED EQUITY GROUPS

„Demystifying' higher education has been noted as an essential strategy for increasing the participation of commencing students from non-traditional backgrounds (Yorke and Thomas 2003). Induction programs which give clear guidance about available support systems and how to access these services are an essential element in this demystification. Yorke and Thomas (2003 p.69) found that this needs to extend well beyond the traditional first week of orientation. Assistance and support should be available to students as problems arise, rather than in one large serving at commencement of their period of study.

Establishing social networks among other students has been identified as a useful aid to retention, particularly for those students who are doubtful about their suitability for a place at university (Wilcox et al. 2005). A feeling of isolation and disengagement at university is a commonly reported precursor to voluntary drop out from study (Laing and Robinson 2003). Traditionally, extra-curricular activities such as clubs and sporting groups have played a strong role in establishing social contacts for new students. This option is less available now at many universities because of government funding changes and the competing demands on student's time. Students from LSES may be less likely to join these bodies than other students because of the costs involved.

Workshops specifically designed to allow students to make contact with others are a strategy employed in some universities (Peat et al. 2001). Internet chat rooms have proven to be a useful strategy for establishing social contacts in other universities (Mubarak et al. 2009). There are safety and responsibility issues involved when universities establish such services, but strong user behaviour protocols and adequate supervision can help avoid problems in these areas.

Even if students feel welcome at university and have adequate social and technical support available to them, they may still have difficulty with matters such as mastering particular academic content and understanding what is required by assessment tasks.

Advice from staff and from more experienced students can be of assistance in these matters. Indeed, such advice or „mentoring' can sometimes be seen as a panacea for educational problems, which is perhaps overstating the case.

MENTORING AS AN EDUCATION STRATEGY

The term „mentor' can refer to a broad range of both formal and informal relationships which involve one person guiding the progress of another. There is a sense of seniority implied, in that the mentor is at least more experienced, if not actually older than the mentee. There is also an implication of a relationship that exists on a small scale, personal level as opposed to the larger-scale relationship between a teacher and a class. Beyond that, mentoring encompasses varied strategies for the transmission of learning from pastoral guidance to provocative challenging of assumptions and stretching the mentee to explore new ways of thinking and operating. The highly experienced practitioner who inducts the initiate into the established practice of a profession or calling is one manifestation of mentorship. However, mentoring can also be practised by individuals only slightly advanced on the mentee's level but who are able to understand the difficulties and challenges that the mentee faces. This is an example of peer mentoring when later year students take on the function of facilitating learning for new students.

PEER MENTORING METAPHORS

In a university based study, Terrion (2007 p.42) has identified peer mentoring as being one of the more successful interventions for ensuring student. Scanlon (2009) describes the role of the mentor in student education as having four possible aspects or metaphors: the *navigator*; the *sage*; the *teacher*; and the *friend*. The idea of the mentor as *navigator* or guide was the most common metaphor used by the student mentors in Scanlon's study. They referred to „walking alongside' the new students and „double-checking the map' for those whom they mentored. This is classically the appropriate role for a peer mentor. By contrast, the idea of the mentor as *sage* is less commonly applied to peer mentoring. Traditionally, the *sage* has not only much more experience than the mentee but also greater wisdom and discriminatory power. If the mentor is a sage then the mentee is a follower or acolyte, and this is not the idea behind peer mentoring. Similarly the peer mentor is normally not a *teacher* except in the most general sense of the word. The peer mentors are not experts in a subject specialty, transmitting a prescribed body of knowledge. However, mentors can be seen as those who provide the „scaffolding' for the mentees to build within. Peer mentors do commonly adopt the role of *friend.* They can assist new students outside the academic sphere by introducing their mentees to

established social networks within the university and thereby reducing isolation and alienation.

Mindful of the roles that a more established student can play in introducing new students to the university culture, formal schemes that bring potential mentors together with mentees can play a significant role in assisting new student orientation and retention. Many students tend to act very strategically with regard to their time allocation. It has been observed that they are less likely to come to campus for informal gatherings than previous generations. Attendance rates are often low unless there is a specific incentive such as assessment or formal credit. Consequently, successful peer mentoring programs need to provide students with clearly recognised value for time invested, or they are unlikely to be successful. As such, the University of Western Sydney (UWS) has decided to put effort into a scheme of Peer Assisted Study Sessions (PASS) in order to induct new students into useful practices for success in university life. This program is particularly helpful to students from non-traditional backgrounds, who may not possess such skills when they arrive at university.

PASS PROGRAM

PASS is a peer assisted collaborative learning program of study sessions run by students for the benefit of students. The program is currently in its fourth year at UWS, and student participation has risen from approximately 200 in the first semester to almost 2000 per semester in 2010. Eleven schools currently participate in the program (UWS PASS Program 2010). The individual study sessions involve up to 30 students. The program is evaluated using both quantitative and qualitative data. The average marks of students who attend PASS are compared with non-attendees, and this data is provided in chart format to the university and the participating schools. Additionally, the actual grades of attendees and non attendees are compared and this information is provided in a separate report to each School and unit. Generally, the average marks of students who attend PASS four or more times during a semester are higher than those who do not attend. The average marks of students who attend less than four times also tend to be higher than non-attendees, but this is not consistent across all units. The actual marks of students who attend PASS range along the spectrum from High Distinction to Fail and this varies proportionately according to each unit.

Student attendance is recorded at each PASS. All attendees are emailed a link to an online survey and aggregated data from their responses and a sample of comments are included in the program report. Unit specific responses are provided with the School reports. Students' comments provide insight into their experiences of attending PASS

and the benefits they gain such as deeper understanding of the content through activities and discussion, greater confidence in their learning and rich interactions with their peers.

PASS facilitators or mentors, the students who run the PASS session, also complete an online survey and provide feedback comments. These mention the benefits they experience in their roles as PASS facilitators both personally and professionally and their impression of the impact of attending PASS for the mentees. Periodically students who have not attended any PASS sessions are also surveyed. A clash with other commitments is the most commonly cited reason for not attending PASS sessions.

Each semester, new PASS facilitators are recruited to join the program. They must attend a two-day training session before qualifying for the role. As the program becomes a more embedded part of university culture, facilitators are increasingly students who have previously attended PASS. For newly established sessions the facilitators are recommended by lecturers, or they may volunteer by sending recruitment letters based on their academic performance. During the teaching session each PASS facilitator is observed at least once by a PASS trainer or senior facilitator. The PASS facilitator's primary role is to encourage learning by creating collaborative and active learning opportunities. One of the main challenges faced by the facilitators is that they are not to re-teach the subject matter delivered in formal classes. Facilitators are paid one hour preparation for their sessions and one hour for running the sessions. They are expected to prepare activities that support students in learning how to learn the content and to guide them through these processes in the sessions. Feedback, and where necessary, guidance is provided to the facilitator by the program coordinator. This relates to how to improve skills in providing interactive learning opportunities. At mid-year a forum is held which provides feedback to the facilitators as well as running mock sessions to provide tips for future and continuing facilitators.

RESEARCH PURPOSE AND METHODOLOGY

The purpose of this paper is to report on a current student engagement program at UWS with the intention of sparking discussion about similar programs at other universities and learning from the experience elsewhere. Evaluation strategies for such programs that provide statistically verifiable data on effectiveness could also be the subject of an interchange of ideas. This has not yet been done for the PASS project. Ongoing monitoring of the impact of PASS on student results is being undertaken in a more limited fashion. At the moment, it is mainly done by recording attendance and comparing the end marks for attendees and non-attendees. This is, of course, a simplistic measure of effectiveness because it may well be that the attendees are the more motivated or able students who would have out-performed the others in any circumstances. It could also be

the case that the students who would most benefit from the program are those least likely to attend. It would be desirable to map student performance against moderating factors such as socio-economic background, kind of school attended and other background factors. Future research aims to evaluate some of these factors in a manner that de-identifies individuals. There are ethical issues, however, with staff members who have actual day to day contact with students having access to such potential predictors of individual performance. Consequently such mapping has not been done for this paper. Qualitative surveys of student responses to the program are the principle research methodology adopted.

The marks achieved by attendees and non-attendees have been compared as a first step in verifying the program's effectiveness and these results are presented here. The first subject or unit in the Construction Management program to join the PASS system was Design Science which is an introductory subject which provides students with an understanding of how the built environment works. The unit provides an introduction to physical units of measure, tolerance, statics, dynamics and optics. It also introduces students to electricity and magnetism as well as the concepts of momentum, energy, work, power and the operation of motors and machines. Students engage with these concepts through a hands-on learning experience including practical projects and live demonstrations (UWS Handbook 2010). Essentially it is a practically-based introductory physics unit. Total enrolment in 2010 was 299 students who completed the subject plus 63 who discontinued during the semester. Many construction students have experienced difficulty with the unit in the past because of lack of formal background in science at high school. This is particularly likely to affect students who come to the program from non-traditional backgrounds. Figure 1 shows the results achieved by students compared with their attendance at PASS during the semester. There is a clear relationship between attendance and end result in the unit although a statistical correlation excluding other critical factors is not yet possible to establish.

Unfortunately, uptake of the sessions by students has been uneven. In 2010 14% of students attended a PASS session. In the case of Design Science, 41 students (14%) attended a PASS session which equates to the university-wide average. Hopefully this will improve as a variety of timetable sessions are made available. The benefits of the program appeared to extend beyond academic performance for those students who did attend.

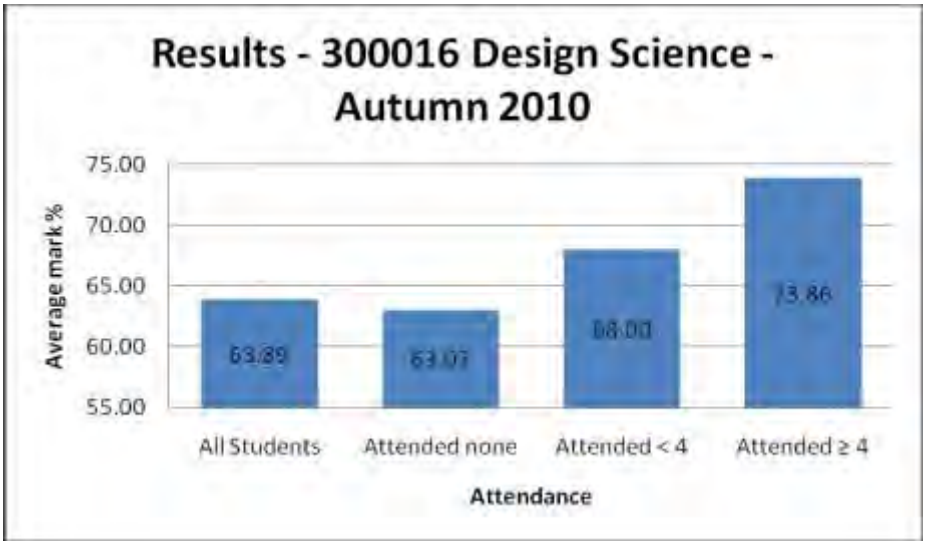


Figure 1 – Average marks for Design Science

Student surveys reported the following reasons for attending PASS:

- "Because, I need someone to repeat what was said in lectures. It really helps me remember."
- "I only attended when I have a particular problem to get extra help in."
- "I thought it would be helpful in preparation for an upcoming assignment."
- "First year student and wanted to avail myself to as much help as possible to ensure that I succeed".
- "Because I had a friend who failed this unit last year and I did not want that to happen to me."
- "A past student told me it would help. I am a mature age student and haven't studied for 25 years - need all the help I can get!"
- "I liked the statistic that you are 2.5 times more likely to retain information if you study in a group"
- "Wanted reinforcement of what I was learning in class."
- "To get further tips from student who had gone through the unit and the exams."
- "Because I did not feel I was getting any benefit from tutorials to understand lecture material and thought to explore another option available"
- "Good way to meet people in my class that are keen to do well too."
- "I had failed the subject twice and was told that the PASS program would help greatly."

  (PASS Report Autumn 2010).

As the comments demonstrate, students attended PASS for both academic and social networking reasons. With considerable anecdotal evidence about the time pressures on

students who are juggling study with work, family and other commitments, it is evident that programs which assist students academically as well as enabling greater social interaction within the university are a positive development for construction management programs.

The facilitators also benefited from their participation in PASS as revealed in their open-ended responses to feedback surveys:

- “It has given me a "voice" for helping other students and has given me a patience.’’
- “It has allowed me to further develop my inter-personal skills and to expand my own knowledge in the subject I was facilitating.”
- “I feel more confident in my understanding of the area, as I have been able to guide others through the material, and improve my communication skills.”
- “It has given me a bit of insight into group dynamics, and how to use the strengths of each individual member to achieve a common goal.”
- “Personally, the PASS Program has developed my ability to cater for the needs of different groups of people at different levels, and who have different expectations of the unit. This is very important because the goals of each individual are not always the same, and you have to tailor a plan to suit that goal.”
- “Professionally, my public speaking and interpersonal skills has improved vastly as a result of running PASS sessions in excess of 30 people.”
- “It has improved the way I approach people, made me realise that students can be inspired by intelligent peers, the importance of cross communicating between groups is something I would take on board for my career.”
- “It has enhanced my confidence and ability to speak in front of large groups with various people which is a major requirement of my degree.”
- “It's good to give something back to an organisation that you are involved with.”

Although the program adds to the demands on facilitator’s time, there was no discernable deficit on their academic performance. It has yet to be determined what the optimum student number is for different groups of students. Given the dual role of academic and social support, sessions of up to thirty students per facilitator are currently viewed as viable.

CONCLUSIONS

While this preliminary study indicates that there is a *prima facie* case that peer mentoring may have a positive impact on student performance, a great deal of further work is required to formally test the research hypothesis of peer mentoring effectiveness.

Feedback from others involved in similar or related projects would greatly assist this process. Given the trend towards involvement of greater percentages of the overall population in higher education, universities need to adapt in order to cope with an intake stream of students who may have come from different and more diverse backgrounds than did previous generations of students. Fostering the safety valve of social networks within the university community for all students is a positive move. When these networks also provide aid with study techniques and tips on how to negotiate one's way through the system there is a double advantage. Of course, continued investment in such networking facilities needs to be tested and evaluated over time to ensure effectiveness. Beyond establishing peer mentoring opportunities, we also need to look at other potential mechanisms for student engagement, such as relationships that can be established with industry mentors. A particularly important area for future research is how various mentoring schemes affect specifically disadvantaged students and those from non-traditional backgrounds. There are many ethical issues involved in the careful planning of such a research project.

REFERENCES

Abbott-Chapman, J. (2006) 'Moving from technical and further education to university: an Australian study of mature students ', *Journal of Vocational Education & Training,* 58 (1), 1-17.

Bradley, D., Noonan, P., Nugent, H. and Scales, B. (2008) 'Review of Australian Higher Education: Final Report', (Canberra, ACT).

Gilmore, H. and Narushima, Y. (2009) 'Gillard planning to raise the bar a degree higher ', *Sydney Morning Herald*.

James, R., Baldwin, G., Coates, H., Krause, K. and McInnes, C. (2004) 'Analysis of Equity Groups in Higher Education 1991-2002', (Centre for the Study of Higher Education, University of Melbourne).

Krause, K., Hartley, R., James, R. and McInnes, C. (2005) *The first year experience in Australian universities: findings from a decade of national studies* (Canberra: Centre for the Study of HE, University of Melbourne, HEIP).

Laing, C. and Robinson, A. (2003) 'The Withdrawal of Non-traditional Students: developing an explanatory model', *Journal of Further & Higher Education,* 27 (2), 175-85.

Levy, S. and Murray, J. (2005) 'Tertiary Entrance Scores Need Not Determine Academic Success: An analysis of student performance in an equity and access program', *Journal of Higher Education Policy and Management,* 27 (1), 129-41.

Moodie, G. (2004) 'Reverse transfer in Australia', *International journal of training research,* 2 (2), 1-20.

Mubarak, A.R., Rohde, A. and Pakulski, P. (2009) 'The social benefits of online chat rooms for university students: an explorative study', *Journal of Higher Education Policy and Management,* 31 (2), 161-74.

Nelson, K.J., Kift, S.M. and Clarke, J.A. (2008) 'Expectations and realities for first year students at an Australian university', *11th Pacific Rim Conference on the First Year in Higher Education : First Year in Higher Education Conference 2008 : an apple for the learner : celebrating the first year experience* (Hobart, Tasmania).

Peat, M., Dalziel, J. and Grant, A.M. (2001) 'Enhancing the First Year Student Experience by Facilitating the Development of Peer Networks through a One-day Workshop', *Higher Education Research & Development,* 20 (2).

Scanlon, L. (2009) 'Metaphors and mentoring: constructing a mentor typology from the perspective of student mentors', *International Journal of Evidence Based Coaching & Mentoring,* 7 (2), 71-81.

UWS Handbook '300016 Design Science', <http://handbook.uws.edu.au/hbook/unit.aspx?unit=300016.1>.

UWS PASS Program (2010) 'UWS PASS Program Report Autumn 2010', (Sydney: University of Western Sydney).

Watson, L. (2008) 'Improving the experience of TAFE award-holders in higher education', *International Journal of Training Research,* 6 (2), 40-53.

Watson, L., Wheelahan, L. and Chapman, B. (2001) 'From silos to seamlessness: towards a crosssectoral funding model for post-compulsory education and training', *Australian Journal of Education and Training,* 45 (3), 249-62.

Wilcox, P., Winn, S. and Fyvie-Gauld, M. (2005) "It was nothing to do with the university, it was just the people': the role of social support in the first-year experience of higher education ', *Studies in Higher Education,* 30 (6), 707-22.

BIM in Tertiary Construction Project Management Education: A Program Wide Strategy

Perry Forsythe, Julie Jupp and Anil Sawhney
Faculty of Design, Architecture and Building
University of Technology, Sydney, Australia

ABSTRACT

This paper reports on the ongoing research and development of teaching and learning supported by Building Information Modelling (BIM) in the undergraduate Construction Project Management (CPM) Program at the University of Technology Sydney (UTS). At its heart, BIM is used to facilitate a more integrated and visual mode of teaching. It provides a new basis for developing problem based learning – one that has the potential to allow students to aggregate their learning around a central project whilst allowing problems to be scaled at different levels of complexity. This approach aims to better integrate and link individual subjects together as well as improve the development of core student attributes such as communication, understanding, decision making, collaboration and information gathering skills; very much mimicking the ongoing BIM driven transformation happening in the industry. The BIM models aim to be regularly used in various formats as students progress through their undergraduate degree Program – and we adopt the term —vertical problems" to capture the way BIM models and problem based learning can be utilised throughout the Program. Here, lecturers are able to author ‗sub-plots' that utilise BIM models in a way that best suits their specific subjects, e.g. cost, time, quality, sustainability subject areas. To this end, the paper reports on findings from the research, development and early implementation stages of a program wide teaching and learning proposition supported by BIM. This includes a typology that helps target varying degrees of BIM utilization and diffusion in given subjects and transitional requirements for both staff and students.

KEYWORDS

construction project management, building information modelling, project-based learning

INTRODUCTION

Designing and constructing the built environment is a creative and collaborative process; making it knowledge intensive and generative (Berente et al. 2010). Marred by tradition and intense fragmentation the AEC industry has relied on a process driven by two-dimensional paper based design documentation (Taylor and Bernstein 2009); a process

that largely flies in the face of creativity and collaboration. Recently realising the impediments of this traditional approach - characterised by a 20% decline in productivity compared to other industries and approximately 30 % waste in processes and delivery methods (Gallaher et al. 2004) - the industry has slowly started embracing advanced digital technologies such as those that support 3D object based Building Information Modelling (BIM).

The benefits to industry that BIM technology offers have been well documented in the literature (Eastman et al. 2008, McGraw Hill 2007, 2009, BEIIC Report 2010), including: (1) improved information sharing; (2) time and cost savings that can be directly translated into productivity gains; (3) improved quality; (4) greater transparency and accountability in decision making; (5) increased sustainability; and (6) labour market improvements. International studies indicate that BIM adoption is likely to accelerate over the next few years (McGraw Hill 2009, Holness 2008). In the US in 2009 it was reported that 50% of the industry was using BIM products; representing a 75% increase in two years (Young et al. 2009). Though uptake in Australia is slower, the same trends are expected to gain traction. From an educational perspective it is proposed that there is a growing need for universities to provide new professionals with appropriate BIM-related skills.

In exploring the nature of this proposition in industry, much research has been dedicated to the identification of barriers to the adoption of BIM (Lamb et al. 2010, Becerik-Gerber and Rice 2010, Taylor and Bernstein 2010, McGraw Hill 2008). There are a range of structural, cultural and technological challenges. Such issues are symptomatic of a more general lack of integration between data sets generated by the various AEC disciplines. This has been identified to be a major cost factor for the construction industry through the introduction of inefficiencies, errors and lost opportunity (Gallaher, et al. 2004). Further to this, the AEC Industry is broadly organised into professional silos which does not assist the aim of obtaining improved efficiencies through improved collaboration. It is therefore also proposed that BIM supported education, understood as a collaborative process - not a technology, has the potential to gradually evolve the industry towards improved efficiency, decision making ability and value generation through a more integrated and collaborative approach.

CONSTRUCTION PROJECT MANAGEMENT LEARNING ENVIRONMENTS

In addressing the above propositions, the present approach to education within most design, building and construction schools reflects the very same fragmentation which has been identified as problematic in the context of the industry. Still further, many tertiary undergraduate construction project management programs are based around teaching

principles and practices that accentuate defined streams of study. Though common and used for a wide variety of reasons, such programs lack the extent to which problem based learning can be applied. Subsequently, construction students do not necessarily recognise how the separate streams of knowledge fit together at the time they undertake individual subjects. In a combined sense, there is limited understanding about how each respective subject intrinsically contributes to construction management or how construction management contributes to the overall objectives of the built environment. This remained a dormant problem as long as the industry was not awakened to this fragmentation. Now as the industry is moving towards more collaborative and integrative paradigms the education sector needs to start shaping the "pipeline" of graduates that can better fit the changing industry.

Delivery and assessment in this discipline has traditionally been driven by didactic, "chalk and talk" teaching which has not necessarily led to appropriate knowledge transfer and learning outcomes. At its core, many traditional approaches to setting assessments in construction management programs (for example, exams, essays, reports, calculation sheets) involve isolated, static and individual learning, often seen as 'boring' by students or of limited relevance to their intended career paths. As a result, these approaches to assessment tend to only attract minimal student motivation and therefore limited learning potential for they do not involve students in the complex dynamics of running real projects or the need to make decisions involving potentially conflicting variables, even though that is what they will likely face once they start working in industry.

BIM-SUPPORTED TEACHING AND LEARNING AT UTS

Motivated by its potential, UTS has embarked on an evolution of its teaching and learning model in the School of the Built Environment. The School provides a mix of construction project management, property economics, planning, property development and project management programmes. Given this vertically integrated set of Built Environment disciplines, the School's aims are predicated by the need to understand and assist the way different disciplinary values are successfully resolved and transformed into physically realised value (Jupp et al. 2010). The information modelling, visualisation and collaborative abilities of BIM technologies provide a basis for achieving this end. Here it is considered that curriculum development be based on an understanding that BIM is not a separate set of technologies across design, planning, property economics, and construction project management, but a means of facilitating integrated decision-support systems and reflecting its networked nature.

Drawing from experience in implementing sustainability across programs globally the program at UTS used a hybrid model. Two distinct models of implementing sustainability

in the curriculum exist. Originally propagated by Hungerford (Hungerford et al. 1994), these models have been adopted and adapted by many authors and institutions. The Hugerford's Diffusion Model or Standalone Model (Majumdar 2007, Hungenford et al 1994) simply takes the sustainability topics from various subject areas and creates a standalone sustainability course that diffuses the ideas into one common subject. In Hugerford's Infusion Model sustainability topics are embedded into the various conceptual subjects without the creation of a new standalone course on sustainability. The pros and cons of both these approaches have been documented in the literature (Peet et al. 2004, Wals and Jickling 2003, Ceulemans, and De Prins 2009). We adopted a hybrid approach. A layer of diffused subjects primarily focusing upon BIM were created. Surrounded by this layer of subjects, core subjects received an infusion of BIM concepts. Figure 1 shows three models, (a) infusion model, (b) diffusion model, and (c) the hybrid model adopted at UTS. For example, as shown in Figure 1, the Digital Design and Construction sequence of subjects are primarily the diffused content pertaining to BIM. Once students have gained the explicit knowledge of BIM they are then exposed to the core subjects in which issues of digital modelling, collaboration and integration are addressed within the context of the subject.

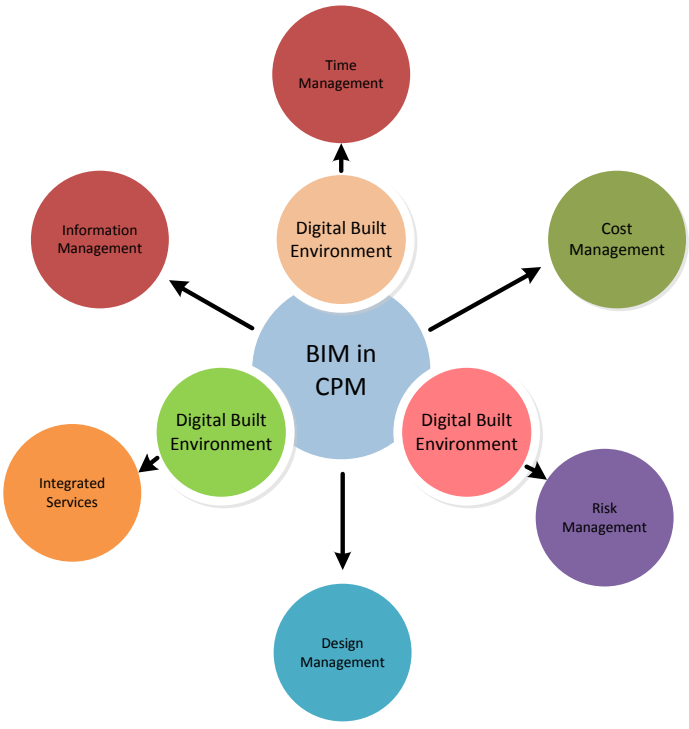
The newly re-structured Construction Project Management Program has been targeted by the School as the first to implement BIM-supported teaching and learning. This paper therefore takes a case study approach (Yin 1994) to reporting the core reasoning and implementation involved in this endeavour. It aims to assist other programs interested in adopting similar modes of teaching and learning. Some key aspects of this approach include the design of learning opportunities so as to:

1. Take greater advantage of problem based learning within stream based construction project management programs;
2. Create a more visually oriented means of teaching and learning;
3. Develop students' capability to work in dynamic industry knowledge networks;
4. Intrinsically engage students in the learning process;
5. Improve linkage between separate subjects and assessment tasks, thereby taking a more integrated and developmental approach to learning and assessment, and
6. Promote a more holistic understanding of issues involved in building projects.

Figure 1 – Hybrid model for UTS CPM program

(a) Infusion Model

(b) Diffusion Model



(c) Hybrid Model Used at UTS

The case for BIM-supported learning in construction project management

From a learning theory perspective, BIM engenders visual-spatial learning and a common basis for collaborating among student-to-teacher and student-to-student groups. However of note, visual-spatial learning differs from the more common form of hearing and language based learning known as auditory-sequential learning. Those partial to auditory-sequential learning respond to ―progression from simple to complex, organisation of information, and linear deductive reasoning" (Gifted & Creative Services Australia 2007). This is still the predominant mode of learning in construction project management programs; however it does not necessarily work well for visual-spatial learners - learners who are present across the built environment disciplines. These learners by definition think in terms of visualisation, images and an awareness of space - they are able to simultaneously process concepts, apply inductive reasoning, and generate ideas by combining existing facts - a benefit of this is that learning is said to be permanent once the student is able to fit the information into the context of what they already know (Gifted and Creative Services Australia 2007). Gareau and Guo (2009) point out that this form of learning is believed to be eight times faster than auditory-sequential learning.

The fit between BIM and construction management pedagogical objectives is obvious - BIM utilises three-dimensional (3D), real-time, dynamic modelling softwares to construct a building virtually, thereby leveraging opportunities to understand the likes of productivity and efficiency in design, construction and operation (Holness 2008). The virtual building model is called a rich model because all objects in it have properties and relationships, and based on this, useful information can be derived by simulations or calculations using the model data. This is much more advanced than 2D CAD which is limited to independent plans, sections and elevations and limited graphical entities such as lines, arcs circles, etc. In contrast, the intelligent semantic objects of BIM models provide objects defined in the terms of building components and systems e.g., spaces, walls, beams, piles etc. The key generic attributes of BIM models are (BEIIC Report 2010):

- *Robust geometry* - objects described by faithful and accurate geometry, that is measurable
- *Comprehensive and extensible object properties that expand the meaning of the object* - any object in the model has some pre-defined properties, or the Industry Foundation Class (IFC) specification allows for any number of user or project specific properties.

- *Semantic richness* - the model provides for many types of relationships that can be accessed for analysis and simulation e.g. is-contained-in, is-related-to, is-part-of etc.
- *Integrated information* - the model holds all information in a single repository ensuring consistency, accuracy and accessibility of data
- *Life cycle support* - the model definition supports data over facility life cycle, from conception to demolition, extending current emphasis on design and construction phase.

Given the above, buildings can be rigorously analysed and simulations can be performed quickly, thus moving construction project management students from abstract concepts to more applied knowledge. Another of the main benefits is the potential for more effective teaching, as information is more easily shared, can be value-added and reused. Other specific benefits that BIM offers to education include engagement and exploration of teamwork, collaboration and continuity across multiple construction stages; defining responsibility, ownership and exchange of information; exploration of design management tasks and core tasks such as construction scheduling, trade coordination, assembly and manufacture and cost and life-cycle analysis.

IMPLEMENTATION STRATEGY

In acting on the potential benefits of BIM in education, there is a continuum that must be considered: at one end is the introduction of small elements of BIM through discrete subjects that operate at the periphery of existing programs; at the other end is the fully integrated BIM enabled degree involving students in the resolution of problems through close to real world experience. As mentioned previously, we support the latter but from an implementation point of view the critical challenge that remains is how to make this significant shift, whilst still providing a high quality of educational program during the change.

Managing risk in BIM-supported teaching and learning

The temptation may be to implement BIM technology as a heavy handed symbol of change. From a risk management point of view, there is much to be considered here:

- Technology failures and glitches.
- Over-worked/ over-stressed academics.
- Poor student experiences as they feel like guinea pigs while staff build new competencies and problem-shoot implementation issues.
- Maintaining political support for the program if things go wrong.
- Funding capital infrastructure to enable the use of BIM in education.

- Threat to accreditation if student experiences are inadequate.
- Ability to source and train appropriate staff.

Thus, the counter argument to a heavy handed approach is that a lower risk approach would enable some of the softer issues to be addressed before significant technological implementation. A critical challenge here continues to be the level of comfort among staff where moving from a more traditional didactic education model to a digitally mediated problem based learning model. The movement from one to the other is substantial, but can be done across the existing curriculum with staged use of technology. In the Construction Project Management Program targeted staff took responsibility for convening and maintaining an overview of how different subject areas integrated BIM in relation to teaching modes, content and digital capacity. The aim was to shift the technology implementation from a push (in terms of adoption), to a pull (from staff who want the technology to improve and enhance the way they teach). Concurrent to this, was the training of staff in BIM technology (which remains ongoing), as well as the use of both outside contractors to author BIM models and appropriately skilled sessional staff to help implement tutorial and studio teaching.

Managing levels of implementation

It is worth highlighting a more conceptual understanding of how BIM-supported teaching and learning has and will continue to take place in terms of a program wider implementation. A structured approach was considered important in order to avoid unnecessary, undirected, or premature use of BIM technologies. There was also the practical need to consider different staff capabilities and motivations for utilising BIM (including differences between permanent versus sessional staff, and early versus late adopters of BIM systems). For these reasons, we have developed a simple typology for BIM-supported teaching and learning that defines different levels of implementation.

The typology shown in Table 1 was applied to all subjects in the program – where the School‘s staff were able to nominate which level was appropriate for their subject in the coming year (2011) and potential options for upgrade in subsequent years. Here, it is pertinent to note that while the ‗instructive‘ level may, by necessity, dominate first year subjects in a program, and the ‗immersive‘ level may dominate in latter year subjects, it is probably better to think in terms of the chosen classification representing a bias (i.e. ―mainly instructive‖ or ―mainly immersive‖) rather than a strict delineation of the approach taken.

In addition to teaching staff, a number of other actors were identified as being integral to the implementation of BIM-supported teaching and learning in the Program including:

- *Technical support personnel:* responsible for the maintenance of the hardware and software associated with the BIM. This potentially carries significant implications for cost depending on the level of implementation across the Program.
- *Administrative staff:* Although unlikely to have much impact on the detail of the program, they will need to field information requests and have an understanding of responsibilities within its operation.
- *External actors:* Accrediting bodies and other regulatory agencies will also have an environmental influence on the adoption of BIM within the course.

Table 1 – Levels of implementing BIM-supported teaching and learning

Implement-ation Level	Purpose and mode of delivery	Implications for T&L	Implementation issues
Instructive	• Basic competency in BIM to establish overall basis for other subjects. • Subjects/ lessons/tutorials/self learning to develop competency in targeted applications • Targeted at the front end of the entire program. • Important to separate model interaction skills (low) from model authorship skills (high)	• Lecturers who have a core interest in BIM technology to teach and or supervise these subjects. • Finer student skill development supported by on-line tutorials, forum groups and self-learning	• Strong teacher knowledge of targeted applications • Tutors required to assist instruction • Program decisions about how much student and staff self learning is realistic
Illustrative	• BIM is used as a visually descriptive means of assisting in teaching traditional construction management subjects. • Best applied to subjects which benefit from constant graphic reference to a 3D building model such as construction technology and site establishment. • Also useful in design related subjects such as structural appreciation and environmental design. • Students can easily use the same model as the one that lecturer is using.	• Lecturers who teach traditional construction subjects should where appropriate. - Use BIM to add a visual dimension to the way they teach the subject. - Only minor skills required as staff/ students can download free ~~–~~BIM viewer software" to visually manipulate models - Use the same BIM in different subjects so that students build on their aggregated knowledge	• Only low lecturer software knowledge required • Only low student software knowledge required • As a minimum, most subjects should be able to adopt this level of BIM usage
Immersive	• Staff set problems and students are actively and experientially involved in using BIM as a tool to assist problem solving.	• Lecturers who teach traditional construction subjects should develop parallel interest in utilising BIM systems to extend	• High teacher software knowledge required • High student software

	• Less lecture, more problem based learning. • Initial subjects should include time, cost, sustainable design.	their ability to teach and involve students using an immersive studio approach. • Lecturers should where appropriate: - Specify project sub-plots and problems for subjects (e.g. cost, time, quality) that involve students in using BIM to obtain a solution - Merge traditional and BIM based methods for best overall affect	knowledge required • High levels of tutor assistance likely

Mapping subject areas to implementation levels

In exploring the Construction Project Management Program and mapping subject types to the levels of implementation in Table 1, the challenge for the Program was to develop and adapt it to the unique set of capabilities of the staff and student body. From this perspective, three main types of subjects were characterised:

- Technical/ Science-based subject areas
- Analytical/ Measurement-based subject areas
- Non-technical, human factors/ organisational/ process/ policy subject areas

Table 2 presents an example relationship matrix illustrating the links between these two aspects of ongoing curriculum development at the School.

Table 2 – Relationship matrix linking types of subjects with levels of implementation

	Instructive	**Illustrative**	**Immersive**
Technical/ Science-Based		x	
Analytical/ Measurement-Based	X		x
Non-technical, including human factors/ organisational/ process	X		x

The relationship matrix was used to harness lecturers working in the same types of subjects to further develop the way they utilised BIM for teaching purposes. For example:

- Technical/ Science-based subject areas – curriculum development is currently focusing on the use of BIM technologies and models as graphical teaching aids. e.g., the School‘s suite of Construction Technology subjects (1-4).

- Analytical/ Measurement-based subject areas – curriculum development is currently focusing on the utilisation of BIM technologies and processes for the execution of domain specific activities. e.g., cost and time management subjects.
- Non-technical/ human factors/ organisational/ policy subjects – curriculum development is currently focusing on the use of BIM technologies and processes in a studio environment using problem-based learning as the foundation to help students understand BIM as a system in construction and aspects of interdisciplinary collaboration and project integration. e.g. Project Management Integration subjects.

This simple approach was designed to promote the new direction of teaching and learning to staff within the School and establish a basis for communication between lecturers in a way that was mutually beneficial. To develop these linkages further the School has begun the implementation of two important concepts: project-based learning and ‗vertical problems'.

PROJECT-BASED LEARNING AND 'VERTICAL PROBLEMS' CONCEPT

In responding to the above, it was considered appropriate to adopt a more specific version of problem based learning which is particularly relevant too building and construction known as ―project-based learning" (PBL). Thomas defines PBL as:

> *'Project-based learning is a model that organizes learning around projects. ... projects are complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision making, or investigative activities; give students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentation'* (Thomas 2000).

Thomas (2000) goes on to specify the five criteria for effective PBL. De Urena et al. (2003) summarise his position.

> *'First, PBL projects are central, not peripheral to the curriculum, so PBL must be a decision of the whole institution, not just some teachers experiencing on their own. Second, PBL projects are focused on questions or problems that drive students to encounter (and struggle with) the central concepts and principles of a discipline. Third, projects involve students in a constructive investigation. New knowledge is necessary to solve the problem (not only to use the things already learnt), so students are responsible for reaching new skills and understandings. Fourth, Projects are student-driven to some significant degree and teachers must renounce continuous supervision and leave some freedom and autonomy to the*

student to lead their own work. Finally, Projects must be realistic, not school like. If projects are real, students will be deeply involved and their results will be better as they feel solving a real problem'. (de Ureña et al. 2003)

In the context of current construction project management programs PBL represents a radical departure from conventional discipline specific approaches to teaching and learning, which involves teaching staff in the use of a very different set of skills and practices. PBL implies a shift to a student focused approach to learning and is generally framed by constructivist principles of learning. In the case of BIM-supported teaching and learning, adoption at an individual course level will not place PBL at the centre of the curriculum and will likely lead to a fragmented and inconsistent approach as different lecturers, with different backgrounds and teaching and learning approaches, apply potentially contradictory methods. Subsequently, a program wide approach offers greater potential.

To address this, we introduce the concept of _vertical problems' as a means of obtaining program wide coverage of BIM-supported PBL. The concept utilises the virtual building model as the problem's core so as to provide a multi-layered vehicle for student and teacher engagement that can be progressively used from early to latter years of learning. At all levels, the base problem embedded in pre-made BIM models provides a key descriptive theme to begin the storey line, conveyed using a BIM model that may describe a number of standard building typologies such as a residential dwelling, a low rise apartment building, an industrial warehouse and a high rise building; the logic of the approach is shown in Figure 2.

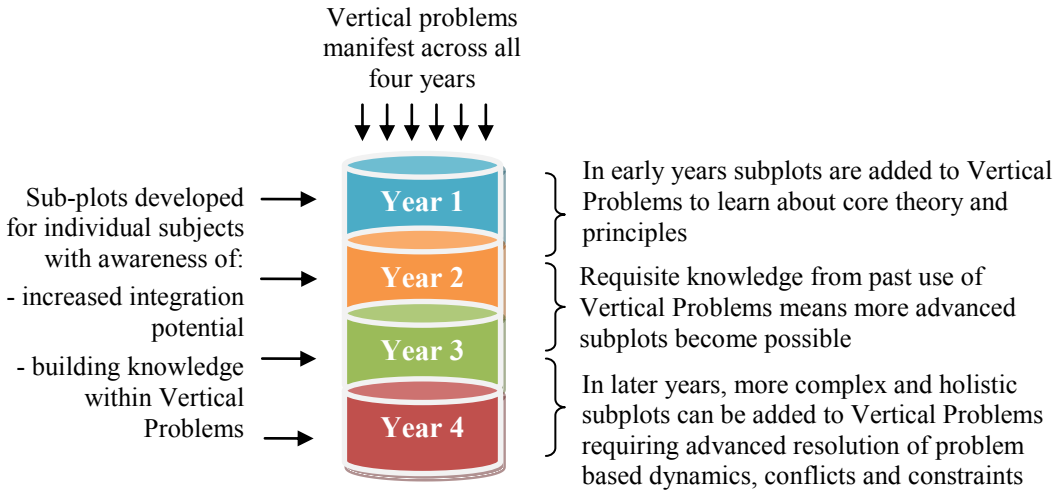


Figure 2 – Vertical problems across a four-year Construction Project Management program

The virtual building model and its site provides the context of the problem and establishes the framework of the vertical problem for ‗sub-plots' to be built in to, so that specific PBL situations are defined to suit areas of learning – be it construction technology, structures, quantity take-off, risk management, project planning and so on. Subplots can therefore be developed to help in-class teaching and/or for assessment. Lecturers of individual subjects and subject areas therefore have considerable control over content, and simply make use of the vertical problem as a means of conveying the principles and methods in an integrated and/ or visually applied way.

In this way, students are able to enhance their understanding (and that of others) by solving project based activities that require detailed insight and analysis; hence students in the early years of their degree can gradually build their knowledge under the auspices of a common theme, and in latter years by embedding their learning in multidimensional, practice based problems that capture the complexities of dynamic systems in the Built Environment.

STATUS OF BIM-SUPPORTED T&L AT THE SCHOOL

Currently the Construction Project Management degree offers six subjects (approximately 20% of the Program) that utilise BIM-supported teaching and learning to various degrees. These subjects can be categorised into two of the previously discussed modes of teaching and learning - instructive and immersive, and are shown in Table 3.

Table 3 – CPM subject offerings at UTS utilising BIM-supported teaching and learning approach

Instructive	Immersive
• Digital Built Environment (1st Year)	• Digital Design & Construction 1&2 (2nd&4th Year)
• Design Team Management (3rd Year)	• Time and Quality Management (2nd Year)
• Cost Management 2, Estimation (3rd Year)	• Cost Management 3, Cost Planning (3rd Year)

Case study of BIM-supported teaching and learning

To provide greater insight into the way BIM is being utilised in the Program's approach to teaching and learning as well as the way BIM systems are taught, this section provides a more detailed view of the subject ‗Digital Design and Construction 2' – taught as a project based learning studio in 2010. The class introduced a variety of BIM technologies and processes to support students in their efforts to integrate three keys aspects of project management: scope, team collaboration and management, and project planning. By simulating a construction project that closely resembled realistic conditions, students

were asked to explore current technological possibilities for integrating project management data by learning the functionality of BIM software applications and applying them when executing a variety of management tasks.

During the Autumn 2010 class, students successfully undertook digital design and construction management tasks for a four storey open-plan office building, including a lower level basement, located in North Ryde, Sydney. A detailed brief was provided and the project was in close proximity to the University which allowed students to visit the building site to obtain location-specific site information. The lecturer provided the students with the complete set of design and bid documents for this project as the information basis for generating the 3D model and subsequent management tasks. Therefore, we can state that the class project resembled real-world conditions closely.

Overall 39 Construction Project Management and three Architectural Design undergraduate students participated in the class. For the course assignment, the lecturer divided students into seven groups of students. In the class, the lecturer introduced the students to the concept of BIM and tutorials were provided in a number of software applications, with the onus put on the student groups to continue the development of their skills. Design and construction modelling exercises were undertaken using digital teamwork functionalities and model serving capabilities. Following this a number of BIM-based project management applications were introduced. Students were exposed to a variety of software as shown in Table 4, and with the exception of Cost X and Vico Estimator all software listed was utilised in the studio.

Table 4 – Software used in the Digital Design and Construction 2 subject 2010

Groups	BIM modelling	Scope	Time	Cost & database	Model Int. & Clash Detect.	Info. Mgmt &. Comm.
2010 Seven	ArchiCAD 13 Project Team	ArchiCAD 13 Vico Constructor	MS Project Vico Control 2009	Cost X Vico Estimator	Solibri Viewer Solibri Model Checker	ACONEX

At the beginning of each week, the lecturer addressed various aspects of BIM, integrated project delivery, and BIM management during a one hour lecture prior to studio commencement. These lectures presented students with concepts, theories and materials covering BIM in relation to people, processes and technologies, and was structured according to four themes: (1) BIM and preconstruction, (2) BIM and design management, (3) BIM and construction, and (4) BIM and updates.

In the first three weeks of the course, studio sessions were used to provide individual support in generating 3D building models and researching the building‘s construction sequence and scheduling (4D) from project drawings and specifications. Once the basic virtual building model had been produced and familiarity with the various software applications was acquired, studio sessions were used to undertake three separate tasks. In the remaining ten week program, students undertook three phases of exercises: *Phase 1* - defining project scope, *Phase 2* - undertaking a series of management tasks that characterise digital collaboration and coordination, and *Phase 3* - developing an integrated project plan.

In the first phase, each student group was required to define the project scope using the information from the 3D and 4D information modelling stage. The construction project scope defined by student groups described the 3D items and structures that would be built and the expected roles of everyone involved with the project. Each group‘s construction project scope also defined the construction delivery method and provided time estimates time for project completion. Group‘s selected a hierarchical modelling approach by dividing the different components of the building into a product breakdown structure (PBS). Groups then assigned responsibilities between members to digitally model the virtual building based on the architectural and structural components of the PBS. All groups reported struggles with missing details in the 2D drawings and lack of specification details. This forced groups to make assumptions about project scope and needed to compensate for missing information in order to generate a complete virtual building model.

In the series of exercises that were targeted in the second phase – typical BIM management tasks – students undertook a number of exercises in digital model integration and coordination using Solibri Viewer and Solibri Model Checker. One example of these digital management tasks included clash detection, where student groups were given an industry pre-made 3D MEP model to embed in their 3D building models. The MEP model contained over 400 legitimate and often occurring clashes. Student examples are illustrated in Figure 3.

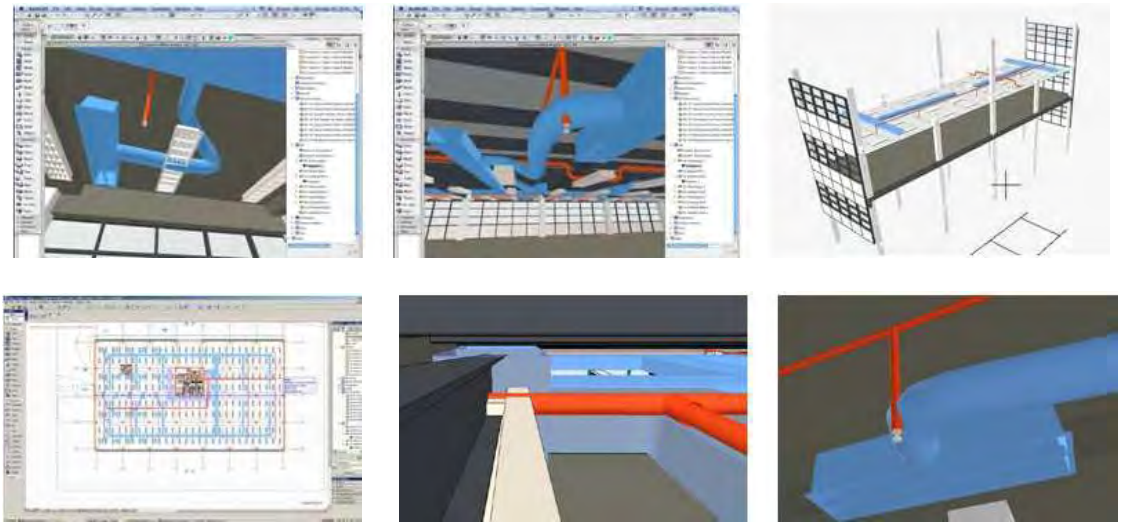


Figure 3 – Student examples of BIM in design management and coordination

Here, groups were required to represent the interests of five disciplines in structured review design meetings, including architectural, structural, building services, quantity surveying, and construction. In these simulated review meetings role playing was introduced to explore these diverse interests. Review meetings were held in a round table format using digital projections of the virtual building model and were video recorded for assessment as shown in Figure 4.

Figure 4 – Student groups participating in design review meetings

The main objective of the final phase – the development of an integrated project plan – was to assess how well the students could integrate project management concepts covered across their four year program into an overall project plan using digital technologies. In this task, student groups were required to optimise for workflow, resource levelling, and duration. They iterated through these three optimisation foci until changes were negligible. Without the virtual building model the connection between the quantities and the schedule and from the schedule to the costs would have been lost, and the students would not have gained as holistic an understanding of the scope, time, and cost relations.

Furthermore, in studio sessions tutors were able to challenge students by testing how well each group was able to quickly change any of the integrated aspects of scope, or time and determine the effects of changes on one of these aspects on the other two.

At the end of the class, the students incorporated a number of changes into their final building models (based on outcomes of Phase 2) and to their integrated project plans. In summary, each of the seven groups was able to cover all three phases and most significantly develop an integrated project plan within the class duration of thirteen weeks. It is questionable whether the students would have been able to generate the integrated project plan without the help of BIM-based applications in the first place. Students reported that modelling the project in BIM helped them to understand the important technical and geometric aspects of the building. This hints towards the possibility that the structured way of modelling a project using BIM systems supported students with their efforts to understand project drawings and specification at the start of a class project.

DISCUSSION AND RECOMMENDATIONS

BIM is as much about people and process as it is about technology. Therefore, BIM in teaching and learning should ensure these three pillars—people, process and technology—are appropriately and strategically considered in a program wide adoption. Of note, its key benefits revolve around the ability to provide a more integrated approach to managing project variables, a more visual basis for understanding and analysis, and the related ability for visual content to provide a common, collaborative and dynamic basis for dialogue between teacher- student and student- -student.

We envision that for undergraduate construction project management programs, the PBL approach discussed in this paper is a suitable means to embrace the three pillars of people, process and technology in teaching, because PBL enables students to contextualise theoretical and practical issues during their studies. In general, PBL uses the project as a means of requiring students‘ demonstrate inquiry, research and information synthesis in a meaningful way, thereby developing understanding, knowledge and analytical abilities. The concept of vertical problems is thought to be the best way of implementing PBL in programs that are stream based – as is the case in the Construction Project Management Program at UTS. Here, vertical problems act as a means of binding individual subjects taught throughout the degree. With the new opportunities that 3D, 4D and 5D digital modelling offers, staff are now able to flexibly write their own –sub-plots" that tap into vertical problems in a way that enhances rather than destabilises existing subject content.

In meeting the above initiatives there is a parallel need for staff buy-in, particularly in the use of BIM tools. Here, some staff represent early adopters but others are not as quick in taking up the technology. A pathway forward – and the one used at UTS - is for the Construction Management Program to provide a structured approach that utilises different levels of implementation across instructive, illustrative and immersive levels. In this way, subject lecturers identify their chosen level of implementation and write "sub-plots" to operationalize an approach suitable to their competencies. Those working in specific subjects areas (e.g. technical, science-based, measurement, analytical, etc.) are encouraged to work in groups to aid systematic adoption of BIM within a given area. As this degree of collaboration matures, the potential emerges to provide harmony, learning efficiency and removal of unwanted overlaps between subject areas and spend more time exploring complexities of dynamic systems in the Built Environment.

Whilst the above concepts and steps are currently in process within the School of the Built Environment, there is still a considerable path to travel regarding Program wide implementation of BIM-supported teaching and learning. Of note, this will include the need to systematically monitor and evaluate teaching and learning outcomes.

REFERENCES

Becerik-Gerber B, and Rice S. (2010) The Perceived Value of Building Information Modeling in the U.S. Building Industry, *Journal of Info. Tech. in Construction (ITcon)* Vol. 15, 185-201

Becerik-Gerber, B. and Kensek K. (2010) "Building Information Modeling in Architecture, Engineering, and Construction: Emerging Research Directions and Trends", *Journal of Professional Issues in Engineering Education and Practice* 136(3): 139-147.

BEIIC Report (2010) *Productivity in the buildings network: Assessing the impacts of Building Information Models*, report to the Built Environment Innovation and Industry Council, from Allen Consulting Group, 2010, Sydney, October 2010.

Berente, N., Baxter, R., and Lyytinen, K. (2010) "Dynamics of inter-organizational knowledge creation and information technology use across object words: the case of an innovative construction project", *Construction Management and Economics*, June 2010, Vol. 28, pp 569-588.

Ceulemans, K. and De Prins, M. (2009) "Teacher's manual and method for SD integration in curricula", *Journal of Cleaner Production*.

de Ureña, J.M., Menéndez, J.M. and Coronado, J.M. (2003) Project/Problem Based Learning in Civil Engineering: the Ciudad Real (Spain) Experience, International Conference on Engineering Education. Valencia, Spain.

Eastman C., Teicholz P., Sacks R. and Liston K. (2008) *BIM Handbook: A guide to building information modelling for owners, managers, designers, engineers, and contractors*, John Wiley & Sons, Inc., Hoboken, NJ, USA.

Gallaher, M.P., O'Connor, A.C., Dettbarn, J.L. and Gilday, L.T. (2004) *Cost Analysis of Inadequate Interoperability in the US Capital Facilities Industry*. Gaithersburg, Maryland USA: National Institute of Standards and Technology.

Gareau, S. and Guo, R. (2009) All Work and No Play" Reconsidered: The Use of Games to Promote Motivation and Engagement in Instruction *International Journal for the Scholarship of Teaching and Learning* Vol. 3, No. 1.

Gifted and Creative Services Australia (2007) Visual-spatial thinking, Retrieved on December 23, 2010 from http://www.giftedservices.com.au/visualthinking.html

Holness, G.V.R. (2008) "BIM Gaining Momentum" *ASHRAE Journal*, June 28-29.

Hungerford, H.R., Volk, T.L., Ramsey, J.M. and Bluhm, W.J. (1994) ―APrototype Environmental Education Curriculum for The Middle School (Revised)" A Discussion Guide for UNESCO Training Seminars on Environmental Education, UNESCO-UNEP International Environmental Education Programme.

Jupp, J.R., Forsythe, P. and Sankaran, S. (2010) Towards a Value Centric Approach to Education: Implications of Changing Practices in Construction Project Management, AUBEA 12-14 June, 2010, Melbourne, Australia.

Lamb, E., Reed, D. and Khanzode, A. (2009) ―Transcending the BIM Hype: How to Make Sense and Dollars from Building Information Modeling" AECbytes View point #48 (September 22, 2009).

Majumdar, S. (2007) ―Integrating Sustainable Development in TVET Curriculum" The 11th UNESCO-APEID International Conference Reinventing Higher Education: Toward Participatory and Sustainable Development, December 2007, Bangkok, Thailand.

McGraw Hill (2007) Interoperability in the Construction Industry, SmartMarket Report, New York, United States.

McGraw Hill (2009) The business value of building information modeling: Getting building information modeling to the bottom line, *SmartMarket Report*, McGraw Hill, NY.

McGrawHill (2008) Building information modeling: Transforming design and construction to achieve greater industry productivity. *SmartMarket Report*, McGraw Hill, NY.

Peet, D.J., Mulder, K.F. and Bijma, A. (2004) ―Integrating SD into engineering courses at the Delft University of Technology-The individual interaction method" *International Journal of Sustainability in Higher Education*; Volume 3 pp 397-288.

Taylor, J.E. and Bernstein, P. (2009) —Paradigm Trajectories of Building Information Modeling Practice in Project Networks", *ASCE Journal of Management in Engineering*, Vol. 25, No. 2, April.

Thomas, J.W. (2000) *A Review of Research on Project-based Learning*. San Rafael, California: The Autodesk Foundation.

Wals, A. and Jickling, B. (2002) —Sustainability in Higher Education: From Doublethink and Newspeak to Critical Thinking and Meaningful Learning" *Higher Education Policy*; Volume 15 pp 121-131.

Yin, R.K. (2009) *Case Study Research: Design and Methods*, Fourth Edition, SAGE Publications, California.

Young, N., Jones, S., Bernstein, H.M. and Gudgel, J.E. (2009) The Business Value of BIM: Getting Building Information Modeling to the Bottom Line, *SmartMarket Report*: McGraw Hill Construction.

The Teaching of Corporate Construction Management

Toong Khuan Chan
Faculty of Architecture Building and Planning
The University of Melbourne, Australia

ABSTRACT

This paper describes the case method approach as a supplementary tool for teaching Corporate Construction Management – a core subject for the Master of Construction Management degree at Melbourne School of Design. The case method of instruction has been found to be an extremely successful method of learning at top business schools and is introduced here to develop case analysis skills. The aim of this paper is to examine the effectiveness of the course design and determine the student and instructor attributes that may lead to better learning outcomes. Four cases were selected to reflect the issues covered in the lectures and to present a mix of commercial, financial and operational concerns. Although the students were initially reluctant to adequately prepare for case discussion, their attitude changed when they became more familiar with the case method. The role of the instructor in case teaching is not to prescribe a solution but to encourage the students to take ownership of the discussion and to guide the students in their search for an answer. The effectiveness of the case approach in facilitating student learning and developing students' ability to analyse complex issues in construction management is discussed.

KEYWORDS

construction management, corporate management, teaching, case study

INTRODUCTION

The case method in business education was pioneered by the Harvard Business School (HBS) in the early part of the 20th century and has become the de-facto standard in many top business schools. The argument was that the business curriculum should emphasise a problem-centred approach based on real-life situations. Cases can be used as specific examples of established theories, to explicate particular themes or principles, to align particular theories within a broader context, or to explore complex or multi-dimensional problems of practice for which explicit theories do not exist. Recent research has indicated that the case method of teaching is effective in other faculties such as accounting (Stewart and Dougherty 1993), education (Levin 1995, Haley 2004), supply-

chain management (Flynn and Klein 2001), small business and entrepreneurship (Perren and Ram 2004), civil engineering (Russel and McCullough 1990) and operations research (Cochran 2000). Pedagogical advantages such as getting students involved in the learning process, bridging the gap between theoretical concepts and actual practical experience, integration of major concepts, increased student interest and motivation for learning, increased class enrolment have been cited as the main drivers for adopting the case method approach.

The Corporate Construction Management subject, a core subject within the Master of Construction Management degree at the Melbourne School of Design, examines management issues relating to contemporary businesses within the construction industry. Detailed description of the Master of Construction Management degree including the program objectives and course plan are available from the faculty website. It is recognised that students of the Construction Management degree will require a succinct understanding of the theories of corporate management and finance, models of organisations, the role of the manager, and corporate strategies to succeed in their future careers. In order to provide a corporate angle to the teaching of this subject, it was decided that the case method of teaching, which has been proven to be an extremely effective method of learning at top business schools, be introduced as a supplement to the traditional lectures and assignments.

The decision to introduce the case method of teaching was informed by the successful application of this method for teaching Strategic Management in the construction program (Macomber, 2010) and the author's own experience in teaching a similar course at post-graduate level (Chan and Yap, 2010). In addition to the practical application and testing of management theory, case discussions can also help students prepare for real-world problems, situations and crises by providing an approximation of various construction industry scenarios (i.e. project finance and planning, marketing, production planning and operations, negotiations, corporate policy). Thus, through the examination of specific cases, students are given the opportunity to work on critical management and strategic issues through the experiences and research findings of others. An obvious advantage to this mode of instruction is that it allows students the exposure to settings and contexts that they might not otherwise experience.

The aim of this paper is to examine the effectiveness of the course design and to determine the student and instructor attributes that may lead to better learning outcomes. The rationale for the selection of the cases is described in the following section. The next section describes the role of the student and instructor in the case discussion followed by discussion on both student and instructor attributes necessary for a successful case discussion.

COURSE DESIGN

The topics for this subject include an introduction to the construction industry, organisational theory, financial management, competitive strategy, marketing, innovation, negotiation, leadership, corporate social responsibility and ethics, supply chain management, operations and productivity, and entrepreneurship. Each of these topics were discussed in a two-hour lecture during the semester and supplemented by two or three readings per week. The students were assessed through three assignments, each worth 20% of the course marks and a two-hour final exam worth 40%. Guest lecturers from industry were invited to teach some of the topics to provide relevance and a first-person industry perspective to the management theories. The aim of the first assignment was to evaluate the financial health of construction companies in the Australian building and construction sector by examining the financial statements and working out the financial ratios. The second assignment involved the application of generic competitive strategies to effectively compete within the construction industry. Students were instructed to prepare a market segmentation matrix for the company selected in the earlier assignment and discuss how each of these segments might be attractive for the company to pursue using Porter's five forces model. The third assignment involved the evaluation of a complex project and the preparation for negotiating a joint venture agreement between Walt Disney and the Hong Kong government on the establishment of Hong Kong Disneyland.

In addition to this conventional approach, the case method of teaching was trialled as a supplementary learning approach to enhance the students' ability to link the management theories from the lectures to practice, albeit at a simulated scale. The inherent strategy here was to transfer much of the responsibility for learning from the teacher on to the student, whose role, as a result, shifts away from passive absorption toward active learning. Through careful examination and discussion of various cases, "students learn to identify actual problems, to recognize key players and their agendas, and to become aware of those aspects of the situation that contribute to the problem" (Merseth 1991). In addition, students were encouraged to generate their own analysis of the issues, to develop their own solutions, and to practically apply their own knowledge of theory to these problems. Along the way, the students were expected to develop the ability to analyse and identify critical factors amongst a complex web of issues.

The cases were selected primarily to illustrate and reinforce the topics of the lectures, and also driven by the need to provide simpler cases at the start of the semester to enable students who are not familiar with this method of learning to gain the necessary skills, and to progress to more complex cases towards the end of the semester. Shapiro (1985)

produced a “Hints for Case Teaching” as a guide for both students and instructors who were new to the art of case teaching.

The first case was SOHO China (HBS 9-703-011 March 24, 2003) which described the founding and early success of a real estate development company based in Beijing. The case revolves around the two founding partners and their role in building one of the most successful real estate companies in China today. Having previously covered Porter’s Five Forces Model in the preceding week’s lectures, this case was centred on creating a market segmentation matrix for the company and to discuss how each of these segments might be attractive from a strategic point of view. The case was also utilised as an example for students to learn the necessary skills for case analysis. Many students have come from a traditional lecture based mode of learning and have had no experience with the case method, and thus have were completely at a loss on how to proceed to examine the vast amount of information contained within a case report. The second case selected for this subject was Kone: The MonoSpace Launch in Germany (HBS 9-501-070 February 25, 2005) which required students to prepare a marketing plan for the launch of the new MonoSpace elevators in Germany. This case provided a good balance of issues ranging from the technical requirements for the installation and operations of the new elevators, to the commercial arrangements to market these elevators in France, United Kingdom and the Netherlands. Students were instructed to develop detailed analyses of the markets in each of these countries and to correlate Kone’s marketing effort to the sales figures. Their task was not only to position and price the MonoSpace, but also to develop a marketing plan. Arborite (HBS 9-796-146 February 14, 2006) was chosen next to highlight the decision making process to improve the manufacturing operations of high-pressure laminates for the Canadian market. This case examined various options for investing into equipment and technology to improve product quality in order to meet a corporate target of 19% return on asset. Students were advised to examine the production process carefully and to determine where savings can be made, or to modify their corporate strategy to adjust to the entry of a new player in the market.

The final case study required the students to play the role of either Walt Disney Company or the Hong Kong Government in the negotiations to establish the joint-venture company to invest in and operate a new Disneyland in Hong Kong. Students taking on the role of Walt Disney were required to read Hong Kong Disneyland (A): The Walt Disney Perspective (HKU-107 01 January 2000) whereas the students representing the government read Hong Kong Disneyland (B): The HKSAR Perspective (HKU-118 01 January 2000). The teaching objectives of these cases were to explore the making of cross-border investments and market entry decisions, and to apply project evaluation techniques. By dividing the class into two groups examining two separate perspectives of

the investment into Hong Kong Disneyland, the cases were also used as the basis for a simulated negotiation between the HKSAR government and the Walt Disney Company in seeking the most favourable terms for the joint venture agreement. Hong Kong Disneyland (C): The Joint Venture Negotiation (HKU-120 01 January 2000) provided the basis for the negotiations with a series of questions to assist students prepare their negotiating strategy.

PREPARATIONS FOR THE CASE DISCUSSION

'If the student does not read and analyse the case, and then formulate an action plan, the case discussion will mean little' (Shapiro 1985). It is recognised that students in the subject will have no previous exposure to the case method of learning and will not be able to adequately prepare for the case discussion. It is worth nothing that the first case was chosen to illustrate the various steps in case analysis from identifying the main points, determining the focus of the case (this is usually provided by questions posed by the instructor before the discussion), the search for pertinent data, and the development of proposed solutions or alternatives. The focus of the SOHO China case was therefore limited to the purpose of demonstrating the expectations for student involvement in preparing for case discussion.

The students were then expected to prepare for the remaining cases on their own and to come to class with their case notes in hand. Numerous students who prefer working with spreadsheets for evaluating financial statements and project evaluation calculations came equipped with personal notebook computers. Students reported that they spent between 2.0 to 2.5 hours preparing each case and up to 7.5 hours for the final case which was conducted over 3 sessions. Once the methodology for case analysis was shown to the students in the first case discussion, a number of students were able to formulate their analysis, to prepare an action plan correctly and were willing to share and defend their proposal in class. As the students grew more familiar with the case method of learning, more students were able to adequately prepare for the case discussion. However, it was disappointing to note that a small number of students remained steadfast in their reluctance to prepare for case discussions and were willing to be observers instead.

On the other hand, preparation by the instructor to teach must include a teaching plan that lists a series of questions to explore the students' understanding of the case. The instructor's preparation to teach the case must include a well developed chalkboard plan of the main issues, a list of questions to encourage greater depth and focus in the discussion, and a sample analysis of the pertinent points in the case.

STUDENT ATTRIBUTES

Attendance at the case discussions ranged from 65% to 90% with an average of 80% which was typical for post-graduate courses in the program. Although the case discussion groups were limited to a maximum of 15-20 students per session to ensure that all students were given ample opportunity to speak and exchange ideas, it must also be noted that a significant number of students enter the classroom late and disrupt the on-going discussion. Clearly the case method requires that student's learning is best facilitated by regular participation where the student shares his or her understanding and analysis with the class to advance the group's collective skills and knowledge. It has been suggested that the single most important rule of case teaching is that the students accept and maintain ownership of the discussion. If the instructor takes the responsibility for ownership of the class, the students can collectively and individually avoid their responsibility and the process will degenerate to the instructor lecturing about the case.

Observations from the class discussions indicate that 70% of the students were participating actively during the class discussions initially and this figure increased to more than 90% for the final case. Many of the questions during the early part of the semester were centred on seeking clarifications but these eventually shifted to more sharing of their understanding and presentation of their action plans during the latter part of the semester. Although a number of students were actively contributing to the case discussions, the quality of their arguments or points were clearly affected by the lack of efforts in preparing for the discussion. Such behaviour was detrimental to the overall quality of the discussion and evidently unfair to the other students.

A substantial number of students were obviously engaged with the case method of learning and commented positively about the course:

> *'Content and material very stimulating and different compared to previous management related subjects', 'Seminar sessions, Two way interaction during lectures, Interesting discussions on topics rather than only going through slides theoretically', 'Give the opportunity for the student to learn about the corporate construction industry deals with their business and strategy', 'Different perspective on the construction industry, from the corporate view', 'The practicality of the assignments, the real case studies and aspects of corporate construction management are intellectually stimulating', and 'Case study format'*

Conversely, a number of students reported a number of shortcomings:

> *'Not immediately relevant to new graduates of the industry', 'We have so much to understand in so little time, especially not from a finance background', 'The poor attendance of students in the tutorials and lack of*

engagement with the readings. It diluted the overall effectiveness of the seminars.', 'Could be too general instead of focusing on construction', and 'Student commitment was low due to external commitment e.g. work'

INSTRUCTOR ATTRIBUTES

As case teaching is very much a mixture of art and skill (Shapiro, 1985), the instructors must cultivate the art of listening to the ideas of others and the importance of the students' ideas and approaches to support the discussion on the case. It is not the instructor's role to provide a solution to the case nor is it the instructor's decision to make a choice on the case approach. His or her principal role is to encourage the students to take ownership of the discussion and to force the students to make a choice of the case decision, to have a plan of action, and to ask supporting questions like "Why would you do that?" or "What evidence can you provide to support your proposed approach?". The instructor must resist all attempts to teach the case, but act to facilitate discussions amongst the students about the case and to guide the analysis toward a meaningful outcome. Most case discussions end with the instructor delivering a few general comments that review and highlight the discussion, frame the approach and action plan in cognisance of the contributions made by the students, and may include a short lecture to either clarify some issue or to cover adjunct material.

DISCUSSION

A survey conducted by the teaching office at the end of the semester in 2009 and 2010 revealed that the students agreed that the subject was well taught, the case discussions were helpful and added to the learning process, and that they were satisfied with the quality of learning (mean scores between 4.3 and 4.5 in questions 2, 9 and 11, for both years, in Table 1). On the course evaluations, some students mentioned that cases were indeed an additional burden, but almost unanimously endorsed them as effective learning tools that were well worth their time and effort.

Table 1 – Results of the quality of teaching survey conducted during 2009 and 2010 (sample rate 33% and 75%, respectively)

		2009		2010	
	Quality of Teaching Survey	Mean Score†	Std Dev.	Mean Score†	Std Dev.
1	Clear expectation of me in the subject	4.2	0.58	4.2	0.63
2	This subject was well taught.	4.4	0.62	4.3	0.60
3	This subject was intellectually stimulating	4.3	0.61	4.3	0.61
4	Received helpful feedback	4.3	0.61	4.1	0.66
5	Teacher showed interest in my academic needs	4.2	0.58	4.4	0.56
6	Felt part of the group	3.8	0.86	4.3	0.67
7	Effective use of computer based materials	3.9	0.47	3.9	0.92
8	Web based materials were helpful	4.2	0.58	3.9	0.92
9	Overall satisfied with the quality of learning	4.5	0.63	4.5	0.57
10	The lectures were well presented	4.7	0.46	4.5	0.57
11	The seminars were helpful and added to the learning process	4.5	0.63	4.5	0.50
12	The assignments were clearly worded and their intent was clear	3.9	0.92	4.0	1.02
13	The assessment helped my learning	4.3	0.82	4.2	0.68

† Five-point scale (5-strongly agree to 1-strongly disagree)

It is obvious that the case method of learning depends two sets of attributes: students' and the instructor's. Although the purpose of instituting the case method was to transfer the responsibility for learning from the teacher on to the student, a number of students were reluctant to take on that responsibility in this example. A number of students were often absent from the case discussion. Another segment of the student cohort was only willing to put in the minimum effort to prepare for the case discussion and was not effective in producing an action plan. Their lack of effort became evident during the early part of the semester but reduced significantly toward the latter half when students realise the value of preparations for these discussions. As students studied the cases more assiduously, they became more confident about expressing their ideas and more secure in what they wanted to say. The more motivated students who attend every case discussion and brought along numerous sheets of case notes were clearly those who benefitted significantly from the case method. These discussions provided a forum in which they could critically analyse one another's ideas in a manner that was academically productive. Feedback from

students indicates that they have learned more from each other than from the lectures or from the instructor, which is an excellent outcome.

The attributes required of an instructor correspond to those suggested by Golich (2000) who noted that successful case teaching "is the art of managing spontaneity". Golich contends that the skills that instructors need to develop are *case mapping, asking questions, active listening, validating student participation*, and *using the blackboard*. Many of these skills can be learned either through practice or by observing an experienced case instructor.

CONCLUSIONS

After offering this subject for two consecutive years in 2009 and 2010, each year to a class size of 39 and 34, respectively, the case method of learning has been found to be an instructive tool to supplement the traditional lectures. Progressively more difficult cases were selected to enable students to be familiar with the case method of learning. Many students have indicated that the additional workload with case analysis was well worth the effort and have contributed significantly to their understanding of the topics covered in the lectures. On the other hand, a small number of students who did not take active part in the case discussions have found the additional workload overwhelming and unnecessary, and may have missed the opportunity to learn a new skill. Students who have responded positively to the case method of learning have confirmed most of the observations from other researchers of the benefits of this approach (Raju and Sankar, 1999,Bocker 1987, and Golich 2000).

Further research into the learning outcomes may be required to determine if the subject should be modified in the future to reflect a greater emphasis on the case method of learning; possibly extending it to teaching the entire subject using the case approach. As it now stands, the case method remains as a supplement to the lectures and written assignments, and serves to provide students with additional case analysis skills. The more difficult task of measuring achievement of the learning objectives beckons (see e.g. Bocker, 1987).

REFERENCES

Bocker, F. (1987) *Is case teaching more effective than lecture teaching in business administration? An exploratory analysis*, Interfaces, 17(5), 64-71

Chan, T.K. and Yap, W.K. (2010) *Construction Finance*, Malaysia University of Science and Technology, http://www.must.edu.my/programs_msconmgmt.php (Accessed 03-Nov-2010)

Cochran, J.J. (2000) *Introductory business OR cases: successful use of cases in introductory undergraduate business college operational research courses*, Journal of the Operational Research Society, 51, 1378-1385

Flynn, A.E. and Klein J.D. (2001) *The influence of discussion groups in a case-based learning environment*, Educational Technology, Research and Development, 49(3), 71-86

Golich, V.L. (2000) *The ABCs of Case Teaching*, International Studies Perspectives, 1, 11-29

Haley, M.H. (2004) *Implications of using case study instruction in a foreign/second language methods course*, Foreign Language Annals, 37(2), 290-300

Levin, B.B. (1995) *Using the case method in teacher education: The role of discussion and experience in teachers' thinking about cases*, Teaching and Teacher Education, 11(1), 63-79

Macomber, J. (2010) *1-46 Strategic Management in the Design and Construction Value Chain, Fall 2003* (Massachusetts Institute of Technology: MIT OpenCourseWare), http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-46-strategic-management-in-the-design-and-construction-value-chain-fall-2003/ (Accessed 03-Nov-2010)

Merseth, K.K. (1991) *The early history of case-based instruction: Insights for teacher education today*, Journal of Teacher Education, 42(4), 243-249, 1991

Perren, L. and Ram, M. (2004) *Case-study method in small business and entrepreneurial research – Mapping boundaries and perspectives*, International Small Business Journal, London

Russel, J.S. and McCullough, R.G. (1990) *Civil engineering education: case study approach*, Journal of Professional Issues in Engineering, 116(2), 164-174

Stewart, J.P. and Dougherty, T.W. (1993) *Using case studies in teaching accounting: a quasi-experimental study*, Accounting Education, 2(1), 1-10

Shapiro, B.P. (1985) *Hints for Case Teaching*, Harvard Business School 9-585-012, 1985

Risk Management of Research Projects in a University Context - An Exploratory Study

David Baccarini
School of Built Environment
Curtin University, Perth, Australia

Todd Melville
Inpex
Perth, Australia

ABSTRACT

All projects have risks. In particular the typical uncertainty of goals and methods in research projects demands robust project risk management. This paper reports the results of a small exploratory study into the risk management of research projects undertaken within a university context, as a basis for future detailed research. One surprising discovery was the paucity of scholarly publications in the area of project risk management in research projects. The exploratory study consisted of a web-based survey completed by 11 research academics at one Australian university. Some key findings from this preliminary research were that formal risk management is rarely or never applied to research projects; that the critical risks related to the quality and availability of researchers; and that ethical risks are not ranked as significant risks. This exploratory study indicates that further research into the risk management of research projects is warranted in order to add to the existing limited body of knowledge in this area, to provide deeper understanding of the nature of the risks, and to identify how these risks are managed.

KEYWORDS

project risk management, research projects

INTRODUCTION

Project risk management

A risk event can be characterised by having consequences should it occur and a likelihood of occurring. Consequence as the outcome of an event affecting objectives and likelihood is the chance of something happening (ISO 2009). The likelihood and consequence can be combined to determine a risk impact level (Turner 1999).

Project risk management is a core process within the project management process (PMI 2008). A range of project risk management methodologies exist such as ISO31000 (ISO

2009), PRAM (Chapman and Ward 2003), PMBOK (PMI 2008) and RAMP (ICE 2005). The processes of project risk management as outlined in ISO31000, an international standard for risk management, are representative of the common project management process found in these methodologies:

i. Communicate and consult with stakeholders throughout the project.
ii. Establish the context for project risk management e.g. policies, roles
iii. Identify risks events and their causes
iv. Analyse risks – i.e. consequence and likelihood of each risk event.
v. Evaluate risks - prioritisation of risk events for management.
vi. Treat risks – i.e. implementation of strategies to manage risk events
vii. Monitor and review effectiveness of the project risk management process.

Project management of research projects

For research projects the whole project is a risk (Winston 2006). Cochrane & Turner (1993) define research projects as having methods and goals that are both ill defined, thereby setting a challenge for project management. Research project management is often left to the researcher or chief investigator as opposed to an experienced project management practitioner (Winston 2006). It is unusual for research projects to utilise established project management methodologies (Gist & Langley 2007). Public research agencies face particular challenges in ensuring value for money in research so a robust project management infrastructure is particularly important (DCITA 2003).

The culture of research projects is characterised by a preference for limited structure and the freedom to experiment without structured management. In this culture project management could be seen as inappropriate, as it could be seen as an attempt to 'schedule an invention' (Larsen 2005). Even with this stated resistance to project management it is acknowledged that project management must be adapted to the research culture (Larsen 2005).

Project risk management in research projects

The risk management of research projects should be applied at the conception of the research idea (Winston 2006). Research projects are unique in that the innovation associated with research inherently involves risk (Leung & Isaacs 2008). So risk management of research projects is centred primarily around planning and controlling of uncertainty (Lee et al 2007). Research organisations are subject to similar risks to a corporate environment when executing their projects (Campbell & Schofield 2006). Risk management performed in research projects is largely focused on specific technical aspects of the project rather than risks that may impact the success of the whole research project (Lee 2007).

There is evidence to suggest that project risk management is not widely practised in research projects. The ARC (2009) project report template makes no provision for the reporting of project risks and proposed treatments. A report into research project management at CSRIO found that only half of projects had a documented project risk assessment completed (ANAO 2005). It is acknowledged that numerous attempts have been introduced to manage research risks through a range of policies, however those policies may have had negative impacts on achieving research goals (Lee 2007).

Lee (2007) states there is a need for strengthening public sector research risk management and that the public sector should take greater risks than the private. If publicly funded research is limited to low risk projects with a high chance of success, there is a risk that innovation is stifled (Leung & Isaacs 2008). Regardless of the complexity associated with risk management in research projects there is an increased expectation for systematic risk management across research organisations (Leung & Isaacs 2008).

Canada's National Research Council has identified potential benefits in using risk management to ensure that research is providing accountability for the funds spent (Leung & Isaacs 2008). In addition, if funding agencies understand the risks associated within a project they may be more inclined to fund it (Winston 2006). Wageman (2004) highlights four key benefits to the application of risk management to research projects there being

i. The identification, analysis, assessment, treatment and monitoring of risks helps bring clarity to the scope of a particular research project.
ii. It assists project participants to defend a project when adverse events occur and assists with a justification of changes as a result of those adverse events.
iii. The greater the risks undertaken by research projects can represent increased opportunity for success if risks can be managed and research outcomes achieved.
iv. The identification of contingency of funds that can increase the ability for a project to survive adverse events through the provision of additional funds.

Researchers in the public sector must be convinced of the value of project risk management in research projects (Gist & Langley 2007). Gorringe & Hochman (2006) state that with increased industry partnership in public sector research, in particular university-based research, there are increasing expectations from industry to manage risk in research projects. The resistance to risk management in research projects may be attributed to a notion that in general there is no visible damage to human and physical resources as a result of adverse incidents (Lee 2007). However Campbell & Schofield (2006) acknowledge that a single badly managed project, particularly in areas of significant public debate can adversely impact the reputation and creditability of a research organisation. To ensure the successful application of risk management to a

research project, the research project manager must believe in the risk management plan as a dynamic tool rather than a static document (Winston 2006).

Risk events in research projects

Some authors have provided categories of risks in research projects - see Table 1. These categories help provide a high-level perspective of the nature of risks in research projects. More specifically, a list of common risks in research projects identified from the literature is set out in Table 2.

Table 1 – Categories of risk in research projects

DCITA (2003)	Commercial, Financial, Health & Safety, Personnel, Project Management. Operational Management, Natural Disaster, Project outcomes
MRC (2004)	Financial, Ethics, Feasibility, Reputation
Winston (2006)	Internal , Project, Technical, External
Kasap (2007)	Organisation, Environment, Technology, Market
Lee (2007)	Legal, Moral, Policy, Technology, Market & Social

Table 2 – Common research project risk events

Risk Category	**Risk Event**	**Reference**
Commercial & Financial	Contractual conflict relating to Intellectual property	(UKRIO 2009)
	Contractual disputes between funder and research team	(Campbell 2006)
	Inefficient funding	(MRC 2004)
	Conflict regarding access and use of research results	(Williams 2007)
Research Achievability & Integrity	Research has low chance of achieving research outcomes	(RAC 2003)
	Research proposal is overly ambitious	(RAC 2003), (Blackmore & Nesbit 2008)
	Misconduct or fraudulent behaviour	(Shaw & Barrett 2006)
	Research data is falsified	(Beins 2009)
	Plagiarised material	(Beins 2009)
	Researchers make unjustified claims not supported by data.	(Beins 2009) (Campbell & Schofield 2006)
Research Methods & Process	Breach of health and safety compliance.	(UKRIO 2009) (Campbell & Schofield 2006)
	Research undertaken without approval of the research design	(McBurney & White 2007)
	Research methods outside of approved research design	(UKRIO 2009)
	Data collection is unverified	(AIR 2003)
	Data is not secured	(AIR 2003)
	Data is lost	(UKRIO 2009)

Risk Category	Risk Event	Reference
	Research methods are not adequately documented	(AIR 2003)
	Misleading results from outliers being eliminated	(AIR 2003)
	Research sample change their behaviours as they know they are being researched	(Beins 2009)
Research Team	Researchers cannot be recruited	(MRC 2004)
	Lack of quality researchers	(RAC 2003)
	Researchers do not have adequate training	(AIR 2003)
	Unrealistic expectations of researcher capabilities	(Blackmore & Nesbit 2008)
External Stakeholders	Research results are not effectively promoted to target market	(Campbell & Schofield 2006)
	Research fails to satisfy funder's needs	(Campbell & Schofield 2006)
	Adverse media commentary of research	(Campbell & Schofield 2006) (MRC 2004)
	Reputational lost as funder is not reputable	(MRC 2004)
	Loss of confidence by funder through poor financial management	(Campbell & Schofield 2006)
Ethics	Physical or psychological harm to research subjects	(Beins 2009)
	Breaches of respect for cultural traditions and customs	(Williams 2007) (Bosch 2007)
	Conflict of interests are undeclared	(UKRIO 2009)
	Misconduct or breaches of protocol are unreported	(Bosch 2007)
	Researchers fail to obtain consent.	(Beins 2009) (MRC 2004)
	Breach of confidentiality	(MRC 2004)
	Researched sample is disadvantaged by the research	(Williams 2007)
Infrastructure	Loss of research resources due to emergency e.g. fire, flood	(Beins 2009)
	Lack of suitable facilities to conduct research	(RAC 2003)

Ethical risks in research

One specific area of risk management in research project that has is given some detailed consideration in the literature is ethical risks. The history of risk management in research projects has some of its foundations specifically in research ethics Ethical risk is that a *'consideration of the risk of harm is integral to high quality research'* (Shaw 2006). Research ethics experienced a watershed with the Nuremburg trials of Nazi war criminals leading to increased awareness of the need for controls in research ethics. Prior to the Nuremburg trials, research ethics was seen as a concern for each individual researcher

and not an issue of risk for funding agencies (McBurney 2007). From the Nuremburg trials came the Nuremburg Code which addresses the following points (Beins 2009):

i. Research on humans absolutely requires informed consent
ii. The experiment must have the possibility of contributing to our body of knowledge
iii. Researchers should be informed about the topic they investigate to maximise the likelihood that the results will be useful
iv. The experiment should avoid unnecessary physical and mental suffering
v. No experiment should be conducted if there is good reason to believe that death or serious injury will occur
vi. The degree of risk must be less that the potential gain from the research
vii. Prior arrangements must be in place for responding to an emergency that occurs during a research project
viii. The investigator must have appropriate training to conduct the research

Research organisations invariably have ethics committee to ensure the research present the lowest risk possible to subjects (Puglisi 2001). These ethics committees will often draw from legislation, regulation, guidelines and codes of conduct to make assessments on risk (McBurney 2007).

RESEARCH METHODOLOGY

The research is a preliminary investigation of project risk management in research projects undertaken within a university context. .Using the classification of research as described by (Kumar 2006), the type of research is applied, descriptive and primarily quantitative. The methodology used for this research included the following steps (Kumar 2006):

- Formulation of the research problem – this was derived from the researchers' experience of being involved in research projects and an awareness of risk management processes and its limited formal application in research projects.
- Review the literature – the review sourced material from journals, books, government reports, conference proceedings, and internet articles. Interestingly, there was found to be relatively little research published in the field of risk management of research projects.
- Identify research constructs and develop survey instrument – the survey can be described as cross-sectional, retrospective and non-experimental (Kumar 2006). The research survey is cross-sectional as responses are collected at one point in time from a sample of the population with a single contact with the sample. The

research survey is retrospective as it asks respondents for their current opinions. A web-based survey was created using www.surveymonkey.com.

- Select sample – the research population was active researchers across all faculties at Curtin University in Perth, Western Australia. The research sample was those researchers who responded to emails distributed by Deans of Research in the Faculties of Health, Business, Humanities and Engineering & Science, or by responding to a general request for the Office of Research at Curtin University for active researchers to complete the survey. So the survey was sent to academics specifically registered in research units at the university who therefore have the appropriate background for the research. The population numbered approximate 90 academics.
- Collect data, analyse results and prepare report – the remaining section of this paper

RESULTS AND DISCUSSION

Eleven responses were obtained and their faculty and experience are shown in Tables 3 and 4. These show that the respondents come from a range of faculties and are generally well experienced in research.

Table 3 – Respondents' faculty

Faculty	#
Engineering & Science	7
Humanities	3
Health	1
TOTAL	11

Table 4 – Respondents' experience

Research Experience (years)		
0 -10	**10 – 20**	**20+**
4	3	4

Risk management

Each of the respondents were asked to respond to three general questions or statements regarding risk management of research projects.

Value of risk management

Two of eleven respondents strongly disagreed or disagreed that risk management adds value to research projects. Whilst this percentage is low it is in line with Lee (2007) who states that there remains resistance to project risk management in research projects. These responses support the case for increasing awareness of the benefits of project risk management in research projects, given that successful project risk management requires recognition by participants and stakeholders of its importance (Wageman 2004).

Table 5 – Risk management adds value to research projects

Risk management adds value to research projects	#
Strongly Disagree	2
Disagree	0
Neutral	1
Agree	5
Strongly Agree	2
Don't Know	1

Frequency of formal risk management

Five of eleven respondants either rarely or never apply formal risk management to research projects. These results strongly match an ANAOe (2005) report that only half of research projects had a documented project risk assessment process. Whilst a small sample, the responses seem to indicate a problem in terms of good risk management practice in research projects and the need for further research in this area.

Table 6 – How often formal risk management is applied to research projects

How often do you apply formal risk management to your research project	#
Never/rarely	5
Sometimes	1
Often/Always	5
Don't Know	0

Risk level in research projects

Six of eleven respondents disagree or strongly disagree that their research is typically high risk. This tends to contradict the literature, which states that projects are inherently risky and research projects are particularly so. For example, Leung & Isaacs (2008) state that research projects are unique and the innovation associated with research inherently involves risk. These responses go some way to explaining why formal risk management is rarely or never applied because research projects are not seen as high risk ventures and so not worthy of the application of formal risk management.

Table 7 – My research is typically high risk

My research is typically high risk	#
Strongly Disagree	2
Disagree	4
Neutral	2
Agree	0
Strongly Agree	3
Don't Know	0

Research Risks

Respondents were asked to assess 37 risk events in research projects extracted for the literature. The likelihood and consequence of a risk event is typically used to determine a risk impact level (Turner 1999). Each respondent was asked to rate each risk in terms of likelihood and consequence that best describes the risk event in the most recent research report they have worked on. The values allocated were:

Probability values: likely=3, possible=2, unlikely=1

Consequence values: major=5, moderate =3, minor=1

The non-linear values for consequences reflect organisations' desire to avoid high-impact risks (PMI, 2008).

$$WS = \sum_{n}^{1} P_{ws} \times C_{ws} \left(P_n C_n \right)$$

Where:

WS = Weighted score of the risk event

P_{ws} = the probability weighting for a given probability measure

C_{ws} = the consequence weighting for a given consequence measure

P = the number of selections made for a given probability measure

C = the number of selections made for a given consequence measure

These weighted scores are summarised in Table 8.

Table 8 – Research risks: rankings based on likelihood and consequence

	Risk Category	Risk Event	Weighted Score
1	Research Team	Lack of quality researchers	122
2	Research Team	Researchers cannot be recruited	119
3	Research Team	Researchers do not have adequate training	111
4	Commercial	Inefficient funding	100
5	Infrastructure	Lack of suitable facilities to conduct research	97
6	Research Team	Unrealistic expectations of researcher capabilities	92
7	Stakeholders	Research fails to satisfy funder's needs	92
8	Research Integrity	Research proposal is overly ambitious	73
9	Research Process	Data is lost	72
10	Research Integrity	Research has low chance of achieving outcomes	70
11	Research Process	Research methods and analysis not adequately documented	69
12	Infrastructure	Loss of research facilities/resources due to emergency e.g. fire	68
13	Stakeholders	Research results not effectively promoted to target market	65

	Risk Category	Risk Event	Weighted Score
14	Commercial	Contractual disputes between funder and research team	64
15	Commercial	Conflict regarding access and use of research results	62
16	Research Integrity	Misconduct or fraudulent behaviour	59
17	Stakeholders	Loss of funder confidence through poor financial management	59
18	Research Integrity	Plagiarised material	57
19	Research Process	Breach of health and safety compliance	55
20	Research Process	Data is not secured	55
21	Research Process	Data collection is unverified	52
22	Stakeholders	Adverse media commentary of research	52
23	Ethics	Researched sample is disadvantaged by the research	51
24	Research Integrity	Research data is falsified	50
25	Research Integrity	Researchers make unjustified claims not supported by data.	49
26	Research Process	Sample change behaviours as they know they are being researched	49
27	Ethics	Breaches of respect for cultural traditions and customs	49
28	Ethics	Conflict of interests are undeclared	48
29	Commercial	Contractual conflict relating to intellectual property	47
30	Ethics	Misconduct or breaches of protocol are unreported	46
31	Ethics	Researchers fail to obtain consent	46
32	Ethics	Breach of confidentiality	46
33	Research Process	Misleading results from outliers being eliminated	45
34	Research Process	Research undertaken without approval of research protocol	43
35	Ethics	Physical or psychological harm to research subjects	39
36	Research Process	Research methods outside of approved research protocol	35
37	Stakeholders	Reputational lost as funder is not reputable	34

The distribution of the average weighted score across the risk categories is set out in Table 9.

Table 9 – Average weighted score of risk per risk category

Risk Category	Average Weighted Score
Research Team	111.0
Infrastructure	82.5
Commercial & Financial	68.3
External Stakeholders	60.4
Research Achievability & Integrity	59.7
Research Methods & Process	52.8
Ethics	46.4

The following broad observations can be made:

- Risks related to the research team are rated as the top-three most critical risks based on level of likelihood and consequences. In particular the quality and availability of researchers are key challenges. Further research based on qualitative surveys would allow greater understanding of these high ranking risks. One possible reason is that research may not be is not seen as a desirable career path and so it is difficult to attract people to be researchers. Furthermore, this could lead to the selection of inexperienced young researchers who do not have the quality of research competency required for some research projects.
- The next two highest ranked risks are related to funding and infrastructure. This highlights the significant challenges in obtaining sufficient resourcing for projects. For example in ARC projects, which are funded by the Australian Commonwealth government, it is often the case that the funds cover for research assistants but often not the supervisory costs of the chief investigators. Given that all the researchers in the sample are from the same university the perception of risk on insufficient funding and insufficient facilities may be localised to the institution at which they are based. However given the identification of these risks as part of the literature review further research is recommended to other higher education institutions to validate this ranking.
- It might be surprising that ethical risks are not highly rated. Ethical clearance for university-based research is typically a vigorous and comprehensive process. The lower risk ratings associated with ethical risks may be attributed to the established processes and measures in place to address and mitigate ethical risk within research projects. Or perhaps ethics are more of a risk in projects not represented by this research sample e.g. experiments on animals

Ethical Risk Management

The literature highlighted the prevalence of ethical risk management for research projects. The case study for this exploratory research, Curtin University, has a detailed prescribed

process for dealing with ethical risks in research projects. For example, it has a policy that:

> *Before conducting research that involves humans as participants, you must receive approval from the Human Research Ethics Committee. In conducting such research, all researchers must also read and abide by the Australian Code for the Responsible Conduct of Research. (http://research.curtin.edu.au/guides/human.cfm)*

Curtin University operates a two-tier system for approving ethics applications. All applications are considered by a sub-committee before being considered by the full Committee. For research that poses a greater risk than participants would face in their normal daily routine, a detailed form must be completed. Examples to the types of risks referred to in these ethical approval forms include:

- Collection of information that may expose people to misrepresentation
- Collection of information that may breach an Information Privacy Principle
- Risk through the use of new and untried procedures
- Harm through damage to community's cultural security

The comprehensive content of the ethical risk approval processes are in contrast to the lack of formal risk management applied to other risk areas within research projects. One possible reason for this is that the ethical approval process is formal and rigorously applied and that researchers must abide by it, thereby enforcing risk management of ethical risks. In contrast the decision on whether to apply management of other risks in research projects is left to the individual researchers.

CONCLUSIONS

This paper reports the findings of a small exploratory study into risk management of research projects in a university context The main aim of the exploratory study was to determine whether the research topic was worthy of further detailed research. The limited amount of scholarly literature in the topic highlighted a gap of knowledge, which suggested further research is warranted. Furthermore the findings indicated some interesting rankings of risk in research projects, in particular the high ranking of risk related to problem of quality and availability of researchers. Further research would provide a deeper understanding of these risks. Also, research would seem warranted into how risks are actually managed in research projects and how effective these actions are. Finally, it seems that formally enforced processes for managing ethical risks, though forms and ethics committee approvals, encourage the management of ethical risk, so perhaps a similar process for risk management generally should be made mandatory in research projects.

REFERENCES

AIR [American Institutes for Research]. (2003) Survey of Research Integrity Measures Utilized in Biomedical Research Laboratories – Final Report

ANAO [Australian National Audit Office]. (2005) Research Project Management Follow-up Audit. Canberra. Australian National Audit Office.

ARC [Australian Research Council]. (2009) *ARC - Progress Reports*. http://www.arc.gov.au/applicants/reported_requirements_progrep.htm (accessed 25th September 2009).

Beins, B.C. (2009) *Research Methods : a tool for life*. 2nd ed. Boston: Pearson.

Blackmore, K.L. and Nesbit, K.V. (2008) *Identifying Risks for Cross-Disciplinary Higher Degree Research Students.* Tenth Australasian Computing Education Conference, Wollongong:

Bosch, X. (2007) Cultural challenges and their effect on international research integrity. *The Lancet* 373 (9664)

Campbell, A. and Schofield, N. (2006) The Getting of Knowledge - a guide to funding and managing applied research, edited by L. a. W. Australia. Canberra. Land and Water Australia.

Chapman, C. and Ward, S. (2003) *Project Risk Management : Processes, Techniques and Insights*. 2nd ed. Chichester: John Wiley & Sons, Ltd.

Cochrane, R.A. and Turner, J.R. (1993) Goals-and-methods matrix: coping with projects with ill defined goals and/or methods of achieving them. *International Journal of Project Management* 11 (2):

DCITA [Department of Communications, Information Technology and the Arts}. (2003) Management of Scientific Research and Development Projects in Commonwealth Agencies : Better Practice Guide for Senior Management. Canberra. Australian National Audit Office.

Gist, P. and Langley, D. (2007) Application of Standard Project Management Tools to Research - A Case Study from a Multi-national Clinical Trial. *Journal of Research Administration* 38 (2): 51-58.

Gorringe, M. and Hochman, M. (2006) The Complexities of Managing Research Projects: An Ongoing Study of Developing a Quality Framework and Measuring Perceptions of Service Quality at UniSA. *Journal of Research Administration* 37 (1/2): 113-121.

ICE [Institute of Civil Engineers]. (2005) *RAMP - Risk Analysis and Management for Projects : a strategic framework for managing project risk and its financial implications*. 2nd ed. London: Thomas Telford.

ISO. (2009) ISO 31000 Risk Management - Principles and guidelines. Geneva. International Organization for Standardisation.

Kasap, D., Asyali, I.S., Elci, K. and Tubitak, G. (2007) *Risk Management in R&D Projects*, *Portland* International Center for Management of Engineering and Technology, Portland, 2287-2290.

Kumar, R. (2006) *Research methodology: a step-by-step guide for beginners*. 2nd ed. Frenchs Forest, N.S.W.: Pearson Longman.

Larsen, F. (2005) Apply Project Management Concepts to R&D. *Chemical Engineering Progress* 101 (1): 47-50.

Lee, Y., Chung, D. and Kim, Y. (2007) Public R&D Risk and Risk Management Policy. *World Academy of Science, Engineering and Technology* 34: 205-208

Leung, F. and Isaacs, F.E. (2008) Risk management in public sector research: approach and lessons learned at a national research organization. *R&D Management* 38 (5): 510-519.

McBurney, D.H. and White, T.L. (2007) *Research Methods*. 7th ed. Belmont: Thomson Higher Education.

MRC. 2004. *Notes on Good Practice for Research Organisations in the Management of a Portfolio of Trials 2: Assessment of Risk*. http://www.ct-toolkit.ac.uk/_db/_documents/MPTrials2.pdf (accessed 14/09/2010).

PMI [Project Management Institute}. 2008. *A Guide to the Project Management Body of Knowledge* 4th ed. Newton Square: Project Management Institute.

RAC [Royal Academy of Engineering]. 2003. *Common Methodologies for Risk Assessment and Management*.

Shaw, S.B. and Barrett, G. (2006) Research governance: regulating risk and reducing harm? *Journal of the Royal Society of Medicine* 99 (1):

Turner, J.R. (1999) *The handbook of project-based management: Improving the processes for achieving strategic objectives*. 2nd ed. Maidenhead: McGraw-Hill.

UKRIO. (2009) *Code of Practice for Research*. London: UK Research Integrity Office.

Wageman, S.W. (2004) Risk Management on Research and Development Projects. *AACE International Transactions*: 171 - 176.

Williams, N.W., Wearne, G., Wearne, J. and Morrison, J. (2007) Guidelines and Protocols for the Conduct of Research. North Australian Indigenous Land Sea Management Alliance.

Winston, R. (2006) Risk Management for R&D Projects? Why bother? *PM World Today* VIII (10).

Achieving Diversity: Pathways may be the Solution!

Anthony Mills and Patricia McLaughlin
School of Property, Construction and Project Management
RMIT University, Melbourne, Australia

Peter Davis
School of School of Built Environment
Curtin University, Perth, Australia

ABSTRACT

This paper examines the role of pathways in increasing the diversity of higher education student cohorts. The Commonwealth Government has as its higher education reform agenda the increased participation of under-represented groups to a 20% diversity target for Australian universities. Yet for many universities, reaching this target will require significant changes to entry and access conditions. This paper examines two case studies of construction education pathways and evaluates their effectiveness in addressing diversity using the DEMO matrix developed by the National Centre for Student Equity in Higher Education (NCSEHE). The first case study was based on a VET in Schools model that articulates school students into construction courses in TAFE and higher education. The second case study targets mature aged people who do not have formal qualifications in construction, but wish to participate in higher education. The results indicate that pathways into construction degrees can improve student equity ratios, but element such as learner engagement, confidence, resources and collaboration are critical features of successful pathways. These results have important implications for future decision making regarding university articulation models in light of higher education diversity targets.

KEYWORDS

diversity, pathways, socioeconomic status, construction

INTRODUCTION

The benefits of tertiary education to the individual have been well documented. Increased employment opportunities, levels of income, social status and economic security are all linked to the completion of tertiary education (Bradley, 2008). In addition, increased participation in tertiary education benefits the social fabric of the nation. Policy decisions at government level in Australia now focus upon increased participation in particular for those groups traditionally under-represented in tertiary education. One key group under-

represented is students from low socioeconomic backgrounds. Bradley (2008) has demonstrated the persistent under-representation of these students in spite of a wide range of policy initiatives by governments, schools and higher education institutions in recent years.

The Commonwealth Government, as part of its higher education reform agenda, has the increased participation of under-represented groups to a diversity target of 20% of student cohort per university by 2020. For a number of Australian universities, this target represents a challenge. The incorporation of a more diverse student cohort into mainstream higher education will require thorough examination of existing models of student access to ascertain their success as equity models and their overall sustainability as higher education in Australia moves towards a demand-driven, performance based model of funding.

This paper examines two higher education access models (pathways) in construction education. The research study of these two models as case studies is part of a broader Australian Learning and Teaching Council (ALTC) study examining pathways models in construction. The primary objective of the ALTC funded project is to determine the effectiveness of pathways models in improving the diversity of the student cohort in higher education. The final release of the ALTC report and its recommendations is planned for 2012.

Addressing diversity of higher education

Twenty years ago Australia was one of the first countries to restructure higher education for wider participation. The results of those changes made it a leader internationally in the movement from elite to mass systems. (Bradley, et al., 2008) The ambitious targets for student participation and attainment in higher education in Australia reflect a neo-liberal economic and social agenda playing out internationally. In most OECD countries "social class is a reliable indicator of the likelihood of participation in higher education at some stage of an individual's life" (James, 2008, p. 71). In the United Kingdom, young people from the highest social classes are 5 to 6 times more likely to attend university than those from disadvantaged classes (HEFCE, 2006). The more prestigious the UK university, the less likely it is to enrol low SES students. In the United States, students from low SES backgrounds are more likely to enrol in community colleges and undertake shorter degrees.

Governments have been eager to address these inequities. In the United States, an increasingly complex number of programs encompassing outreach, academic preparation, access and financial support operate a wide range of interventions. The best know of these programs – Upward Bound, Talent Search and Student Support Services – are

defined by federal legislation. In England, interventions have focused on raising educational attainment, aspirations and ensuring fair admissions. Aim Higher is the best known of English initiatives – a collaborative effort between universities, schools local councils and communities. The success of such an initiative is still under debate and emphasis is turning towards the issue of broadening access without any depth of support. Northedge (2003) notes "the stately home of elite higher education in the UK has simply been extended by adding a large paupers' wing. „Proper' students continue to define the norms, while the rest tag along behind as best they can" (p. 17).

Canada, propelled by a declining work-age population, a labour force crisis and a saturation point level of high SES university students (Berger, 2008; Currie et al, 2007) has undertaken, with some success, a series of loans and funding arrangements under the broad theme of Pathways Canada. The schemes include mentoring, advocacy and financial support for under-represented students.

It is difficult to review access programs across nations. Comparisons are constrained by the differences and difficulties of measurement. Gorard (2008) notes that how low SES and under-represented groups are defined varies amongst OECD countries. Whilst debate continues around the measurement factors, it is obvious that similarities exist between Australia and other OECD nations. Gale et al (2010) note that equity barriers fall into four main categories: availability and accessibility of higher education and achievement and aspirations of students. Based upon Anderson's (1980) work on conditions for entry to higher education, Gale et al (2010) stress the critical interrelatedness of the four conditions and the constancy of these conditions over time. Put simply, without addressing all four conditions, namely; availability, accessibility, achievement and aspiration, access to university for under-represented groups will not occur.

Measuring successful models

In recent years the primary focus of access-oriented programs has shifted to raising students' aspirations for higher education (Gale, Hattam et al. 2010). While their academic achievements remain important for gaining access to higher education, students' aspirations have become central in achieving the growth ambitions of government and institutions, in a context of relatively low student demand for university places.

Drawing on the international research literature and on these exemplars, Gale, (2010) found that programs that are quite likely to increase the number of disadvantaged students going on to higher education than otherwise would have been the case, exhibit at least 4 (from 10) design characteristics, 3 (from 4) implementation strategies and 2 (from 3) equity perspectives (see Table 1).

Table 1 – Four strategies and ten characteristics of outreach programs

Assembling Resources	Engaging learners	Working together	Building confidence
People-rich	Recognition of difference	collaboration	Communication and information
Financial support and/or incentives	Enhanced curriculum	Cohort-based	Familiarisation/site experience
Early, long-term, sustained	Research-driven		

	Equity Orientation	
Unsettling deficit views	Research, local knowledge, and negotiation local interventions	Building capacity in communities, schools, and universities

Source: Gale, Sellar et al. 2010: 12

These characteristics, strategies and perspectives form the basis of a meta - analysis, named the Design and Evaluation Matrix for Outreach (DEMO). The DEMO foregrounds program conceptualisation and design as significant factors contributing to the likelihood of programs making a difference for disadvantaged students (see figure 1). In these terms, the overall effectiveness of a program will depend on the combination of depth (the number of characteristics), breadth (the number of strategies), and equity orientation (the number of equity perspectives).

The DEMO emphasises the importance and value of combining characteristics and draws attention to the strengthening of programs that results from synergistic relationships between different characteristics and strategies. Programs are „Very Likely' to be effective once at least half of the 10 characteristics are combined (and which necessarily involves at least two strategies). In this sense, the strength of a program depends more on the combination of program characteristics, in response to the particular needs of different contexts, than on the specific characteristics that are combined. Therefore, two programs comprising quite different sets of characteristics could be equally effective.

A number of pathways models are currently in use in Australian universities and make a successful contribution to the aim of increasing the participation of more diverse groups in higher education. In a number of cases, these models are excellent examples of a commitment to diversity and a more equitable higher education sector that represents access for all Australians. This paper examines in detail two of these models and highlights the defining features of the model. Too often these models have operated at the fringe of tertiary education access in isolation of mainstream entry and for a variety of reasons have been difficult to sustain over time. Through a detailed examination of two of the selected models and in-depth interviews with key stakeholders along with diversity

data information collected by student cohort surveys, detailed case studies have been built.

Pathways in education must provide an educational ladder of opportunity if the efficiency objective is to be met and a social ladder of opportunity if the equity objective is to be met. (Wheelahan, 2009). These two purposes go together for those from disadvantaged backgrounds because access to education is one of the key ways in which occupational progression and social mobility can be achieved. However, these two objectives are not always aligned. Stuart, (2002) believes that we need to distinguish between measures that deepen participation in education by providing more opportunities and access for particular social groups already represented in education, and those that widen participation by including groups that are under-represented.

Therefore these two contrasting case studies are examined using Gale's DEMO matrix in order to provide an insight into the effectiveness of the pathways model as a sustainable lifelong learning model, that both widens and deepens participation.

Educational context

The two case studies presented in this research provide contrasting approaches to improving the diversity of student cohorts. It is important to recognise that while both models aim to address the issue of raising aspiration, they are directed towards different groups of students. The first case study is directed at high school students, while the second case study is aimed at people already in the workforce. The effectiveness of the models is discussed in the sections below.

The case studies: VET in schools – pathways to construction

The "Pathways to Construction" is a VET in Schools program in building and construction. The program was set up in 2008 and has approximately 30 secondary school students from years 11 and 12 enrolled in both years of the program. The students attend RMIT university one day a week and undertake competencies in the Certificate 4 in Building and Construction (Building). The subject contributes to the students' final VCE and carries a loading in the calculation of the students' Australian Tertiary Admission Rank (ATAR). The subject is built around the Certificate IV in Building and Construction and consists of 1400 hours of instruction and student work. Upon completion of the two year program, the students are eligible for the Certificate IV, which is embedded in the Diploma with one year credit transfer. RMIT staff teach the subject and maintain regular communication with the students, their schools and their guardians. The VET in Schools coordinator conducts recruitment, promotion and liaison and enrolment and is the link between the university, the schools and the students.

While the transfer pathway is not guaranteed, the VET in Schools "Pathways to Construction" Program is an innovation of RMIT University, and deliberately targets secondary schools to provide access to tertiary education for students not normally represented. There have been two successful intakes with 100% retention rate.

The students involved in the Pathways Program represent a more diverse cohort than the traditional intake to the Certificate IV in Building and Construction. The 2009 student intake indicates 50% of the students come from low SES groups, whilst 40% of the 2010 intake come from low SES groups. The high percentage of students from low SES groups may be explained by a number of factors:

- The recruitment processes used by the VET in Schools coordinators at RMIT
- The aspiration and enthusiasm of careers teachers in particular schools
- The appeal of the building industry as an employment destination to particular parents and school communities
- The cultural perception of the building industry as an industry of opportunity for the less academically inclined adolescents
- The central city location of the RMIT campus offering Pathways to Construction, VET in Schools

After completion of the Certificate IV in Building and Construction (AQF 4), the students have the opportunity to enrol into the Diploma of Building (AQF 5) and then into the Bachelor of Applied Science (Construction Management) (AQF 6). The model has interrelated links between each of the AQF levels (4 – 6) by embedding qualifications as exit points, whilst still allowing access to higher AQF levels.

The case studies: Graduate Certificate in Construction Management

The Graduate Certificate in Construction Management is part of AQF level 8. It is offered at RMIT through the School of Property, Construction and Project Management. The Graduate Certificate was offered for the first time in 2007 and there are currently 16 students enrolled and intakes have been consistent at 25 over the last 3 years. In spite of consistent enrolments, only 12 students have graduated since 2007.

The Graduate Certificate aims to address the need for advanced management training in the construction industry by providing training within an accelerated time frame to suit industry needs. The target group for this qualification is trades people who are in or could move into supervisory roles. The course is one year part-time with on-campus delivery. There are number of entrance requirements. Applicants are required to:

- Be currently employed in the construction industry
- Possess at least a Certificate IV in Building or a related trade

- Possess some supervisory experience and at least three years experience in the construction industry

Both of the case studies are based upon models that provide access pathways to higher education. The effectiveness of each model is discussed in the next section.

RESEARCH METHODOLOGY

The two case studies examined in this study are both located in the built environment discipline at RMIT University. RMIT is an urban, dual-sector university located in the city of Melbourne. It is one of the largest universities in Australia. As a dual sector institution, RMIT has vocational education along with a diverse suite of higher education undergraduate and post-graduate degrees. There are a number of pathways models in use in the university. It is therefore valid to examine two of these models within a dual sector environment. Having access to both sectors in the same institution provides valuable longitudinal pathways data that can be readily utilised in the case studies.

The first case study „VET in Schools – Pathways to Construction' operates across both the VET and HE sectors of the university. At the time of writing the majority of the participants were engaged in either Certificate IV (AQF4) or Diploma (AQF5) level training. The program exists for students to work through AQF 4 to 7 in a sequential linear progression. The second case study is the Graduate Certificate (Vocational) in construction (currently at AQF8). Both of the case studies operate in the mainstream provision of RMIT offerings and have open enrolment with no pre-requisites. Some entry provisions apply to the Graduate Certificate.

Both case studies were examined on the basis of data collected by a student cohort survey, staff interviews, key stakeholder group and individual student interviews. The data was analysed using the DEMO Matrix developed by Gale et al (2010) at the National Centre for Student Equity in Higher Education (NCSEHE, 2010). The DEMO model provides a conceptualisation of the relationship between particular features of effective programs that are designed to improve equity and access of under-represented students in higher education.

Gale (2010) notes: "The DEMO provides indicative guidance for the analysis of any program in terms of effectiveness, including the dynamics produced by different combinations of characteristics and strategies" (p. 13).

The DEMO model is based upon research identifying ten characteristics of successful access programs measured against the breadth of strategies. The strength of a program in terms of effectiveness increases from weak to very strong as its depth of characteristics and breadth of strategies increases. By evaluating the models inherent in the two case studies selected for this paper against these characteristics, a better abstract indicator of

the likely effectiveness in terms of achieving student cohort diversity is provided. The next section outlines the background of each case study.

RESULTS AND DISCUSSION

Research by Gale et al (2010) has identified ten characteristics of effective equity programs. Effective programs were defined as those that have a likelihood of increasing the number of disadvantaged students going on to higher education than would otherwise have been the case. Gale et al (2010) grouped the characteristics into four strategies: Assembling resources, Engaging learners, Working together, Building confidence. Both of the case study models are discussed in relation to these strategies to ascertain their effectiveness in improving student cohort diversity.

Assembling resources

Three characteristics are inherent in assembling resources – People Rich elements; financial support, and early, long-term sustained approaches.

People rich resources and elements are indicated by activities used within and in parallel to the model that provide for the development of on-going relationships between stakeholders. Relationships that focus upon mentoring, guidance and support are paramount, along with an understanding of the situation and capacity of the student cohort.

The VET in Schools model was able to provide a strong people-rich component to the program. Orientation and information nights were conducted in schools the year before the students commenced and careers teachers were briefed about the program and its pathways. In addition to a VET in Schools coordinator, RMIT staff were available for consultation. Once in the program and visiting the university for one day a week, students were exposed to RMIT staff that had all been employed at the university for some time and were able to give casual advice about university pathways and credit transfer. Staff/student ratios were deliberately capped at 15 students per class. If a student was absent or performing poorly, the VET in Schools coordinator acted as a mentor to the student and his parents.

The survey and interview results from the students also reveal that the students understand the relationship between the VET in Schools Pathways to Construction program and future opportunities. Students in their second year of the program (mostly year 12 students) were focused upon completing their high school studies and moving into the Diploma and later the Degree in construction. The students were well aware of the university structures and the contexts and lifestyles arising from these structures. Their responses indicate the view that they believe participation in higher education is

achievable for themselves and "everybody". For a number of the students this perception of university as being for "everybody" was an important change to their understanding prior to entering the program. Some of their comments indicate they appreciated the people rich element:

> *—If I hadn't done this program I wouldn't know of the pathways now I know If I don't get an apprenticeship I can always come back to RMIT University and try to get the diploma (then the degree) – the teachers have explained this" (R)*
>
> *—I would be the first in my family to come to uni—I tell my parents what I go through when I'm here then they know" (R)*

The students, although most are still in senor secondary school, indicated a familiarity with the university setting and staff. Although they had been quite anxious at the outset and commencement of their first year, all were not at ease and felt confident in the environment; all were keen to return to the university at some stage. A few had re-aligned their career aspirations in the face of what they had encountered through this program.

By comparison, the Graduate Certificate in Construction was unable to provide a people-rich experience for the students. The one lecturer was also responsible for recruitment with some direct marketing provided from the university school (Flyers, website updates). The recruitment and information processes consisted of a mail-out to Victorian building companies with a number of posters displayed on commercial sites. The non-targeted natured of the marketing meant that mature-aged students with first degrees were enrolled alongside students who had completed secondary school. Some students were employed in the construction industry; others were attempting to gain entry to the industry. As the lecturing staff were employed on a contract basis, there was little "university-rich" understanding of pathways and credit transfer. The graduate certificate was not formally articulated to any other program in the university. The information night was a one-off event, with students then left to find their way to the first class or appropriate pathway. Students in the VET model had access to people-rich resources, whilst the Graduate Certificate students did not have such access.

A second characteristic of assembling resources is the use of financial or monetary support – such as incentives, scholarships, bursaries or costs. Neither of the models provided any financial support. In the case of VET in Schools, students or their guardians paid up-front course fees and all associated costs such as travel and work gear. In the case of the Graduate Certificate in Construction, students paid all course fees as well as associated costs.

The access to such incentives did not appear to affect the student cohort in the VET Pathways, but the drop-out rate for the Graduate Certificate students was considerably

higher. Without a comprehensive survey it is difficult to isolate financial factors as a contributing element, but it is reasonable to assume some degree of contribution to the decision to remain in or leave the program.

Another characteristic of enabling resources is early, long-term and sustained intervention by the university in students' careers. In the case of VET Pathways, RMIT University had committed staff, resources and status to the model. School students were enrolled as RMIT students and afforded the same status as other VET students. Staff were specially recruited for the program and allocations of funding set aside for resources. These resources included administrative as well as academic support. The Graduate Certificate was not supplied with additional resources, staff were employed on 12 month contracts and the university school provided limited administrative support. The program co-coordinator was not provided time allowance for student support or administration. As a result, there was no early intervention or follow-up of students who dropped out.

In addition, the intervention relied upon the students being proactive. Enquiries about the course were followed up with a marketing brochure and ended there. Students who did not attend the information night were not re-contacted.

Gale et al. (2010) note the importance of sustained intervention over time to help students make the transition to higher education. Although based upon his study of school outreach programs, the need for early, sustained interventions realised with financial and people-rich strategies is applicable to all students entering higher education. The difficulties faced by the Graduate Certificate students in this case study were similar to other younger students contemplating higher education. Unfamiliarity, complex information avenues and a lack of sustained support effort hindered opportunities and efforts. Comments from the students in the Graduate Certificate program included:

> *—Articulation or other opportunities and where this course leads has not been explained to us yet".*
>
> *—For me this course was a bridge. I thought it went into a Masters degree, but I now know it doesn't".*

The importance of assembling resources as a strategy to improve the effectiveness of models is paramount to developing a more diverse cohort in higher education. The Higher Education Funding Council for England (2006) found that some of the most effective activities for increasing progression to higher education are those strategies that provide information, advice and guidance. In terms of strategy, only the VET in Schools pathways model was able to provide depth of strategy in this area.

Engaging learners

A key characteristic of engaging learners is recognition of difference. The recognition of difference is premised on the perspective that students in these two case studies bring a range of knowledge to their formal education and this should be recognised and valued. Both programs provided RPL and recognition of learning, both formal and informal, although only the Graduate Certificate acknowledged this through formal "exemptions" from units of study. However, VET Pathways staff were cognisant of underlying skills and knowledge and created opportunities for students to share their existing knowledge. Both programs were deliberate in their targeting of students; the Graduate Certificate demanded either formal qualifications or informal work experience, whilst the VET Pathways concentrated upon motivation and interest in the industry. Thus both models in the two case studies recognised and valued this characteristic. The knowledge students brought was valued and recognised, along with the learning capabilities of the students.

A second characteristic of engaging learners is the pedagogy that is designed for the academic curriculum. The quality of the curriculum needs to be enhanced to capture the particular cohort and prepare them for future study higher education. Neither model enhanced the academic curriculum to sustain the ongoing quality of everyday lessons. Both programs rigidly adhered to the set national curriculum as a tenet of the program. Neither program had staff who felt qualified to vary the curriculum to suit the learners. Hence, changes to the curriculum were made at the margins, if at all.

This adherence to a prescribed national curriculum was not seen as a negative by the students, who welcomed the opportunity to obtain a national certificate for their studies. This was true of both models:

> *—People are doing this course to be able to change careers – it gives them a qualification" (Graduate Certificate staff member).*

Whilst Gale et al. (2010) have identified this characteristic as important in engaging learners, students in both case studies did not value an enhanced curriculum as much as the credentialing arising from the standard curriculum. This may be an indicator of the need for further research in relation to this characteristic.

Similarly, neither VET Pathways nor the Graduate Certificate engaged in research-driven interventions. The research capacities of RMIT were not used to inform program design or implementation or evaluation. Staff in both programs felt confined by the national curriculum and were afraid to steer the curriculum away from the set competencies. Part of this was due to the cultural background of the staff, part appeared to be due to the fact that they did not "own" the program and felt that intervening in curriculum or program design was not their prerogative. This was true, even when student numbers in the

Graduate Certificate declined and it was obvious students wanted greater control over the design of the program, especially assessment. Results-drive research did not affect either program design or evaluation in either case, although the VET Pathways coordinator attempted to intervene to affect change when results indicated dissatisfaction with program implementation.

Working together

Working together as a strategy has two identified characteristics: collaboration and cohort based (Gale et al., 2010). A key measure of working together is collaboration between stakeholders across different sectors and agencies at all stages of program development and enactment. Evidence from the VET in Schools Pathways Project illustrates the extent to which the whole school systems, independent school and teachers were involved in the program design and implementation –

> *—Our careers teacher came to my homeroom at X College and he advertised that RMIT were having an information night at my school, along with other schools in the area and I went along and heard from guys who are in second year now and they talked about what they did and I found that interesting. Then my parents and I were talking to the RMIT coordinator and then I had an interview and then I got in". (Z)*

The involvement of parents and teachers in on-going program design was also evident:

> *—Myparents like the fact that I am here, but they don't push it. We get reports from RMT to the school and my parents and they talk about the future courses with Elise (RMIT Coordinator)". (K)*
>
> *—Yeah my school is helpful. Like every Wednesday they let me come in here and they make me do the work, but I have to catch up other work – but they don't make me do too much. It's okay, they understand". (R)*

Each school was making specific accommodations to help implement the program –

> *—At X College in mainstream course, we've got a line system and on Wednesdays years 11 and 12 have a sports session in the afternoon. As the lines form you have one subject on every line and there are six lines, the VET line at X College is on the Wednesday morning in the double so at X College there's a double in the morning followed by an assembly and then there's recess and then there's one period and then there's lunch and then you have double sport in the afternoon. So you don't miss out on – you only miss out on one period on a Wednesday". (Z)*

All the stakeholders, students, parents, schools and RMIT, were clearly involved in the VET in Schools Pathways program. In the course of the interviews, all the students felt

that their schools and parents were in partnership with the university to provide a positive outcome for them. This was evident in their familiarity with the program and its implementation in their schools. None of the students reported clashes with their own school about course material, requirements or attendance. There was evidence that the whole of their community, including in some cases their part-time employers were both aware of their studies and actively providing motivation, support and interest in what they were learning and the outcomes of this learning.

By comparison, the collaboration and cohort-based engagement of the stakeholders in the Graduate Certificate in Construction was limited, if evident at all. The various stakeholders – the students, the employers and the university were operating independently especially in regards to program design and development. As a pre-packaged competency based curriculum, the Graduate Certificate had not input from the student's employers and the students enrolled in a "take it or leave it" program. The course design conforms to national standards and alterations can only be made at the local level through teaching modifications that recognise the local differences. When asked if the Graduate Certificate needed development in this area, the staff gave the following answer:

> *—The curriculum's got to be developed, and I think the curriculum's got to be fairly consistent with what the industry's requiring of construction managers, which is similar to what I suppose we're doing in our undergraduates currently. And making certain that we develop Industry specific skill that are a lot more tailored towards architectural/engineering issues, and starting to develop some of those skills. And that's where the void is". (Staff)*

In terms of implementation, the Graduate Certificate in Construction is structured around industry availability – rostered days off – so attempts are made to facilitate its attendance success. This consultation is made with the students, and to a limited extent their employers, but does not extend to the wider industry. The program does not articulate into any existing pathway and students are required to seek their own credit and pathway into further study. This was noted by staff and students alike:

> *—I don't think it's in the wrong school. I think the structure's incorrect. I think we shouldn't have it as a Grad. Cert. only. I really do believe we should have it going on to a Masters". (Student)*
>
> *—The current Graduate Certificate being at 12 month solo currently. If they wanted to develop their skills and continue on, they'd have to enrol into, as far as RMIT goes, the Master in Project Management. And that's probably the only link we have. If they wanted to continue, they'd have to outsource it*

to another university, and look at going into a Diploma of Construction or a Diploma of Building". (Staff)

Not every student in the program was supported:

—No, my employer doesn't actually support me coming to this program at all. So it is something that I do out of my own time, and effort and price". (Student)

In relation to pathways and inclusion of the whole student, staff, employer cohort there was considerable misunderstandings. This was evidenced in the student's understanding of where the program was in terms of accreditation and on-going studies:

—Yeah at the moment, I know that they don't, yeah, I don't know the pathways. I don't know if the Master is going to be held next year. I don't know if there's going to be another course or a Dip or whatever it is, they still haven't told us". —And I'm not aware of what credit you'd get if we do start the Masters?" (Student)

In terms of evaluation, the VET in Schools Pathways Project was far more successful in collaborating with all key stakeholders on program design and implementation than the Graduate Certificate in Construction.

A second element of working together is developing an approach that engages with the whole cohort to change peer cultures and still supports individuals. A clear influence is the size of the cohort – how many students are involved. But the actual number is not as important as the contribution this number makes to changing peer group attitudes towards university pathways. Gale et al (2010) make the point that the operational footprint could be state-wide, even by the measure of one student. Essentially it is the capacity of that one student to influence the attitudes and behaviours of peers. In this evaluation, the VET in Schools model engaged with larger cohorts and had affected peer culture as well through wider dissemination and promotion of exemplars. There was little evidence that the Graduate Certificate had achieved the same cohort based change.

Building confidence

Gale et al. (2010) also identify two characteristics in building learner confidence: communication and familiarisation. The VET in Schools model gave students information about university life, how to get there and information once there. Evidence from the interviews with students endorsed this communication:

—If I hadn't done this program I would know of the pathways I now know. I know if don't get an apprenticeship I can always come back to RMIT University and try to get the Diploma, then the Degree".

When asked about this communication and familiarisation with the university, this staff member was very clear about the success of VET in Schools:

> *—If students do not get an ATAR score of mid seventies, the normal thing is that they won't get into the Diploma of Building here at RMIT because I think this year's intake we needed an ATAR score of 74 or 73. Whereas young Donny, one of our second year students I think he got 52 for his ATAR score. Now Donny is one of our best VET in Schools students and when he goes into the diploma as a second year student next year, he'll be one of the best students in that class. He'll run rings around all the other students because one, he's got building skills and knowledge and he loves it and he works hard at it and he works at his studies because he enjoys it, he wouldn't be here at all if he wasn't in pathways. He would have gone another path similar to getting an apprenticeship, doing a four year apprenticeship, then coming in as a part time student doing a Diploma of Building, because his score, he wouldn't have been accepted, if ever and so he would have had a 10 year path in front of him to get his Diploma of Building and yet, he will be one of the best graduates we have at the end of the Certificate IV and I'm assuming when he goes through to do the diploma, he'll also be one of our best graduates. The pathways really worked quite well for him because he wouldn't have been on this track if he hadn't been involved in the VET in Schools."*

Appadurai (2006) has argued that "without systematic tools for gaining relevant new knowledge, aspiration degenerates into fantasy or despair" (pp. 176-177). Students involved in VET in Schools, Pathways to Construction, have, through student/staff ratios and attendance at the university, access to people who have significant experience in university programmes and teaching. The students are able to gauge or benchmark their performance against the requirements of the new context. The teacher/student ratio of 15/1 produced great opportunities for interaction and discussions about the university environment, and students were immersed in the university one day a week for the whole year.

By comparison, the Graduate Certificate students had access to limited information and although they visited the university on RDOs (Rostered Days Off), the intensive nature of the classes meant they did not participate in the wider university life. Students noted that classes could have been held anywhere – they were not really part of the campus, commencing classes at 7:30am. The idea of being a higher education student was lacking – the Graduate Certificate students did not have the opportunity to benchmark their

performance against other higher education students. The characteristics of building confidence were absent in this model.

The above analysis indicates the strength of the two case studies and their likelihood of success in improving the diversity of the higher education student cohort. Of the two models, the VET Pathways have eight out of ten characteristics across all four strategies. It is therefore a very strong model for promoting under-represented student groups into higher education.

By comparison, the Graduate Certificate in Construction has two characteristics out of the ten, across two strategies. As a model it is very weak and unlikely to make any impact in providing access to higher education for low SES or other under-represented groups.

CONCLUSIONS

During the last 15 years there has been a long term failure to increase the rate of participation of low socio-economic status, Indigenous and regional and remote students. This has happened at a time where some other nations have begun to see results from their social inclusion initiatives (Bradley, 2008, pg 149).

Gale et al. (2010) have argued that the Australian higher education sector is "haunted" by the absence of change in participation rates for certain under-represented groups across the sector and over time. They argue that good programs that address the under-representation of disadvantaged groups throughout the sector have operated in isolation and their effect on the sector has been minimal. Gorard (2008) has argued that measuring this under-representation is complex and parallels difficult to create. What is evident is that achievement of the attainment target outlined above will require concerted action on a number of fronts, including an examination of the effectiveness of pathways models. In this paper, two models designed to provide access to higher education have been examined as separate case studies. The two case studies in construction education pathways have been evaluated using the DEMO model (Gale et al., 2010)

Whilst evidence from these case studies indicates that pathways models can improve student diversity ratios, it is clear from this study that a number of key characteristics must be present for the pathways model to be truly effective and sustainable over time. These characteristics need to be across strategies such as appropriate resources, learner engagement, collaboration and confidence building.

Whilst this study has examined only two case studies in the same university, there is still sufficient evidence to indicate the viability of the DEMO model as a useful evaluative tool which could be applied to further pathways models in higher education.

REFERENCES

Anderson, D., Boven, P., Fensham, P. and Powell, J. (1980) *Students in Australian Higher Education: a study of their social composition*. Canberra, AGPS.

Appadurai, A. (2006) The right to research. *Globalisation, Societies and Education*, 4(2), pp. 167-177.

Berger, J. (2008) *Why Access Matters Revisited*. Montreal, Millenium Scholarship Foundation.

Currie, S., Hutchinson, R., Ford, I., Kwakye, I. and Tattie, D. (2007) *Future to discover Pilot Project*. Montreal: Canadian Millennium Scholarship Foundation.

Bradley, D. (2008) *Review of Australian Higher Education: Final Report*, Department of Education, Employment and Workplace Relations, Commonwealth of Australia.

Bradley, D., Noonan, P., Nugent, H. and Scales, B. (2008) *Review of Australian Higher Education, Final*, Department of Education, Employment and Workplace Relations, Commonwealth of Australia.

Gale, T. (2009) Towards a Southern Theory of Higher Education, National Centre for Student Equity in Higher Education, 12th Pacific Rim FYHE Conference.

Gale, T., Hattam, R., Comber, B., Tranter, D., Bills D., Sellar, S. and Parker, S. (2010) *Interventions early in school as a means to improve higher education outcomes for disadvantaged students*. National Centre for Student Equity in Higher Education, University South Australia.

Gorard, S. (2008) Who is missing from Higher Education? *Cambridge Journal Education* 38(3) 421-37

Higher Education Funding Council England. (2008) Aim higher.www.hefce.ac.uk/widen/ aimhigh accessed 19 September 2008

Northedge, A. (2003) Rethinking Teaching in the context of Diversity. *Teaching in Higher Education*, Vol 8, no. 1.

James, R., Anderson, M., Bexley, E., Devlin, M., Garnett, R., Marginson, S. and Maxwell, L. (2008) *Participation and Equity: A review of the participation in higher education of people from low socioeconomic backgrounds and Indigenous people*, Universities Australia, The Centre for the Study of Higher Education, University of Melbourne.

Stuart, M. (2002) *Collaborating for change?, Managing widening participation in further and higher education*, NIACE.

Wheelahan, L. (2009) *What kind of access does VET provide to higher education for low SES students? Not a lot. Student Equity in Higher Education: What we know. What we need to know'* National Centre for Student Equity in Higher Education, Launch & Forum. University South Australia, Adelaide.

Virtual Community of Safety Practice for Construction Organisations

Imriyas Kamardeen
Faculty of Built Environment
University of New South Wales, Sydney, Australia

ABSTRACT

Communities of practice provide a platform for sharing know-how knowledge and experiences amongst employees within an organisation. They could offer a great deal of opportunities and potentials for improving the occupational health and safety performance of builders. However, because construction projects are remote and scattered, and each project has its set completion schedule and progress status, interactions between employees of a construction organisation is minimal. It is nearly impractical to establish a group of professionals from different construction sites who could meet on a regular basis to share safety related experiences and information. Nonetheless, the formation of virtual communities of practice, departing from the conventional model, would alleviate the impediments caused by geographical, time and work pressure constraints. This paper discusses the development of a virtual community of safety practice (VCoSP) for construction organisations, leveraging on the power of web 2.0 technologies. The implementation of VCoSP within a construction organisation could bring about numerous benefits, including: nurturing a strong safety culture within the organisation and helping site professionals continually improve safety competency.

KEYWORDS

occupational health and safety, knowledge management, community of practice, web 2.0

INTRODUCTION

Informal conversations occur all day long among employees in an organisation in the lunchroom, on a coffee break or in corridors. These conversations allow employees to share experiences. The shared experience may be an innovative idea, procedure or an insight into how a person performs a task more effectively and efficiently. These experiences embody expertise and know-how knowledge and are known as tacit knowledge, which becomes an asset for the organisation. Hence, it is crucial for an organisation to create a structure to enable internalisation of this valuable asset. One way to create a structure among employees is to develop a community of practice (Wenger, McDermott & Snyder, 2002). A community of practice is a group of people who share

an interest or passion for something that they know how to do, and who interact regularly in order to learn how to do it better. The primary purpose of communities of practice is to create and share knowledge among participants. Carlsson (2003) quoted that communities of practice enhance and improve effectiveness of both individuals and the organisation.

Communities of practice could offer a great deal of opportunities and potentials for improving the occupational health and safety performance of builders. Lingard & Rowlinson (2005) claimed that a construction company may have several professionals and team players. Each professional may have some knowledge and experience in OHS. If these experiences and knowledge were collated and internalised, it could help improve the organisational learning ability and thereby OHS performance. Chua & Goh (2004) argued that in order for the construction industry to improve its poor safety performance, it needs to learn from its mistakes and put the lessons learned to good use. Gherardi & Nicolini (2000) reinforced that safety is situated practice and safety knowledge is culturally mediated by forms of social participations, material working conditions and the negotiated interpretations of actions on site.

Safety knowledge is therefore dynamic and profoundly rooted in communities of practice. Safety culture is learnt when joining a community of practice as a distinctive feature of professional identity. Hence, the formation of communities of safety practice, amalgamating professionals from different projects, could facilitate the sharing of tacit OHS knowledge and thereby improving safety performance of the organisation as a whole. Moreover, this could assist the organisation in alleviating the challenges posed by high employee turnover and skill shortages. It is also an effective means of educating new entrants to the community or organisation. Flannery & Hinze (2008) also underpinned that through participations in a safety community of practice, which consists of safety professionals who network regularly through meetings and teleconferences, this type of information could be shared on an ongoing basis. The community could serve as a viable means of getting information on new and proposed regulations, successes related to best practices, new concerns on interest to safety professional, accident reviews, emerging issues or concerns, etc. Another means of getting information would be through inquiries that would be made by individuals to the entire safety community of practice.

The application of communities of practice in construction organisations faces a major challenge. Because construction projects are remote and scattered, and each project has its set completion schedule and progress status, interactions between employees of a construction organisation is minimal as opposed to other types of organisations where corridor conversations and coffee/lunch break chats are ordinary norms. Hence, it is nearly impractical to establish a group of safety professionals from different construction sites who could meet on a regular basis to share information of mutual interests. This

situation is also a challenge even for facilitating post accident reviews so as to learn from past mistakes. Nonetheless, the formation of online/virtual communities of practice, departing from the conventional model, leveraging on the power of web 2.0 technologies would alleviate the impediments caused by geographical, time and work pressure constraints. Moreover, the information shared by community members could systematically be archived for future references and to avoid reinventing the wheel. Hence, this paper discusses the development of a virtual community of safety practice (VCoSP) for construction organisations using web 2.0 technologies. Firstly, a review of literatures on communities of practice and virtual communities of practice is provided, followed by a discussion on the process involved in developing the VCoSP. Then the potential benefits of and challenges for the VCoSP is discussed followed by a conclusion.

COMMUNITIES OF PRACTICE

Many definitions are found in the literature for communities of practice. Each definition tells about varying features of communities of practice. Communities of practice (CoPs) are groups of people that share a concern, a set of problems or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger et al., 2002). Communities of practice are groups of people who share ideas and insights, help each other solve problems and develop a common practice or approach to the field (McDermott, 1999). Communities of practice are groups that form to share what they know and to learn from one another regarding some aspects of their work (Nickols, 2003). They formalise their existence through the establishment of common goals and values and are often deliberate in their construction and seek to meet predetermined needs which have been identified by their participants (Molphy, Pocknee & Young, 2007).

Communities of practice are learning environments. They are groups of people who come together to share with and learn from one another. They are held together by a common interest in a body of knowledge, and are driven by a desire and need to share problems, experiences, insights, templates, tools and best practices (Hubert, Newhouse & Vestal, 2001). CoPs are an intrinsic condition for the existence of knowledge (Kimble & Barlow, 2000). It is a tool for converting implicit knowledge into explicit form of knowledge (Davenport & Prusak, 1998). Knowledge-intensive consulting firms value CoPs as a valid method for knowledge acquisition and transfer. As such, key elements in CoPs are knowledge sharing and learning. The learning that evolved from these communities is collaborative, in which the collaborative knowledge of the community is greater than any individual knowledge. In a CoP environment, a person's learning is enhanced through engagements with others which enable the extension of that person's capability to a new,

high level. Wegner (1998) defined that the life cycle of CoPs has five maturity stages as shown in Figure 1.

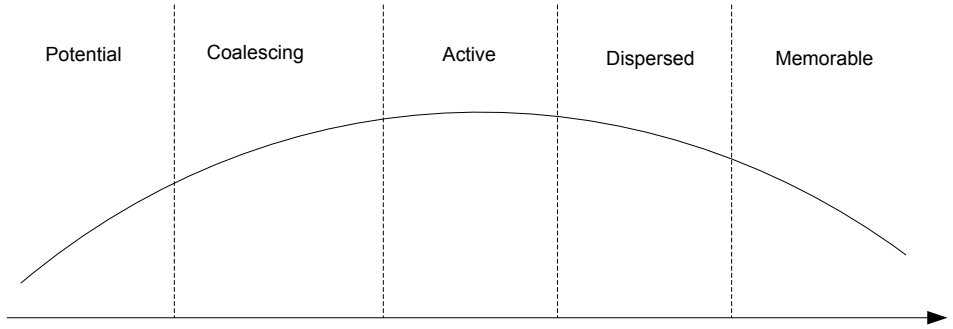


Figure 1 – Life cycle of CoPs

1. *Potential stage* – involves finding people with similar interests, establishing contacts and building informal relations.
2. *Coalescing stage* – where identity is formed and the values are discussed. Members engage in discussions in the field of interest and move from a loose network to a common sense of purpose.
3. *Active stage* – where CoP becomes highly dynamic and comes into its own by engaging in high level interactions and socialisation. This is where generation of new knowledge, dissemination and learning occur.
4. *Dispersed stage* – members of the community lose interest in the topic, activities reduced and influx of new knowledge is reduced, making the CoP less attractive.
5. *Memorable stage* – here the CoP is dispersed but tales and anecdotes live on for a while. People still associate with the CoP as part of their identity.

VIRTUAL COMMUNITIES OF PRACTICE

A Virtual Community of Practice (VCoP) is a network of individuals who share a domain of interest about which they communicate online. The practitioners share experiences, problems and solutions, tools and methodologies online, which contribute to the development of the knowledge of each participant in the community as well as the domain as a whole. VCoPs enhance the learning environment since they allow both synchronous and asynchronous communications, integrate geographically isolated experts with novices, and promote situated learning. Several benefits of VCoPs are identified in the literature.

- Physical location of employees is unimportant and isolation from the peer group is less problematic when employees are scattered geographically. The use of

technology bridges the geographical gaps. Hence, Virtual CoPs enable collaborations, sharing of specialist interests and experience, and access to mentors and like-minded individuals, irrespective of geographical locations.

- Virtual CoPs can afford a combination of synchronous and asynchronous communications and socialisation, access to and from geographically isolated communities, and international information sharing.
- Virtual CoPs and ICTs provide a systematic means for managing knowledge as an asset. Experiences, insights and ideas of people are captured and stored systematically, which can be reused in the future via sound search and retrieval functions.
- Virtual CoPs provide interested professionals with opportunities for collaboration, discussions and debates through networked technologies. This gives them benefits of others' experiences and often saves themselves reinventing the wheel by finding out what others have done when faced with particular problems.
- Virtual CoPs establish a networked environment where interactions that improve learning can occur. The interactions within these communities focus around knowledge sharing within the membership, who may range from experts to novices. Via the interactions of experts and novices, neo-apprenticeship style learning can occur.
- Using ICT to support the ongoing interactions and activities of CoP members frees the members from constraints of time and space.

Critical success factors

Gannon-Leary & Fontainha (2007) identified nine critical success factors for the existence and evolvement of virtual CoPs and thereby knowledge creation and learning.

1. Virtual CoPs are formed on ICT and Web 2.0 platforms. The success and growth of CoP is heavily relied on the level of technological provision and ICT skills that members posses to support mutual engagement.
2. The evolution of a CoP is reliant upon the effective communication of the members, most easily achieved through face-to-face meetings. Virtual communities transform personal interactions and physical relationships into cyber interactions and electronic relationships. Hence, technology needs to be regarded as an acceptable and transparent means of communication.
3. Consolidate membership and develop trust through effective personal identification modes in the virtual CoP.

4. CoP members must have a sense of belonging: being an insider of the community and actively participating in the activities.
5. A virtual CoP must have a purpose and this purpose must be achievable via ICTs.
6. Consideration needs to be given to the influence of shared repertoire of the community when using ICTs.
7. Usage of user-friendly language and graceful ways of bringing people into conversations.
8. Longevity – time is needed for communication and to build up trust, rapport and a true sense of community.
9. Leadership is important to sustain the community. In the case of virtual CoPs, a moderator, facilitator or a list owner is important.

Knowledge creation and dissemination in VCoPs

Knowledge creation, sharing and learning take place through different modes in CoPs. Nonaka and Takeuchi (1995) introduced a four-staged knowledge transfer spiral model that explains the stages and forms of knowledge creation and transfer in an organisational context. These modes include socialisation, externalisation, combination and internalisation. Socialisation is where individuals acquire knowledge from others through shared experience, observation and imitation. Externalisation involves meaningful dialogues and reflections to articulate tacit knowledge into explicit concepts. It also includes a systematic collection and archiving of explicit concepts drawn from different sources for future use by the organisation. The utilisation of the archived knowledge to benefit when faced with knowledge crisis is known as combination. Internalisation refers to the process of learning by doing and verbalising and documenting experiences. Hafeez & Alghata (2007) contextualised these modes of knowledge creation and sharing to Virtual CoPs as summarised below.

- *Socialisation* – where knowledge creation and transfer take place through interactions with experts in virtual chat rooms and in seminars and workshops organised by the community. Also storytelling by CoP members to relate their experiences is a powerful communication tool which helps listeners form ideas and concepts.
- *Externalisation* – where a CoP holds a structured archive or repository that contains all the discussions ever took place since the start of the CoP in a topic-by-topic structure.
- *Combination* – in the combination process, the structured archive that the CoP holds, makes it possible for members to access information over a period of time

and benefit from the use of "CoP memory" if one is faced with a knowledge crisis situation.

- *Internalisation* – issuing electronic newsletters for promoting event, courses, publications, stories and ideas help in the internalisation of knowledge within the community.

DEVELOPING A VIRTUAL COMMUNITY OF SAFETY PRACTICE (VCOSP) FOR CONSTRUCTION

Terms of reference

Flannery & Hinze (2008) recommended valuable terms of reference for a community of safety practice in construction. Their suggestions are listed as follows:

1. A query process is central to the working of the community of safety practice whereby members can post questions for comments and inputs being provided by the other members.
2. In the spirit of sharing safety information freely among all interested parties, the membership to the community should be open to any individuals who are interested in construction OHS. This may include professionals from different types of contractors, designers, researchers and OHS authorities.
3. In the same vein of thought, it could benefit the construction industry to a greater extent if the work products of the community of safety practice can be viewed by the public and pose questions because these could impact significant changes on the overall performance of the construction industry. Adequate efforts should therefore be made to publicise the existence of the community.

From functionalities point of view, Schweitzer (2003), Molphy et al. (2007) and Gannon-Leary & Fontainha (2007) listed important features that should be included in the virtual community of safety practice platform.

1. Discussion boards and email groups for asynchronous threaded discussions
2. Chat and conferencing tools for synchronous discussions
3. Tools for circulating community news among its members
4. Community resources archives/repositories to retain the work products of the community over time
5. Document exchange tools for sharing documents, photos, video clips and mp3 sound
6. Community event manager tools for facilitating face-to-face meetings and forums for community members
7. Quiz/survey/poll tools for getting the views of community members on various issues

8. Blog/notes tools for letting individuals share OHS experiences with other members in the CoSP through written entries
9. Personal identity (virtual business card) tool for creating personal identity or individual biography pages as a way to give contextual information about people. Community members are much more likely to engage in social interactions if they know about the individual they are engaging
10. CoPs should provide a way of searching through their site materials such as documents, blogs, stored threaded discussions, etc.
11. Section based and taxonomy based navigations are important.

Conceptual model of the VCoSP

A conceptual model for the VCSoP was developed, as seen in Figure 2, to address the requirements mentioned in the terms of reference above.

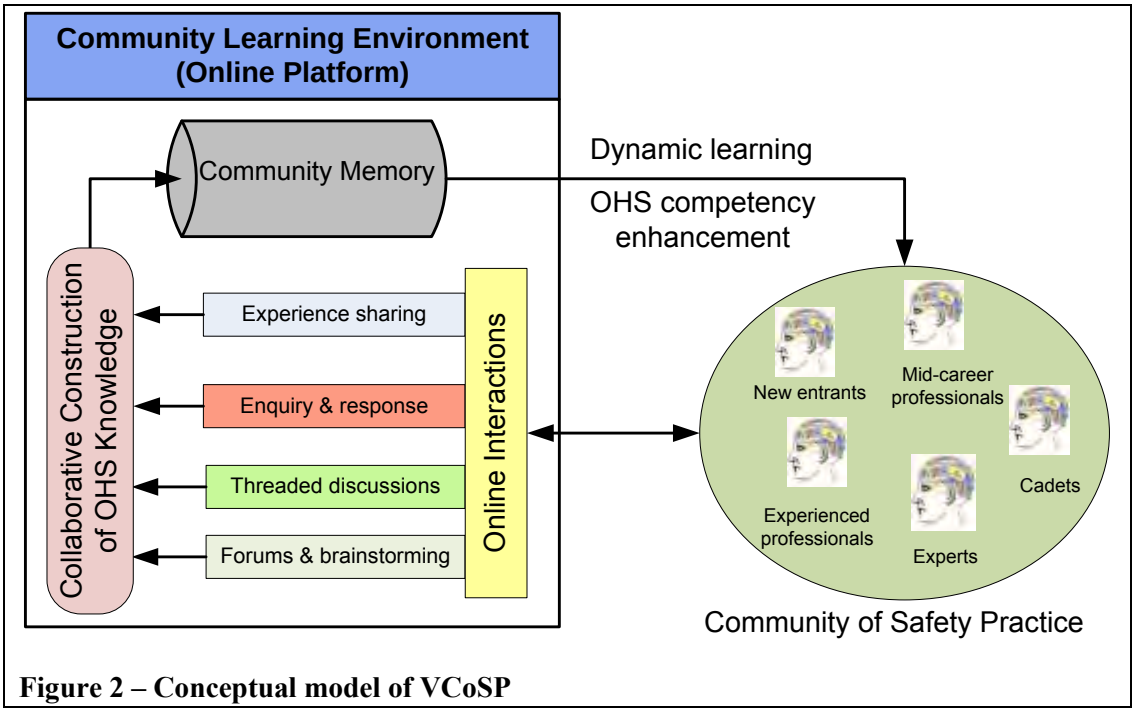


Figure 2 – Conceptual model of VCoSP

There are four key components in the proposed model for the VCoSP:

1. Online interactions between members of CoSP – these take place in different forms such as seeking information through enquiries, initiating threaded discussions on topics of concern, sharing success stories of applying innovative ideas and conducting online forums and brainstorming sessions.
2. Collaborative construction of new knowledge – by collaborating through various modes of interaction as mentioned above, new OHS knowledge is created

collaboratively by the members of CoSP and validated collaboratively by them before it is applied on site. The consultation and threaded discussion sessions function to perform the validation exercise of new knowledge automatically.

3. Retaining new OHS knowledge for re-use – new knowledge created by collaborations of members is a valuable asset that adds value to the organisational practices and thereby improves the competitiveness. Hence, this asset should be retained for re-use in the future. The community memory functions as the repository to store this asset in an organised manner.
4. Dynamic learning and competency enhancement – learning among the community members occurs in two modes. First mode is whereby members who participate in the interaction sessions as well as observers learn as new knowledge is created out of these sessions. In the second mode, members can retrieve retained knowledge from the community memory when they are struck by a need to learn. Both of these modes facilitate OHS competency advancement for individual members. And, learning via these modes takes place continually as a dynamic process.

Developing the online system

There were three possible options to develop the VCoSP, including: (1) coding using web development languages such as HTML, PHP, Cold Fusion, ASP, JSP etc., (2) using a Contents Management System (CMS) or (3) using a social networking website. It was decided to use Groups feature of Facebook social networking site for this purpose. Facebook Groups is a feature that allows Facebook users to connect, discuss and network with each other within the context of a common interest or topic. The following rationales backed this selection:

1. It is freely available to all and as such organisations of any size would be able to develop a VCoSP.
2. It needs no programming or web development skills to set up and no server or network administration and maintenance are required from the group administrator or the organisation.
3. Construction professionals find it hard to dedicate time to participate in online discussions whether on site or in the office due to work pressure and schedule constraints. It may dilute the potential benefits of the VCoSP should it set up as part of their work. However, if participation in the VCoS is blended with leisure activities of professionals, the group activities are likely to grow overtime. Most people these days have a Facebook account and they check it quite regularly at

their leisure time. A Facebook Group for the VCoSP would make the participation as a fun activity at leisure.

4. No training is needed to use the VCoSP as it is similar to the tools available in Facebook individual profiles and all Facebook users are familiar with these tools.
5. It is very easy to extend the group outside the organisation when it is needed.
6. Facebook is continually introducing new functionalities and the improved functionality of Facebook Groups makes it easier for members to connect, share and collaborate smoothly. The benefits of these improvements will be readily available to the organisation hosting the VCoSP at zero cost.

Creating the VCoSP in Facebook

The VCoSP was created in Facebook Group and Figure 2 depicts the main window of the online platform.

Figure 3 – VCoSP main window

Creating the VCoSP as a Facebook Group essentially involved four key steps as described below.

1. *Creating a Facebook account and logging in:* A Facebook Group cannot be created unless the creator of CoSP is a member of Facebook and logged in.
2. *Creating a group:* Once logged in, clicking on the "Groups" link in the main menu on the left side of the page will open the “Groups” window where the “+Create a Group” button was clicked to create a new group. Once the "+ Create

a Group" button was clicked, a Facebook group creation form appeared which needed to be filled out with basic information such as name of the group, description for the group, type, a slogan for the group (recent news), an address and email contacts for the group. A picture that correctly reflects the theme of the community was also uploaded.

3. *Privacy setting for the group:* Facebook provides many privacy setting facilities as shown in Figure 4. The key privacy setting is the "Access". There are three access options, namely open group, closed group and secret group. While anyone can join an open group, for closed groups members can join upon administrator's approval and for secret groups membership is provided only by invitation by the administrator. Depending on the organisational policies, the administrator can select an access type for the VCoP. The administrator can also define who can post materials to the platform. Because the objective of the VCoP is to create and disseminate new knowledge among community members, it was appropriate to permit all members to post materials on the online platform.
4. *Inviting members to the group:* After creating a group and setting the privacy issues, the administrator can invite members to join. Members can be invited either from the Facebook friends list or by adding the email address to the email address box that is directly under the friends list for others those who are not yet on Facebook. Once all these steps were completed, the Facebook group was ready to function as the virtual platform for the community of safety practice.

Member collaboration and safety knowledge management

The virtual platform features eight tools for member collaboration and safety knowledge management and they appear as tab controls as seen in Figure 3.

1. *Wall*: The Wall is the central location for recent information posted by community members and it is where up-to-date contents from community activities are kept. When a community member shares contents (videos, photos, notes, etc) on one of the tabs other than the Wall, they will appear on the Wall for high visibility for other members.
2. *Info:* The Info tab lets the community administrator share key information about the community under three areas, known as Basic Info, Contact Info and Recent News. The administrator can share information such as overview, mission and other relevant news in this area.

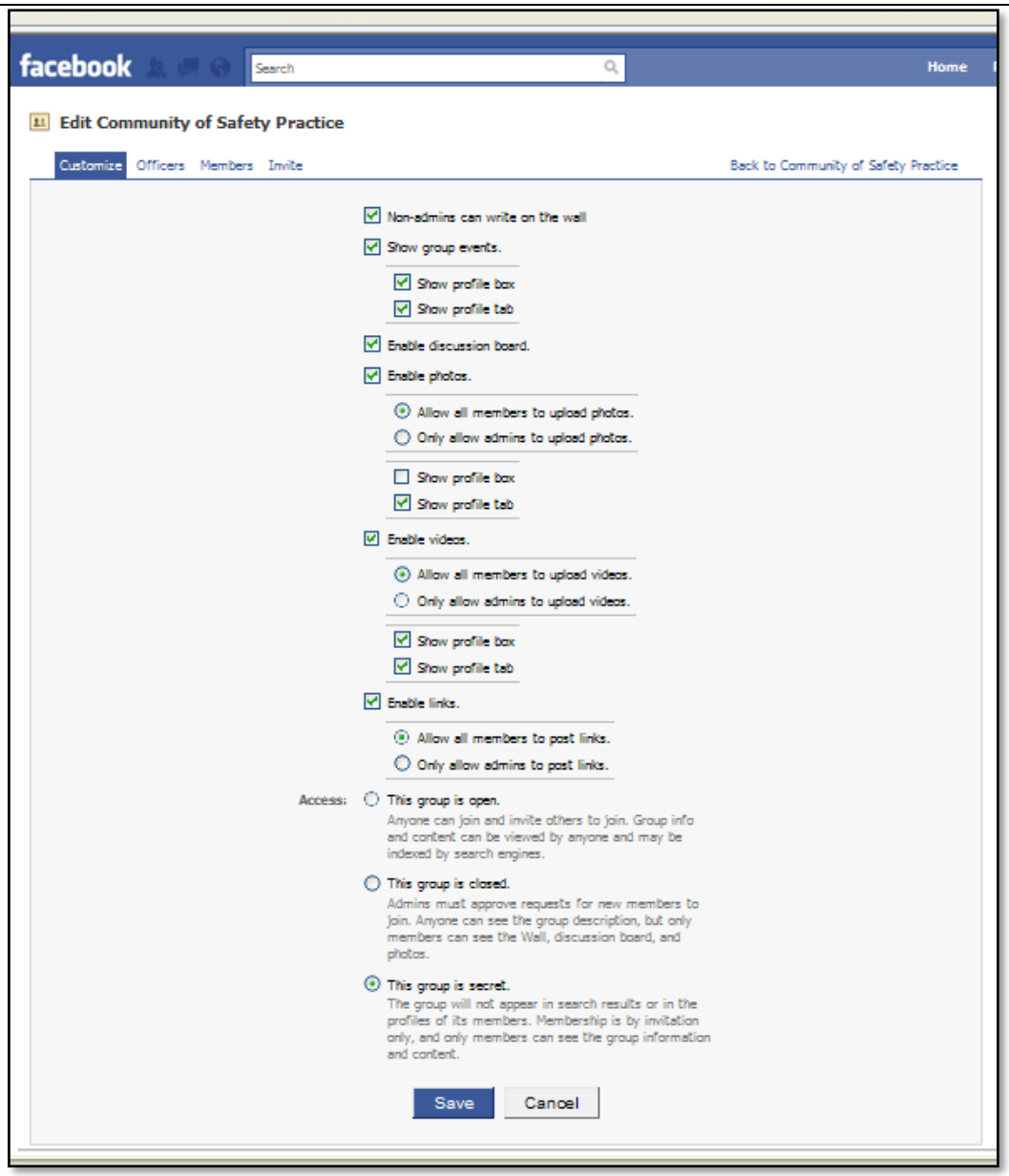


Figure 4 – Privacy settings for groups

3. *Discussions:* Discussion board enables community members to initiate and engage in threaded discussions about topics that are of interests at a given time, share experiences with other members in the community through written entries (other members can also write comments on entries) and query other members for information.
4. *Photos:* With the Photos tab, members can upload an unlimited number of photos to the online platform and take photos from personal computers and smart phones. Members can also edit and comment on those photos as appropriately. These photos can be reordered and members can tag their colleagues in them.

5. *Video:* The Video tab provides a high-quality video platform for the community. With Video, members can upload video files, send videos from mobile phones, and record video messages to community members. Additional features include full-screen playback, tagging other colleagues and members in videos and rotating videos.
6. *Events:* The Events tab helps promote community events. It allows simply create an event, add pictures to suite the theme of the event and invite community members to participate. Also, members can RSVP. There are also options to leave the event open to members in the community alone, invite guests and/or open to everyone.
7. *Links:* With Links, members can share anything on the internet by posting it on to the community platform. Members can post websites, blogs, YouTube videos, pieces of news as well as contents on Facebook like photos, videos, events, groups and pages.
8. *Chat:* Facebook Chat is an instant messaging tool. When members of the community log into Facebook, they are automatically logged into Facebook Chat. The chat tool is available at the bottom of Facebook page and it lists members who are online. With Chat, community members can have synchronous discussions.

Apart from these user-centred functionalities, the virtual platform also features administrative functionalities to constantly manage community's privacy, contents, membership, access level and mass messaging.

BENEFITS OF AND CHALLENGES FOR THE VCOSP

The following benefits could be enjoyed by a construction organisation if the VCoSP is set up and all site management team members within the organisation actively participate in its course:

1. Learning from success stories of "how to" and stories of what has not worked.
2. Sharing innovative ideas and technologies that could assist and educate the field safety personnel to work more effectively in the supervision and management of safety.
3. Finding ways to positively influence safe behaviours.
4. Obtaining collaborative opinions from fellow experts on specific issues/questions.
5. Collaborating and sharing strategies to address chronic challenges of diverse workforce, language barrier, skill shortages and poor safety attitude of workers.
6. Helping site professionals continually improve safety competency.
7. Identifying and standardising best safety practices for the organisation.

8. Improving safety constructability on site.
9. Staying informed of changes on regulations, policies and procedures concerning safety that may affect obligations of safety professionals.
10. Meaningful changes to current practices might easily be implemented through the community of safety practice.
11. Aiding professionals demonstrate safety leadership in the organisation.
12. Nurturing a strong safety culture within the organisation.
13. Easy to warn and alert safety personnel on different sites of unexpected safety and hazardous concerns such as health issues, radiations, pandemic, etc. on sites.
14. Knowing about leading indicators of safety flaws on site.
15. Getting directions to external sources of information, agencies and guidelines by community members.

Nevertheless the following challenges need to be addressed to ensure the above benefits are reaped:

1. Weak motivation to join the VCoSP and participate in its activities may lead the community to a dying state.
2. The VCoSP needs to work hard to maintain energy and a high degree of participation. Individual members of the community must engage with it in order that it may develop and grow.
3. The VCoSP lacks the opportunity for face-to-face interactions and socialising which can consolidate group membership. Consequently, individuals may fail to engage in the CoP. Trust building is vital for sharing and trust primarily develops through face-to-face interactions. In the virtual environment, identities can remain hidden.
4. Computer skills of members.

CONCLUSIONS

Establishing a virtual community of safety practice within a construction organisation could offer a great deal of opportunities and potentials for improving the occupational health and safety performance of the organisation. On one hand could this function as a platform for competency improvement and capacity building for the employees within the organisation, and on the other hand this could help uplift the safety standard on site. The usage of freely available social networking tools like the Facebook provides a zero cost technology for builders to set up a virtual community of safety practice with very minimal administration efforts. The membership of VCoSP can also be extended to outside the organisational boundary to establish an industry wide community. This would create a strong safety mentorship culture within the industry and help address the chronic

challenges facing the industry, including skill shortages and other human-related causes of poor safety records.

REFERENCES

Carlsson, S.A (2003) Knowledge managing and knowledge management in inter-organisational networks. *Knowledge and Process Management*, 10 (3), 194-206.

Chua, D.K.H. and Y.M. Goh. (2004) Incident causation model for improving feedback of safety knowledge. *Journal of Construction Engineering and Management*, 130 (4): 542-551.

Davenport, T. and Prusak, L. (1998) *Working knowledge: how organisations manage what they know*. Cambridge, MA: Harvard Business School Press.

Flannery, J. and Hinze, J. (2008) "The Value Of A Safety Community Of Practice". In *CIB W99 2008 International Conference on Evolution of and Directions in Construction Safety and Health*, Gainesville, Florida, U.S.A., March 9-11.

Gannon-Leary, P. and Fontainha, E. (2007) *Communities of practice and virtual learning communities: benefits, barriers and success factors*. Available from: http://www.elearningeuropa.info/files/media/media13563.pdf. [3 April 2010].

Gherardi, S. and Nicolini, D. (2000) The organisational learning of safety in communities of practice. *Journal of Management Enquiry*, 9 (7), 7-18.

Hafeez, K. and Alghata, F. (2007) Knowledge management in a virtual community of practice using discourse analysis. *The Electronic Journal of Knowledge Management*, 5(1), 29-42. Available online at: www.ejkm.com. [23 March 2010].

Hubert, C., Newhouse, B. and Vestal, W. (2001) *Building and Sustaining Communities of Practice*. Houston: American Productivity Centre.

Kimble, C. and Barlow, A. (2000) Effective virtual teams through communities of practice. *Glasgow: University of Stratchclyde, Strathclyde Business School. (Management Science Research Paper No. 00/9)*.

Lingard, H. and Rowlinson, S. (2005) Occupational Health and Safety in Construction Project Management. New York: Spon Press.

McDermott, R. (1999) How information technology inspired, but cannot deliver knowledge management. *California Management Review*, Vol. 41 (4), 103 -117.

Molphy, M., Pocknee, C. and Young, T. (2007) *Online communities of practice: are they principled and ho do they work?* Available from: http://www.ascilite.org.au/conferences/singapore07/procs/molphy.pdf. [30 March 2010].

Nickols, F. (2003). *Communities of practice: an overview.* Available from: http://www.providersedge.com/docs/km_articles/CoPOverview.pdf. [15 April 2010].

Nonaka, I. and Takeuchi, H. (1995) *The Knowledge Creating Company*. New York: Oxford University Press.

Schweitzer, S. (2003) *Functionalities of online communities of practice*. Available from: java.cs.vt.edu/public/classes/communities/.../schweitzer_project_draft.pdf. [12 April 2010].

Wenger, E. (1998) *Communities of practice*. Cambridge, UK: Cambridge university press.

Wenger, E., McDermott, R. and Snyder, W.M. (2002) *Cultivating Communities of Practice: A guide to Managing Knowledge*. Harvard Business School Press.

Knowledge Transfer: A Model Framework for Construction Knowledge Integration

Moh'd Azian Zaidi and Hilary Davies
School of Architecture & Building
Deakin University, Geelong, Australia

ABSTRACT

Managing information and knowledge in the construction industry is an important focus for research. The goal is to expedite better integration of construction knowledge amongst the stakeholders. Better use of this knowledge could allow the building industry to achieve quality outputs making best use of resources – the linked goals of time, cost and quality. Information networks and knowledge transfer are central to this and are recognized as integral to an industry strategy to improve productivity. However, poor delivery of information to those at the construction site and lack of effective methods of transferring knowledge between parties involved in construction become major challenges. Based on a critical review of literature and an interview survey, this paper identifies the information networks adopted in the Malaysian construction industry and models these using four knowledge transfer components classified as 'control', 'innovation', 'best practice' and 'audit' element. Knowledge integration practices - attitude, communication, skills, commitment and monitoring; and factors related to information barriers including accessibility, service delivery, information updates and publication, were identified as critical features for the success of knowledge integration in the Malaysian construction industry. A framework for knowledge transfer is proposed to promote better practices in the Malaysian construction industry.

KEYWORDS

construction knowledge, information flow, knowledge transfer

BACKGROUND

The challenge to integrate and share knowledge in the construction industry has become an important agenda for many researchers worldwide. The issues relate to a lack of quality revealed through building defects, poor building performance and poor management of the construction project (Wong, 1996; Georgiou et al. 2000). As construction knowledge is recognized as a process to integrate information at every level of the construction process (Griffith and Sidwell, 1997; Nima et al., 2001), the factors that contribute to its success need to be identified. Poor practices relating to construction

process, that include lack of interaction, miscommunication and inappropriate use of knowledge by industry personnel, suggest that this issue needs to be prioritized. Many construction projects do not receive feedback input due to the lack of a formal and explicit knowledge base, resulting in low quality outputs and poor building performance (Jergeas and Van der Put, 2001).

One of the factors closely related to this problem is caused by inadequate transfer of information in the building production process. Information is a key component for updating and optimizing knowledge. This information must be managed to bring in value. Previous research by Zaidi and Davies (2009, 2010) has proposed a model of information networks that includes the elements of 'control', 'innovation', 'best practices' and 'audit' as being relevant areas to explore to improve knowledge transfer. Developing from this work, this paper has the following objectives:

1. To explore how the model of information networks ('control', 'innovation', 'best practices' and 'audit') contributes to construction knowledge integration;
2. To identify any areas for improvement in knowledge transfer that could improve construction knowledge integration as well as to ensure better building quality in the Malaysian construction industry.

Inefficiency in handling information does not depend solely on the industry process or the technologies adopted (Titus and Brochner 2005). It requires good social networks to create a better learning environment in such communities. Miscommunication and lack of trust prove to be challenges, for example, Faniran et al. (2001) suggest that poor interaction between different disciplines during the design and construction process explains the poor coordination and integration often seen during projects. Therefore, this paper offers a model of the knowledge transfer process that could assist industry players to develop better construction knowledge integration through effective handling of information.

CONSTRUCTION KNOWLEDGE INTEGRATION

Knowledge in construction project usually understands as technical knowledge, practical knowledge, experience and skills (Fong, Hills and Hayles, 2007). This knowledge could be exploited for the maximization of project goals and building performance by the integration of construction knowledge in the building process (Griffith and Sidwell, 1997). The best use of knowledge and experience in planning, engineering, procurement and field of operations to achieve overall objectives is essential for the accomplishment of the project success (Arditi et al. 2002).

Griffith and Sidwell (1997) have argued that integration of construction knowledge should not be focused only on the design and construction relationships, but must examine the total building production process throughout a project's life cycle (Table 1).

Table 1 – Construction knowledge integration

Project Phases	Construction Knowledge that needs to be integrated
Feasibility, Conceptual Planning and Procurement Stages	Client's corporate objectives; client's project requirements; project strategy; project priorities - time, cost, quality; project team selection; definition of relationships, responsibilities and authority; type of project; location, site conditions and environment; resources; legislation and regulation; climatic influences; project risk; form of contract; contract negotiation; and contract administrative procedures
Design Stages	Design concepts; specifications; construction details; task dependency; standardisation; tolerances; dimensional co-ordination; and drawings and communication.
Construction and Management Stages	Construction knowledge; skill base; construction methods; sequencing; resource deployment; standards and control of quality; organisational structure; management and supervisory style; industrial relations; planning and progressing methods; material procurement; use of plant and equipment; site layout and temporary facilities; and site safety
Post-Construction Stages	Installation and commissioning; operational requirements; user requirements; and life cycle provision and maintenance.

Source: Griffith and Sidwell (1997) pp301-302

Nima et al. (2001) emphasise integration of construction knowledge depends on the role of contractor's through every stage of the construction process. Nima et al. (2001) propose three aspects - the need for individual knowledge and experience, advanced information technology requirements and the need for innovation during the whole building life cycle as the basic fundamental components for construction knowledge integration. Table 2 illustrates the roles of contractor personnel offered by Nima et al. (2001) in knowledge integration.

Table 2 – The roles of contractor personnel for construction knowledge integration

Project Stages	Contractor Personnel Roles
Project constructability enhancement during conceptual planning	i. A project team (all stakeholders) should be formed to take constructability issues into consideration from the outset of the project and through all its phases. ii. The project constructability programme should be discussed and documented with the participation of all project team members. iii. Experienced individuals should be involved in early project planning so that problems at the interface between design and construction can be avoided. iv. Construction methods should be discussed and analysed in conjunction with selection of contract type. v. Site layout should be devised for efficient construction, operation and maintenance.
Project constructability enhancement during design and procurement phase	i. Design and procurement schedules should be dictated by construction sequence. ii. The use of advanced information technology could improve communication between stakeholders and enhance constructability. iii. Designs should be reviewed (and simplified) by qualified construction personnel iv. Project elements should be standardised and modularisation and pre-assembly utilised. v. The project technical specifications should be simplified and configured to achieve efficient construction performance. vi. Project design should take into consideration the accessibility of construction personnel, materials and equipment to the required position inside the site. vii. Design should facilitate construction during adverse weather conditions.
Project constructability enhancement during field operations phase	i. Field tasks sequencing should be configured in order to minimise damage or rework; scaffolding/formwork; congestion on project elements. ii. Innovation – utilise new methods, construction materials, pre-assembly, or modification of the available tools to increase productivity. iii. Evaluate documentation and feedback any issues of the constructability concepts used throughout the projects.

Source: extract and adaptation from Nima et al. (2001) pp194-195.

Nima et al. (2001) also concluded that construction personnel must not only be knowledgeable in the technical aspects of engineering and construction but also be able to manage people and be good organizers and administrators. Practical knowledge, good collaboration and effective monitoring were suggested as essential to improve knowledge

integration. Thus it is requires consideration of technical, managerial and relationship skills to incorporate all aspects and personnel involved in a building project. These considerations remain as challenges for the construction industry trying to improve information and knowledge transfer.

THE ROLE OF INFORMATION

Information is a part of construction industry communication and critically influences the conception and completion of a building project (Coulson, 2004). In the building production process, information is a significant input or resource. The construction process involves repetitively using a network of orderly linked activities which use information for transforming inputs to outputs (Titus and Brochner 2005). Information is usually captured from a client, design team or contractor and disseminated to generate project outputs in the construction life cycle (Alshawi and Underwood 1996).

'Information' could be in the form of a message, usually a document, and/or an audible or visible communication, which has a sender and a receiver (Eliufoo, 2005). According to Nonaka and Takeuchi (1995), information could provide a new point of view for interpreting events or objects. Beijerse (2000) defines information as the amount of data that needs to be distributed for any organization to function successfully. However, information is not a 'free good' and requires an appropriate level of understanding. Accordingly Quintas et al. (1997), suggest information is only valuable within a context where other forms of knowledge are brought to bear.

In the construction process, information should be elicited from all industry stakeholders and be effectively integrated (Eliufoo 2005). Information needs in the construction industry sector include client needs for information to help with their development planning; consultant teams need detailed information to help them monitor and control construction activities; and contractors need information to program and to enable satisfactory completion of the project. Therefore, in the construction project life cycle, information and its transfer mechanisms should be brought together for all activities.

Project success has traditionally been represented as the 'golden triangle' of cost, time and quality objectives. However, a major challenge in achieving project success is how to effectively integrate construction knowledge and experience into each phase of the project development process (Anderson et al. 2000). Several studies have recognized that the problems relating to a lack of information and poor knowledge sharing constitute a major issue requiring urgent improvement (Jergeas and Van der Put 2001; Arditi et al. 2002; Walker and Shen 2001). These authors highlight relationship issues such as lack of trust, lack of commitment and poor communication as major challenges. Arditi et al. (2002), suggest that construction knowledge has also been hindered by designers'

misunderstanding or lack of appreciation of construction requirements. Often, contractors are not invited to participate or take part in design activities, when they can provide invaluable construction inputs at early stages of the building production process (Alshawi and Underwood 1996). Saghatforoush et al. (2009) also recognized the lack of contractor involvement in the early phase of the design process and Malaysian contractors' shortage of knowledge as main barriers for project success.

Information is recognised as a key driver for success in the building production process (Coulson 2004; Titus and Brochner 2005; Chen and Mohamed 2008). Knowledge and information transfer have been identified as areas in which the construction industry must achieve significant improvement (Zaidi and Davies 2009). However, information transfer is generally given little attention in many country's construction activities including Malaysia (Wong, 1996; de Silva et al. 2004). There is thus a lack of integration in construction inputs and inadequate transfer of information, often resulting from lack of appreciation of the potential contributions of all parties involved in a construction project, the contractual process itself with its conflicting objectives and the often adversarial nature of construction contracts, all of which result in a general lack of communication which in turn creates problems for construction knowledge integration.

PRODUCTION OF INFORMATION FROM KNOWLEDGE PROVIDER AGENCIES

To demonstrate the proposed framework, this paper viewed information in four different of knowledge providers agencies. Knowledge can primarily be described as something that makes data and information manageable (Beijerse, 2000). This data and information are produced from different sources of organizations. Therefore, a model incorporating four different components of information sources are proposed in order to integrate construction knowledge effectively (Zaidi and Davies 2009, 2010). These components - 'control', 'innovation', 'best practice' and 'audit' are explained as follows:

a) *Control Element*. In the construction process, 'control' refers to any information received from any public agency including any law, regulation, guideline or policy produced by local, national or international bodies. This also refers to the enforcement of building regulations made by government in order to ensure that any construction project complies with standards. Contractors are expected to comply with building codes, standards and good building practices; therefore information from the control element needs to be effectively communicated to ensure contractors are up-to-date with current requirements.

b) *Innovation Element*. Under the innovation element, optimization of construction knowledge could be achieved through an effective integration of information

produced by research and development (R&D) agencies. Effective use of R&D information could be one of the strategies to increase construction project performance (Panuwatwanich et al. 2009). Latest findings such as new construction materials, construction techniques or any novel approach could achieve better construction project quality and increase productivity and constructability. Given the ever increasing amount of information being generated, gaining attention for important new discoveries is a continuing challenge for R&D agencies.

c) *Best Practice Element*. Best practice is an initiative by governments and research agencies to motivate key players in the industry to apply proper building practice. This could be achieved through training programs offered by any public or private organization in the construction industry. Information related to any new technique such as supply chain management, value engineering, partnering, total quality management (TQM) etc is invaluable for construction personnel to improve their skills and practices.

d) *Audit Element*. Integration of construction knowledge is not solely dependent on the effective delivery of information from outside agencies from the control, innovation and best practice elements. The requirement to receive feedback on project performance should become one of the essential strategies for construction knowledge to succeed. Therefore this paper suggests the audit element as an additional way to integrate construction knowledge in the construction process. Audit can include developing databases of projects to be used for benchmarking and setting Key Performance Indicators (KPI's). Table 3 maps these elements against information sources for Malaysia construction industry.

THE STUDY: INDUSTRY PRACTITIONERS PERCEPTION OF KNOWLEDGE TRANSFER APPLICATION IN THE MALAYSIAN CONSTRUCTION INDUSTRY

The study was carried out to investigate those factors that could contribute to the success of information and knowledge transfer in the Malaysian construction industry. The first phase was to define the problem and the scope of research. A literature search of construction project and knowledge management provided a framework for understanding information transfer concepts in integrating construction knowledge. The second part of the research was a survey of industry practitioners.

Table 3 – Information sources for construction knowledge integration in Malaysia

Information Element	Strategy and Initiatives	Current Practices
CONTROL	Building Control and Legal Aspects	Applied the 'conventional method' of building plan assessment. Introduced the 'One Stop Centre' (OSC) system in monitoring building plan submission process.
	Construction Board Establishment	Establishment of the Construction Industry Development Board (CIDB) Malaysia
	Standardization Strategy	Materials and products inspected and certified by the Standard Institute of Research and Innovation (SIRIM) Establishment of the Malaysian Standard (MS)
INNOVATION	Research Initiatives	Establishment of the Construction Research Institute of Malaysia (CREAM)
	Innovation Initiatives	Establishment of the QLASSIC and MCEIA approach in assessing quality of construction.
BEST PRACTICES	Quality Management Approach and Initiatives	International Standard of Organization (ISO) application (Encouraging construction company to implement ISO procedure)
AUDIT	Auditing Process Initiatives	Initiated the Blue Ribbon Award for outstanding housing project. ISO certification

Survey approach

An interview survey of thirteen industry practitioners, including company directors, project managers, engineers and site supervisors from different construction organizations, was employed to assess factors considered to promote successful construction knowledge integration. These participants were selected at random from various regions in Malaysia including Kuala Lumpur, Selangor, Perak, Negeri Sembilan and Terengganu.

To ensure a substantial amount of expertise for the interview participants, individual positions in the company is the key criteria used to select the members. A sample of three director, two project manager, four engineers, three quantity surveyors and one project executive involves for this interviews. The lists of the respondent are shown in Table 4.

Table 4 – List of interview respondents

Position	Nos. of Respondents
Director	3
Project/Construction Manager	2
Engineer	4
Quantity Surveyor	3
Project Executives	1
Total	13

In the interview process, a semi structured interview with open ended question was used. The basic themes of the interview were classified in two parts that consisted of the themes for critical issues in integrating construction knowledge in section A. Section B consisted of knowledge transfer questions which included the importance of information sharing and information transfer applied in construction organizations. The survey results were combined with the literature search to yield knowledge issues and their impacting factors. Finally, a set of conclusions and recommendations was derived after analysing the outcomes and results of the survey.

Section A: factors affecting knowledge transfer

Based on the survey interview conducted, factors relating to poor attitude, communication, skills, commitment and poor monitoring were perceived by the interviewees as critical factors that influence construction knowledge integration. In this interview, the majority of respondents agreed attitude has a high impact influencing the success of knowledge transfer. This survey found that every respondent voiced their concerns of poor attitude such as poor feedback from staff in public agencies and delays in confirmation of any construction task by the staff that could influence successful knowledge transfer. Attitude was considered an important aspect of knowledge transfer.

Communication problems were listed as a second contributor to the knowledge transfer barrier. This factor allows delays to the project progress due to incompetent communication skill. Lack of informal discussion and lack of involvement by the contractor in delivering input to the designer in early stages of the design could affect the construction work during implementation stages. Besides that, poor understanding of the documentation including construction work procedure and guideline was identified as a main reason for this problem.

In general, construction expertise is in the form of written documents (explicit knowledge) and in people's head (tacit knowledge) (Mohamed and Anumba, 2006). According to Fong, Hills and Hayles (2007), skills are recognized as one of the factors that could influence tacit knowledge. Tacit knowledge is that knowledge where the 'owner' is not fully aware of it and finds it difficult or impossible to articulate in written form. Based on interview feedback, the majority of the respondents also indicated that skill is an essential factor that could affect the integration of construction knowledge. An issue related to the lack of skill such as poor workmanship and incompetent construction workers were described as a real challenge in integrating construction knowledge. This is mainly due to insufficient guidance and training of the workers. Other causes of lack of skill advice were drawing inaccuracy and drawings that did not integrate information provided by the designer. In respect of the potential for construction knowledge improvement, the respondents suggested the provision of effective supervision and sufficient training of construction workers would overcome the major cause of lack of skill specified above.

The fourth factor revealed from the interviews relates to staff commitment. The study found that half of the respondents were concerned about poor commitment of the staff as a reason to influence construction knowledge integration. Most of the interviewees believe that poor feedback, inconsistency in decision making and lack of trust have a significant impact on the success of knowledge transfer processes. This study further found that the staff from the public sector and the staff from the consultant company were considered to have often delivered poor service to the construction company staff. A majority of the respondents claimed that a delay in processing contract documents and confirmation for any construction task appeared to be the reasons associated with poor commitment of staff.

The final factor key contribution in influencing construction knowledge integration is monitoring and supervision. Based on the interview feedback, a problem related to monitoring could be viewed in a number of situations. Lack of enforcement was accorded the most influence by the respondents followed by insufficient staffing to monitor projects at the construction site. This problem is due to poor supervision work by the staff including rare visits to the construction

site. Table 5 illustrates critical factors in construction knowledge integration perceive by the interviewees in the Malaysian construction sector.

Table 5 – Critical factors influencing construction knowledge integration

Factor	1	2	3	4	5
Respondent 1	√	√		√	√
Respondent 2	√	√	√		
Respondent 3	√	√	√		√
Respondent 4	√		√		
Respondent 5	√	√		√	
Respondent 6	√		√		
Respondent 7	√			√	
Respondent 8	√			√	√
Respondent 9	√	√		√	√
Respondent 10	√		√	√	
Respondent 11	√				
Respondent 12	√		√		√
Respondent 13	√	√			
	13	6	6	6	5

Note: 1-Lack of attitude, 2-Communication Problem, 3-Lack of skilled, 4- Poor Commitment, 5- Monitoring Problem.

Section B: information barriers

The second objective of the interview survey was to identify key factors that contribute to the information barriers in the Malaysian construction industry. The investigation of the factors that create information barriers highlighted four critical issues including difficulty accessing information; poor delivery of information, non-updating of information and lack of publication were identified as key concerns for this barrier.

This study found that majority of respondents faced difficulty accessing information from various agencies in the public and private organizations such as Public Works Department (PWD), Construction Industry Development Board (CIDB), Local Council, Standard Institute of Research and Innovation Malaysia (SIRIM), Professional Institution such as Architect Association Malaysia (PAM), Board of Architect (LAM), Board of Engineer and Board of Quantity Surveyor Malaysia etc.

Table 6 – Information barriers from the agencies

Participants	Critical Issue			
	1	2	3	4
Respondent 1	●	●	●	
Respondent 2	NR	NR	●	
Respondent 3	NR	NR	●	●
Respondent 4	●			
Respondent 5	●	●	●	
Respondent 6	●		●	
Respondent 7	●		●	
Respondent 8	●		●	
Respondent 9	●	●	●	
Respondent 10	●		●	
Respondent 11	●		●	
Respondent 12	●		●	
Respondent 13	●	●	●	
N= 13	11	4	12	1

Note: 1-Inaccessibility of information, 2-Poor delivery of information, 3- Non-update of information, 4-Lack of Publication, NR- No Remarks

The interviewees indicated that most of these agencies have treated information as a highly private and confidential resource to access. Important information such as the building cost index is very difficult to obtain. Restrictions on searching information through agency websites; public and private bodies could also contribute for this barrier. However, most of the interviewees agreed the online information is very important for the industry practitioners. The government was advised to improve on IT facilities including updating information on the corporate website by providing useful information connected to the construction sector such as new products; technology or any other matters related to information respectively.

Ishikawa et al. (1999) mentioned that information is a mechanism to improve performance. However, failure to transfer this information diligently could result in great challenges to integrate construction knowledge. According to the respondents 1, 5, 9 and 13, a second barrier to transfer effective information is caused by poor delivery of information in the industry. The sole factor creating this barrier is due to poor service delivery by the agencies including lack of cooperation and service obstruction by the public and private agency staff. To use information effectively, construction players must be able to find what they need in a convenient and recoverable manner. Therefore, the participants have suggested that through an effective service delivery offered by both agencies, it could provide a better information transfer for the industry.

The third critical issue of information distribution is to deliver updated information to the construction actors in industry. The majority of the respondents claimed that they were not correctly informed of any updates of information including new policies or new guidelines by the public and private agencies. For an example, the latest research findings in relation to construction techniques and products from research agencies such as SIRIM and CREAM, are not successfully delivered to the industry practitioners. Therefore it is suggested for these agencies to provide a platform that could encourage practitioners to receive information related to the industry.

The fourth barrier to distributing information raised by the respondents is the lack of relevant publications in the industry. Only one respondent mentioned that knowledge could be acquired through reading. However, shortages of publications such as newsletters, government information and bulletins, hinders industry practitioners increased knowledge. Updates from agencies such as CIDB could also assist. Thus, the public and private agencies need to enhance their role by producing information through ongoing publications. Table 7 summarises the interview outcomes for knowledge integration perceived by the industry practitioners in Malaysia.

MODEL FRAMEWORK FOR CONSTRUCTION KNOWLEDGE INTEGRATION

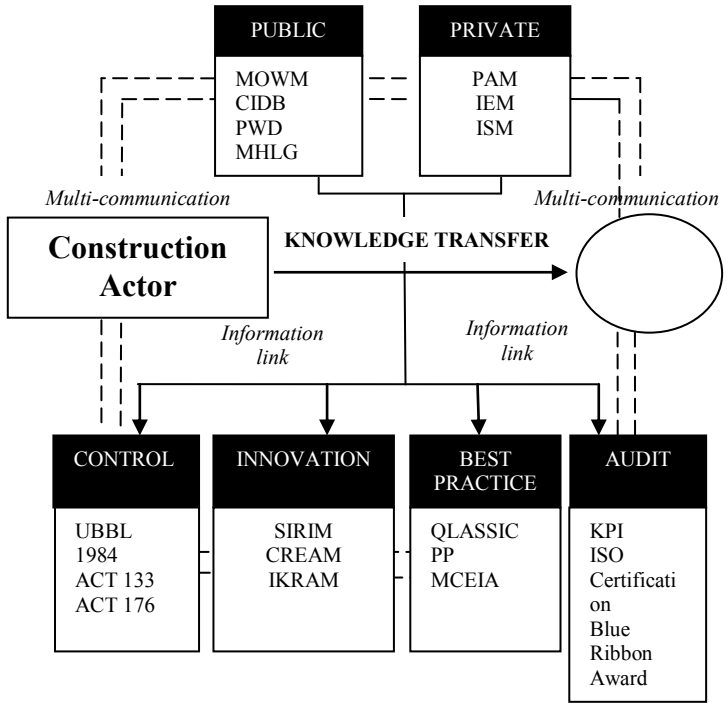
Knowledge transfer is increasingly seen as an important approach to improve construction performance and it has received considerable attention in recent years. Over the last couple of decades, there has been considerable interest in the application of knowledge transfer in construction. This interest is reflected in the literature, where knowledge transfer addresses social capital in construction project management (Manu and Walker 2006), knowledge creation and learning organizations (Eliufoo, 2005), communities of practice (Ruikar et al. 2009) and technology transfer (Li Hua, 2009). However, there have been few attempts to provide recommendations to improve knowledge transfer practice for construction knowledge integration.

Table 7 – Summary of interview outcomes

Themes	Critical Factors	Sub-components
Knowledge Integration	Poor attitude	Poor feedback, delay confirmation
	Communication problem	Lack of informal discussion, lack of involvement in early stages of design, poor understanding of documents and work procedure
	Lack of skill	Poor workmanship, incompetent construction workers, insufficient guidance and training
	Poor commitment	Poor feedback, inconsistency in decision making, lack of trust, poor service by the staff
	Monitoring problem	Lack of enforcement, insufficient staff to supervise work
Information Barriers	Accessibility of information	Information is treated as highly confidential, restrictions on online agency website searches
	Poor service delivery	Lack of cooperation, poor service offer by the staff
	Non-updating of information	Lack of information informing of policy changes
	Lack of publications	Short of publication such as newsletter and government information related to new policy and guideline

In an attempt to improve knowledge in the construction industry, various mechanisms have been adopted and discarded by industry-based organisations and government organisations. This paper suggests that what is required are better linkages between the four factors considered to influence constructability - The elements of 'Control', 'Innovation', 'Best Practice Guidance' and 'Audit', illustrated for Malaysia (Figure 1).

Loh (2007), from investigating knowledge sharing, has suggested that the aim of the transfer process is for the right information, within the right context, to reach the right person at the right time for the right purpose. Therefore, for construction knowledge transfer and integration, the first strategy of this model proposes that good multi-way communication channels should be encouraged between construction 'actors' and the information providers, such as local authority agencies, research bodies and other institutions. This could be achieved through more effective interaction and socialization by the construction community. One of the reasons why constructability issues recur is due to poor decision making and communication breakdown. Brackertz and Kenley (2001) identify that there were no suitable communication channels and processes between authorities and other agencies. This justifies the proposed need for good multi-way communication.



Notes:

MOWM : Ministry of Works, Malaysia
CIDB : Construction Industry Development Board
PWD : Public Works Department
MHLG : Ministry of Housing & Local Government
PAM : Architect Association Malaysia
IEM : Institute of Engineers Malaysia
ISM : Institute of Surveyors Malaysia
SIRIM : Standards and Industrial Research Institute of Malaysia
CREAM : Construction Research Institute of Malaysia
IKRAM : Public Works Institute Malaysia
QLASSIC : Quality Assessment System in Construction
PP : Partnering Program
MCEIA : Malaysian Construction Industry Excellence Award
KPI : Key Performance Indicators
ISO : International Organization for Standardization

Figure 1 – Knowledge Transfer (KT) approach proposed for the Malaysian construction industry

The second strategy that could be adopted to integrate construction knowledge is through the effective distribution of information from research agencies. Research bodies such as the Standards and Industrial Research Institute of Malaysia (SIRIM) in Malaysia provide a wide range of research information. However, effective dissemination relies on information reaching the developer or builder on site. In an attempt to improve constructability, it is important to review current policy and to encourage contractors' involvement. Short briefing notes or training days could facilitate more effective transference of knowledge.

In the best practice element, integration of construction knowledge is proposed through conducting workshops or seminars and best practice notes. Government initiatives such

as these are intended to encourage the industry to apply proper building practice. Attendance at seminars and workshops could be a mandatory condition to renew builders' licences and could be a significant way of updating skills and knowledge. The concept of Continuous Professional Development (CPD) could also be extended to construction actors and not be limited to professionals such as architects, surveyors and engineers. These approaches could increase builder's awareness of useful information from research organisations.

Finally, construction knowledge could be improved through an effective knowledge transfer through auditing. Benchmarking and setting Key Performance Indicators (KPI's) can monitor the performance of organisations and the construction projects. However simply conducting audits for benchmarking does not of itself educate people within an organisation. Motivation to improve and to surpass benchmarks can be useful to organisations wishing to stay ahead of their competition. Rewards and recognition can be a way to motivate people within organizations (Zaidi and Davies, 2010). Introducing reward and incentives schemes can facilitate motivational achievement in project teams and increase organisation performance (Hartmann, 2006; Grisham and Walker, 2006).

In order to achieve successful integration for the above model, a basic strategy map (figure 2) for knowledge transfer is recommended in encouraging information transfer for control, innovation, best practice and audit elements (Figure 1 above). Critical factors identified through the interviews that include attitude, communication, skills, commitment and monitoring need to be improved. These factors for improvement are then referred to on Figure 2 as strategy map 1. Strategy map 2 lists factors relating to the information barriers, including difficulty in accessing information, poor service delivery, inadequate updating of information and publications that also need to be enhanced. These are explained further below:

- *Strategy Map 1*. Knowledge could be integrated through sharing of information among industry practitioners during the construction process. For an example, the need for improved workmanship and skills can be achieved if information is fully created and organized among industry practitioners and knowledge providers. This requires better communication platforms by considering a good commitment from staff in both public and private agencies. Whilst for the knowledge provider agencies, monitoring can be improved through an effective enforcement and supervision process. The requirement to provide training is suggested as one of the solutions in handling information transfer.
- *Strategy Map 2*. Construction knowledge can be integrated through an improving of the information networks from the knowledge provider agencies. This requires a drastic change of the system that delivers information to the industry

practitioners including the improvement of service delivery; providing effective accessibility to browse information, update information regularly and improved publication are recommended as an approach to integrate construction knowledge in industry. Through this, information can be successful delivered to the industry practitioners. Figure 2 shows the recommendations for knowledge transfer in integrating construction knowledge.

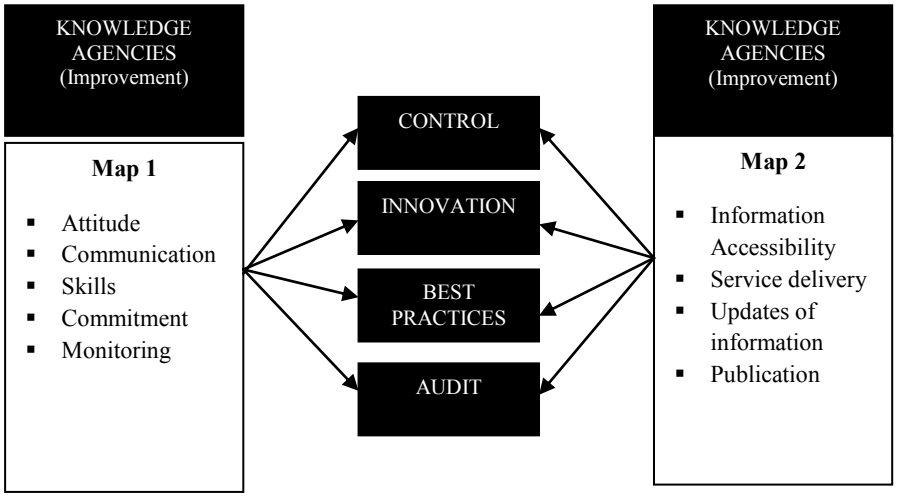


Figure 2 – Knowledge map strategy

CONCLUSIONS

Knowledge can be integrated and optimized through successful transfer of information. The need to upgrade and improve knowledge transfer approaches will facilitate and enhance building performance throughout its lifetime, by educating everyone involved in the construction development process. The practices adopted in Malaysia for knowledge transfer development intended to improve construction knowledge integration have been reviewed and mapped against a model of improved information transfer.

Based on the current issues in construction industry, an analysis of current literature and survey interview on the perception of knowledge transfer applied in the Malaysian construction industry, this paper suggests the following:

i. The need to improve communication and interaction between information providers and parties involved in the construction process should be the first priority to be considered for the success of construction knowledge transfer.

ii. Construction companies and information providers must engage to ensure information transfer systems are set up that are effective thus achieving the goals of improved building quality.

In conclusion, the implementation of better knowledge transfer mechanisms through an effective information distribution strategy is likely to improve construction knowledge. Finally, creating a knowledge chain among the four elements (control, innovation, appraisal, audit) of the proposed model could initiate continuous improvement in the construction industry.

REFERENCES

Abdul-Karib, S. (2009) Integration of the construction industry through partnering: the Malaysian initiatives, Theme Paper, the 15th Asian Construct Conference, October 19-20, Kuala Lumpur, Malaysia.

Alshawi, M. and Underwood, J. (1996) Improving the constructability of design solutions through an integrated system, *Journal of Engineering, Construction and Architectural Management*, 3(1/2), pp 47-67.

Anderson, S.D. Fisher, D.J. and Rahman, S.P. (2000) Integrating constructability into project development: a process approach, *Journal of Construction Engineering and Management*, 126 (2), pp 81-88.

Arditi, D., Elhassan, A. and Toklu, Y.C. (2002) Constructability analysis in the design firm, *Journal of Construction, Engineering and Management*, 128(2), pp 117-126.

Beijerse, R.P. (2000) Knowledge management in small and medium-sized companies: knowledge management for entrepreneurs, Journal of Knowledge Management, 4(2), pp 162-179.

Brackertz, N. and Kenley, R. (2001) Evaluating community facilities in local government: managing for service enablement, *Journal of Facilities Management*, 1(3) pp 283-299.

Chan, T.K. (2009) Measuring the performance of the Malaysian construction industry, *Construction Management and Economics*, 27(12), pp 1231-1244.

Chen, L., and Mohamed, S. (2008), Impact of the internal business environment on knowledge management within construction organisations, *Construction Innovation*, vol.8(1), pp 61-81.

Construction Industry Development Board Malaysia (2010), CIMP implementation roadmap framework, retrieved 1 July 2010, <http://www.creams.com.my/publications/ implementation.pdf >.

Coulson, J. (2004), *Architectural information, a modeling relating project specific information and knowledge*, Masters Thesis, Deakin University, Australia.

de Silva, N., Dulaimi, M., Ling, F. and Ofori, G. (2004), Improving the maintainability of buildings in Singapore, *Building and Environment*, vol. 39(10), pp 1243-1251.

Eliufoo, H.K. (2005). *Knowledge creation and transfer in construction organisations in Tanzania*, PhD Thesis, Royal Institute of Technology.

Faniran, O.O., Love, P.E.D., Treloar, G. and Anumba, C.J. (2001), Methodological issues in design-construction integration, *Journal of Logistics Information Management*, 14(5/6), pp 421-426.

Fong, S.W., Hills, M.J. and Hayles, C.S. (2007), Dynamic knowledge creation through value management teams, *Management in Engineering*, vol.23 (1), pp 40-49.

Georgiou, J., Smith, J. and Love, P.E.D. (2000), A review of builder registration in the state of Victoria, Australia, *Structural Survey*, 18(1), pp 38-45.

Griffith, A. and Sidwell, A.C. (1997), Development of constructability concepts, principles and practices, *Engineering, Construction and Architectural Management*, 4(4), pp 295-310.

Grisham, T. and Walker, D.H.T. (2006). Nurturing a knowledge environment for international construction organizations through communities of practice, *Construction Innovation*, 6(4), 217-231.

Hamid., Z.A. and Kamar, K.A.M. (2010), Modernising the Malaysian Construction Industry, In Proceedings, 18th CIB World Building Congress, May 2010, United Kingdom , retrieved 1 September 2010,<http://cibworld.xs4all.nl/dl/publications/w089_pub340.pdf>.

Hartmann, A. (2006), The role of organization culture in motivating innovative behaviour in construction teams, *Construction Innovation*, 6(3), 159-172.

Ilozor, B., Okoroh, M.I. and Egbu, C.E. (2004), Understanding residential house defects in Australia from the state Victoria, *Building and Environment*, 39(3), pp 327-337.

Jergeas, G.P.E., and Van der Put, J. (2001), Benefits of constructability on construction projects, *Construction Engineering and Management*, vol.127(4), pp 281-290.

Kamarani, M.K.A. (2010) Reforming Malaysian construction technology towards higher dynamism, retrieved 10 February 2010, <http://www.asian-forum.net/conference/paper/07-2002PaperMalaysia68E.pdf>.

King, G. (2002) Policing the building industry, Current Issues In Regulation: Enforcement and Compliance Conference, Australian Institute of Criminology in conjunction with the Regulatory Institutions Network, RSSS, Australian National University and the Division of Business and Enterprise, University of South Australia, September 2-3, Melbourne, Australia. http://www.aic.gov.au/events/aic%20upcoming%20events/2002/~/media/conferences/regulation/king.ashx.

Li Hua, R. (2009) From technology transfer to knowledge transfer: a study of international joint ventures project in China, retrieved 26 May 2009, <http://www.camot.org/files/From_Technology_Transfer_to_Knowledge_Transfer.pdf>

Loh, W.S. (2007) *The development of a knowledge sharing culture in the construction industry*. Masters Degree Thesis, Universiti Teknologi Malaysia.

Manu, C. and Walker, D. (2006) Making sense of knowledge transfer and social capital generation for a pacific island aid infrastructure project, *The Learning Organization*, vol.13 (5), pp 475-494.

Mills, A., Love, P.E.D. and Williams, P. (2009) Defects costs in residential construction, *Journal of Construction Engineering and Management*, 135(1), 12-16.

Mohamed, S.F. and Anumba, C.J. (2006) Potential for improving site management practices through knowledge management, *Construction Innovation*, vol.6(4), pp 232-249.

Nima, M.A., Abdul-Kadir, M.R. and Jaafar, M.S. (2001) Evaluation of the role of the contractor's personnel in enhancing the project constructability, *Structural Survey*, vol.19(4), pp 193-200.

Nonaka, I. and Takeuchi, H. (1995) *The knowledge- creating company: How Japanese companies create the dynamic of innovation*, Oxford University Press, New York.

Panuwatwanich, K., Stewart, R.A. and Mohamed, S. (2009) Validation of an empirical model for innovation diffusion in Australian design firms, *Construction Innovation*, vol.9(4), pp 449-467.

Quintas, P., Lefrere, P. and Jones, G. (1997) Knowledge management: a strategic agenda, *Long Range Planning*, vol.30(3), pp 385-391.

Ruikar, K., Koskela, L. and Sexton, M. (2009) Communities of practice in construction case study organisations: Questions and insights, *Construction Innovation*, 9(4), pp 434-448.

Saghatforoush, E., Hashim, S., Jaafar, M.D. and Abdul-Kadir, M.R. (2009) Constructability implementation among Malaysian Building Contractors, *Scientific Research*, 29(4), pp 518-532.

Shaffin, N. (2009) Malaysia country report, The 15th Asia Construct Conference, October 19-20, Kuala Lumpur, Malaysia.

Titus, S. and Brochner, J. (2005) Managing information flow in construction supply chains, *Construction Innovation*, 5(2) pp72-82.

Walker, D.H.T and Shen, Y.J. (2001) Integrating OHS, EMS and QM with constructability principles when construction planning- a design and construct project case study, *The TQM Magazine*, 13 (4), pp 247-259.

Wong, S. (1996) Quality in Construction: An Overview of the Report of the Construction Quality Working Group, In Proceedings, National Engineering Conference: Engineering Tomorrow Today; the Darwin Summit; Preprints of Papers. Barton, A.C.T.: Institution of Engineers, Australia, 1996: pp261-266.

Ying, L.J. and Pheng, L.S. (2007) Enhancing buildability in China's construction industry using Singapore's buildable design appraisal system, *Journal of Technology Management in China*, vol.2(3), pp 264-278.

Zaidi, M.A. and Davies, H. (2009) A question of continuing control - balancing building quality of housing and building codes, In Proceedings, Building Australia's Future International Conference, September 20-23, 2009, Gold Coast, Australia.

Zaidi, M.A. and Davies, H. (2010) A prospective study on building quality: enforcement of control in the Australian Housing Industry, In Proceedings, Sustainable Building Conference: Innovation and Transformation, May 26-27, 2010, Wellington, New Zealand.

Winning Work: An Action Research Approach to Improve Experiential Learning through Industry Simulation in a Construction Management Course

Virginia Mehrtens
School of Natural & Built Environments
University of South Australia, Adelaide, Australia

ABSTRACT

This paper reports an action research enquiry undertaken to improve experiential learning in a construction management course through the implementation of an industry simulation. The first cycle of action research is described and discussed. Theoretical literature relating to action research and experiential learning is reviewed as it influenced the process. The planned action drew upon industry input to simulate in the classroom the procurement process undertaken by a construction company in preparing a tender submission for a building project. In the context of a broader study of the procurement of projects in the construction industry students participated in teams in a staged scenario entitled Winning Work. An industry guide tutored students at each stage of the process as they prepared specific deliverables. Each student also wrote in their learning journal reflecting upon their experience of preparing the tender submission with the industry guide. Evaluation of the planned action took multiple forms and indicated that student engagement was enhanced by learning based on experience. Implications for future teaching strategies and action research are discussed.

KEYWORDS

action research, experiential learning, construction management

INTRODUCTION

This paper describes an action research enquiry undertaken in 2010, when the focus of the action research was to improve experiential learning for students in a construction management course. The perceived problem, the plan, the action, the evaluation of the effect of the action and implications are described. Theoretical literature relating to action research and experiential learning is reviewed as it influenced the action research process.

Context

In 2007 University of South Australia (UniSA) introduced a new Teaching and Learning Framework (University of South Australia 2007) with a commitment to increased student

engagement by 2010 through experiential learning, using some preferred mechanisms including authentic and active learning in workplaces and in the classroom. In implementing the Teaching and Learning Framework, the School of Natural & Built Environments (School of NBE) at UniSA involved all academic staff through a network of working groups, and also engaged as a consultant Martin Jenkins, Academic Manager at the Centre for Active Learning (CeAL) at University of Gloucestershire in the UK, „an international centre of excellence reviewing, developing, promoting and embedding inclusive and exemplary active learning for students throughout the University of Gloucestershire' (University of Gloucestershire n.d.). The particular approach to enhancing experiential learning described in this paper was influenced by the work of Martin Jenkins and CeAL.

Experiential learning

The theoretical basis of experiential learning derives from the work of Kolb (1984) who in turn built on earlier work by other scholars in the fields of human learning and development. Kolb and Kolb (2005) comprehensively review the earlier development of experiential learning theory (Kolb 1984) and subsequent research and developments. Kolb and Kolb (2005, p.194) identify six propositions that form the foundations of experiential learning theory and most relevant in the context of the action research enquiry described in this paper is the statement that „Learning is best conceived as a process, not in terms of outcomes. To improve learning in higher education, the primary focus should be on engaging students in a process that best enhances their learning- a process that includes feedback on the effectiveness of their learning efforts' (p.194). Experiential learning theory defines learning as: „the process whereby knowledge is created through transformation of experience. Knowledge results from the combination of grasping and transforming experience' (Kolb 1984, p.41). The resulting approach is based upon a learning cycle „that shows how experience is translated into concepts, which in turn are used as guides for active experimentation and the choice of new experiences' (Healey and Jenkins 2000, p.186). Kolb (1984, p.41) identified four stages to be followed sequentially, although a learner may enter the cycle at any stage, and should go through the cycle repeatedly. It is clear that feedback and reflection upon experience are critical elements in experiential learning.

The four stages of the Experiential Learning Cycle are shown in Table 1, including some variations to the language used by other authors to describe each stage. The simpler language is more accessible and particularly useful when planning learning activities.

Table 1 – Alternative descriptions of the four stages of Kolb's Experiential Learning Cycle

Kolb (1984)	**Jenkins (1998), cited in Healey & Jenkins (2000, p.187)**	**Race (1993) cited in Healey & Jenkins (2000, p.194)**
Active Experimentation (AE)	PLAN Where the learner is trying to plan how to test a model or theory or plan for a forthcoming experience	Wanting
Concrete Experience (CE)	DO Where the learner is actively experiencing an activity	Doing
Reflective Observation (RO)	OBSERVE Where the learner is consciously reflecting back on that experience	Feedback
Abstract Conceptualization (AC)	THINK Where the learner is being presented with/or trying to conceptualise a theory or model of what is (to be) observed	Digesting

There are two critical characteristics of experiential learning that warrant further examination: it is a student-centred approach, and the role reflection is critical. If it is accepted that „the aim of teaching is simple: it is to make student learning possible' (Ramsden 2003, p.7) then effective teaching requires an understanding of the learning process. Experiential learning theory advances that understanding and through the Experiential Learning Cycle provides some guidance for teaching.

There is a range of ways to think about teaching. Experiential learning is at the basis of thinking about teaching as student-centred / learning-oriented and not teacher-oriented / content-oriented, with a student-focused strategy aimed at students changing their conceptions and not a teacher-focused strategy with the intention of transmitting information to students (Prosser and Trigwell 1999, p.153). The focus is on what the student does, not what the student is, or what the teacher does (Biggs 1999, p.22). Experiential learning therefore requires a commitment to „teaching as making learning possible' (Ramsden 2003, p.7), rather than „teaching as telling or transmission', or „teaching as organising student activity'. However, Ramsden (2003, p.113) also notes that „student activity does not itself imply that learning will take place'. It is important that students go through each stage of the experiential learning cycle. As noted by Gibbs, a long-time contributor of practical guidance in teaching and learning: „It is not enough just to do, and neither is it enough just to think. Nor is it enough simply to do and think. Learning from experience must involve links between the doing and the thinking' (1988, p.9).

The question remains as to how to apply the theory and engage students in the Experiential Learning Cycle. Gibbs (1988) provides some practical methods. University of South Australia (2007) provided some guidance on the preferred mechanisms for implementing experiential learning. The Centre for Active Learning developed an approach, extended from Kolb's (1984) Experiential Learning Cycle, and also Performances of Understanding (Blythe and Associates1998, cited in University of Gloucestershire, n.d). More usefully, CeAL developed some planning tools for use in the design and the development of new courses and individual learning activities (University of Gloucestershire, n.d.), all consistent with Kolb's Experiential Learning Cycle, and further informed by research on learning design (Oliver 1999, Boud and Prosser 2001). This range of guides provided a framework to utilise in the action research enquiry described in this paper.

THE ACTION RESEARCH ENQUIRY

The enquiry consisted of one cycle of action research, which is one of a range of methods (Kuit, Reay & Freeman 2001) for use in reflective teaching practice where our own teaching practice becomes the object of systematic enquiry (Brookfield 1996, p.39). Prosser and Trigwell (1999, p.166) note that good teaching is characterised by a continuing effort to evaluate our teaching for improved learning. Action research applied in teaching is a process in which teachers „observe situations in their classrooms that are less than optimal, they identify the problem, they think about what and how to change, they make the change, they evaluate the impact of the change on the situation and begin again' (Collins & Speigel, 1995 p.118). The Kemmis & McTaggart (1988, cited in Kemmis 1999) approach to action research is based on repeated application of plan, act, observe and reflect.

The approach as implemented was based on the guidance of Kemmis (1999), Altrichter et al (2002) and Collins & Speigel (1995), and had been used to improve the likelihood that students would use a deep approach to their learning in this same course (Mehrtens 2007). Although the results of action research are not to be generalised, it is recommended practice (Collins & Speigel 1995) to communicate with others about the research and share the knowledge. The enquiry is described and discussed as it unfolded, to convey the approach, outcomes and implications.

THE PROBLEM

There was a requirement to fulfil the university's commitment to increase experiential learning experience for students. Construction Management 3 is a fourth year option course in the Bachelor of Construction Management and Economics program at UniSA.

In 2010 there were 42 students (98% male). Approximately 70% of the students had at least 100 days industry experience, some continued to work in construction firms. Other students had little or no industry experience.

The university approved assessment structure for the course, not able to be changed, included two assignments (weighting15% and 35%), reflective learning journal (15%) and open-book exam (35%). The second assignment as designed in previous years provided an opportunity to implement change at the same time as sensibly limiting the scope of the action.

The assignment and associated learning activities used in the previous year was analysed and assessed as experiential learning based on the checklist for active engagement developed by the CeAL (University of Gloucestershire, n.d.), and elaborated by direct reference to the framework of influences on high quality learning activities (Boud & Prosser 2001). The checklist and the results of that assessment are shown in Table 2.

Considering the results of the analysis as shown in Table 2, there were several areas with scope for improvement. Written summative feedback to students was provided, but with very little opportunity to use that feedback within the course. Formative feedback, although offered, was not often sought by students. Flexibility of delivery, and increasing inclusivity, were both challenges. There was scope to move to a more authentic focus for the learning activities. In the planning for 2010, what could be done to improve the experiential learning for students in the course?

Table 2 – Analysis of experiential learning in previous assignment and associated learning activities

Areas influencing high quality learning activities	**Principles**	**Prompts**	**Not at all**	**To some extent**	**To a great extent**
Engage learners	**Learner empowerment**	To what extent are students encouraged to take greater responsibility for their learning as they progress through their learning?		X	
		What scaffolding is provided to help equip students with the demands of the learning activity?		X	
		What support is in place for new skills?		X	
	Peer collaboration	To what extent are students provided with opportunities for working within learning communities through collaborative learning and peer interaction?		X	
		To what extent have the students been inducted to group work?		X	

	Feedback	Are students provided with regular opportunities to receive feedback? (Tutor and peer)? What opportunities does the learning activity provide for students to engage with their peers and gain feedback from them? How is formative and summative assessment used to facilitate student engagement? Do student have opportunities to use the feedback provided?	 X X	X X	
	Delivery	To what extent is flexibility in delivery allowed? How does the learning activity take account of different learning styles?	X X		
	Inclusion	To what extent does the design and delivery show awareness of diversity and cultural issues and students individual learning needs? How does the learning activity engage with students as individuals?(affective support) To what extent are students prepared to make connection with different ideas or groups of people?	 X	X X	
Acknowledge the learning context	**Reflection**	Are students provided with opportunities for reflection, both individual and social (public)? Have students been provided with scaffolding learning activities and experience of reflection? How does the learning activity help students see the transfer of current learning to other contexts and situations?		 X	X X
	Authenticity	To what extent does the nature of the learning activity have an authentic focus? To what extent does the learning activity and resources used provide substitution for direct work experience?	 X	X	
Challenge learners	**Complexity**	Are students engaged in complex, unstructured problems? Have students been involved in designing some aspects of the learning activity?	 X	X	
	Exploration	Are students stimulated to seek and explore new information and knowledge?		X	
Provide practice	**Articulation**	To what extent are students provided with opportunities to articulate their learning (to self and others)? Are students provided with examples of the kind of work expected of them?		X X	

THE PLAN

The planned action was developed with four elements, all focused on the assignment and associated learning activities for 2010 and taking account of three selected areas of experiential learning with scope for improvement as previously identified i.e. authenticity, feedback and reflection.

Planned element 1: to introduce more authenticity by staging a scenario, Winning Work, to simulate an industry process in the class

The Procurement Manager of a locally based construction company with annual turnover approximately $350 million was engaged to prepare a scenario and guide the 42 students through the preparation of a Tender Submission, replicating as far as possible the processes undertaken in the company's office. Before the scenario was introduced to students, it was planned that students would undertake a wider study of procurement of building projects, including examination of a range of procurement strategies commonly used in the industry. In 2010 the Australian Government's economic stimulus program Building the Education Revolution (BER) was being implemented across the country, and with access to published sources and a presentation by a Government official, students would also examine the different procurement strategies utilised by each state for the BER. When the scenario for the assignment was introduced to students it would then be placed firmly within the context of the BER, and based on a BER project under construction at that time.

The scenario was developed to unfold in 4 stages. At each stage, the Procurement Manger would provide specific information and resources, and guidance for set tasks for student groups to undertake before the next stage, and also meet with each student group to discuss current tasks and review draft deliverables from the tasks set in previous stages. The authenticity of the learning activity would be further emphasised by providing to each student a full set of printed tender documents including all drawings and specifications. Students would also inspect the site where the building was already under construction.

The teacher's role in the staging the scenario would include developing the learning design (as described in this paper), facilitating the learning activities including each session with the Procurement Manager, providing learning resources, support and specific coaching to students, reviewing submissions with the Procurement Manager and providing formative and summative feedback to students.

Planned element 2: to provide multiple opportunities for feedback, both formative and summative

It was planned that students would receive formative feedback from the Procurement Manager at each stage of the scenario. They could then act on that feedback to review and improve the deliverables before the final Tender Submission. Summative feedback, after the Procurement Manager reviewed the Tender Submissions, would be written (according to a framework of previously advised assessment criteria) and also provided in a subsequent class session scheduled for the Procurement Manager to return the Tender Submissions and discuss his feedback and students' response to that feedback.

Planned element 3: to strengthen the emphasis on reflection and prompt students to see the transfer of current learning to other context

It was planned to maintain the requirement in the course for students to write a reflective learning journal, with the added specification that each student write at least one entry based on their experience of participating in the Winning Work scenario. Scaffolding for the reflective journal would include prompting questions. To stimulate students to transfer their current learning to other contexts, a final session was planned, after the return of their Tender Submissions with feedback from the Procurement Manager, to prompt them to discuss their reflections within each group and formulate theoretical guidelines for good practice in preparing a future tender submission.

Planned element 4: to evaluate the planned action through multiple sources

There would be three sources of feedback from students to aid evaluation.

- The content of entries in the reflective learning journals would be analysed to identify themes as they arose but also seek evidence that the student might transfer their learning to other contexts.
- The student perceptions of their experience of participating in the Winning Work scenario as obtained through a specific survey to be administered in class at the end of the scenario.
- The student perceptions of their teaching and learning experiences in the overall course as obtained through standard online evaluation instruments at UniSA

THE ACTION

Students participating in the industry simulation scenario: Winning Work

The scenario proceeded over as planned in 4 stages over a period of 6 weeks. At the first class session each student collected a full set of printed tender documents and received a

briefing document. Students worked in self-selected teams of 4 people. For each session the classroom was set with a work table for each student team and a large conference table where each team met separately with the Procurement Manager.

Each class session began with the Procurement Manager introducing the new stage with a discussion of the context, objectives and issues. He then briefed the students on the tasks and deliverables required for that stage, and provided resources and guidance. In this period of the session students also practiced some aspects of the required tasks with immediate feedback from the Procurement Manager.

In the next phase of the session, students worked in their teams to review draft deliverables from the previous stage, discuss the new information and tasks, plan how to proceed, and also prepare to meet with the Procurement Manager to seek advice, ask clarifying questions, show draft deliverables and seek feedback and advice on how to proceed and improve them. Each team was scheduled to meet with the Procurement Manager at an appointed time in each session. When all teams had met with the Procurement Manager he had obtained an overview of the current issues, problems and questions arising from the whole class. In the final phase of the class session he then discussed these with the all of the students and responded to further questions.

These class sessions required careful planning and scheduling, and considering Ramsdens's (2003) theories of teaching, although the intention was „for teaching as making learning possible', it was more akin to „teaching as organising student activity'. The nature of the student activity was however an authentic industry based process involving peer collaboration, feedback and opportunity for planning, doing and reflection. Beyond the scheduled sessions, in their own time, the student teams worked on preparing the deliverables. Student attendance was close to 100% for all of the class sessions with the Procurement Manager.

Students receiving and acting on feedback

As described above, the Procurement Manager provided informal formative feedback to students in each scheduled class session. Students did use these opportunities to obtain feedback and then revise and improve their final submission. After the Procurement Manager had reviewed all of the Tender Submissions, written summative feedback was also prepared using a framework of previously published criteria. Finally, when the Tender Submissions were returned to students, the Procurement Manager provided general feedback to the whole class and met with each student team to discuss their submission and provide feedback beyond the formal written assessment and feedback.

Students reflecting on their experience and thinking about transferring that learning

Immediately following the return of Tender Submissions and the feedback session with the Procurement Manager, there was a learning activity where each team discussed the overall experience and the lessons learned and formulated guidelines of good practice for preparing a Tender submission. Students were able to readily formulate their guidelines based on their recent experience. All guidelines from every team were then recorded and displayed, and in a whole class activity, involving much discussion, the guidelines were categorised and grouped to formulate a final set of guidelines for good practice.

35 of the 42 students wrote a specific entry in their reflective learning journal on the experience of participating in the scenario. It is not clear why other students did not write a reflection. Three themes emerged from the submitted reflections, as shown in Table 3, with excerpts from student reflections tagged with relevant principles from the CeAL checklist for active engagement.

Table 3 – Analysis of excerpts from students' reflective learning journals

Relevant principles from CeAL checklist for active engagement. Refer to Table 2 above.	**Excerpts from students' reflective learning journals**
Major Theme	***Students were engaged by the authenticity of the industry based scenario.***
Peer collaboration Feedback Reflection Authenticity Articulation	„This by far was the best assignment I have worked on throughout my time at the university because it clearly related to the industry I will be working in and the amount of information that goes into a tender submission. …It makes me have a greater respect for project managers because of the great pressure that need to deal with, when going over all the cost from the sub-contractors and selecting the best price for the work. Many factors come into this when selecting a price received from sub-contractors for example cost, is everything included in the works, is it thorough are they reliable. This assignment helped me understand that point.'
Reflection Authenticity	„Procurement is the means by which the industry survives. Without winning work a company will not last long. The tasks which we carried out as part of the assignment were reflective of industry practices. This provided a good perspective for a student aspiring to have a career in the construction industry.'
Peer collaboration Reflection Authenticity Articulation	„I have never been involved in an assignment which has seen the availability of such extensive and detailed documentation; this has been excellent as it gives you a very good idea of all the documents that are actually involved in a construction project no matter how simple. I was also previously unaware of how stressful tender submission due dates can be. The PM was able to provide us with an activity that simulated this environment and gave the class an idea of how quickly decisions have to be made on days such as this. The activity required our groups to select the "best price" from a range of prices for various trade packages in a given time frame. This assignment I found was very good at relating back to the industry, as it presented a very real scenario.'
Major Theme	***Students valued and did act on the constructive formative feedback.***
Peer collaboration Feedback Reflection	„The assignment was a great way to learn how the industry goes about how to procure work for their company. I learnt how a tender submission is complied together and the specific documents and information in what must be provided in the submission. By completing the assignment in stages, weekly,

Authenticity Articulation	and having the opportunity to present drafts in class sessions it enabled my group and I to ask questions in which we were unsure and to gain constructive feedback in completing the next step of the assignment. By doing this assignment, it exposed me to documentation and information in which I have not had the chance to work with closely, such as creating an environmental management plan. It also showed me the amount of work put into a tender submission, and how small errors can affect the chances of the company winning the tender. Overall I enjoyed the project, my group and I worked well consistently and collaborated well together. I think the time frame we were given to complete each task weekly was very adequate and it was a great way to learn how a tender submission was put together.'
Minor Theme	***Some students indicated that they were likely to transfer learning from this experience to other contexts.***
Reflection Authenticity	„This assignment has encouraged me to be more involved during the tender period at my work with the estimator and head project division manager in understanding the approach to pleasing the client's needs as well as pricing the works.'
Reflection Authenticity	„Knowing more about the roles of procurement teams, or estimators as referred to at my place of employment, makes me more inclined to get involved within the department to build my knowledge of this process. As part of the company's graduate program some time must be spent in an estimating role and I look forward to developing my skills in a real life scenario in this department. Since taking part in my current employer's scholarship program I have been exposed to a number of different departments and roles including programming, contract administration, project coordination and management of various tasks however I have had no experience yet in procurement/winning work. As a result of this learning I feel that in order to enhance my knowledge some time spent in the estimating department will provide me with both new and enhanced skills in the area of procurement.'
Reflection Authenticity	„I was able to relate to this learning activity quite well as I have been involved with preparing quotes and tenders for the past couple of years. I could identify with the pressure and the importance of being well organised on the close of tender date. The processes were quite similar to the processes that we follow at work. Witnessing how other companies prepare their tender helps to identify ways in which we can improve our tender preparations. This was a positive outcome.'

Students reporting their perceptions of the teaching and learning experience

The content of 35 student reflections (representing 85% response rate) was analysed and the major themes were summarised in Table 3 above.

70% of students completed the specific survey (10 closed questions, 2 open questions) of student perceptions of their experience of participating in the Winning Work scenario. The most positive responses (more than 80% strongly agree or agree) were in relation to the following statements:

- *This assessment task is related to my future in the construction industry.*
- *The industry guide provided clear direction.*
- *The way in which the scenario was staged over several weeks suited my approach to learning.*

- *During the process I received feedback on draft deliverables that was constructive and useful.*
- *I learnt new skills through undertaking the scenario.*

The least positive responses (60% strongly agree or agree) indicated that the assignment did not provide a challenge for some students, and also that the feedback on the final submission could have been more constructive and useful.

65% of the students completed text responses to the open questions. The best aspects identified by students were very similar to the content and themes also evident in their reflective learning journals: the authenticity of the scenario, and the value of formative feedback. Asked how the experience of undertaking a similar scenario could be improved in future, there were strong responses that recommended more clear assessment criteria, and more direction and assistance with some of the tasks and deliverables. Three students noted specifically the effect of their lack of industry experience e.g. *'I found some aspects difficult due to not having any job experience in this area'*. Other students commented that their industry experience assisted them e.g. *'My job experience meant I could tackle the scenario with confidence'*.

There was a 20% response rate for the standard online evaluation instrument at UniSA, offered to the students 4 weeks after the completion of the scenario. The most positive responses were in relation to the following statements:

- *The staff teaching in this course showed a genuine interest in their teaching.*
- *I felt there was a genuine interest in my learning needs and progress.*
- *The least positive responses were in relation to the following statements suggested*
- *The course developed my understanding of concepts and principles.*
- *I have received feedback that is constructive and helpful.*

Text responses valued that the course was *'practical and industry related'*, but sought *'clearer expectations'*.

EVALUATING THE ACTION

Collins and Spiegel (1995, p.120) provide a framework to stimulate evaluation of the action and lead to a new action plan for the next cycle of research.

What impact did this change have on the students?

The students felt satisfied. As they noted „it clearly related to the industry' and „it provided a good perspective for a student aspiring to have a career in the construction industry.' Considering the characteristics of the industry simulation and the process of the scenario, the student satisfaction is consistent with their involvement in a holistic process:

„the integrated functioning of the total person-thinking, feeling, perceiving and behaving' (Kolb and Kolb 2005, p. 194). There are indications that they were more likely to be engaged in the learning process and enjoying their participation in the industry simulation because they were „learning to satisfy internal demands' (Prosser and Trigwell 1999, p.75).

What impact did this change have on the students' learning?

The students wanted to learn. The change provided an opportunity for students to learn through doing, feedback and making sense of what they had done. There is evidence for this in the range of indicators from the students' reflections and evaluations. Considering these indicators in relation to the CeAL checklist for active engagement (refer to Table 2), the strengths of industry simulation were particularly in the areas of authenticity, feedback, peer collaboration and reflection. The plan as implemented focused on „what the students do', with the teaching mainly directed to „making learning possible', although in future there is scope to reduce some of the remaining elements of „teaching as telling' as described by Ramsden (2003, p.115).

What did the teacher learn about students?

Every student is an individual, with a unique set of prior knowledge and experience. The student reflections and evaluations confirmed that student related factors, such as prior knowledge and ability, do influence the student's perceptions of the learning task. This was also one of the key findings of a previous action research enquiry (Mehrtens 2007). It is consistent with experiential learning theory (Kolb 1984) and the emphasis on the „presage factors' identified by Biggs (1999, p.21). The student evaluations show that some students sought more direction and assistance, and it is possible and likely that it was the students who did not have some related prior knowledge and experience. In future, it will be necessary consider the variation in prior experience of the students, because although it may not be a necessary pre-requisite for their learning, it does influence how the student perceive the learning task and therefore how they approach it.

What did the teacher learn about learning?

Students are likely to want to learn if they are engaged in learning process which they perceive as valid, and they particularly value feedback throughout that process. On the basis of the action research enquiry reported here, with the positive outcomes for student engagement and satisfaction, then experiential learning theory and Kolb's (1984) Experiential Learning Cycle do together provide a valuable basis for thinking about learning. However in order to translate that theory into practice, it is necessary to take a deliberate approach to learning design as described by Oliver (1999). The practical

guidance provided by the resources of Centre for Active Learning (University of Gloucestershire n.d.) and Boud and Prosser (2001) informed the learning design and contributed to the effectiveness of the learning activities and the positive outcomes for students.

What did the teacher learn about the subject matter: in this case an industry simulation to enhance experiential learning?

The practical reality of the construction industry exerts a powerful force on the students. The teacher may think of them as students, but it is evident from their reflections and evaluations that they are more likely to perceive of themselves as prospective or existing employees in the construction industry. As one student suggested in evaluation- *'Emphasise the fact that the tender submission is for a client and it is not just submitting an assignment – treat it more like a job than uni work'*. In order to make learning possible, then „uni work' must be more real and valid for the learners. This action research enquiry has shown that an industry simulation, in conjunction with careful learning design, does provide an effective mechanism to introduce that essential authenticity, and so improve experiential learning.

Should this change become a regular feature?

Learning designs should be devised to provide experiential learning opportunities, and industry simulations would be an effective mechanism to provide the authentic focus for the learning activities. Authenticity is one of multiple features of experiential learning, although it is a powerful motivator to engage learners. Design for experiential learning should continue, considering not only authenticity but also other aspects such as learner empowerment, feedback, reflection and complexity as prompted by the CeAL checklist for active engagement and consistent with Kolb's (1984) Experiential Learning Cycle.

What new problems emerged that the teacher now wants to research?

Some areas remain with scope for future improvement and action research. In their evaluations some students noted the need for more assistance with new skills and activities, so learner empowerment remains to be addressed, particularly in view of the differences in prior knowledge and experience. Complexity must also be reviewed. Some students reported that they were not challenged by the process. The industry simulation as implemented did lack some opportunities for students to be engaged in complex unstructured problems.

CONCLUSION

This action research enquiry was the first cycle and there is potential to further improve the experiential learning in the course that was the focus of this research. Evaluation of the effect of the planned action took multiple forms and indicated that student engagement was enhanced by learning based on experience in an industry simulation. The strengths of industry simulation, as evaluated by students, were particularly in the areas of authenticity, feedback, peer collaboration and reflection. The industry involvement provided the key feature of authenticity; the other features resulted from deliberate learning design.

There are several implications for future teaching strategies. The focus of teaching should be to make learning possible. It is preferable think of the students as learners. Consider every learner an individual with a unique set of prior experiences and knowledge which influence their perceptions of learning tasks and their approach to learning. Empowering and challenging learners is therefore necessary. Kolb's (1984) Experiential Learning Cycle provides a valuable basis for thinking about learning, however in preparing experiential learning designs it is effective to also utilise more practical guidance, for example the checklist for active engagement ((University of Gloucestershire n.d.) and the framework of influences on high quality learning activities (Boud and Prosser 2001). Action research provides an effective approach to reflect upon and improve teaching practice for the benefit of learners.

REFERENCES

Altrichter, H., Kemmis, S., McTaggart, R. and Zuber-Skerritt, O. (2002) „The concept of action research', *The Learning Organzation*, vol. 9, no, 3, pp.125-131.

Biggs, J. (1999) *Teaching for Quality Learning at University*, Open University Press, Buckingham.

Boud, D. and Prosser, M. (2001) „Appraising new technologies for learning: a framework for development', *Education Media International*, vol.39, no.3, pp.237-245.

Brookfield, S 1995, Becoming a critically reflective teacher, Jossey-Bass, San Francisco.

Collins, A. and Speigel, S. (1995) „So you want to do action research?' in *Action research: Perspectives from teachers' classrooms*, eds S Speigel, A Collins & J Lappert, viewed January 3, 2001,

www.enc.og/professional/research/journal/science/document.shtm/ input >.

Gibbs, G. (1988) Learning by doing: a guide to teaching and learning methods. Further Education Unit, London, viewed 25 February 2010, <http://www2.glos.ac.uk/ gdn/publ.htm#other>.

Healey, M. and Jenkins, A. (2000) 'Learning cycles and learning styles: the application of Kolb's Experiential learning model in higher education', *Journal of Geogr*aphy, vol.99, pp.185-195.

Kemmis, S. (1999) „Action research' in *Issues in educational research* eds JP Keeves & G Lakomski, Pergamon, New York, pp.150-160.

Kolb, A.Y. and Kolb, D.A. (2005) „Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education', *Academy of Management Learning & Education*, vol.4, no.2, pp.193-212.

Kolb, D.A. (1984) *Experiential learning: experience as the source of learning and development*, Prentice-Hall, Englewood Cliffs, New Jersey.

Kuit, J.A., Reay, G. and Freeman, R. (2001) „Experience of Reflective Teaching', *Active Learning in Higher Education*, vol.2, pp.128-142.

Mehrtens, V. (2007) 'Improving Teaching and Learning in a Construction Management Course using Action Research', Proceedings: 2007 Conference of the Australasian Universities Building Education Association, Swinburne University of Technology, 248-259, Melbourne, Australia, AUBEA 2007, (Russell Kenley Ed).

Oliver, R. (1999) „Exploring strategies for on-line teaching and learning', *Distance Education*, vol.20, no.2, pp.240-254.

Prosser, M. And Trigwell, K. (1999) *Understanding Learning and Teaching: The experience in Higher Education*, SRHE and Open University Press, Buckingham.

Ramsden, P. (2003) *Learning to Teach in Higher Education*, 2nd ed. Routledge Falmer, London.

University of Gloucestershire, n.d, Centre for Active Learning, viewed 15 February 2010, <http://resources.glos.ac.uk/ceal/>.

University of South Australia. (2007) Teaching and Learning Framework, viewed 10 February 2010, <http://www.unisa.edu.au/ltu/staff/start/framework/default.asp>.

Setting Academic Standards for Tertiary Education in the Construction Industry

Sidney Newton and Rosalie Goldsmith
Faculty of Built Environment
The University of New South Wales, Sydney, Australia

ABSTRACT

The Australian Government recently established a new national regulatory and quality agency for higher education, the Tertiary Education Quality and Standards Agency (TEQSA). TEQSA will register providers, carry out evaluations of standards and performance, protect and assure the quality of international education and streamline current regulatory arrangements. As a precursor to TEQSA, the Australian Teaching and Learning Council has been commissioned to work with clusters of discipline communities to begin to specify how threshold learning outcomes particular to each discipline might be used as a basis for academic standards. This paper details the work of the Building and Construction discipline. A draft set of six TLOs have been developed to benchmark the graduate outcomes from Bachelor-level study in building and construction management in Australia. The draft TLOs have broad consensus agreement across the building and construction discipline and are evidence-based. It remains for the TLOs to be made more specific through further notes and examples, and for the representation of industry, students and recent graduates in the process to be improved.

KEYWORDS

academic standards, threshold learning outcomes, professional accreditation, building and construction.

INTRODUCTION AND BACKGROUND

> *"The new [Tertiary Education Quality and Standards Agency] will be at the centre of a new standards-based quality assurance framework. The framework will establish minimum standards that higher education providers are required to meet in order to be registered and accredited, as well as academic standards… Key to the success of the new quality assurance arrangements–and meaningful academic standards in particular–will be the active involvement of the academic community. It will be critical to strike the right balance to avoid generalisation or over prescription… Discipline communities will „own' and take responsibility for implementing academic standards (working with professional bodies and other*

stakeholders where appropriate) within the academic traditions of collegiality, peer review, pre-eminence of disciplines and, importantly, academic autonomy." (Australian Government, 2009:32)

The Australian Government is in the process of establishing a new national regulatory and quality agency for higher education, the Tertiary Education Quality and Standards Agency (TEQSA). TEQSA will have responsibility for the registration of all higher education providers, undertake the evaluation of the standards and performance of all such providers, protect and assure the quality of international education undertaken by the higher education sector and will seek to improve and streamline all current regulatory arrangements in Australia's Higher Education system. As a precursor to the establishment of TEQSA, and in particular response to Recommendation 23 from the Bradley Review of Higher Education (Bradley, 2008:137), in 2010 the Australian Teaching and Learning Council (ALTC) was commissioned by the Australian Government to undertake a demonstration program to work with those communities of academic, professional, scholarly and business groups who constitute the broad range of discipline stakeholders represented in the higher education sector. The principal objectives of this Learning and Teaching Academic Standards (LTAS) project are to:

(i) engage clusters of discipline communities in the standards-setting agenda

(ii) define the appropriate level of detail and specificity for threshold learning outcomes on a discipline-by-discipline basis

(iii) achieve national agreement on a set of threshold learning outcomes for each discipline

(iv) articulate the framework of relationships between threshold learning outcomes and existing accreditation standards.

A total of nine broad discipline clusters have been identified, defined according to Australian definitions of Field of Education from the Australian Standard Classification of Education. Each broad cluster was supported by a designated Discipline Scholar. The discipline clusters are:

- Architecture, Building and Design
- Business, Management and Economics
- Arts, Social Sciences and Humanities
- Health, Medicine and Veterinary Science
- Science
- Education
- Creative and Performing Arts
- Engineering and ICT
- Law

For the Architecture, Building and Design cluster, the Discipline Scholar role has been split equally between Architecture and Building, with funding from July 2010 until July 2011. The key deliverable is a document that defines the nature and extent of the relevant discipline, establishes a set of Threshold Learning Outcomes (TLOs) as determined by

that discipline community, provides evidence of the development process and the extent of the support for and endorsement of the findings, and relates the TLOs to other relevant professional and international benchmark statements.

Central to all of this is the possibly vague notion of a discipline. In the current context, a discipline largely equates to a particular field of study and is measured operationally in terms of its particular subject matter, the skills and knowledge it requires, the methods and techniques it applies, and in the broad sense of a particular vocational destination. Even in that context, the notion of a discipline remains relatively amorphous. One of the critical tasks for each Discipline Scholar has been to constitute the nature and extent of their discipline. For the Building Discipline this involved establishing a Building Discipline Reference Group, comprising senior representation from various key stakeholder groups. There are currently 19 members of the Building Discipline Reference Group, representing the Australian Deans of Built Environment and Design, a range of relevant professional bodies, a mix of industry/employers, final year students and recent graduates, and academics from across the sector. The group has an independent Chair and the Discipline Scholar is an observer only.

RESEARCH METHODOLOGY AND PURPOSE

The critical task of the LTAS project is to define a set of Threshold Learning Outcomes (TLOs) based on community consensus. There was reasonable latitude for each Discipline Scholar to negotiate with the discipline over precisely which level of award and for which specific discipline community the TLOs would apply. In early discussions with key stakeholders it was agreed that the focus for Building would be the Bachelor-level award (Australian Qualification Framework, Level 7). However, there was no specific discipline group identified beyond Construction Management. The definition of the scope and extent of the Construction Management discipline is still being discussed, but is generally taken to exclude Building Surveying, Facilities Management, Land Economics and similar related fields. Whether or not Quantity Surveying will be identified separately remains one of the issues still under discussion.

A TLO can be defined as a clear statement of the set of knowledge, skills and the application of the knowledge and skills a person has acquired and is able to demonstrate as a result of a particular program of study in a given discipline, at the point of graduation (Australian Qualifications Framework Council, 2010:82). In other words, the TLOs are clear statements of what every Bachelor of Construction Management, or equivalent, graduate in Australia is expected to know, understand and be able to do as a result of their undergraduate program of study.

A broadly consultative approach has been adopted, fashioned to involve the key representative stakeholders as far as is practicable given the obvious constraints of time and other logistics, such as distance and availability. The consultation process began with a series of meetings with relevant professional accrediting bodies and academic peak groups, where the LTAS project was introduced, the project objectives discussed and community engagement encouraged. This was followed by a series of workshops convened with distinct key stakeholder groups to discuss the LTAS project objectives and identify an initial set of draft TLOs. The workshops were conducted as focus groups in order to provide the opportunity for stakeholders to communicate their perspectives with specific and detailed responses (Bender & Ewbank, 1994; Wilkinson, 2007).

A total of 14 half-day workshops have been completed, including eight specific to the academic staff of Construction Management programs, three specific to industry practitioners and employers, two specific to current students and recent graduates, and one a mix of academic staff and students. The workshops have involved a total of 108 participants, at locations across Australian Capital Territory, New South Wales, Queensland, South Australia, Victoria and Western Australia. The findings from the workshops have been analysed using both quantitative and qualitative methods so as to gather rich and detailed data that can also be triangulated.

The structure of the workshops was intended to elicit from the participants what they regarded to be the key TLOs from their particular perspective, and then to arrive at some level of consensus as to what the national TLOs for the discipline might comprise (Wilkinson, 2007). Each workshop commenced with a short presentation about the background and broad aims of the LTAS project. Participants were then invited to volunteer their key learning outcome proposals, and asked a series of open-ended questions to refine further the statements that were generated from this process. Following this discussion, a prepared set of 64 candidate TLO statements printed on individual cards were randomly distributed to pairs of participants. Each pair was asked to select only their five most preferred expressions of TLOs from the cards allocated to them, using a pyramid form of discussion (Jordan, 1990). These selections were recorded and then discussed specifically to identify any of the candidate TLO statements that had particularly captured one of the key learning outcomes previously mentioned, identified a critical TLO not previously mentioned, or had prompted consideration of a learning outcome not included in the discussion or in the candidate set.

The 64 candidate TLOs were compiled from a number of sources in order to provide as broad a spectrum of potential learning outcomes for the discipline as possible. The candidate set was never intended to be a comprehensive set of all potential learning outcomes, but rather to represent the typical range of statements that might be considered

and prompt discussion. The sources selected were representative of relevant professional accreditation requirements, the TLOs already identified in other related disciplines and the required graduate attributes typical of academic providers. Relevant professional accreditation requirements were summarised and drawn from the Royal Institution of Chartered Surveyors (16 in total) and Australian Institute of Building (15 in total). The draft TLOs for Engineering (14 in total) and Business (5 in total) were reworded into the context of construction management. The graduate attributes identified by Queensland University of Technology were included as a typical example of the more generic, institutional outcomes often required by the providers of Construction Management undergraduate education (14 in total).

Records were kept of the top five preferences for each pair of participants, and this data was recorded into a spreadsheet. The spreadsheet listed each candidate learning outcome by source, and for each workshop the top selections were separately identified for each pair. The records for each workshop were also distinguished so that the selections made by academics, industry and students could be analysed separately. In addition, both the pre-selection and post-selection discussions at each workshop were recorded with permission of the participants, and later transcribed for analysis using the thematic analysis functionality of Concordance software (Smith & Osborn, 2007; Wilkinson, 2007; Watt, 2011).

Working through the thematic analysis and a direct cluster analysis of the candidate TLO statements, several broad classification categories (or themes) were identified; some were expected themes while others were emergent (Bender & Ewbank, 1994:71). An example of an expected theme is that of communication, and one of the emergent themes was that of industry/work experience. Each of the candidate TLO statements were then allocated by the Discipline Scholar to a single one of the five potential categories identified. Despite the potential for subjectivity in such an approach, this was in practice a very straightforward process.

The spreadsheet analysis then comprised a simple tallying of the number of times each candidate TLO statement was selected at a workshop, grouped by stakeholder type (academic, industry or student) and again by classification category.

Based primarily on the spreadsheet analysis, but informed by the thematic analysis, an initial draft TLO statement was proposed by the Discipline Scholar under each classification category. These classification categories and draft TLO statements were then distributed to the 150 registered parties with an interest in the project at that time. An anonymous online survey was made available where registered parties were invited to evaluate and comment on the categories and statements. The survey comprised eight questions. Question 1 sought an indication their primary interest in the building discipline

(academic, industry, student or other). Question 2 used a five-point Likert scale, from strongly disagree to strongly agree, that the proposed categories best represent the range of critical learning outcomes for a building graduate. Questions 3-7 used a five-point Likert scale, from strongly disagree to strongly agree, that the draft TLO statement best describes the requirements for the relevant category. Questions 2-7 also invited any comments specific to that selection. Question 8 invited participants to register any other comments or broad concerns they had with the draft TLOs or the academic standards project more generally.

Based on an analysis of the survey responses the categories and statements were reviewed by a small panel of experts and a revised draft set of TLOs are now available for further consideration and comment.

RESULTS AND ANALYSIS

The broad classification categories (or themes) resulting from the thematic analysis and a direct cluster analysis of the candidate TLO statements were as follows:

- Cognitive Skills
- Coherent Knowledge
- Effective Communication
- Process Management
- Self-Development

From the spreadsheet analysis of the candidate TLO statement selections, the following results were determined:

1. The top three candidate TLO selections overall (maximum count 14) were:
    - integrate theoretical and technical building knowledge which includes a selection of construction technology, management, economics and law (source: Accountancy; count: 11; category: Coherent Knowledge)
    - apply problem solving and decision making methodologies to develop components, systems and/or processes to meet specified requirements (source: Engineering; count: 9; category: Cognitive Skills)
    - capacity to manage the planning, procurement and coordination of construction work (source: AIB; count: 9; category: Coherent Knowledge)
2. The top three candidate TLO selections by academics (maximum count 9) were:
    - integrate theoretical and technical building knowledge which includes a selection of construction technology, management, economics and law (source: Accountancy; count: 8; category: Coherent Knowledge)

- apply problem solving and decision making methodologies to develop components, systems and/or processes to meet specified requirements (source: Engineering; count: 6; category: Cognitive Skills)
- capacity to measure, cost plan, estimate and evaluate the construction and property economics over a building life cycle (source: AIB; count: 6; category: Coherent Knowledge)

3. The top three candidate TLO selections by industry (maximum count 3) were:
   - an understanding of construction practices and principles (source: AIB; count: 3; category: Coherent Knowledge)
   - the ability to identify, define and solve problems relevant to building (source: QUT; count: 3; category: Cognitive Skills)
   - an understanding of construction law, codes, standards and contract administration (source: AIB; count: 3; category: Coherent Knowledge)
4. The top three candidate TLO selections by students and recent graduates (maximum count 3) were:
   - capacity to manage the planning, procurement and coordination of construction work (source: AIB; count: 3; category: Coherent Knowledge)
   - function as an effective member or leader of diverse teams, including those with multi-disciplinary and multi-cultural dimensions (source: Engineering; count: 2; category: Self-Development)
   - communicate proficiently in listening, speaking, reading and writing English for professional practice (source: Engineering; count: 2; category: Effective Communication)
5. The candidate TLO selections by category overall (expressed as a percentage of the overall vote) were:
   - Coherent Knowledge (27.4%)
   - Self-Development (23.0%)
   - Process Management (19.1%)
   - Cognitive Skills (17.8%)
   - Effective Communication (12.6%)

Based primarily on the spreadsheet analysis, but informed by the thematic analysis, the initial draft TLO statements under each classification category were then composed as follows:

- Coherent Knowledge

  integrate and evaluate theoretical and technical building knowledge which includes construction science and technology, management, economics and law

- Cognitive Skills

  apply creative and analytical problem-solving and decision-making methodologies to develop components, systems and/or processes to meet specified building performance requirements
- Self-Development

  reflect on and develop personal performance and capabilities in terms of ethics, learning, accountability and teamwork in the context of professional practice
- Effective Communication

  source, justify and communicate reasoned advice and ideas in multidisciplinary and multicultural situations involving both builders and non-builders and using technical, formal and informal communication instruments
- Process Management

  judge and implement effective methods and strategies for the procurement, planning, control and financial management of construction work
- Industry Experience

  demonstrate a level of engagement with the industry during the term of study that provides for an integrated understanding of both the theory and practice of building

The addition of the Industry Experience category and TLO statement came after a review of the workshop transcripts. The issue of work experience was a significant topic of discussion, although it was never presented as a potential learning outcome by participants and is not explicit in any of the candidate TLO sources. There is no doubt however that it provides an underlying theme: "*Experience is critical, work experience is critical" (TLO Workshop, University F)*. Its inclusion in the initial draft TLOs will be canvassed for more specific comment on the utility and viability of this as a TLO. Its inclusion is anticipated to be contentious.

Feedback and commentary from the online survey of project contacts regarding the initial draft TLOs has been encouraging. A total of 46 responses (with 1 spoilt) from the 150 registered parties represents a response rate exceeding 30%. The respondents were broadly representative of the overall composition of the registered parties, with 62% being academics, 31% industry and 7% students. Based on an analysis of the survey responses the categories and statements were reviewed by a small panel of experts using the following guidelines provided by the Tuning Project. According to Tuning (2010:44) for learning outcomes to be most effective they need to be:

- *Specific (giving sufficient detail, written in clear language)*
- *Objective (formulated in a neutral way, avoiding opinions and ambiguities)*
- *Achievable (feasible in the given timeframe and with the resources available)*

- *Useful (they should be perceived as relevant for higher education studies and civil society)*
- *Relevant (should contribute to the aim of the qualification involved)*
- *Standard-setting (indicate the standard to be achieved)*

The key changes made to the initial draft TLOs are as follows:

- The category themes have been simplified and made more distinctive.
- Innovation has been introduced explicitly in place of the more general Process Management category.
- Industrial Experience has been replaced with Work Integrated Learning. This implies a richer variety of ways to experience the building industry, other than just work experience, including the use of industry-sourced projects in assessments, industry guest lectures, case studies and other forms of engagement.
- Wording of each TLO has been changed to make the level of expectation more explicit. For example, knowledge is specifically fundamental, problems are specifically routine, collaborative situations are specifically straightforward.
- Safety has been added explicitly as a part of Self-Development.

The second draft TLOs are therefore as follows:

- Communication

  source, justify and communicate reasoned building advice and ideas in straightforward collaborative situations involving builders and non-builders
- Innovation

  research and evaluate emerging methods and strategies for the procurement, planning, control and/or financial management of contemporary construction work
- Judgement

  exercise judgement, employing appropriate problem-solving and decision-making methodologies to solve routine building problems under supervision
- Knowledge

  integrate and evaluate theoretical and technical building knowledge which includes fundamental aspects of construction technology, management, economics and law
- Self-Development

  critically reflect on personal performance and capabilities in terms of ethics, safety, teamwork and learning in the context of routine building problems
- Work Integrated Learning

  demonstrate a level of engagement with the industry during the term of study that promotes an integrated understanding of both the theory and practice of building

DISCUSSION OF RESEARCH METHODOLOGY AND RESULTS

The aim of this paper is to explain and describe the research methodology employed to develop the current draft TLOs, and present some of the evidence derived from and used to inform that process. The methodology has utilized a combination of workshops and questionnaires to determine both quantitative and qualitative data from a representative sample of key stakeholders in the building discipline. As with any such research methodology, there are a number of limitations and qualifications to the work:

(i) Is the sample of key stakeholders truly representative?

It is certainly the case that whilst the broad key stakeholder groups are a sufficient representation of the discipline, individual groups are not equally represented. As one might expect, the participation of academics in this process has been strong and almost comprehensive. Professional bodies are also well represented. More direct industry representation is very limited, given the huge potential population of employers from which we might draw, and is bias towards the larger, top-tier construction companies. For the next round of workshops and invitations to comment on the draft TLOs it is intended that the number of industry representatives be increased quite substantially. This will require direct marketing of the project to industry through professional bodies and broader engagement with peak groups such as the Master Builders Association. Student and recent graduate representation is also very limited. Again, for the next round of workshops and invitations to comment on the draft TLOs it is intended that the number of student and recent graduates be increased significantly. An initiative to constitute a national student network for building and construction to support this process has not been successful. Instead, Heads of Schools will be asked to circulate information about the project and encourage greater student involvement.

(ii) Are the TLOs sufficiently specific and meaningful?

There are few surprises in the current draft TLOs in terms of their scope and content. The proposal to include Work Integrated Learning may be contentious, but given the extent of the existing professional accreditation regulation the draft TLOs were always going to be relatively predictable. What did not exist previously was the evidence to support such a choice of TLOs. That said, the TLOs remain, of necessity, rather broad in their definition. This is probably inevitable for a national agenda taking a light-touch approach. It does, however, leave a significant scope for different interpretations of the same TLO statements and that is always going to be of concern for a regulatory framework. This will be addressed to some extent by the provision further explanatory notes for each TLO

statement, and it is hoped such notes will include examples of the type of evidence/assessment outcomes that might demonstrate achievement of each TLO.

(iii) How objective was the process of identifying and collating the draft TLOs?

There is potential for anchoring and bias in any process of group work where opinions are being sought. The selection and composition of the candidate TLOs, for example, might represent some bias towards particular professional accreditation requirements and/or particular graduate attributes. This may well be the case, but to include a comprehensive set of all possible candidate learning outcome statements would have been overwhelming. The structuring of the workshops to seek unprompted participant suggestions before the use of prompt-cards helped guard against anchoring to some extent. The open-ended discussion after the card selection process and later invitation to revise and comment on draft TLOs also sought to mitigate the potential for anchoring to bias the results. Wherever possible the analysis has been driven by a mechanical process of numerical clustering which is explicit and repeatable. The most critical point in the process in terms of subjectivity was in the allocation of candidate learning outcome statements to the themes that had identified. This process will now be repeated using independent classifiers to ensure the robustness of that stage of the process. The actual/final wording of the TLOs remains open to continuing comment and feedback, but no further changes will be made without a general consensus of the full participant group.

(iv) What use will the TLOs be put to and how will they be reviewed?

The outcome of the Learning and Teaching Academic Standards project is a report that will go to inform TEQSA. It is not clear at this stage what regulatory approach TEQSA will adopt, but there is every indication that academic standards will be benchmarked in some way and that learning outcomes are highly regarded as a means to that end. Of course the TLOs in any such approach would need to be reviewed and modified to reflect changes in circumstance and fine-tune the intentions of key stakeholders. This process of review will be risk-based and proportional, rather than time-based.

(v) What lessons are there for other discipline groups in developing such TLOs?

The main lesson would seem to be that the process of grassroots consultation with all key stakeholder groups is an effective way to reach consensus on TLOs. The particular methodology used here provides a robust set of outcomes, supported with evidence. There is concern at this stage at the relatively low representation from key stakeholder groups such as employers, students and recent graduates. A broader representation of these groups from the start would have been useful. Finally, the potential for different interpretations of any TLO statement needs to be addressed as early as possible through

the use of explanatory notes and examples of the kinds of evidence and actual assessment outcomes are deemed to be acceptable.

CONCLUSIONS

The paper details the purpose and research methodology used to determine a draft set of TLOs to benchmark the graduate outcomes from Bachelor-level study in building and construction management in Australia. A draft set of six TLOs have been derived and presented. The draft TLOs have broad consensus agreement across the building and construction discipline and are evidence-based. It remains for the TLOs to be made more specific through further notes and examples, and for the representation of industry, students and recent graduates in the process to be improved.

ACKNOWLEDGEMENTS

Support for this research has been provided by the Australian Learning and Teaching Council (ALTC), an initiative of the Australian Government Department of Education, Employment and Workplace Relations. The views expressed here do not necessarily reflect the views of the ALTC.

REFERENCES

Australian Government. (2009) *Transforming Australia's Higher Education System*. [online]. Available from: http://www.deewr.gov.au/ [Accessed 30 January 2011].

Australian Qualification Framework Council. (2010) *The Australian Qualifications Framework (pending MCTEE approval - late 2010)* [online]. Available from: http://www.auqa.edu.au/ [Accessed 30 January 2011].

Bender, D.E. and Ewbank, D. (1994) The focus group as a tool for health research: issues in design and analysis. *Health Transition Review*, 4(1): 63-79.

Bradley, D., Noonan, P., Nugent, H. and Scales, B. (2008) *Review of Australian Higher Education: Final Report*, [online]. Available from: http://www.deewr.gov.au/he_review_finalreport/ [Accessed 30 January 2011].

Jordan, R.R. (1990) Pyramid discussions. *ELT Journal,* 44(1):46-54.

Smith, J.A. and Osborn, M. (2007) Interpretative phenomenological analysis. In G.M. Breakwell, (Ed.) *Doing Social Psychology Research*, Chichester: Wiley-Blackwell.

Tuning. (2010) *A Tuning Guide to Formulating Degree Programme Profiles*. [online]. Available from: http://www.core-project.eu/ [Accessed 30 January 2011].

Watt, R.J.C. (2011) *Concordance 3.3*. [online]. Available from: http://www.concordancesoftware.co.uk/ [Accessed 30 January 2011].

Wilkinson, S. (2007) Focus groups. In G.M. Breakwell, (Ed.) *Doing Social Psychology Research*, Chichester: Wiley-Blackwell.

Rationalising Property Management Decisions using the *iconCUR* Model – An Australian Case Study

Hemanta Doloi, Robert H. Crawford and Zhanghong Ma
Faculty of Architecture, Building and Planning
The University of Melbourne, Australia

ABSTRACT

Adaptive reuse of existing buildings is recognised as an effective means for achieving sustainability in the construction industry. A recently developed model known as *iconCUR* has been used to assess the potential for adaptive reuse of a building located in Melbourne, Australia. The model uses a weighted matrix methodology to support reuse decision making according to building condition, utilization, and reward in 3D space over time. In this research, a building located within the University of Melbourne, built in the 1960s, was investigated. The condition information of the building was gathered from a Building Regulatory Compliance report; utilization and reward was assessed based on expert opinions. This information was subsequently fed into the *iconCUR* model to generate an adaptive reuse index. This case study provided a real-life example of the applicability of the *iconCUR* model for assessing the current potential of the existing building and then supporting investment decisions for improving the building condition. Potential problems of applying the model to real projects have been discussed.

KEYWORDS

adaptive reuse, *iconCUR*, sustainability, property management

INTRODUCTION

Adaptation and reuse of existing buildings are considered an effective means for improving building sustainability (Bullen, 2007). In Australia, adaptation and rehabilitation of existing structures was charted as the trend for the future, as it supports key sustainability features by reducing material and energy consumption, and lower contamination (Bullen, 2007). Bullen defines adaptive building reuse as follows:

> *Adaptive building reuse is a process of adding new functions of the existing building to fulfill user's demand with minimum modification. It includes four cases, 1. upgrading the performance of the building to suit modern standards and user requirements, 2. Converting existing building to undertake a modified change of use, 3. Rehabilitation or renovation to extend the use of the building, 4. Changing a disused or ineffective item into a new item that can be used for a different purpose.*

Adaptive building reuse can play a major role in sustainable development of communities, circumventing the wasteful processes of demolition and reconstruction. Through adaptive reuse of unproductive property, significant reductions in land acquisition costs and the material/energy consumption involved in construction processes, as well as the creation of greater value for the community, are able to be achieved.

Wilkinson and Reed (2008) found that office buildings contribute significantly to global warming as a result of the release of significant quantities of greenhouse gas emissions during the building life cycle (Wilkinson and Reed, 2008). Adaptive building reuse provides a practical means to improve energy efficiency and reduce greenhouse gas emissions by extending the life of existing buildings. Even if much of the old building stock, often in poor physical condition, continues to operate less efficiently than a new building, the social, environmental and economic benefits can be significant through the retention of these existing buildings (Wilkinson and Reed, 2008). For example, the value of the energy embodied in the building materials alone can be as significant as the energy needed to operate the building over its life (Crawford, 2010).

BACKGROUND

In the U.S, Cooley analyzed five adaptive reuse projects (Cooley, 2008) which have proven to be economically successful developments, retaining a significant proportion of the original building. The five projects were used to test the hypothesis that the adaptive use of the building should be compatible with the designated use of the original building. He found that compatibility of the use of the building is less important than expected, i.e. adaptive reuse of buildings has broad potential, and becomes an even more viable strategy when tax incentives are present.

In Australia, much of the existing building stock has the potential to be adaptively reused. However, the National Australian Built Environment Rating System (NABERS) does not assess adaptive building reuse in evaluation of environmental performance. Love and Bullen (2009) examined the use of NABERS, and suggested that from a sustainability perspective, adaptive building reuse should always be a viable strategy (Love and Bullen, 2009).

In the U.S, some church buildings have been adopted by new owners and converted into a variety of uses, including restaurants, retail, residential, community centers and commercial buildings. Johnson (2004) investigated the reuse of church buildings, and concluded five success factors for adaptive building reuse: location, availability of funding incentives, real estate values, historic designation, and community commitment. Within the five factors, incentive and community commitment are of primary importance. In terms of sustainable development, successful adaptive reuse of churches has to take

advantage of economic and community value (Johnson, 2004).

In the Netherlands, Velthuis and Spennemann (2007) reviewed the Dutch approach of adaptive reuse of defunct religious buildings. They found that redundant and unused churches can be reused as community facilities such as multifunctional halls for sport, music, etc, and private buildings, either commercial or residential. They identified that the attitude of communities and the original building owners plays an important role in the success of adaptive reuse projects (Velthuis and Spennemann, 2007).

In Canada, Shipley *et al*. (2006) examined a number of historic buildings, many of which have been demolished because the cost of adaptive reuse of the buildings was considered to be too high. However, a growing number of the buildings have been renovated and reused. They found that recent legislation preventing demolition of historic buildings is one of the reasons for an increase in adaptive building reuse (Shipley et al., 2006).

Having reviewed the above selected literature, it has been evident that while the adaptive use of buildings' is a widely published topic, a holistic approach in making in rationalising investment decisions on the existing building is not quite widespread. While current approaches predominately focus on the issues of profitability and financial bottom line, a clear analysis of the triple bottom line in assessing investment decisions is crucial. In this paper, the MCDA based model *iconCUR* developed by Langston and Smith (2011) is used to demonstrate the application and usability in justifying investment decisions in projects (Langston and Smith, 2011). A building located within the University of Melbourne, built in the 1960s, was investigated to demonstrate the model.

The *iconCUR* MODEL

With regards to the ongoing management of existing buildings, the decision of refurbishment, reuse or disposal has to be justified by property and facilities managers. Multiple factors will be taken into account in the decision making process: the condition of the building, financial feasibility, social and environmental benefits, etc. (Mendoza, 2006). A framework for integrating these critical factors and the goals of multiple stakeholders is needed, and the optimization of project value will only be achieved by refining prediction with learning from previous experience.

By investigating the real estate market in Hong Kong, Langston et al. (2008) identified a number of issues that may be used to inform decision making on the demolition, refurbishment or reuse of existing buildings (Langston et al., 2008). These issues include building condition, economics, building management, building services engineering, and legislative concerns (CKII report).

Multi-criteria decision analysis can be used to optimize decision making in the context of a range of multi-faceted issues (Herath and Prato, 2006). Decision making for improving

existing buildings demands multi-criteria evaluation models based on qualitative or quantitative assessment of the building. Multiple criteria decision making (MCDM) tools provide a framework for making decisions by evaluating, prioritizing or selecting possible alternatives according to multiple correlated criteria (Gomes *et al*., 2008). For property investment decisions, Langston and Smith (2011) developed a conceptual MCDM framework for evaluating existing buildings and making recommendations for future investment, named the *iconCUR* model.

The decision of whether to reconstruct, renovate or reuse existing buildings is made based on three criteria: the condition of the building, utilization of the building and potential stakeholder reward. Assessing the building according to these three criteria allows information about the building to be captured and used for future investment decisions. Condition, utilization and reward comprise the three axis of a 3D space, and the building's status is represented as a point in this 3D space (Figure 1).

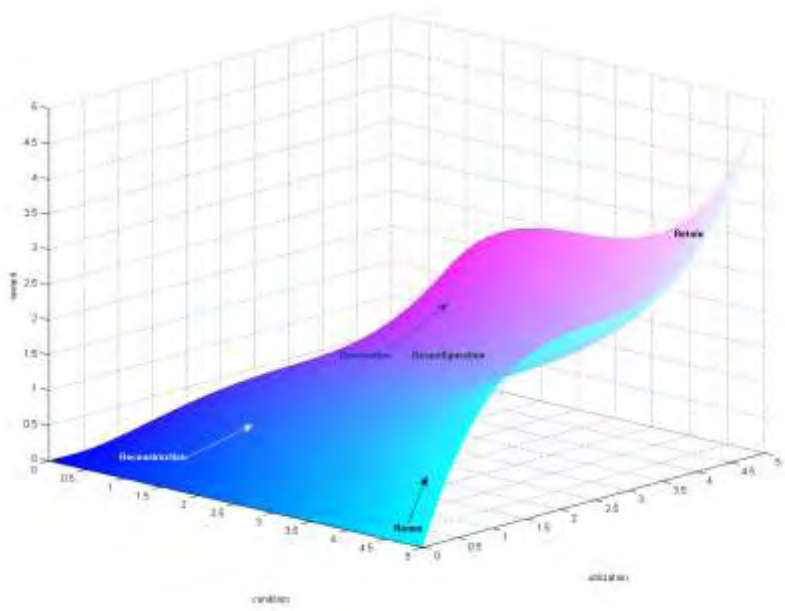


Figure 1 – 3D spatial model of *iconCUR*

A new building will be in maximum condition (5 on the condition axis), will be utilized to its maximum potential (5 on the utilization axis) and the reward should be maximized. In Figure 1, the point where each of these intersect represents the current state of the building (5,5,5 for example). Over a number of years, the condition decays, utilization potentially reduces, and the reward out of the building diminishes. These changes for any building can be tracked and monitored in order to make the best investment decisions at the right time to improve the building's long-term performance. The value of condition

and utilization determines the type of actions required to maximize reward of the property, whereas the z axis indicates the amount of extra reward that may be obtained by applying the specific upgrade action. Generally, according to the condition and utilization, there are five major types of actions that can be taken to improve reward:

- Low condition and low utilization – reconstruct or dispose
- High condition and high utilization – retain or extend
- Low condition and high utilization – renovate or preserve
- High condition and low utilization – reuse or adapt
- Medium condition and medium utilization – reconfiguration

APPLICATION OF *iconCUR*

The building housing the Faculty of Architecture, Building and Planning within the University of Melbourne is constructed on government land designated for the use of the University. The building was initially constructed in 1961, and now provides teaching, administration and recreation use for staff and students (Figure 2).

Being in service for over 40 years, the condition of the building has decayed notwithstanding good maintenance. A major inspection of the building took place in 2008, auditing the existing condition, facilities and systems of the building with regard to general levels of compliance with current regulations. The report pointed out that the building is substantially complaint with current building regulations except for the fire isolation system and disabled access provision. However, as the building is on government land, the enforcement provision applicable to existing buildings would not apply.

In order to improve user satisfaction with the functions that the building provides, a recent decision has to be made to demolish the building and replace it with a new building. In light of this decision, the analysis of the building using the *iconCUR* model provides an opportunity to assess whether there may have been potential for retaining the building and whether there exists enough value in the existing building to warrant further investment in a non-demolition strategy.

The building's current condition and level of utilization was assessed by the users of the building in order to determine the investment strategy recommended by *iconCUR*. The users of the building were asked to rate the building's condition and level of utilization using a simple questionnaire (See Appendix 1). The users' responses were collected and inspected manually to ensure the consistence of condition and utilization assessment among users.

Figure 2 – Case study building - Faculty of Architecture, Building and Planning

The condition of the case study building was assessed in terms of design standards, maintained level of service, and regulatory compliance. For each criterion, structure, exterior envelop, interior finishes/fitout, engineering services and external works were scored separately. The condition score for each criterion is derived by weighted average of the scores of the elements of the building, with a weight of 20%, 30%, 20%, 20% and 10% respectively. The individual scores for each criterion were then summed with a weight of 50%, 25% and 25% respectively, according to the default configuration of the *iconCUR* model. These weightings can be altered depending on the perceived importance of each criteria and building element. The overall condition score for the case study building was found to be 2.29, as shown in Figure 3.

Similarly, the utilization of the building was assessed in terms of demand or relevance, fitness for purpose and user satisfaction. For each criteria, internal space, external space, outdoor site area, equipment and fitout, and engineering systems were scored separately. The utilization score for each criterion is derived by weighted average of the scores of the elements of the building, with a weight of 30%, 10%, 10%, 30% and 20% respectively. The individual scores for each criterion were then summed with a weight of 40%, 40% and 20% respectively, according to the default configuration of the *iconCUR* model. The overall utilization score for the building was found to be 2.83, as shown in Figure 3.

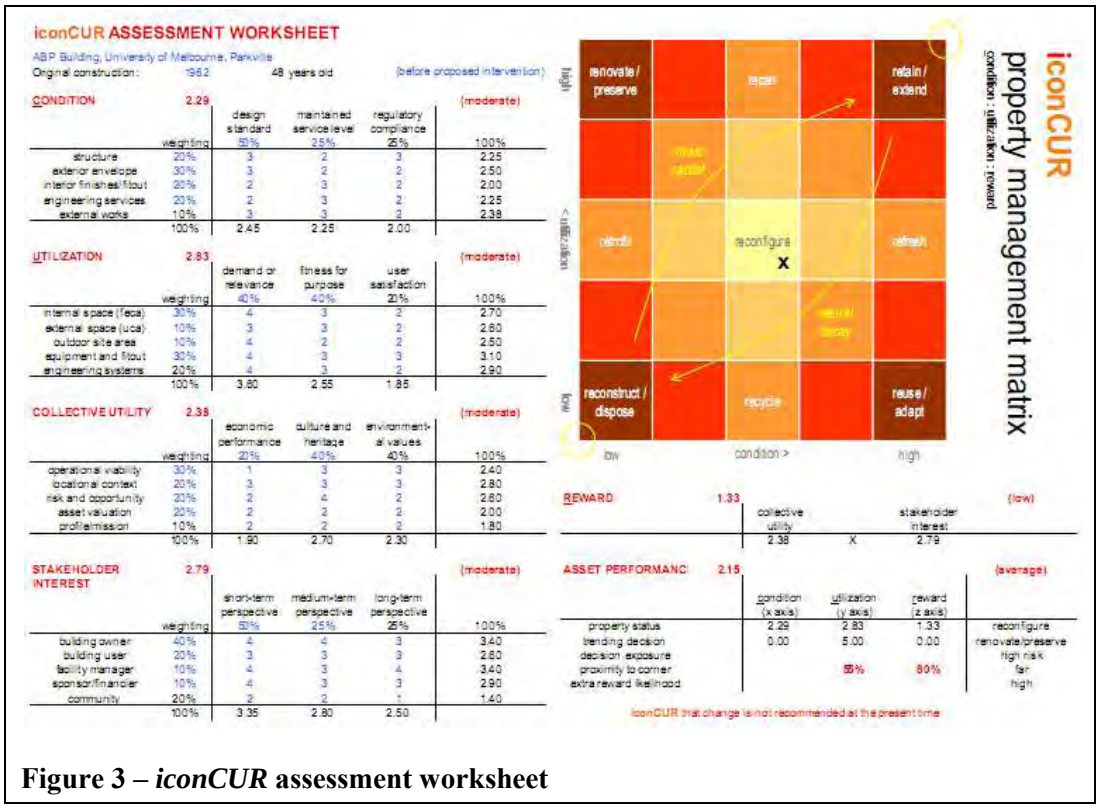


Figure 3 – *iconCUR* assessment worksheet

The reward score for the building is determined by the collective utility and stakeholder's interest. Collective utility indicates the benefit that stakeholders obtain out of the building. The *iconCUR* model integrates financial benefit, culture and heritage value, and environmental values together in consideration of collective utility. As the building may have a number of stakeholders, financial performance is critical for building owners and investors, whereas cultural and environmental benefits are of more concern by community and building users. Stakeholder's interests indicate the significance of interest for different stakeholders within the building. Generally speaking, building owners and users are more focused on short term benefit, whereas facility managers and financiers see long term benefits as important as short term benefits.

Assessed by users in the building for collective utility and stakeholder's interest, the reward of the building can be derived by multiplication of these two values. The value of reward for the case study building was found to be 1.33, which indicates that there is an opportunity for a significant amount of extra reward to be achieved in this building.

Figure 4 indicates the overall score for the case study building within the 3D model, represented by the small back dot. This indicates that reconfiguration of the building is the recommended investment strategy for this building.

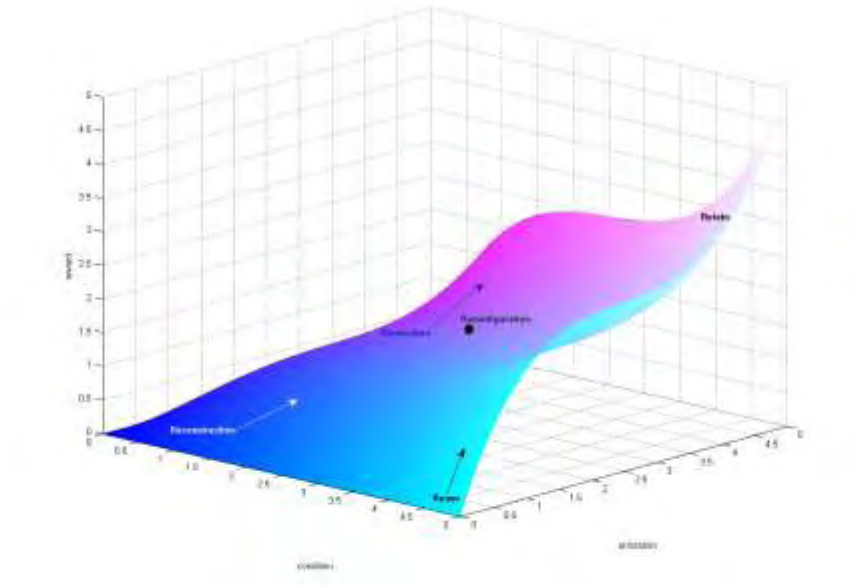


Figure 4 – *iconCUR* score for the case study building

DISCUSSION AND CONCLUSION

The condition, utilization and reward parameters describe the basic state of a building. Figure 4 shows the case study building in 3-D space, with a condition score of 2.29 (out of 5), a utilization score of 2.83 (out of 5) and a reward score of 1.33 (out of 5). In terms of condition, the case study building is currently under moderate condition, which means that, despite the decision that has already been taken to demolish the building, some retrofit work is due in order to improve user satisfaction and ensure the compliance with respective regulation. A utilization score of 2.83 indicates that the building is currently well-utilized; however, there is still room to expand the use of the building to increase utilization. The reward of the building is relatively low, which indicates that there is potential to increase the reward of the building.

Whilst the condition and utilization of the building is moderate, *iconCUR* has shown that there is an opportunity to prolong its life and improve both its condition and utilization through reconfiguration. This indicates that the demolition of the building may not be the best option for maximising the resources embodied in the building.

However, risk is another factor which should be considered before making any decision. Low condition of a building implies that with a little investment, the condition can be significantly improved, which subsequently affects user satisfaction and reward. Similarly, low utilization can be improved substantially with reuse of the building without too much risk, as the utilization is unlikely to be lower after functional expansion. However, high reward is achievable only if condition and utilization of the building is

improved significantly as the condition and utilization is moderate for the building (shown in Figure 4). Therefore, a substantial investment is required and the risk associated with reconfiguration of the building is high. The recommendation is not to change the state of building at present, and further action will be taken only if the condition or utilization deteriorates further.

This paper has demonstrated the use of a model (*iconCUR*) for rationalizing property investment decisions in order to maximise the value embodied in existing building stock whilst optimising the utilization, financial and environmental performance and user satisfaction of a building. This model provides an opportunity for maximising the environmental performance of the current building stock, avoiding unnecessary waste of materials and resources by capturing the value in existing buildings and potentially at a lower cost than building new. These benefits are expected to only increase in the future with the advent of higher material, resource and waste disposal costs. Further research includes testing and validating the *iconCUR* model on a range of other building types.

REFERENCES

Bullen, P.A. (2007) Adaptive reuse and sustainability of commercial buildings. *Facilities,* 25**,** 20-31.

Cooley, R.L. (2008) Transforming ordinary buildings - The role of adaptive use. *In:* Ecocity World Summit, 2008.

Crawford, R.H. (2010) *Life Cycle Assessment in the Built Environment*, Taylor and Francis, London.

Gomes, C.F.S., Nunes, K.R.A., Helena Xavier, L., Cardoso, R. and Valle, R. (2008) Multicriteria decision making applied to waste recycling in Brazil. *Omega,* 36**,** 395-404.

Herath, G. and Prato, T. (2006) *Using multi-criteria decision analysis in natural resource management,*, Ashgate Publishing.

Johnson, T. (2004) *Socio-Economic and Political Issues in the Successful Adaptive Reuse of Churches*. University of Cincinnati.

Langston, C. and Smith, J. (2011) Modelling Property Management Decisions using *iconCUR*. *Automation in Construction* (under review).

Langston, C., Wong, F.K.W., Hui, E.C.M. and Shen, L.Y. (2008) Strategic assessment of building adaptive reuse opportunities in Hong Kong. *Building and Environment,* 43**,** 1709-1718.

Love, P. and Bullen, P.A. (2009) Toward the sustainable adaptation of existing facilities. *Facilities,* 27**,** 357-367.

Shipley, R., Utz, S. & Parsons, M. (2006) Does Adaptive Reuse Pay - A Study of the Business of Building Renovation in Ontario, Canada. *International Journal of Heritage Studies,* 12**,** 505-520.

Velthuis, K. & Spennemann, D. H. R. (2007) The Future of Defunct Religious Buildings - Dutch Approaches to Their Adaptive Re-use. *Cultural Trends,* 16**,** 43-66.

Wilkinson, S. J. & Reed, R. G. (2008) The Business Case for incorporating Sustainability in Office Buildings - the Adaptive Reuse of Existing Buildings. *14th Annual Pacific Rim Real Estate Conference.* Kuala Lumpur, Malaysia.

APPENDIX A

Table 1 – Sample questionnaire used to collect information on the condition of the case study building

	Design Standard	**Maintained Standard**	**Regulatory Compliance**
	The level of quality including durability and appearance of the building 0 – Unusable condition 1 - very poor condition 2 - poor condition 3 - moderate condition 4 - good condition 5 – new	Level of upkeeping and maintenance, including regular repair and cleaning 0 – No maintenance at all or not available 1 – Minimal maintenance 2 – Occasional clean and maintenance 3 – Regular clean of the building, no routine inspection 4 - Regular clean and inspection, repair was taken in place promptly 5 – Optimal asset management, building and equipments maintained in good condition	The level of conformity of the building with current regulation, including certification and public safety. 0 – incompliant at all or not available 1 – incompliant with most regulations 2 – partially compliant with a few regulations 3 – partially compliant with most regulations 4 – compliant with most regulations 5 – fully compliant with current regulations
Structure	The structure elements of the building, including foundations and superstructure		
	0 1 2 3 4 5 | 0 1 2 3 4 5 | 0 1 2 3 4 5		
Exterior Envelope	The exterior envelope of the building, including façade and roof		
	0 1 2 3 4 5 | 0 1 2 3 4 5 | 0 1 2 3 4 5		
Interior finishes/fitout	The interior fitouts of the building, including subdivision, finishes, equipment and furnishings		
	0 1 2 3 4 5 | 0 1 2 3 4 5 | 0 1 2 3 4 5		
Engineering Services	Mechanical, electrical and hydraulic systems of the building		
	0 1 2 3 4 5 | 0 1 2 3 4 5 | 0 1 2 3 4 5		
External works	External works including site works and external services		
	0 1 2 3 4 5 | 0 1 2 3 4 5 | 0 1 2 3 4 5		

Table 2 – Sample questionnaire used to collect information on utilization of the case study building

	Demand or relevance	**Fitness for purpose**	**User satisfaction**
	The ability to satisfy the current demand place on it, reflected by level of usage according to the demand and the capacity of the building. 0 – Not utilized at all or not available 1 – Under utilized: demand less than 65% of capacity 2 – Growth available: demand 65%-85% of capacity 3 – Well utilized: demand 85% - 100% of capacity 4 – Overcrowded: demand exceeds 100% of capacity, level of service degraded but still acceptable 5 – Demand failure: service denied for legislative or compliance reasons	The level of suitability of the design to its functional objectives, which includes flexibility and technology support. 0 – Design doesn't fit for purpose at all or not available 1 – Design doesn't fit for purpose and access of the functions is difficult for most users 2 – Design fits for purpose but not easily accessible for most people. 3 – Design fits for purpose but not easily accessible for some users. 4 – The design fits for most users' purpose and easily accessible 5 – The design fits for all users' purpose, easily accessible, and flexible for future expansions.	The level of endorsement of the property, which includes comfort and satisfaction perceived by users 0 –Service not available or not applicable 1 – Less than 50% of users are satisfied with service delivered 2 – 50% - 70% of users are satisfied with service delivered 3 – 70% - 80% of users are satisfied with service delivered 4 – 85% - 95% of users are satisfied with service delivered 5 – More than 95% of users are satisfied with service delivered
Internal space (feca)	Fully enclosed cover area exclusive of primary functional and service space		
	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
External space (uca)	Unenclosed covered area of the external space		
	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
Outdoor site area	Land area excluding the building footprint		
	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
Equipment and fitout	Primary functional space of the building		
	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5
Engineering systems	Mechanical, electrical and hydraulic systems space of the building		
	0 1 2 3 4 5	0 1 2 3 4 5	0 1 2 3 4 5

Applying the Living Curriculum Approach to Undergraduate Sustainable Design and Construction Education in NZ

Linda Kestle and Roger Birchmore
Faculty of Technology and Built Environment
Unitec Institute of Technology, Auckland, New Zealand

ABSTRACT

Sustainable Design and Construction is an undergraduate course for construction management, construction economics and property development students, at UNITEC Institute of Technology, in Auckland. The intention was to directly involve the 2010 cohort in current sustainable design and construction/development best practice, relevant new technologies and policies/tools. The students were to apply their new found theoretical knowledge in small groups, to a hypothetical assessment event. The given concept was a Visitor Tourist Centre to be considered in a variety of rural and different climatic locations around New Zealand, and which had to meet relevant RMA (1991) requirements for each of the particularly assigned regions. The objective was to get the students to establish a range of plausible solutions, and how sustainability issues differed according to the various geographical and climatic regions for the Visitor Tourist Centre project. The resultant findings demonstrated a range of plausible and at times superficial solutions of the similarities and differences between the various locations, whilst also demonstrating the learning challenges they personally realised, faced and resolved. In addition the paper maps the course, its outcomes and the student learning realities against the use of the Living Curriculum approach to teaching and learning.

KEYWORDS

sustainable design, tertiary education, real-time solutions, living curriculum, New Zealand

INTRODUCTION

Undergraduate courses in the Department of Construction at Unitec focus on industry related disciplines such as Construction Management, Construction Economics, Architectural Technology and Property Development. The aim is to provide graduates that meet or exceed the expectations of industry's current and future needs. The course outcomes, delivery method and assessment mechanisms are a result of incremental development over the last few years, and have not been specifically chosen with the

Living Curriculum in mind. The Living Curriculum whilst not unique to Unitec refers to an approach to learning that encompasses interactive problem-based learning approaches, and includes theoretical and/or practical descriptors/characteristics such as ‚complex conversations', ‚curiosity led (learning)', ‚socially constructed collaboration', ‚practice focused learning and assessment'.

The aim of this paper was to explore and map how delivery, assessment and student experiences on the Sustainable Design and Construction course may align with the principles and characteristics of the living curriculum on a single degree course.

Unitec has offered Sustainable Design and Construction ‚elective' courses on the Bachelor of Construction (Management, or Economics) since 2002. Since 2008 however, there has been a significant shift in emphasis toward embracing and addressing sustainable design and construction practices in the commercial sector of New Zealand's construction industry. Students are therefore now required to undertake the (level 6, second year) Sustainable Design and Construction (SDC) Course as a core part of their undergraduate Bachelor of Construction studies at Unitec.

The course aims include the study and application of passive solar design and environmentally sensitive design (ESD-environmentally sustainable/sensitive design) principles. This includes alternative energy options, water conservation and recycling, sustainable materials' specifications, construction waste minimisation, integrated low energy life-cycle costings and analysis, indoor air quality, on-site water supply and waste systems. The principles and application of NZ's Green Star Rating Tools are addressed, and the preparation of CEMPs (Construction and Environmental Management Plans), are included as the latter are now required by an increasing number of local and regional councils

ESD is specifically associated with designing for, and with, the specific site and its natural features whilst minimising the impacts of that development on the site. ESD is also concerned with orienting the buildings to realise the best sun ingress and solar storage advantage for the built spaces all year round (Elkink and Pringle, 2008).

Vale & Vale (1991) discussed the principles of design in action to considerable depth, when addressing green architecture, suggesting that one of the principles of sustainable design is "to respect the site. These philosophies for practice fit well and resonate with the defining discussion on sustainable design and construction by researcher, academic and US Green Building Councillor, Professor Charles Kibert. According to Kibert (2008):

> *"The terms ‚high performance', ‚green' and ‚sustainable construction' are often used interchangeably, however the term sustainable construction most comprehensively addresses the ecological, social and economic issues of a building in the context of its community."*

Kibert (2008) also identified the fact that:

> *"The International Construction Research Networking Organisation, CIB (International Council for Research and Innovative Building and Construction), articulated seven Principles of Sustainable Construction, which would ideally inform decision making during each phase of the design and construction process, continuing throughout the building's entire life cycle."*

The principles referred to by Kibert (2008) in terms of the CIB are to reduce resource consumption, reuse resources, use recyclable resources, protect nature, eliminate toxics, apply life-cycle costings and focus on quality. These principles have formed a basis for sustainable design applications internationally and locally. Within New Zealand for example:

> *"Regional and local councils have a range of statutory policies and plans which provide a framework for sustainable building. Under the Resource Management Act, regional councils prepare regional policy statements and plans These plans identify significant resource management issues for their area, with energy, water and local air quality featuring frequently. Poor urban design and housing affordability are sometimes mentioned (…) the response however, tends to be limited, with issues being addressed by low level initiatives."* (Bernhardt, Ed., 2008).

Unitec's SDC course design and assessment approach is further supported by current national and international building and design practice and associated research publications. The impacts of sustainable technologies in NZ are currently being investigated globally at an increasing rate as a result of a resurgence of interest in sustainable design and construction and ESD (environmentally sustainable/sensitive design) in the commercial and residential sectors This is clearly evidenced in the ongoing development and use of Green Star Rating Tools (initially introduced in 2007 in NZ), and demonstrated in the work by Duncan, (2010) suggesting the use of integrated hybrid active-passive systems designed to optimise thermal energy storage in building projects. Linked to this, there has been a growing interest in the development of more sustainable buildings due to the perceived impacts buildings have on the natural environment and internal working environments. The need for a review of the realities of owning or working in existing „sustainable buildings', has been conducted and published on thirty buildings across eleven countries worldwide by Baird, (2010).

CONTEXTUALISED LITERATURE REVIEW

The profile and expectations of construction industry tertiary student cohorts have changed significantly over the last fifteen years or so in Auckland in particular. There have been significant changes in the cultural profile, class sizes and expectations that the students have of themselves at tertiary level learning, the lecturers and the learning experience itself. There has always been a mix of school-leavers and those studying whilst working, therefore bringing a range of differing previous experiences. Therefore the aim is to respond in a positive and appropriate manner, when developing and delivering curricula that integrates both theoretical and practical learning experiences.

Problem-based learning and ‚scenario setting' have been a part of the lecturer's toolkit for a decade or so now, yet still "educators, particularly higher educators, have traditionally focused on the cognitive domain of learning; what we know and understand, and how we describe, comprehend, apply, analyse, synthesise and evaluate this knowledge and understanding", according to Shephard (2008) on reading Krathwohl et al. (1973). Shephard (2008) further suggested that levels of learning in the affective domain had been identified by Bloom et al. (1971), that involved our "values, attitudes, and behaviours, including an ability to listen and respond in interactions with others, to revise judgements and change behaviour in the light of new evidence".

According to Beard et al. (2007), "students' motivation to learn and their emotional state whilst learning are also elements of the affective domain".

Shephard (2008) postulated that "many educators are comfortable with teaching processes that emphasise a willingness to listen, discuss and acquire information, but that they may not be comfortable with a quest for higher order outcomes relating to opinions and behaviours described by Lemkowitz et al.(1996)". Shephard (2008), cited Chalkley (2006) when discussing how valuable higher education's contribution was to sustainability where the view was expressed that "education for sustainability must seek outcomes that involve not only knowledge and skills but also the values that underpin sustainable behaviour by businesses, government and society", and that is the challenge addressed by the students on the Sustainable Design and Construction course.

The ‚Living Curriculum' is an integrated and forward-looking approach to learning that is being embraced by educational practitioners and researchers worldwide, as a result of a growing sense that actively involving students in their own learning can provide positive and enhanced learning outcomes. The Living Curriculum approach is being considered and implemented from primary through university levels, as described in publications by Squires (2004), and Bernhatzky and Gerber (2002), because for example, it is curiosity/inquiry led, and stimulating, and develops literacies for life-long learning

through collaborative, and independent self-sufficiency. Their research into ‚experiential education' suggested that:

> *"While effective in one sense, "normal" classroom teaching does little to nurture the curiosity, inventiveness, or leadership capacity of active adult learners. Experiential education leaves primary responsibility in the hands, hearts, and minds of the learners. While experiential education may be guided, it is not controlled by the teacher. Integration of concepts acquired in varying disciplines happens in "real-world" settings where there are consequences, challenges, insights, and breakthroughs. In other words, the learning process is holistic."*

Many, if not all of the students in the Department of Construction are, or will be practitioners within the construction industry, and therefore making theoretical connections to real-world practice is a key focus of course delivery and the facilitation of learning. Moon (1999.ch 3), deals with reflection in experiential learning and states that, " the distinguishing features of experiential learning are that it refers to the organisation and construction of learning from observations that have been made in some practical situation, with the implication that the learning can then lead to action(or improved action)". Moon (1999) continued by acknowledging that the term ‚experience' has no single definition and rarely comprises just one element, instead experience may involve workshops, field trips, processes involving ‚learning by doing', that could involve the additional cognitive work of translating the action into language, represented in written or oral form.

Studies on increasing the use of student discussion in the learning environment, are grounded in theories of social constructivism, which focuses on an individual's learning that takes place because of their interactions in a group, rather than just observations (Vygotsky, 1930,1978).

Social constructivism was a key focus of work conducted by Reznitskaya et al. (2007), Nystrand (1996) and Corden (2001) where they suggested that ‚discussion plays a vital role in increasing student ability to test their ideas, synthesise the ideas of others and build deeper understanding of what they are learning", which increases student motivation, collaborative skills and the ability to problem-solve.

Unitec has been offering and delivering tertiary level programmes and courses for the construction industry sector for more than thirty years, and takes pride in having been continually recognised and accredited by national and international organisations in terms of the quality and pertinence of the programmes, and the calibre and employability of the graduates. A recently reshaped Strategic Plan at Unitec, has ‚Innovation in Teaching and Learning' as one of the key drivers, and one of the most prominent

outcomes of that particular strategy is that the Living Curriculum approach to the design and delivery of courses is being introduced across all disciplines and academic levels at Unitec, (Curriculum Design Policy, 2009). The aim is to basically future-proof the students' learning as they commence or continue to work in their chosen industry/discipline, by offering the opportunity to construct their own understanding and solutions to problems through discourse with peers and a broader community. The Curriculum Design Policy (2009), states:

"Unitec Programmes will have a Living Curriculum that:

1. *involves complex conversations,*
2. *is curiosity/inquiry led, and stimulating,*
3. *is practice-focussed-educating students ‚for work, in work, through work,'*
4. *is socially constructed - self-sufficiency and collaboration are equally valued, and together they help nurture resourcefulness and resilience,*
5. *blends face-to-face and web-based learning,*
6. *is research-informed,*
7. *has a discipline base, and is also interdisciplinary,*
8. *develops literacies for life-long learning,*
9. *includes embedded assessment,*
10. *involves active and responsive interaction with industry, professional and community groups shapes content, curricula and delivery modes."*

With particular reference to the course Sustainable Design and Construction (SDC), the following statements by (Bernhatzky and Gerber (2002), resonate particularly strongly with Unitec's Living Curriculum desired approach, and the actual delivery and assessment of the 2010 SDC course:

> *"A critical aspect of education for sustainability is the ability to integrate theory and practice. This ability can't be acquired by sitting passively in a classroom, listening to a lecture, or reading a textbook. We know that most adult learning (after graduation) is unstructured, random, and takes place as a result of living and making meaning out of everyday experience. However in much of our university education, knowledge is handed over to students in safe, officially approved packages to be handed back to teachers for evaluation and reward. The interchange of information between teachers and students is like a "mental handshake" in which a prescribed set of facts is passed from an old head to a young one and back again. Power remains in the hands of the teacher."* (Bernhatzky and Gerber (2002).

For the suggested links between the Unitec Living Curriculum's 7 key principles and associated characteristics, and how they matched with the SDC 2010 course delivery and assessment see Table 1.

Table 1 – Curriculum design policy

The 7 principles and associated characteristics of the Living Curriculum (LC) as per Unitec's LC Design Policy (2009).	*How the 2010 SDC course and assessment approach resonated with the ‚LC principles and characteristics'.*
Conversation- Learners and teachers engage in ‚complex conversations' within and beyond the learning community. Inter-disciplinary conversations and perspectives.	Facilitation of two assignment specific workshops. Conversations involving student's prior knowledge and experience. The requirement for students to establish the specific region's council RMA and CEMP requirements *et al.* Involvement of / accessibility to NZ Green Building Council technical specialists
Curiosity / Enquiry Led- Teachers are facilitators, learners are investigators, problem-solvers. Assessments and activities that have a real-world context. Practice focused. Realistic to industry.	The assignment aim was to get the students to address the reality of building an ESD Visitor Centre and prepare a plausible submission to the developer clients
Collaboration- Learners take responsibility for their own learning, and participate actively with peers and community resources. Teacher-led community of enquiry. Teachers provide regular and timely feedback to learners.	This was implicit and explicit within the assignment expectations and the weekly lecture/tutorials and workshops
Self Efficacy- Learning is focused on the development of confidence and capability. Learners become self-monitors of their learning. Self-sufficiency and collaboration are equally valued. Developing individual expertise within a group via feedback and discussion with the cohort/practice group.	13 Peer groupings conducted the assignment project, and peer assessments made via presentations to the whole cohort. The student groups were encouraged, and given the freedom/flexibility, to interrogate the particular local /regional council regulations and interact with Council and industry personnel.
Problem Solving- Learning is anchored in meaningful problem-solving environments. Learners are involved in creating solutions to authentic problems through the development and completion of projects.	This was the explicit intention of the assignment project as noted in the setting of the scenario and expectations within the marking schedule. The student groups were to explore the range of possibilities, for the hypothetical concept, for their allocated region, meaning that they could then create and hopefully make the big picture /holistic connections, and be consistent in their own defensible unique solutions.
Reflection – Learners and teachers collectively reflect on and evaluate the learning and teaching environment and processes, and the implications of learning outcomes on the practice environment.	Students were able to reflect on the staged feedback from lecturers, community and industry personnel and peers, while preparing their final submissions. [Refer to the reflections section of the paper herein for a more detailed description.]
Creativity- Learners are encouraged to find creative alternatives to known situations to gain new skills and construct new understanding.	Students were provided with significant flexibility to demonstrate their creative alternatives, for example in terms of all external claddings, selection of glazing types and extent, internal linings and finishes, and the siting/orientation of the building project.

THE ASSIGNMENT PROJECT

The 2010 Visitor Tourist Centre Project assessment event was designed to specifically engage the student cohort in the real-life challenges of current sustainable design and construction/development best practice, relevant new technologies and policies/tools, in the New Zealand context. The project was expressly concerned with integrating sustainable building principles and practices with the economic, social and environmental impacts of the proposed development. A concept plan, notional skeletal cross sections (see Figure 1), were provided to the students for a hypothetical development by a group of property developer clients, who wanted to be able to build ‚green' projects that were sustainably designed and addressed ESD principles.

Process

The objective was to get the students to establish a range of plausible solutions, and demonstrate to the developers, the extent in which sustainability issues differed, according to the particular geographical locations and climatic regions within New Zealand for the given Visitor Tourist Centre project.

The students were asked to form themselves into thirteen three person groups, with the intent of working as integrated teams. Each team was allocated a different region around New Zealand. The locations included for example, Otorohanga, Riverton, Awanui, Waipara, Thames, Motueka, Taupo, Hanmer Springs and Tekapo, in order to establish the likely differing council and climatic requirements for such a development.

Of note was that the 2010 Sustainable Design and Construction student cohort of 39 students comprised a range of people with either no construction industry experience, a few with a few years experience, up to sixteen years previous industry relevant experience. Most though were relatively new to or unfamiliar with the tertiary learning environment.

Base information

The newly formed groups were then required to prepare an A4 report and an A2 poster that included the scaled and annotated concept plans, section and elevational drawings, all associated basic heat loss/gain (ALF) roof, walls, floors and ceilings calculations, to comply with NZ Building Code H1 Energy Efficiency, (OR they were to conduct the LCC of one item on the project), overall costings, the CEMP plan, and materials/product specifications.

The built budget, (excluding siteworks, consultant and council fees, and GST) was not to exceed $\$3{,}400/m^2$.

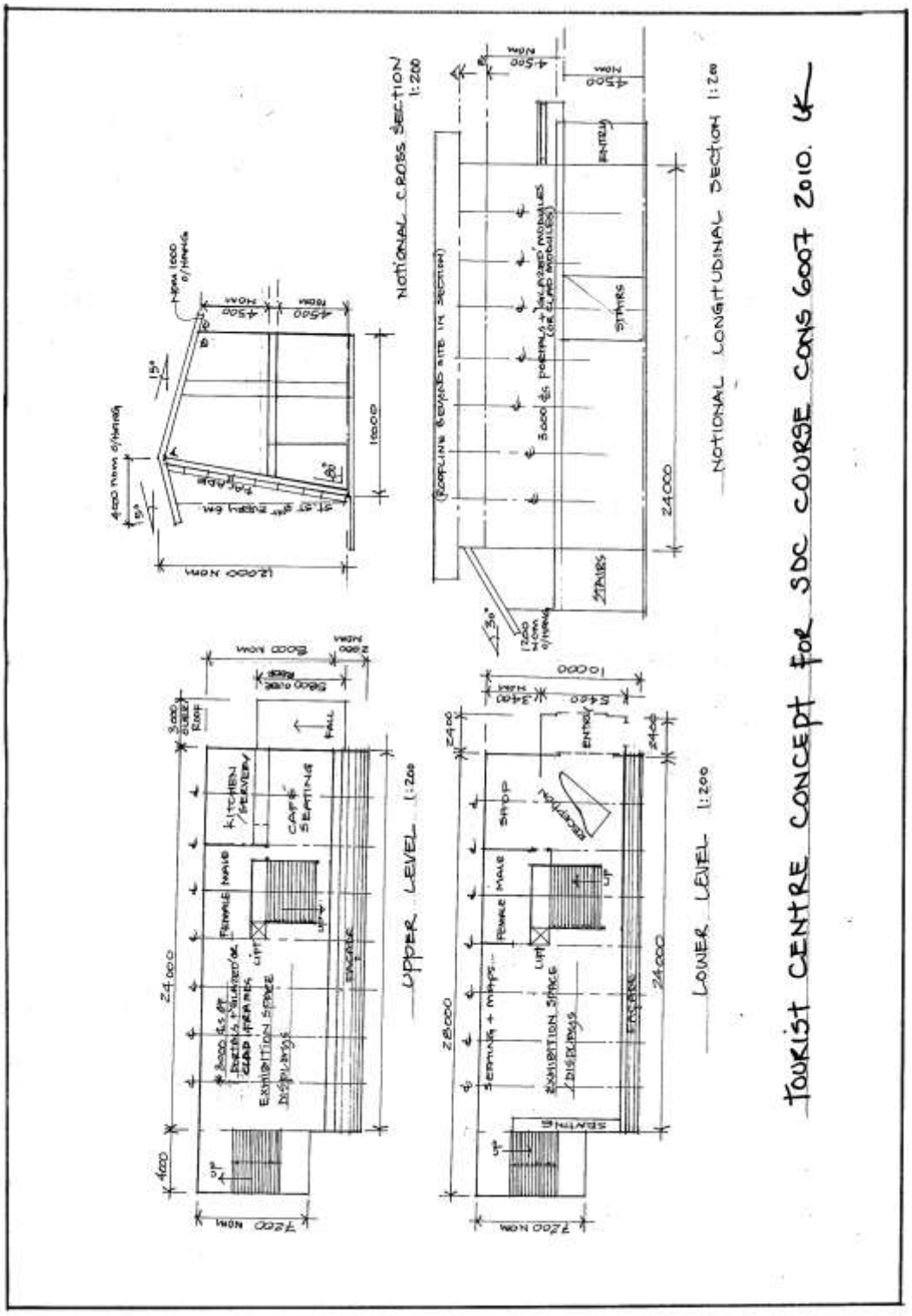


Figure 1 – Concept sketches for the 2010 SDC course project assignment

Tasks

The student groups needed to specifically defend a plausible and integrated set of decisions for:

a) Sustainable materials specifications for the exterior claddings, glazing types, interior wall, floor and How ceiling linings throughout),
b) Roof, floor and ceiling insulation that conformed with sustainable principles and specifications, and in addition the extent of glazed areas shown on the elevations,,
c) Annotated drawings of elevations, floor plans, sections and site plan that identified their solutions to the real-life challenges of sustainable design and construction, as applied to the Conceptual Visitor Tourist Centre,
d) Stormwater would be recycled/used on the actual site, and how natural runoff addressed to meet ESD and RMA principles/requirement,
e) How passive solar design principles addressed and were applied to the actual structure and siting of the project building,
f) Instructions on the on-site management of the potential environmental impacts when constructing the Visitor Centre (i.e. a CEMP – construction environmental management plan),
g) Basic heat loss/gain (ALF- annual loss factors) for roof, walls, floors and ceilings calculations, to comply with NZ Building Code H1 Energy Efficiency,
   OR the LCC (Life Cycle Costing) of one item on the Visitor Centre project.

Throughout the eleven week assessment preparation period the lecturers delivered sustainable design and construction topic related lectures on a weekly basis, answered the various groups' questions regarding the assignment project as they arose, and facilitated two assignment specific workshop sessions, to assist with the application of in-lecture theory and case studies to the 2010 assignment scenario. In addition, the NZ Green Building Council CEO and one of their Technical Team members were invited to make interactive presentations to the whole cohort in order to answer any questions that the students may have had in reference to the use of the Green Star Rating Tools, to sustainable design and construction in general, and in regard to their research findings/plausibility of their proposed assignment submissions.

FINDINGS AND DISCUSSION

Peer presentations were made to the lecturers and the entire class of 39 students by each of the 13 groupings. These presentations needed to identify each of the student groups' key findings relative to the marking schedule. Most chose to use PowerPoint slides and the associated posters, each of the groups created. Each group was given 7-10 minutes to present and 3 minutes for questions from their peers.

At the same time, the groups' peers assessed each of the group presentations, giving a mark out of 10 and provided written constructive comments on the actual presentations. This feedback was later integrated into the overall assessment for each of the groups.

Around 60% of the presentations were very thorough, insightful, relevant, and addressed the marking schedule in some depth and stayed within budget whilst at times suggesting a range of unexpected yet valid ESD solutions and approaches. Several of the groups had not only contacted, but also interviewed the local council representatives in their project area, with some interesting results. For example the group investigating the potential building siting, stormwater recycling, reuse and natural runoff issues in Hanmer Springs (South Island, NZ), conducted in-depth investigations with the local council authorities. They discovered that the council had very strict requirements around the siting and environmental impacts of such a building in that particular township, making the point that for example, the project was considered over-height, and had an oversized footprint for the overall township zoning criteria.

The 2011 cohort of 13 groups' submissions tended to either be those that had conducted thorough investigations and created plausible and integrated suggestions, or those who had not fully understood nor completely met the expectations of the assignment. A few groups though optimistically and unrealistically hoped that their humorous and slightly glib presentations would be sufficient to convince their peers and the developer clients that their solutions were viable. Perceived barriers raised by the student groups included for example, budget constraints initially, until the groups worked their way more deeply into the process and realised to their surprise that the project could in fact be achieved with the majority of the ESD principles et al. addressed. The compromises made were clearly identified too and defended convincingly in the main. Other perceived barriers in a few of the allocated regions included the non-availability or difficult availability of sustainable materials/products, as yet, and for a viable cost.

REFLECTIONS

Reflections on the expectations and realities of the assignment outcomes

- The objectives /aims of the set assignment were reasonably well handled by the majority of the 13 groups, with four very strong, plausible submissions. Their understanding of passive solar design principles regarding materials that offer thermal mass, the use of natural shading, orientation, and glazing variational percentages according to whether north, west, east or south facing fenestrations was reasonably well handled.
- Most of the groups were surprised that they could and did keep within the set budget of $3,400/m^2$.
- The South Island costs overall and particularly for insulation and double glazing were considerably higher than in the North Island. Interestingly coastal and

marine locations also realised increased costs due in the main to more expensive exterior cladding solutions to resist corrosion, and the need for extra insulation, watertightness provisions and extensive double glazing.

- The section that asked students to assess annual heating costs and code compliance with the energy standards required the use of software covered in a course from a previous year was generally well investigated and applied to a new and more complex problem, with low levels of additional lecturing and guidance via a self-directed user-guide.
- The main weaknesses across many of the group projects were:
    - The basic structural and commercial construction naivety, for example specifying unreinforced and under-supported rammed earth external cladding for walls (500mm wide in one case) that exceeded 9m in height or was set atop of glazed panels, or thinking that NZS 3604 (the residential lightweight timber framed building code) could be used for a commercial scale high rise building that was well outside the scope of that building code, or trying to create a full scale green turf roof with no thoughts evidenced that extra structural roof support would be required. Similarly the suggestion that unreinforced brick veneer could be used to a height of 9-12m,
    - The lack of any rigorous defence of the materials and construction systems selected and specified. Instead a set of generic descriptors sourced directly from „manufacturers' specifications' was the norm for too many of the group submissions. There was a lack of a convincing defence for the use of imported materials such as tiles from Asia or Europe and „Marmoleum' from Scotland, for example. This despite strong and reiterative messages from the Green Building Council representatives and the lecturers on the importance of using sustainable sources, wherever practicable.
    - Mind dumps of information rather than application of principles to the particular scenario.

Overall a slightly disappointing result compared with the 2009 cohort's outcomes (for a hypothetical „terraced unit complex'), see Kestle & Rimmer (2009), which resulted in around 95% of the presentations being thorough, insightful, relevant, and kept within the budget, whilst at times suggesting a range of unexpected yet valid ESD solutions and approaches. This is most likely a reflection on this particular 2010 cohort which had a few high flyers who were decidedly committed, capable and passionately interested students who worked in an integrated manner, whilst others were distinctly average in terms of their level of commitment, ability and engagement with each other within the

groups, and with the principles and applications of sustainable design and construction, and ESD.

Reflections on how the Living Curriculum approach/principles might aid /inform the future delivery of the SDC course

The following comments are a result of reflecting on the 7 basic principles and a selection of the characteristics of the Living Curriculum (see Table 1 previously) being: Conversation; Curiosity / Enquiry Led; Collaboration; Self Efficacy; Problem Solving; Reflection; Creativity, and then reviewing the match with the course delivery and outcomes in 2010, going forward.

The application of the Living Curriculum principles and characteristics to the SDC 2010 course assessment would appear to highlight the gaps in learning and previous experience (or lack of it), and/or ways in which delivery or assessment modes may need amendment or enhancement in future years.

Probably the most significant questions needing to be answered going forward then are:

1. whether the opportunity for creativity was a little too wide or even slightly intimidating for Year 2 (level 6) degree students,
2. whether a number of the students did not fully appreciate the expected depth of enquiry, and/or did not apply themselves fully,
3. whether a number of the students perhaps enrolled in this course before being sufficiently commercial-construction-capable, even at a basic level. This would appear to be a key reason for their poor judgement regarding external claddings specifications in particular, and one that did not surface until the final submission was received by the lecturers.
4. whether the students need more guidance particularly as self monitors of their learning, given the failure of several groups to use the marking schedule as a guide to the type of work they were expected to conduct and submit. In addition there was also evidence that they were reluctant to really confront the issue of how each member contributed to the group assignment which was an important component of the mark allocation. The tendency was for groups to avoid the issue, and evenly share marks out even when this did not reflect the real situation. Those that did not contribute need more guidance to help self monitor their own learning.

Personal reflections

The fundamental mindset and operational shifts required to produce more sustainable built environment requires and involves more collaborative and integrated approaches to

building construction through concept to handover. This course assignment has appropriately, modelled that collaborative approach, and at the same time has in fact aligned itself closely with the characteristics of the Living Curriculum, on reflection.

Is the extra work involved (for the lecturers) regarding delivering, setting and assessing a course and project like this (rather than a more closely controlled series of directed assessments) reflected in the short or long-term usefulness of the problem–based assignment exercise from the students' perspective, and the new information gained and shared with the whole group for future reference. The answer to this question appears to be a resounding yes from the students' verbal and candid feedback, despite the obvious need for more in-depth and time-consuming investigative work on their part.

The challenges to collaboration and preparing plausible, in-depth and defensible solutions to practice-focused project assignments, that were experienced by the students, are likely to be reflected in their future real life projects, and therefore provide an insight into how this new way of working may be achieved.

CONCLUSIONS

The objective of the course and the associated assignment was to get the 2010 SDC students to establish a range of plausible defensible solutions, and establish to what extent sustainability issues differed, according to the particular geographical locations and climatic regions within New Zealand for the given conceptual Visitor Tourist Centre project. The aim of the paper was to also match the course against the use of the Living Curriculum approach to teaching and learning, to highlight the usefulness and/or gaps in learning, and ways in which delivery or assessment modes may need amendment in future years. On reflection the findings suggested that cohort's abilities and engagement differ from one year to another, with the 2009 cohort seemingly performing better on the 2009 Terraced Unit project assessment in terms of their outcomes relative to similar marking schedule criteria to that used in 2010. Whether the differences are attributable to the make-up of the differing cohorts or to the observations and insights gained by applying the Living Curriculum principles to the 2010 course and assessment is possibly debatable, but the overall sense is one of valuing the Living Curriculum approach to the Sustainable Design and Construction course going forward, as it tends to highlight the learning needs and strengths of the cohort, and the desire on the part of the students to be involved with real-life learning experiences.

REFERENCES

Baird, G. (2010) What the Users Think of Sustainable Buildings – a global overview, Proceedings of SB10 NZ – Sustainable Building-Innovation and Transformation Conference, ICONDA CIB.

Beard, C., Clegg, S. and Smith, K. (2007) Acknowledging the affective in higher education, *British Educational Research Journal*, 33 (2), 235-252.

Bernatzky, R. and Gerber, J.M. (2002) *Creating a Sustainability Curriculum at the University of Massachusetts*. Amherst, (n.p).

Bernhardt, J. (Ed.) (2008) *A Deeper Shade of Green – Sustainable Urban Development*, Building and Architecture in New Zealand, Balasaglou Books.

Bloom, B.S., Hastings, J.T. and Madaus, G.F. (1971) *Handbook on Formative and Summative Evaluation of Student Learning*, McGraw-Hill.

Chalkley, B. (2006) Education for Sustainable Development Continuation, *Journal of Geography in Higher Education*, 30 (2), 235-6.

Corden, R.E. (2001) Group discussion and the importance of a shared perspective: learning from collaborative research, *Qualitative Research*, 1(3), 347-367.

Duncan, A. (2010) Active Solar Design with Thermal Storage, Proceedings of SB10 NZ – Sustainable Building-Innovation and Transformation Conference, ICONDA CIB.

Elkink, E. and Pringle, T. (Eds.) (2008) *Passive Design*, BRANZ.

Kestle, L. and Rimmer, T. (2009) Sustainable Design and Construction Education-Getting the Students on Board with The Real Challenges in NZ, Proceedings of SB10 NZ- Sustainable Building - Innovation and Transformation Conference, ICONDA CIB.

Kibert, C.J. (2008) *Sustainable Construction-Green Building Design and Delivery*, Second Edition, Wiley & Sons.

Krathwohl, D.R., Bloom, B.S. and Bertram, B.M. (1973) *Taxonomy of Educational Objectives, the classification of educational goals, Handbook II: Affective Domain*, David McKay.

Moon, J. (1999) *Reflection in Learning & Professional Development: theory and practice*, Stylus Publishing.

Nystrand, M. (1996) *Opening Dialogue: understanding the dynamics of language and learning in the English classroom*, Teachers College Press.

Resource Management Act. (1991), NZ Government Printer.

Reznitskaya, A., Anderson, R. and Kuo, L. (2007) Teaching and Learning argumentation, *The Elementary School Journal*, 107 (5), 449-472.

Shephard, K. (2008) Higher Education for Sustainability: seeking affective learning outcomes, *International Journal of Sustainability in Higher Education*, 9 (1), Emerald Publishing Ltd.

Squires, D.A. (2004) *Aligning and Balancing the Standards-Based Curriculum*, Thousand Oaks, Corwin Press.

Curriculum Design Policy. (2009) Academic Policies and Procedures Manual, Unitec Institute of Technology, (n.p).

Vale, B. and Vale, R. (1991) *Green Architecture-Design for a Sustainable Future*, Thames and Hudson.

Vygotsky, L. (1978) *Mind in Society*, Harvard University Press.

Design Management: Challenges for Adaptive Re-use

Kartina Alauddin and Kerry London
School of Property, Construction and Project Management
RMIT University, Melbourne, Australia

ABSTRACT

Adaptive re-use is an important strategy in overcoming the problem of dilapidated and redundant historical buildings. It is a significant strategy for achieving sustainability as it ensures a continuous building life cycle and prevents building destruction. Adaptive re-use projects have their own unique environment and specific challenges to ensure success. As building stock ages, more and more attention is focus on adaptive re-use projects. The aim of this paper is to explore the unique problems and critical success factors in the design brief development phase for heritage buildings. The literature review has identified incomplete information on historical buildings, lack of creativity and flexibility and lack of collaboration among project stakeholders as a unique problem. Specifically an architect with specific expertise to provide the necessary creativity in design problem solving, stakeholders who will collaborate during design decision-making processes and quality information to support problem solving are among the critical success factors for these projects. It is a highly specialised field with significant experience and knowledge domains that accumulated from past projects. Such knowledge and expertise often create intellectual capital within project teams. These teams comprises of professionals in a niche market who typically work together on subsequent projects, which makes it as important as to understand reflexive modes of management. Two projects of the same project teams are examine as case studies to explore the relevance of the concept of reflexivity. We propose a design management framework to understand how to capture, transform and accumulate social, cultural and intellectual capital within design teams that are dedicated to adaptive re-use projects towards development of a practical design management methodology grounded in theory and empirical observations. The paper describes the conceptual model and the proposed methodology for the study.

KEYWORDS

design management, adaptive re-use, critical success factors, case study, intellectual capital framework

INTRODUCTION

In the late 1970s to early 1980s, the Australian Council of National Trusts identified „recycling' as the best method to protect and maintain the historical or old building with new uses (Latreille et al. 1982). There are many examples of recycled building case studies that have been review to identify the potential benefits of the adaptive re-use strategy. Adaptive re-use can however be a complex process. The complexity of the adaptive re-use project is often concerned with the design and construction phases. A strong factor that contributes towards the complexity is lack of professional expertise (Ball 1999;Kurul 2007). According to Bullen (2007), less creativity in solving any problem occurred in adaptive re-use projects contributed to the project complexity. Incomplete and inaccurate design information (Karim et al. 2007; Shipley, Utz & Parsons 2006) is also a challenge in this type of project. During the design and construction phase, the need for historical information provided by the original drawings and documents of the historical buildings is crucial. The investigation process conducted by professional practitioners during initiation phase up until development approval aids the quality of the information. However, Kurul (2007) believed that improving the project team members' skills related to heritage will contribute to more creativity in design and decision making thus avoiding project complexity.

Therefore, this study seeks to analyse the literature on critical success factors that can potentially improve knowledge management within the context of design management towards enhancing the expertise of project stakeholders. This study will attempt to make two contributions. First, defining a set of critical success factors towards the development of an intellectual capital model of project stakeholders' for the design stage. London and Chen (2004) defined intellectual capital as a collection of skills, experience, competences and knowledge in organizations. The accumulation of intellectual capital would involve human capital, organizational capital and social capital.

Second, an analysis on the case studies, specifically on knowledge accumulation, critical success factors and the design management approach in handling design issues. This study shall also acknowledge the link between the two case studies. The involvement of multi-disciplinary within project team is also a key element of this study. Team members with information on knowledge creation and transfer of past adaptive re-use projects and how it contributes toward the project. Adaptive re-use projects differ from many building typologies because a high level of knowledge about the existing building is required. Unknown matters revealed as the project unfolds and have to be solve within the context of the existing building fabric and within the existing cultural heritage context. The depth and breadth of knowledge on any project type can be quite extensive. However, the

uniqueness of adaptive re-use projects is sustainability and its different dimensions for any different types of historical buildings particularly in design-oriented items.

LITERATURE REVIEW

There are a number of issues in the design phase that will eventually generate a challenge for an architect in an adaptive re-use project and these are now considered.

Design development issues

Design is a crucial stage when dealing with historical buildings. In preparing the drawings, all information and data must be clear and accurate particularly in the design brief development phase. However, incomplete information occurs quite regularly with adaptive re-use projects, as historical buildings often do not have complete documentation for assessment and design purposes. Incomplete information during the design process is the source of complexity in adaptive re-use projects (Pham; 2006). Gorgolewski (2008) also found that, lack of clear information would provide a challenge to the architect in early phases of design decisions. It is important to investigate and locate the original information, as it will reflect in the quality of design decisions. Any delay would cause the architect to require more time in preparing the design and negatively affect the whole project schedule.

Next is the difficulty in obtaining stakeholders' collaboration in design brief development process. It is important that a mutually agreed design that meets the heritage requirements is achieved (Latham 2000). This collaboration is important because it reduces the potential of design changes during construction. Any further design changes will challenge the architect as it involves design amendments and increases the number of unscheduled meetings. Thus, affected the project performance and extended the construction project time and cost from the original estimate (Ali, Kamaruzzaman & Salleh 2009). It is ideal if the architect has specialized experience in capturing the client's requirements for historical building re-use, as they are unique building types. It is also critical that the design team has a specialist that is highly experienced and knowledgeable in heritage conservation as typical adaptive re-use projects is compelled with various heritage legislation. The architect needs to synthesise the project objective and functional design with the historical context, the local methods of construction and the timeline of which different methods were used and when.

The architect's lack of creativity and flexibility also becomes an issue in designing and adapting historical buildings to a new function. It requires a high level of creativity to redesign historic buildings that are no longer compatible with the original function. Significantly, the combination of the historic building original design with modern design

elements poses a challenge during design development. The design must be compatible with the new purpose, current situation and heritage obligation to obtain development approval. In relation to design flexibility, Haymond (1982) stressed that the architect's ideas must be flexible to adapt with the existing building components. Thus, the architect needs to develop an intellectual capital to assist them in being more creative and flexible in design and responding to unique problems of adaptive re-use projects. Next, this study will review literatures of critical success factors related to adaptive re-use projects in regards to designing a solution that responds to the unique problems.

Critical success factors

The design activity is the most complex and crucial stage in adaptive re-use projects. It is essential to manage the design process appropriately, as it involves identification of critical success factors that contributes towards project performance. This section describes four critical success factors in adaptive re-use.

The literature review on project management and critical success factors in relation to adaptive re-use project has identified a higher level of expertise of professional designers, controlling problems in design (Reyers & Mansfield 2001), collaboration and historical dynamics (Roecker 2008) and a good historical buildings condition assessment (Clark 2008) as the critical success factors that can overcome the challenges faced by the architect. Redevelopment of a historic building with the need to preserve the historical values is a challenge in relation to development and building approvals. The new designs will be influenced by factors that lead to modernity and at the same time reduce the value of history of the building. To overcome this challenge, one of the critical success factors is the need of a high-level expertise in designing an adaptive re-use project. To increase the expertise level of design teams, they should be involved in similar projects as much as possible. The cumulative experience from other projects would build the intellectual capital of the designers.

Reyers and Mansfield (2001) mentioned that controlling the problems in design brief development is critical for adaptive re-use success. This activity would help through the initiation of getting all the approvals and be acceptable as an element in design management approach. As an example, London and Cadman (2009) defined the conflict in defining sustainability in terms of inconsistency between regulatory environments caused many of the problems in gaining development approvals in relation to design management. They also suggested that in reducing the conflict, it involves individual attitudes and personalities within procedural matters in relation to approval. However, controlling problems does not just rely on individual but also to the design team with high level of accountability in the activity of problem solving. Woodyard (2004) suggested

that to maintain accountability, design teams should have regular, frequent team meetings, and addressed the unique problems due to heritage and design requirements. The solution found for the problem will then become a part of the intellectual capital of the architect as an individual, as part of the team and to the project organization.

According to Roecker (2008), two key critical success factors in adaptive re-use projects are project stakeholders' collaboration and the historical dynamic. A historical dynamic strategy requires a multi-dimensional view of the historical building. The architectural embeds meaningful information in the inter-relationships between environmental, economic and cultural/social categories. The heritage building's history is to be preserved throughout the contemporary design with respect to the formality, spatiality, structural, and material (Roecker 2008).

The collaboration refers to multiple partners and users involvement in adapting the architecture and history as elements in design development. Clark (2008) defines a high level of collaboration between professional experts including the client or project manager, architect, contractor, historic conservator and the local preservation office as critical for a success in an adaptive re-use project. As cited in London and Cadman (2009), Greene and Elfrers 1999 outlined the expertise, skill and knowledge as important elements in becoming a professional expert and a personal power in influencing others in gaining collaboration.

In summary, the design development issues that contributed to design challenges are:

- Limitation of architect's creativity and flexibility
- Stakeholders collaboration difficulties
- Incomplete historical information

The critical success factors that contribute to design strategy are:

- Professional designers level of expertise
- Controlling problems in design
- Collaboration
- Historical dynamic elements

Therefore, design challenges and strategy are an appropriate approach for design management in relation to the adaptive re-use project. Whilst all large-scale projects have design management methodologies, it is argued that the design management methodology in an adaptive re-use project may have unique situations that requires a particular focus and that we can build upon a generic methodology to create a unique methodology. The professionals involved in an adaptive re-use project should integrate the process and the skills at the beginning of a project. Even during the process of adaptive re-use projects, the process of peeling away the layers of the physical fabric as well as the social

historical layers of the site and building, new knowledge in the practice of design and construction are created. The creation and transfer of the knowledge is necessary and important to enhance the success of future adaptive re-use projects. Thus, a design management approach is appropriate to support the creation and transfer of intellectual capital of multi-disciplines working together as they develop shared understanding about the significance of the buildings history and the surrounding areas where the building is located.

Intellectual capital model for adaptive re-use projects - design management approach

This section proposes a model of design management that supports the development of intellectual capital through design brief process for an adaptive re-use project (Figure 1). The model shows the importance of understanding the input by project teams in producing design ideas and managing issues within design strategy to enhance the experience and expertise of project stakeholders. The important point is what and how they learn and how they share their explicit knowledge (experience and expertise) gained from previous projects within similar project characteristic. Experience and knowledge will critically enhance adaptive re-use project to ensure continuous success. This model is composed of six important components that is interrelated with design and knowledge management in relation with adaptive re-use project

1. The Project
2. Design Strategy
3. Design Challenges
4. Sharing and Learning
5. Knowledge Creation and Knowledge Transfer
6. Intellectual Capital

The project

The Project represents a single adaptive re-use project that includes design and management activities. It consists of the challenges and strategies to achieve project success and provides existing intellectual capital for an adaptive re-use project. It will then utilise the strategies of the stakeholders through processes of sharing and learning to undertake design challenges. All created knowledge shall then be transferred to the intellectual capital of the project and serve as valuable information for future reference. This is particularly important and beneficial for the stakeholders who may be working back together to enhance the future project performance. It will also benefit project

stakeholders who may not be involve with similar project previously as added knowledge in managing the design process and challenges for future projects.

Design strategy (critical success factors)

Four design strategies identified are to represent human and historical tools in overcoming the design challenges. The human-based capitals are expertise, control of issues and collaboration that are also known as tacit knowledge. In this stage, the human-based capitals that are adapted to the strategy in overcoming the challenges of designing historic buildings are:

- *Professional designers with a high level of expertise*. Expertise can be assessed in terms of the architect's experience and qualifications in carrying out similar projects. Expertise may increase the architectural creativity in providing design, highly skilled in managing the design brief meeting as to obtain collaboration from all parties involved. It is also extended in finding all the channels that could provide source of information on historical buildings in helping to provide the best design for the development approval.
- *Controlling issues in design*. Issues associated with the design may result in additional time on the overall project schedule. These issues are identified through regular meetings conducted before the final design issued to prevent any further change in the future. This also suggests a method of prevention for recurring issues that might arise and prolonged the project schedule. Every individual must provide a feedback to the control channel which coincides to prevent issues that could disrupt the process of designing and creativity process.
- *Collaboration among stakeholders*. Establishing collaboration among project stakeholders is considered critical to achieve a consensus on the result of good designs. It also facilitates the design issues by taking into account all stakeholders' requirements and not only focuses on the client's needs alone. The requirements of the local or state government in approving the project development need to be addressed as well. It is highly recommended that an architect experienced in organising a collaboration of all stakeholders to be the best selection for a leader of a 'community of practice' in managing all the different expertise but with similar interests of purpose.

This study also contributes new knowledge in intellectual capital by proposing a historical dynamic-based strategy. This determines the importance to adapt the dynamics of historical value and the buildings' original architectural in the design. To adjoin all aspects of original design, structural and fabric to coordinate well with new and contemporary design in accordance with heritage requirements as much as possible as to

maintain the historical and architectural significance of the buildings. The historical dynamic elements provide a unique situation for adaptive re-use projects. This is the uniqueness of the model suggested by this study, as it is not applicable to common projects.

Design challenges

Design issues in this model are challenging factors to the architect in the design brief development stage. Specific issues in relation to adaptive re-use projects are the architect's design flexibility and creativity limitation, stakeholder's collaboration difficulties (organisational and economic conditions) and incomplete historical information for the designers:

- *Design flexibility and creativity limitation*. This is influenced by the physical condition of the historical building that provides limited space and idea for the architect to be more creative in the design. Greater challenge to the architect is to merge modern design with existing elements of the historical buildings to accord to new function and new era. In other words, architect needs to be more creative to integrate the requirements of the client (new function) with a heritage requirements, standards and policies.
- *Collaboration difficulties*. Two conditions contributed to this difficulty. First, Organisational Conditions: this refers to project organisational structure. It is a challenge to collaborate multidisciplinary requirements during design brief development due to different background and skills amongst a multi-disciplinary project team. The organisational structure and procurement strategy can assist in creating an appropriate culture of problem solving amongst the project team. The organisational culture within the project team is also critical to ensure a commitment towards design flexibility. Second, Economic Conditions: the adaptive re-use project can be a slow and tortuous process with numerous delays and difficulty to get collaboration with local government. The development approval processing time in Australia in the last decade has almost doubled in some local government areas due to the increasing need to consult with stakeholders, lack of professional expertise in planning, increased complexity in regulatory requirements (particularly in relation to sustainability) and conflicting regulatory requirements at various levels of government and across different agencies.
- *Incomplete information*. A typical problem area involved in re-design of historical buildings to new functions is the lack of information to enable a thorough building assessment. Incomplete assessment of the building makes it

difficult for architects due to the lack of guidance and information for the design process.

Previous studies proved that the above three challenges are theoretically a critical problems for the architect in design brief development of adaptive re-use project (Ali, Kamaruzzaman & Salleh 2009; Gorgolewski 2008; Pham 2006). Once the challenges discussed among the design teams and project stakeholders, the next stage is to define the strategy to overcome these challenges.

Sharing and learning

The group should develop an understanding of the key problems to solve and develop approaches in solving future problems through the development of a particular group culture. Knowledge is important in the historic environment because of its richness in interpretation thus transforming it into historical buildings have to be detail and accurate. Shared understanding about the importance of history in relation to the building, hence history of the area and history of the building is significant and a shared understanding and respect for this amongst the stakeholders is critical.

In relation to that, it is important to identify that there is a history with some of the key stakeholders and project team members associated with adaptive re-use projects. The project stakeholders in many cases may have developed a shared learning capacity over time within the group. As often it is a specialized, small and unique market segment, a group may have previously collaborated and carry out all the activities and processes of adaptive re-use projects. This is an ideal situation whereby the teams can capture what they have learnt from past projects and share their knowledge to the current project.

Knowledge creation and knowledge transfer

An important part of understanding the creation and transfer of knowledge within a shared professional collaborative environments often comes with a shared history, it is important to identify a working history with some of the key stakeholders associated with adaptive re-use projects. The group may have developed an intellectual capital, aided by the completion of past project. Past involvement in adaptive re-use processes particularly during design brief development makes it much more comfortable to confront the problems related to design creativity and flexibility, design information and stakeholders' collaboration for the current project in hand. As it is with a new and different project, new approach and solution created and later transferred into the intellectual capital for future project undertakings. Reusing past knowledge accumulated through experience will reduce the time taken to solve problems thus increasing work efficiency (Dave & Koskela 2009).

Intellectual capital

Is an accumulation of information, knowledge of issues, solutions and identifiable approaches in handling situations and many other valuable inputs generated by actual experience. The capital would serve as a main reference for having a better outcome with a faster response time due to its prior occurrences' in other similar projects.

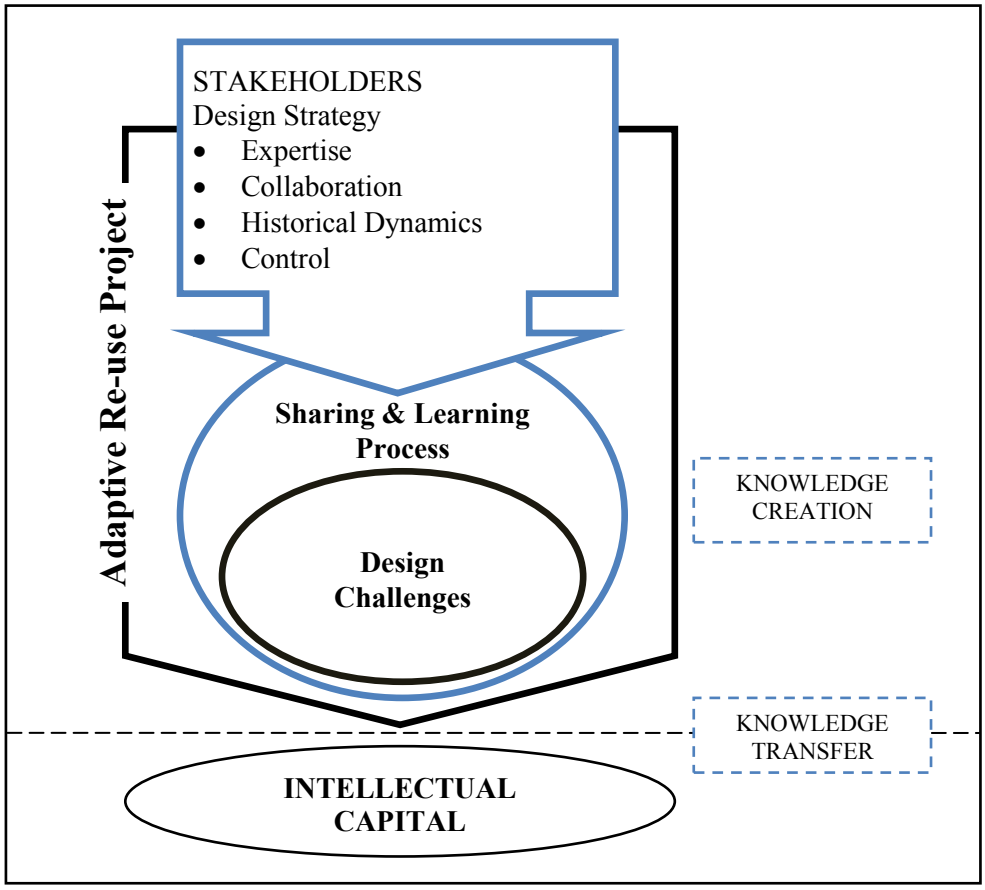


Figure 1 – Design management approach to support intellectual capital for adaptive re-use projects

The knowledge created and transferred reflects the different backgrounds of project stakeholders and impacts upon how they individually and collectively approach the current issues. Shared understanding about the importance of history in relation to the building and the area is significant and a shared understanding and respect amongst the stakeholders is critical.

Research questions generated from the above model based on the findings from project management and adaptive re-use literature are as given below:

1. What are the challenges that project stakeholders (design teams) faces throughout design decision process?
2. How does the knowledge of project stakeholders (design teams) utilized towards creating new design strategy and later transferred for future benefit?

RESEARCH METHODOLOGY: CASE STUDY DOCUMENT ANALYSIS

This study uses a case study methodology and a qualitative data collection and analysis method. According to O'Leary (2004), qualitative methods can be subjective, value-laden, biased and an ad hoc process that accepts multiple realities through the study of a small number of cases. This study will explore two completed adaptive re-use development projects of heritage-listed buildings as case studies.

Figure 2 summarised the description of methodological design of this study. This paper presents the exploratory and preliminary results and describes the data collection and analysis from the two case studies. The first step towards developing an understanding on the unity and wholeness of the particular case begins with understanding of the history of the original buildings and its relationship with the design brief development for adaptive re-use. The second step is an empirical study involving interviews with the design teams. However, this study only focuses on preliminary report of the document analysis. The historical documents reviewed were conservation management plans, contract documents, drawings and other related documents. Two completed adaptive re-use projects in Geelong selected with more details on the case studies in the following sections.

Case study

Case study methodology is appropriate to explore the role of design management as a means to ensure project success. According to Kurul (2007), a case study approach enables us to develop a holistic and meaningful view of real-life events. Case studies assist with the questions of "how" and "why", enabling explanatory investigations into conceptual relationships which need to be traced over time (Kurul 2007). It also facilitates "getting inside the project or the minds of individuals", to uncover explanations (Punter 1989; Lartkham 1996 in Kurul 2007). Case studies can provide strong supportive evidence for a proposed conceptual model. The evidence from the „real world' provides anecdotal evidence to support a theory. Thus, the findings anticipated the research in generating a new theory in relation to project success for adaptive re-use projects.

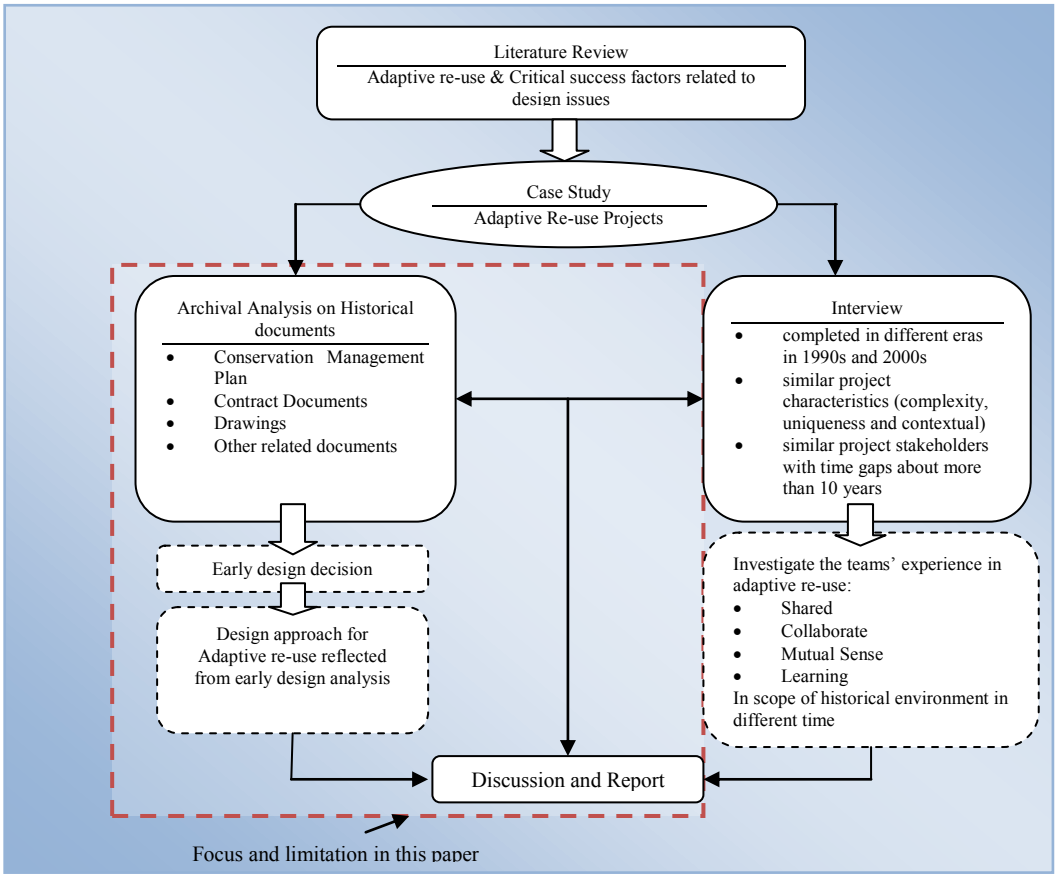


Figure 2 – The methodological design

Archival analysis

The analysis used the documents for both case studies to support the data analysis from the interviews towards understanding the completed projects. The document analysis provides context to what might be important in relation to the future interviews with the project team members. This also provides information on the unique elements that mark the cultural and architectural significance of the buildings. The interview data analysis will then provide us with an understanding on how the various professionals from different disciplines tend to understand the historical value in regards to developed design at the design brief stage. We can then explore how they used their experiences and knowledge from two different aspects of knowledge creation and knowledge transfer.

Selection criteria of case study

Three criteria in relation to case study selection are an assumption of the existence of knowledge creation and transfer in the design management, same type of projects (adaptive re-use projects with similar new functions) and involvement of similar stakeholders in both development projects which makes the understanding of the challenges in the design process and critical factors comparable in establishing the project

success. It is crucial to assure that intellectual capital exists throughout the first project, and knowledge creation acquired during the 10 years gaps between project 1 and project 2. Most importantly is that both case studies bring forward the significance in the aspect of architecturally and historically within the specific significance area. Project 1 is the former Dalgetys Woolstores and Project 2 is the former Dennys Lascelles Woolstores. Deakin University is the client for both projects. The location of the wool stores is in Geelong, Victoria about 75km from Melbourne, Australia. The Dalgetys Woolstores and Dennys Lascelles Woolstores were significant heritage buildings in Geelong. Both Woolstores represent an important aspect of the land settling process particularly in Victoria. There are significant woolstore groups in other areas within Australia; however, not all those structures of woolstores buildings matched with the unique qualities of the Geelong waterfront woolstores including the former Dalgetys Woolstores (1891 – 1954) and the former Dennys Lascelles Woolstores (1934) buildings.

Further discussion on case study is related to the preliminary background of adaptive re-use project on both projects as university. This is to understand the challenges and the strategy at the beginning of the design stage. However, detailed analysis of the overall challenges and strategies in the design stage is not included in this paper. This is because the analysis is part of on-going PhD study. The detail analysis will be described after the data obtained from the interview session in the further paper.

Discussion

This makes a unique and interesting set of case studies to examine and explore the intellectual capital created amongst the professional multi-disciplinary project team. Then, understanding the design management process in creating intellectual capital and transferring with particular reference to the adaptive re-use building typology. Assuming that the project team members had created and transferred knowledge from the first project to the second project according to the following elements:

1. *Collaboration*. This study analyses that there is some evidence through the award that there was a collaborative and sharing attitude across disciplines - between the design team and all stakeholders. The architect was able to oversee the interests of the client requirements to ensure the unique historic value preserved according to the statement in the Conservation Plan prepared by Alan Willingham in 1994 based on building's condition assessment. As described in the Authentic Heritage Services Pty Ltd Report for the Local Government Planning Scheme, "the architect reviewed their design to ensure the retention of as much original building fabric as possible as part of their contemporary design" (Victoria, SG 2010). It means, the collaboration have been developed in project 1. This study

assumes that the development of knowledge creation in human-based capital and historical dynamic happens throughout the process. The client's satisfaction on level of collaboration in design in project 1 could be one of the reasons to used similar stakeholders for project 2. Financial and economic condition is also one of the collaboration elements. The government decision to provide funds for the project 2 is reflection by the professional peer reviewed in project 1. It is stated in Deakin Prime News that the project 2 (Dennys Lascelles Woolstores) cost to refurbish the 1934 sections was approximately $37M AUD and was a joint project between Deakin University and the Victorian and federal governments. A sense of collaboration existed at these early project initiation stages. The Commonwealth and Victorian Government funded approximately $15.6M each for this project.

2. *Expertise and controlling the problems*. The architect for this project won the Royal Australian Institute of Architect's President Award for recycled buildings in 1997. The winning criterion indicates that the architect applied good design and good management. A good or effective management relates to how well the architect controls the design problems to produce a good design for the new purposes. In the other hand, a good or effective design implies to the success of the architect to fit the university design naturally and comfortably within existing structure. The architect provided a total competent design scheme that functions well, with superb space and light quality throughout the area of the woolstores. It is assume that the architect has successfully identified the problems related on space requirements by providing a most suitable and appropriate functions for each spaces in historic buildings.
3. *Historical dynamic*. Retaining the historic value quality of the woolstore, merging well with an existing building component with new purpose as a university is the architect's winning criterion in project 1. It is a valuable element to make the historical dynamic unique to adaptive re-use when defining the adaptive re-use as "a significant change to function". Example, it was happened to former Dalgetys Woolstores and Dennys Lascelles Woolstores has changed as university that well integrated the modern design and balance with the historical dynamic. It means, everyone still recognizes that the university was once the woolstores when we looked inside and outside of the buildings, as the name of Dalgetys Woolstores and Dennys Lascelles Woolstores are maintained on the wall. The Dennys Lascelles Woolstores building created an exciting multipurpose environment, providing light-filled spaces of varying dimensions. The value of history of this building merges with technology, and environmental

sustainability as a critical part in the design development for Dennys Lascelles Woolstores that the stakeholders learned from Dalgetys Woolstores. The location of this building at a well-known corner with waterfront views also provides the answer that understanding the history of area (surrounding) and the buildings itself is important and critical in order to gain intellectual capital. The historical elements and the importance of protecting the architectural and historical significance inside and outside the buildings influenced Deakin University's design concept. The Victorian Heritage Database stated, "The architectural significance of this building relies on the retention of the remaining parts of the woolstore complex". This project was successful in design because the University's Master plan was consistent with the Environmentally Sustainable Design (ESD). However, this paper does not discuss the detail of ESD.

CONCLUSIONS

According to the preliminary analysis, it is apparent that architect has higher expertise in getting collaboration from all project stakeholders and provides the creative design that fit with existing building structure and fabrics. The literature review considered the issues of design; incomplete information, difficulty to obtain collaboration in design and the architect's lack of creativity and flexibility, which creates a big challenge in the design development phase. The critical success factors identifies; higher level of expertise of professional designers, controlling problems in design, collaboration and historical dynamic elements are points suggested in overcoming the issues. In particular, adaptive re-use project requires a thorough understanding; knowledge and experience to ensure architectural and historical significant buildings reinterpreted in an appropriate manner. It proved that project management is a key critical success factor for the success of adaptive re-use project. We contended that a design management methodology is particularly important within the project management approach and that knowledge management was a key to adaptive re-use projects. There is little theoretical development and empirical research in relation to developing a design management methodology underpinned by an appreciation for the role that intellectual capital can play in ensuring adaptive re-use projects are well executed. The paper sought to establish knowledge creation and transfer within the scope of design management as a strategy to ensure a successful project. We began exploring the proposed Intellectual Capital Model for adaptive re-use projects in relation to two situations namely the former Dalgetys Woolstore and Dennys Lascelles Woolstores. These two heritage listed buildings were located in an Australian city adjacent to each other and had architectural and cultural significance and were developed more than ten years apart by the same project team and client. The document analysis

provided substantial background towards understanding the nature of the projects within a case study research methodology. The document analysis is ongoing.

REFERENCES

Ali, A.S., Kamaruzzaman, S.N. and Salleh, H. (2009) *The characteristics of refurbishment projects in Malaysia*, Facilities, vol. 27, no. No.1/2, pp. 56-65.

Ball, R. (1999) *Developers, regeneration and sustainability issues in the reuse of vacant industrial buildings*, Building Research & Information, vol. 27, no. 3, pp. 140 - 8.

Bullen, P. (2007) *Adaptive reuse and sustainability of commercial building*', Facilities, vol. 25, no. 1/2, pp. 20 - 31.

Clark, D. (2008) *From Eyesore to Opportunity: Adapting an Older Building for a New Use*, Buildings, vol. 102, no. 4.

Dave, B. and Koskela, L. (2009) *Collaborative knowledge management-A construction case study*, Automation in Construction, vol. 18, no. 7, pp. 894-902.

Gorgolewski, M. (2008) *Designing with reused building components: some challenges*, Building Research & Information, vol. 36, no. 2, pp. 175-88.

Haymond, J. (1982) *Adaptive Reuse of Old Buildings for Archives*, American Archivist, vol. 45, no. 1, pp. 10-8.

Karim, S.B.A., Kamal, K.S., Wahab, L.A. and Hanid, M. (2007) *Risk assessment and refurbishment: The case of Ipoh Railway Station Perak, Malaysia*, paper presented to MICRA 2007, Malaysia, March 2007.

Kurul, E. (2007) *A qualitative approach to exploring adaptive re-use processess*, Facilities, vol. Vol. 25, no. No. 13/14, p. 16 pages.

Latham, D. (2000) *Creative re-use of buildings*, 2 vols., Donhead, Dorset.

Latreille, A., Latreille, P., Lovell, P.H., Australian Council of National Trusts. and Historic Buildings Preservation Council (Vic). (1982) *New uses for old buildings in Australia*, Oxford University Press, Melbourne.

London, K. and Chen, J. (2004) *Firm social, cultural and intellectual capital: strategic indicators of international client satisfaction*, paper presented to Clients Driving Innovation International Conference, <http://eprints.qut.edu.au/27358/>.

London, K.A. and Cadman, K. (2009) *Impact of a fragmented regulatory environment on sustainable urban development design management*, Architectural Engineering and Design Management, 5, vol. 1, no. 2, pp. 5-23.

O'Leary, Z. (2004) *The essential guide to doing research*, SAGE, London.

Pham, N.H. (2006) *Complexity of Data Rich Architectural Environments*, Research thesis, Doctor of Philosophy thesis, Deakin University.

Reyers, J. and Mansfield, J. (2001) *The assessment of risk in conservation refurbishment projects*, Structural Survey, Vol. 19, No. 5, pp. 238-44.

Roecker, I. (2008) *Sustainable Revitalization: An Adaptive Reuse Strategy for the Society Buildings of Vancouver's Chinatown*, in S Elwazani, S Malhis & J Al-Qawasmi (eds), The Fifth International Conference of the Center for the Study of Architecture in the Arab Region (CSAAR 2008B), College of Architecture and Arts, Petra University, Jordan, vol. Vol. B, pp. 33-48.

Shipley, R., Utz, S. and Parsons, M. (2006) *Does adaptive reuse pay? A study of the bussiness of building renovation in Ontario, Canada*, International Journal of Heritage Studies, Vol. 12, No. 6, p. 15 pages.

Victoria, G. (2010) *Geelong Woolstores Conservation Area : Geelong Historic Buildings*, http://vhd.heritage.vic.gov.au/ database.

Victoria, SG (2010) *Victoria's Planning Schemes (PSO Indexes)*, Department of Planning and Community Development, retrieved 17 December 2010, <http://www.dse.vic.gov.au/PlanningSchemes/>.

Woodyard, J (2004) *Adaptive Reuse - A Case Study*, Professional Report, Winter 2004, pp. 1-4.

The Development of an Online Bidding Game as a Learning Tool

David Cattell
Institute of Sustainable Development and Architecture
Bond University, Gold Coast, Australia

ABSTRACT

Competitive bidding in construction involves high degrees of risk. The nature of the work involved is not certain: the contractor cannot accurately predict all of the factors that are involved such as the weather, soil conditions, labour rates, reliability of plant, the extent of wastage, and productivity. Whilst cost estimates are usually done deterministically, these uncertainties will give effect to some degree of unavoidable error in these estimates. Despite these risks, the mark-ups in this industry are typically relatively small. Given this environment, the lowest bids in any tender may be the cause of comparatively low costs (for reason of some competitive advantage), erroneously low estimates of these costs, low mark-ups, or a combination of these factors. As a result, contractors suffer the risk of the "winner's curse" which is otherwise known as a Pyrrhic victory. A contractor's bid may be the lowest because they made an error under-estimating their costs, causing them to win the tender but make a loss. An online Bidding Game is in development that will facilitate that students will be able to compete against each other in a safe, simulated environment. They will be able to test their skills at deciding strategies as regards selecting projects on which to compete and then decide bid prices that are sufficiently low for them to "win" and yet sufficiently high as to produce profits, given conditions that resemble the real world.

KEYWORDS

bidding, pricing, bidding models, game theory

INTRODUCTION

Research on bidding models was started by Friedman (1956). He proposed a mathematical technique for predicting the bid prices of competitors and hence the determination of an optimum bidding price, given a competitive situation. He formulated models for three different scenarios, namely (a) if a contractor has knowledge of who their competitors are for a given project, or (b) if they only know how many competitors they have, or (c) worst of all, if they don't even know how many bids they will be up

against. Friedman's model provides a basis by which a contractor can analyse the data they have available and decide their best-suited bid.

Around the same time, and independently of Friedman's efforts, Gates (1959) formulated an alternative model. The Gates versus Friedman debate has raged on ever since, with many dozens of researchers falling largely into one or other of these two camps (see, for example, Skitmore 2002). Most bidding models are derived from either Friedman's or Gates' original models. Abdel-Razek (1987) is one of those who have provided a synopsis of the early stages of this conceptual „battle', Crowley (2000) provides a more recent assessment, and Skitmore (2002) provides a quantitative comparison.

Despite extensive research on bidding models (comprising well over 1000 journal papers) these theories are believed to be seldom applied in the „real world'.

The role of these bidding models is not to be confused with that of *unbalanced* bidding models (see Cattell et al. 2007), which are aimed at optimizing the pricing of the component items *within* a project (given that the contractor has already decided their bid price for the overall project).

The use of Bidding Models is highly contentious and many practitioners believe that the theory is of no practical use. Some students believe that they can justifiably discard having to study these techniques. It was for this reason that a simulation game was developed for use as a tutorial in the classroom environment, whereby students could try a variety of techniques of their own choice, including those supported by prior research and theory, as well as any other approach that they believe to be more appropriate.

There is now a game in development that is a modern, online version of this early (offline) game. It is suited to being a teaching aide for some users as well as a game of entertainment for others. Both such situations will serve to generate data for academic research.

EARLY DAYS

It was decided by the author in 1984, at the University of the Witwatersrand in Johannesburg, South Africa, that a simulated Bidding Game could serve to give students practice in bidding, and in particular, that it would give them opportunity to test various bidding models in a safe and risk-free environment (Cattell 1985). It was started in a very simple manner, given that these were early days with PCs. The university's department was fortunate to be a beneficiary of an HP mini-computer, donated by Skok Systems (an early pioneer in desktop-based CAD software). The game was put together to simply function as follows:

a) Students were invited to a tutorial in which they competed against each other, by submitting bids in secret, to test their effectiveness at deciding tender prices.

b) Prior to the tutorial, some software was written to run on the computer to randomly generate a series of cost estimates, roughly simulating contractors' inability to be 100% accurate with their deterministic estimates of a project's total cost (see Beeston 1975). The software was given as input a supposed value of a project's final, true cost, and it then randomly generated, using a normal distribution, a series of numbers which were then treated as estimates of this final cost (ignoring the effects of inflation).

c) Sufficient data was generated in advance of the tutorial so as to have simulated cost estimates for several such „projects'.

d) The tutorial started by giving each student a piece of paper that secretly revealed to them, their (personal) „cost estimate' for the first „project'. Each student's estimate was drawn out of a hat so as to be obviously unbiased.

e) The students were given a few minutes to decide their tender price and they then submitted these, written on paper. The bid prices were then announced, together with identifying the students who had submitted them, and the project was „awarded' to the lowest bidder. This bidder alone was then told of the project's true cost, which was then used to determine if they made a profit – and this information was kept secret from the other competitors.

f) The students then went on to compete for the next project, on the same basis, and repeatedly so until the end of the tutorial. At the end, it was revealed how much profit or loss each student had made over the course of the full session.

Interestingly, the students started this exercise with an attitude of suspicion as regards the theory of bidding models. They appeared to have an attitude that the tutorial would be easy and that the mathematics of bidding models would likely have little to offer them with what seemed to be an „obviously' easy exercise in which intuition would guide them to making great profits. To their surprise, the tutorial ended with them all having made losses, and seemingly very confused about how to make a profit.

They couldn't seem to escape the wrath of Pyrrhic victories: where their (winning) mark-ups regularly proved to be insufficient to overcome their higher probability of winning whenever they were assigned an under-estimated cost. Those who drew high cost estimates had little chance of winning, regardless of their mark-ups, whilst those who drew low cost estimates fell foul of having chosen a mark-up that would, typically, be insufficient to yield a profit.

The course then went on to teach them about the mathematics of bidding models, by which time this subject had become more meaningful to them. The tutorial was then repeated on the same basis as the first session. This time, the students were noticed to be adopting more formal strategies and the session ended with many of them having made

profits. Overall, the exercise proved useful at illustrating the practical need for the theory of bidding models. It proved the merit of a mathematical approach, albeit that, given that the students had discretion on their individual strategies, this brief exercise didn't provide any assessment of any particular bidding model.

MERIT GAME

Loughborough University ran their first, paper-based MERIT game in 1988 (Loughborough 2011). Since then they have run the game for more than 20,000 contestants. Their game has a wide agenda: aimed as functioning as a teaching tool for most of the management skills involved in construction, and not merely that of bidding. It is also designed around an annual schedule, which builds up to a final round in which the teams of contestants gather together in a physical location to compete. The system is largely dependent on being administered by software that has been developed especially for this purpose.

THE NEW BIDDING GAME

A new bidding game is now in development that has been patented. It will be solely Internet based and is being designed to be freely available to be played, in some modes, throughout the year, by anyone who has web access. Access will also be given to some mobile devices, such as Android- and Apple's iOS-based smartphones and tablets. Some gaming sessions will be „closed' and restricted to use only by groups of students, and more particularly, set up to assist universities as the basis of tutorials, to be administered (online) by the respective lecturer / tutor.

Players will be able to compete against each other, else against simulated players that will implement bidding strategies that have been proposed by various researchers over the past 50 years.

Players will start with an assigned profile, describing their work in progress, location, reputation, skills set, amongst other characteristics and resources. These will be adjusted (enhanced or depleted) as the game progresses based on the players' performance. Each project will be announced with some description of the project and the requirements that the players will have to be measured against in order to qualify to tender. Of those projects for which a player is qualified to tender, they will be able to select the projects on which they wish to compete. This will give them the facility to employ a strategy as regards which nature of work they wish to pursue, as well as the level of bid to submit in each instance. Their strategy could include the submission of non-competitive „cover prices'.

As a further consideration, there are times when some contractors will enjoy a competitive advantage on a project whereby their costs will be lower than their competitors. This may be because of their location, prior experience of similar work, exclusive access to some resources, or by way of having the benefit of some proprietary knowledge or skill that will ensure comparatively better productivity in some manner.

Different projects will have different degrees of information published as regards which players have chosen to submit bids. Players will be able to adapt their bidding strategies accordingly, to take advantage of whatever information is available to them in each instance.

Players' success at the game will be measured according to their long-term ability to survive the perilous conditions typically prevalent within the construction industry, inclusive of the varying conditions arising from business cycles. By comparison, players' short-term successes or failures will be, more so, determined as a function of random „luck'.

Players will be encouraged to adopt a systemized approach in which their pricing on individual projects will be governed by their own algorithms that they will have to set up in advance. They will be able to tweak these and refine them as they progress. Players will be able to input these in the manner of macros as has become popular in application software such as MS-Word and Excel.

The game is also being designed to serve to gather data on bidding behaviour for the purposes of making this available for academic research. Researchers will have data on the relative success of different bidding strategies, under a variety of conditions and in competition with a variety of other strategies.

The game is also being designed to appeal to players with skills that would traditionally fall outside of the discipline of construction management. It should, hopefully, for instance, serve to interest those with applied mathematics and operations research skills. This multi-disciplinary environment should service to cross-pollinate skills besides serving to test the practical efficacy of various theoretical approaches on an even playing field.

ADMINISTRATION

In the academic environment, lecturers / tutors will be able to administrate the games that their students will play under their control. This administrative role will give them the ability to set the accuracy of the cost estimates as well as the variance between contractors as regards their real costs. For instance, if a lecturer wants to simulate an environment in which contractors are all identical as regards incurring equal actual costs and, also, if they wish to empower their students with a super-human ability by which

they can be 100% accurate when estimating these costs, then the players of the games that they administrate will all be given the same cost estimate. Whilst this scenario does not represent the real world, the administrator will be given control of their games to this extent that they can create such an environment for their students to play in, for whatever reason they may want to test this.

CONCLUSIONS

The new bidding game should complement the MERIT game. It will address a far-wider audience and could even interest people from outside the industry, in the same manner as the game of Monopoly (Hasbro 2011) is not only of appeal to property developers. It will, on the other hand, by comparison to the MERIT game, have a more narrow focus on project procurement by way of bidding. Its primary purpose will be to serve as a teaching aide whilst further academic benefits will include the data that will be generated as regards players' bidding behaviour.

The game will not require the use of bidding models or any mathematical technique or strategy, nor does it advocate that any methodology is preferable or necessary for success. Instead, it will present a safe, simulated environment in which students, academics and other players can apply their own strategies. They may choose their approach to be a derivative of an established bidding model or to be a novel mathematical technique of their own. Alternatively, they may wish to try an approach that has little or no mathematical sophistication. In this context, it should prove to be interesting for both students and their teachers to test the effectiveness of this variety of strategies, recorded over multiple projects and in laboratory conditions where any noise from extraneous factors can be excluded.

REFERENCES

Abdel-Razek, R.H. (1987) Computerised analyses of estimating inaccuracy and tender variability: causes; evaluation and consequences. Unpublished PhD thesis, Loughborough University of Technology.

Ahmed, V. (2001) Computers in construction: strategy or technology? in Singh, A. (ed.) *Creative systems in structural and construction engineering: proceedings of the first international structural engineering and construction conference.* Rotterdam: Balkema, pp. 371-374.

Beeston, D.T. (1975) One statistician's view of estimating. *Chartered Surveyor, Building and Quantity Surveying Quarterly*, vol. 12, no. 4, pp. 49-54.

Cattell, D.W. (1985) An introduction to bidding models. *Planning and Building Developments*, no.74, June/July, pp.61-63.

Cattell, D.W., Bowen, P.A. and Kaka, A.P. (2007) Review of unbalanced bidding models in construction, *American Society of Civil Engineers, Journal of Construction Engineering and Management*, vol. 133, no. 8, Aug, pp. 562-573.

Crowley, L.G. (2000) Friedman and Gates – another look. *Journal of Construction Engineering and Management*, vol. 126, no. 4, July, pp. 306-312.

Friedman, L. (1956) A competitive bidding strategy. *Operations Research*, vol. 4, no. 1, Feb., pp. 104-112.

Gates, M. (1959) Aspects of competitive bidding. *Annual Report*, Connecticut Society of Civil Engineers.

Hasbro. (2011) http://www.hasbro.com/monopoly last accessed 29 January 2011.

Komisarczuk, P. and Welch, I. (2007) Web based board game for teaching aspects of internet engineering. *ACTA, Advanced Technology for Learning*, vol.4, no.4.

Loughborough University (2011) http://meritgame.com last accessed 27 January 2011.

Nassar, K. (2003) "Construction contracts in a competitive market: CM, a simulation game", *Engineering, Construction and Architectural Management*, Vol. 10 Iss: 3, pp.172 – 178

Skitmore, M. (2002). Predicting the probability of winning sealed bid auctions: a comparison of models. *Journal of the Operational Research Society,* vol. 53, pp. 47-56.

Stark, R.M. and Rothkopt, M.H. (1979) Competitive bidding: a comprehensive bibliography. *Operations Research*, vol.27, no.2, March-April, pp. 364-390.

Wall, J. and Ahmed, V. (2007) Use of a simulated game in delivering blended lifelong learning in the construction industry – opportunities and challenges. *Computers & Education,* vol.50, no.4, pp.1383-1393.

Developing the Eclectic Paradigm of Internationalization on the Issue of Multinational Contractors Bidding for Australian Infrastructure

Azmeri Rahman and Adrian J. Bridge
School of Urban Development
Queensland University of Technology, Australia

Steve Rowlinson
Department of Real Estate & Construction
The University of Hong Kong, Hong Kong, PRC

Tommy Kwok
School of Urban Development
Queensland University of Technology, Australia

ABSTRACT

Against a background of already thin markets in some sectors of major public sector infrastructure in Australia and the desire of the Australian federal government to leverage private finance, concerns about ensuring sufficient levels of competition are prompting federal government to seek new sources of in-bound foreign direct income - as part of attracting more foreign contractors and consortia to bid for Australian public sector major infrastructure. As a first step towards attracting greater overseas interest in the Australian public sector market infrastructure market, an improved understanding of the determinants of multinational contractors' willingness to bid in this market is offered by Dunning's eclectic paradigm and which have has been a dominant approach in international business for over 20 years and yet has been little used in the context of international contracting. This paper aims to develop Dunning's eclectic framework and also gives a brief outline of a research plan to collect secondary data and primary data from international contractors worldwide in pursuance of testing the eclectic framework.

KEYWORDS

foreign direct investment, multinational contractors

INTRODUCTION

Given estimates of demand for infrastructure spending of US$53 trillion between 2007 and 2030 (OECD 2006), a key challenge for governments across the globe is not only to fund new infrastructure but at the same time deliver value for money (VfM) in its provision. In order to address both these concerns Public Private Partnerships (PPPs) are being seen as an important part of the procurement strategy in many countries, not least

of which in the US; UK and in Australia (World Economic Forum 2010; HM Treasury 2010; KPMG and Infrastructure Australia 2010).

At the same time, although the role of PPPs in leveraging private finance and addressing government funding constraints is evident, the extent to which PPPs deliver VfM is a vexed question. To illustrate this, Hodge and Greve (2009) review the notable evaluations of PPPs from 1998 and conclude that the evidence for and against PPPs delivering value for money is at best mixed. Putting aside the debate concerning overall question of relative VfM realized through PPPs, there does seem to be consensus on the importance of the role of competition in ensuring that PPPs have the best opportunity to deliver superior VfM relative to other procurement modes (Grimsey and Lewis 2004; KPMG and Infrastructure Australia 2010). That is, achieving a sufficient level and balance of competition as part of the process of selecting a PPP bid not only creates downward pressure on prices (for example, on the service charge) but just as importantly encourages innovation and which crystallizes the benefits of output specifications and other measures designed to improve VfM in whole life terms.

Before the Global Financial Crisis (GFC), Runeson and de Valence (2008) observed the emergence of a two-tiered construction market comprising the more traditional local/national market and a new global construction industry based on high technology and a business strategy revolving more around VfM throughout the project's life cycle and fuelled to a significant extent by procurement modes like PPPs. Runson and de Valence (2008) consider that this market is oligopolistic and it seems reasonable to suggest that this market has become even less competitive, perhaps towards a duopoly in some sectors and locations - amidst and in the wake of the GFC. Indeed and in Australia for example, there are examples of projects that have been switched from a proposed PPP to a more traditional funded project due to a lack of expressions of interest from PPP consortia. At least as a partial response to the lack of competition in the PPP market, the Federal government has noted its desire to see new foreign entrants into the Australian public sector major infrastructure market and in pursuance of this, is developing a number of initiatives including trade-delegation style meetings and reforms to PPP procurement practice to reduce bid costs (Hepworth, 2010 and Cameron 2008).

On the other hand and with respect the market for major infrastructure procured using more traditional government funded approaches, this market may still be oligopolistic in Australia (de Valance 2003) and this level of competition may be appropriate in the range of major projects from say $100million up to the very large end of the scale - exceeding $1 billion. That is, it’s important to note that research on the net benefits of a greater number of competing firms and more price competition is inconclusive (Layton, Robinson and Tucker 2009). More competitors and a high level of price competition can

lead to short term opportunistic behaviour and under investment generally. In contrast, particular markets with less competition may exhibit greater technological change, as above normal profits can be invested in new special purpose technology. Again, in Australia the level of mergers and acquisitions and particularly since 2000 is at least part of the evidence to suggest that indigenous contractors in the Australian market for major projects are performing well relative to the world class standards (de Valence 2003).

Based on this background, an investigation into the determinants of multinational contractors' willingness to bid for Australian public sector infrastructure projects is warranted from both the perspectives of both government and multinational contractors (MNC) domiciled in Australia. On the government's side, an improved understanding of which MNCs are better suited to the Australian market and which MNCs are closer to contemplating bidding for Australian public sector projects, along with surfacing any misconceptions held by MNCs of the Australian market appears to hold significant value. That is, in terms of allowing government to target MNCs from certain countries/regions and providing government with the basis upon which it can more effectively work towards eliminating any misconceptions in terms of its efforts to increase the attractiveness of Australia public sector infrastructure and attract more Foreign Direct Investment (FDI) to this market and particularly in the PPP sector. At the same time, a greater appreciation of the relative strengths of MNCs currently operating and not currently operating in Australia is useful to government in justifying resisting unduly seeking more competition in perhaps the more traditional government funded major infrastructure market in Australia and is of benefit to MNCs domiciled in Australia in terms of helping to develop strategies to enhance and develop sources of competitive advantage. The effectiveness of these strategies is likely to be further enhanced through knowledge gained concerning which MNCs not currently operating in Australia and which are the closest to contemplating competing for Australian projects.

Elsewhere and in pursuance of explaining the determinants of multinational contractors' willingness to bid for Australian public sector infrastructure projects, Rahman, Bridge and Rowlinson (2010) summarize the relevance of Dunning's eclectic paradigm of internationalisation. Dunning (1989) has explicitly explored the application of his eclectic paradigm or *OLI* framework to the service sector including construction services. Dunning's eclectic paradigm has remained the dominant analytical framework for accommodating a variety of economic theories concerning the determinants of FDI and the foreign activities of MNEs for over two decades (Caves 1996; Dunning 2002). Rahman, Bridge and Rowlinson (2010) proceed to justify why they consider a federally funded research project they are progressing will be the first empirical study to deploy the *OLI* framework to explain in-bound FDI (to Australia as the host country) and using the

dominant economic theories advocated by Dunning mindful of the nature of the study and its context or multinational construction.

Dunning (2008: 99-100) notes that the principal hypothesis of the eclectic paradigm is "that the level and structure of a firm's foreign value-adding activities will depend on four conditions being satisfied. They are:

1. The extent to which it (enterprise) posses unique and sustainable ownership (*O*) advantages *vis-à-vis* firms of other nationalities, in servicing of particular markets or groups of markets…
2. Assuming that condition (1) is satisfied, the extent to which the enterprise perceives it to be in its best interest to add value to its *O* advantages than to sell them, or their right of use, to independent foreign firms. These advantages are called market internalisation (*I*) advantages…
3. Assuming that conditions (1) and (2) are satisfied, the extent to which the global interest of the enterprise are served by creating, accessing or utilizing, its *O* advantages in a foreign location (*L*)…
4. Given the configuration of the *OLI* advantages facing a particular firms, the extent to which a firm believes that foreign production is consistent with the long-term objectives of its stakeholders and instructions underpinning its managerial and organizational strategic."

In relation to generalized predictions of the eclectic paradigm, or OLI framework, Dunning (2008: 100) also notes that:

> *At any given moment in time, the more a country's enterprises – relative to those of another - possess desirable O advantages, the greater the incentive they have to internalize rather than externalize their use, the more they find it in their interest to access or exploit them in a foreign location, then the more they are likely to engage out-bound FDI. By the same token, a country is likely to attract in-bound investment by foreign MNE's when the reverse conditions apply.*

Rahman, Bridge and Rowlinson (2010) also explain the logic and selection of theories advocated by Dunning and which are to be used in their research project concerning in-bound FDI mentioned above. Building on this contribution and again with reference to this research project, the main aim of this paper is to develop Dunning's principal hypothesis, first to more clearly articulate the four conditions within the context of MNC and specifically the reverse conditions to reflect *a lack of* in-bound FDI (at least in terms of observations of a lack of competition in some sectors of the PPP market in Australia and an oligopolistic market structure more generally in respect of large scale infrastructure projects) and second to address a weakness arising in the hypothesis that is based on a nominal (yes or no) approach to the *O, L* and *I* factors and which fails to speak

to the relative explanatory power of these factors. The paper also briefly outlines a research plan to collect secondary data and primary data from international contractors around the globe in pursuance of testing the developed version of Dunning's principal hypothesis.

DEVELOPING DUNNING'S PRINCIPAL HYPOTHESIS

The four conditions (or general statements) are first restated within the context of MNC and to reflect in-bound FDI as follows:

1. The extent to which it (MNCs outside Australia) posses unique and sustainable ownership (*O*) advantages *vis-à-vis* other MNCs outside and domiciled in Australia, in servicing the Australian market…
2. Assuming that condition (1) is satisfied, the extent to which MNCs outside Australia perceive it to be in their best interest to add value to their *O* advantages than to sell them, or their right of use, to independent foreign firms…
3. Assuming that conditions (1) and (2) are satisfied, the extent to which the global interest of MNCs outside Australia are served by creating, accessing or utilizing, their *O* advantages in Australia (*L*)…
4. Given the configuration of the OLI advantages facing a MNC outside Australia, the extent to which this MNC believes that foreign production in Australia is consistent with the long-term objectives of its stakeholders and instructions underpinning its managerial and organizational strategic.

The corresponding hypothesis is given in reverse terms to reflect in-bound FDI and more specifically to reflect a lack of in-bound FDI as per the introduction in this paper as follows: *the more Australian-based MNCs relative to other MNCs possess desirable O advantages, the lesser the incentive other MNCs have to internalize rather than externalize their use (I disadvantages), the less other MNCs find it in their interest to access or exploit them in Australia (L disadvantages), then the less Australia is likely to attract in-bound investment by other MNCs.*

Having more clearly articulated the four conditions within the context of MNC and specifically the reverse conditions to reflect *a lack of* in-bound FDI (at least in terms of observations of a lack of competition in some sectors of the PPP market in Australia and an oligopolistic market structure more generally in respect of large scale infrastructure projects), attention is now given to addressing a weakness arising in the hypothesis that is based on a nominal (yes or no) approach to the *O, L* and *I* factors and which fails to speak to the relative explanatory power of these factors. That is, whilst there is evidence in the context of MNC that demonstrates the significance of these three factors in the FDI decision (including Cuervo and Pheng 2003a and b) there is an absence of research that

reveals the *relative importance* of these factors with respect to a specific industry sector in a particular host country. This weakness can be demonstrated having discounted the *I* factor in the context of the research project in this paper. Rahman, Bridge and Rowlinson (2010) justify discounting the *I* factor on the basis of the immobile nature of construction and the dependent variable that concerns MNCs bidding for projects as head contractors. That is, the necessity to have on-the-spot interactions with the client, co-consortium members and subcontractors and suppliers, means that the issue is not so much *if* internalization occurs but more *how much* internalization occurs. Indeed, Abdul's (1995) critique of Seymour (1987) seminal work and Chen and Messner (2011) support this view in so far as exporting and FDI in service industries like construction can be seen as almost inseparable. Moreover, although Abdul argues that licensing is a perfectly feasible alternative to FDI, the dependent variable in this research is solely FDI - to be measured both in terms of MNCs operating / not operating in Australia (categorical) and MNCs views of the level of attractiveness for FDI into Australia (interval/ordinal).

The weakness in Dunning's hypothesis concerning revealing the relative importance of the remaining *O* and *I* factors is now demonstrated. Top-tier MNCs not operating in Australia with *O disadvantages* relative to those observed in top-tier MNCs operating in Australia (vis-à-vis a particular sector in the Australian market) *and* with *L disadvantages* (facing an inferior return/risk profile and including higher levels of home-host/Australia risk) are expected to rate the overall attractiveness of the Australian market lower than top-tier MNCs not operating in Australia with *O advantages* relative to those observed in top-tier MNCs operating in Australia (vis-à-vis a particular sector in the Australian market) *and L advantages* (facing a superior return/risk profile and including lower levels of home-host/Australia risk); and in turn these MNCs are expected to rate the overall attractiveness of the Australian market lower than top-tier MNCs *operating Australia*. However, based on Dunning's theory it's not logical to deduce where in the overall attractiveness continuum top-tier MNCs with *O advantages* and *L disadvantages* and where top-tier MNCs with *O disadvantages* and *L advantages* will be situated and ranked between the two types of MNC not operating in Australia mentioned above. Moreover, the notion that the *O* and *L* factors can display different levels of explanatory power can be expected – at least in the extreme conditions when MNCs have similar *O* attributes or MNCs are from the same location such that the *L* and O factors would dominate.

Addressing this weakness in Dunning's theory, looks to be a very important practical issue for MNCs and their clients as this knowledge would provide an improved basis upon which MNCs can assess competition for a host country and client's could make more effective decisions concerning the extent and manner by which they may seek to encourage greater FDI (by targeting either issues associated with firms in the domestic

market and/or issues associated return and risk for all firms). More fundamentally, the ability to generate this knowledge would also represent a significant contribution to the overall explanatory power of Dunning's eclectic paradigm.

Hence, the hypothesis is subsequently developed across three propositions that are designed to extend the scope and explanatory power of the *O* and *L* factors (Dunning's conditions 1 and 3) - contingent on the firm's motivation (Dunning's condition 4) and having discounted the *I* factor (Dunning's condition 2).

Proposition 1 (an extreme condition pertaining to same location)

With respect to the first condition and component of the reverse/lack of in-bound FDI hypothesis concerning *O* advantages, sources of sustainable competitive advantage amongst MNCs within and outside Australia and *vis-à-vis* a particular sector in the Australian market are assumed to be unevenly distributed and associated with MNCs in the top-tier of contractors (Bridge and Tisdell 2004). Thus, in the following first proposition, it expected (subject to the firm's motivation) that:

> Foreign top-tier MNCs within the *same country/region* and not operating in Australia will display varying degrees of similarity/dissimilarity of *O* attributes with key/common *O* attributes possessed by both foreign top-tier MNCs within the *same country/region* but which operate in Australia and indigenous/Australian top-tier MNCs. The variation in the pattern of the profile of *O* attributes is expected to match the variation in the pattern of overall attractiveness and with no pattern match expected between the *L* factor and variations in the level of overall attractiveness.

Proposition 2 (an extreme condition pertaining to same O attributes)

The third condition and component of the reverse/lack of in-bound FDI hypothesis concerning *L* advantages is central to the issue of return-on-investment. With respect to a particular host market, although all MNCs may face similar upper levels of revenue and/or similar costs (arising from the size of the market; governments' attitudes, polices and regulatory framework; industrial structure; resource and manpower quality and availability; bespoke costs associated with materials and specified suppliers) MNCs may perceive potential returns differently mindful of competing returns achievable at home and/or in other host markets. MNCs also face very different levels of risk generated from home-host induced differences. That is, differences arising from cultural, administrative, geographic and economic distances (Abdul 1995; Cuevo and Pheng 2003). Here, costs and associated risks are created by linking the firm and home advantages with the country specific advantage of the host country. With reference to the logic of Transaction Cost

Economics (TCE), Rugman and Verbeke (2005: 13) describe these costs and risks as location-specific linking investments and required to bring a new entrant's operations up to a fully productive level and before it can contemplate achieving at least the expected normal industry rate of return in the host country. Thus, in the second proposition it is expected (again, subject to the firm's motivation) that:

> Groups of top-tier MNCs in *different foreign countries/regions* may have *similar O* attributes (at a high through low level of match to those possessed by both foreign top-tier MNCs operating in Australia and indigenous/Australian top-tier MNCs). The variation in the pattern of the *L* factor created by the different foreign countries/regions is expected to match the pattern of the level of overall attractiveness within each group and with no pattern match expected between the *O* factor and variations in the level of overall attractiveness – again within each group.

Outcomes from propositions 1 and 2 towards revealing relative importance of O and L factors

By adopting the extreme positions and observing differences in the range of the level of overall attractiveness down the four columns of MNCs with dissimilar *O* attributes in the same countries/regions (Proposition 1) and in contrast to the range of the level of overall attractiveness across each of the three rows/groups of MNCs with similar *O* attributes in different countries/regions (Proposition 2) as shown in Table 1 (and which is a preview of part of the research plan), evidence is generated to indicate the relative importance of *O* and *L* factors *vis-à-vis* a particular sector in the host market (Australia).

Table 1 – Case studies

	Foreign country A	**Foreign country B**	**Foreign country C**	**Foreign country D**
Operating in Australia Group 1	☺ MNC 1A	☺ MNC 1B	☺ MNC 1C	☺ MNC 1D
Not Operating in Australia Group 2	😐 MNC 2A	😐 MNC 2B	😐 MNC 2C	😐 MNC 2D
Not Operating in Australia Group 3	☹ MNC 3A	☹ MNC 3B	☹ MNC 3C	☹ MNC 3D

That is, if a greater range of overall attractiveness is observed down the columns than across the rows, then this indicates that the *O* factor is more important and has more explanatory power than the *L* factor *vis-à-vis* the sector concerned in the host market (Australia) and vice versa.

Proposition 3 (full range of conditions pertaining to both O and L attributes)

In the next section, the rationale for selecting the matrix of foreign MNCs shown in Table 1 (along with indigenous Australian MNCs) is justified using the technique of analytical generalization. This approach uses purposive sampling in order to support claims for external validation or generalization of results beyond the cases studied. However, in order to make claims for the statistical generalisation of the results a much greater number of data points are required and hence Proposition 3 is given to facilitate this approach and contribute to the strength of the findings. Thus, in the third proposition it is expected (once again, subject to the firm's motivation) that:

> Notwithstanding the level of match of *O* attributes possessed by a foreign MNC to those possessed by both foreign top-tier MNCs operating in Australia and indigenous/Australian top-tier MNCs and in whichever country/region the foreign MNC is domiciled, the variation in the overall level of attractiveness correlates with, and is explained by, the *O* and/or *L* factors.

And in terms of helping to reveal the relative importance of *O* and *L* factors, it is expected that the relative strength of the correlation/level of statistical significance of the *O* and/or *L* factors/dimensions would be consistent with the outcomes from Propositions 1 and 2 *vis-à-vis* the selected sector concerned in the host market (Australia).

Exception to the propositions

The fourth condition of the reverse/lack of in-bound hypothesis FDI concerning the firm's objectives or FDI motivation plays an important intervening role in terms of determining the MNC's perception of the overall attractiveness of the Australian market with respect to the particular *OLI* configuration the firm calculates it faces. Rahman, Bridge and Rowlinson (2010) summarise the three types of type's of firm objective/FDI motivation envisaged by Dunning (Market seekers ; Strategic Asset Seekers : and Efficiency Seekers) within the context of MNCs. Market Seekers (MS) are likely to be highly specialized and operating in markets with very limited competition and in sector(s) with very large scale capital expenditure. These firms may seek to dominate and impose their expertise and may be able to seek lower levels of commitment in terms of the degree to which they localize within the host market with higher levels of central control and shorter investment timelines along with more mobile entry modes. In sum, these firms may seek a highly favourable risk/return profile. In contrast, Strategic Asset Seekers (SAS) firms may seek to gain expertise and knowledge from the host market and extend higher levels of commitment in terms of the degree to which they localize within the host market and lower levels of central control and longer investment timelines, along with more permanent entry modes (Anderson and Gatigon 1986). As such, these firms may

accept much less favourable risk/return profiles. Somewhere between these stereotypical extremes, Efficiency Seekers (ES) firms may be faced with spare capacity and seek overseas demand to return the firm to its minimum efficient scale in conjunction with moderate levels of commitment to the local/host market; control; and a timeline to recover investments made neither project-based nor open-ended but rather falling somewhere between these extreme types, as well as accepting moderate risk/return profiles. As such, the propositions are expected *not to hold* in respect of MNCs with an *SAS* motivation – as these firms may perceive the relationship between the overall level of attractiveness of a host country and the *O* and *L* factors in the opposite direction to that envisaged in Dunning's principal hypothesis and by MS and ES firms. That is, an SAS firm may well view a host country attractive despite it possessing *O* and/or *L* disadvantages.

OUTLINE RESEARCH PLAN

The research plan is depicted in Figure 1 and comprises three stages concerning four home countries/regions, namely China; Europe; Japan; and US *vis-à-vis* Australia as the host market. This plan is next outlined in pursuance of testing the above propositions.

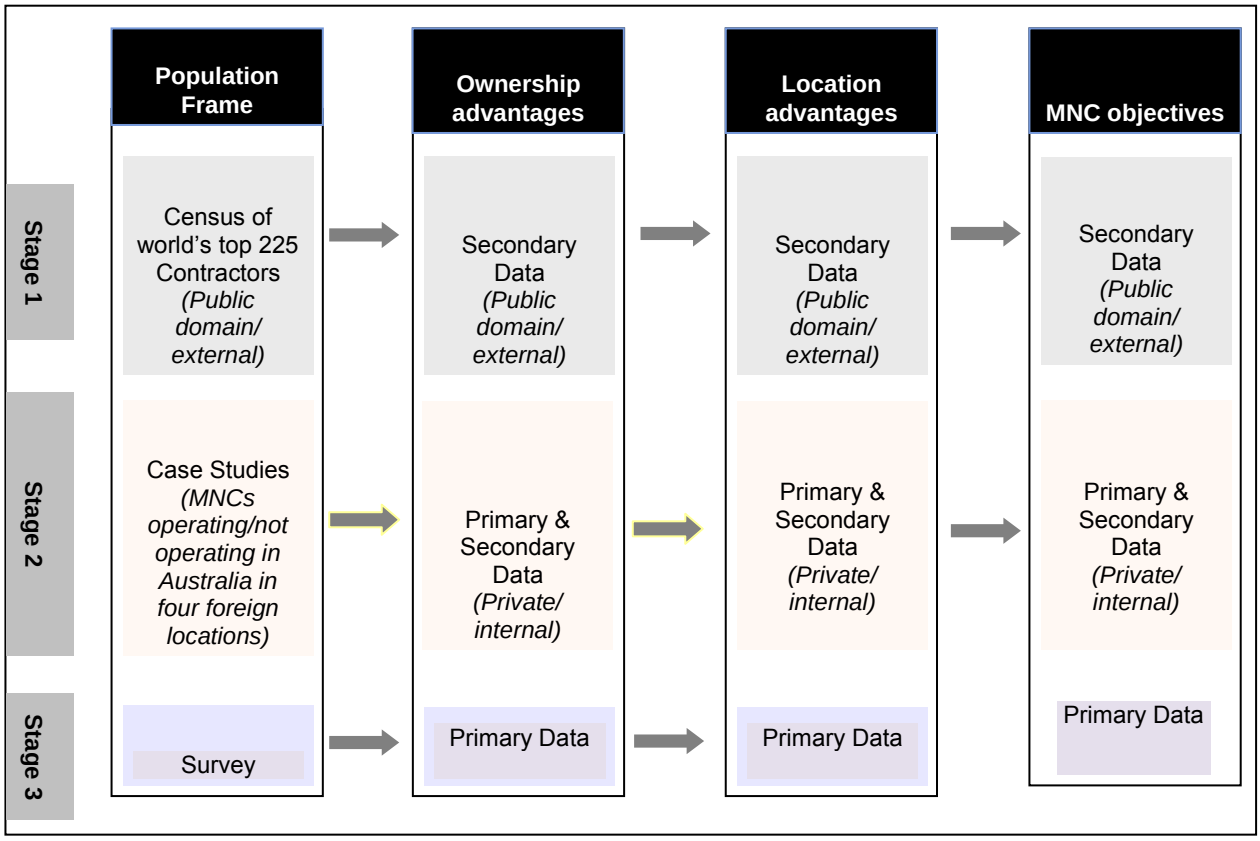


Figure 1 – Outline research plan

Stage 1: Census of world's top 225 contractors.

In this initial stage, the first step is to examine all top-tier Australian-based MNCs (that generate more than 50% of their primary revenue/sales from Australian projects) and extract these firms from the starting population frame and which comprises the list of the world's top 225 contractors in published by *Engineering News Record* (ENR). Next, the sector that will form the basis of this research (in conjunction with Australian as the host country) is identified. This sector needs to be at least monopolistic across the entire population frame. Such that it can be inferred that firms in this sector are at least near top-tier firms. This decision to relax the market structure from oligopolistic to monopolistic and from top-tier MNC to near top-tier is justified on the grounds that only a small number of Australian-based MNCs appear in the world's top 225 MNCs and near-top-tier MNCs in foreign locations may be equivalent in capability to top-tier Australian-based MNCs.

Here, ENR and websites are used to generate secondary data pertaining to the parameters comprising: *what; where; and how.* For example, project type and size; geographical operations; and procurement modes offered, may be are used in order to identify possible sectors and in which firms' pricing decisions affect each other and who can be considered as operating in at least a monopolistic market structure (Bridge 2008). In order to judge whether these sectors are monopolistic, a Structure-Conduct-Performance (SCP) analysis is used to assign the market structure to the sectors and, in doing so, various proxies of performance are used including internationalization ratios developed by Pheng and Hongbin (2004). The monopolistic sector with the greatest number of MNCs is selected for study. In doing so, the population frame (top 225 MNCs less any top-tier Australian-based MNCs) may further reduce in number to reflect only at least the near top-tier MNCs operating in all locations and in the monopolistic sector selected – with a the target of at least 150 firms remaining in the population frame.

ENR and websites/annual reports are used to generate secondary (public domain/external) data to corroborate the primary data and secondary (private/internal) established from MNCs in Stage 2 and which are selected from four foreign/home locations in the remaining population frame. More specifically, keywords/phrases are identified to reflect MNCs generic capabilities/competencies in respect of the selected sector and which may be a proxy for firm specific *O* advantages. Websites and industry reports are also used to assess industry and home *O* advantages, along with the application of Porter's (1990) diamond model in terms of home *O* advantages. Furthermore, this stage uses secondary data in relation to the selected sector to analyse the two *L* factor dimensions concerning return and risk and this factor's contribution to the host/Australia industry overall

attractiveness (Seymour 1987). The *L* factor's return dimension is surfaced by Porter's (1985) five forces model and the *L* factor's home-host induced risk dimension is captured using Transaction Cost Economics (TCE). Rugman and Verbke (2005) explain that TCE's logic and variables (asset specificity; uncertainly; and frequency) can be used to reflect the influence of country specific investments. Here, asset specificity is measured in terms of the cultural; economic; administrative; and geographic differences created between each of the home locations and the host location/Australia. And Chen (2008) has usefully developed a number of measurements across cultural; economic; administrative; and geographic differences. Differences in financial measures, including credit risk ratings between home and host locations, are used to indicate likely perceptions amongst MNCs in home locations of the uncertainty of doing business in the host country/Australia, whilst differences in size of projects/pipeline between home and host location/Australia is used to indicate likely perceptions amongst MNCs in home locations concerning opportunities to recover and justify country specific investments. Finally, this stage again generates secondary data mainly from MNC's websites/annual reports concerning keywords/phrases used to describe MNCs overseas business strategies in respect of the selected sector and which may be a proxy for each firm's objectives/motivation.

Stage 2: Case studies

As shown in Table 1, 12 MNCs are case studied, as well as up to three Australian-based MNCs. The approach is to begin with local case studies (comprising the Australian-based MNCs and foreign MNCs operating in Australian) before proceeding to the overseas case studies and which comprise two foreign-based MNCs not operating in Australia in each of four foreign locations. One of these two foreign-based MNCs studied overseas is selected as the closest rival of the foreign MNCs operating in Australian studied locally. In contrast, the other foreign-based MNC studied overseas is selected as being a lesser/least rival of the foreign MNC operating in Australian studied locally. Here, the intention is to create the greatest opportunity to observe the relative effect of differential *O* advantages across each of the two foreign-based MNCs that do not operate in Australia.

Multiple sources of evidence are generated from a structured questionnaire, interviews and private internal documents in terms of variables from the Resource-Based Theory (RBT) to indicate the MNC's sources of competitive advantage and its nature and extent of *O* advantages vis-à-vis the selected sector in Australia. To help operationalise the RBT variables, as well as both the return and risk dimensions on the *L* advantages, empirical studies by Pheng and Hongbin (2006) and Cuervo and Pheng (2003 a and b) are adapted.

Moreover, a semantic different scale is used to capture MNCs' perceptions of their competitive advantage (*O* advantages); the return and risk (*L* advantages); and the overall attractiveness of the Australian market in the selected sector. Finally in this stage, a categorical scale comprising the three sets/ranges of attributes pertaining to business strategy; control; commitment and entry mode (based on Anderson and Gatignon 1996 and Chen and Messner 2009) is used to assign each MNC to one of the three stereotypical firm objective/motivation types.

A key outcome from this stage would be to indentify a MNC not operating in Australia with similar/superior *O* advantages and the same firm objective/motivation as one of the MNCs from the same home location but which does operate in Australia. In this case, a different risk and return profile pertaining to *L* advantages is expected to be creating differences in the perceived overall attractiveness of the Australian market and it will be very useful from both government and contractors' perspectives, to explore these differences and to see whether any misconceptions exist on the part of either or both of the MNCs concerned.

Stage 3: Primary data only from top-tier MNCs not operating in Australia

A structured questionnaire survey is developed that distils and replicates the approach in Stage 2 and is administered to all MNCs in the population frame established by the end of Stage 1. The aim is to go beyond analytical generalisation used in Stage 2 case study approach and to develop statistical generalization and increase the validity and strength of the overall findings.

CONCLUSIONS

The research plan outlined in this paper employs multiple sources of evidence and research methods that allow the relative strengths of different approaches to be combined to more effectively test the propositions developed out of Dunning's principal hypothesis. A number of theoretical contributions are expected including extending the scope of Dunning's eclectic framework for the first time to the issue of in-bound FDI to Australia and in the context of MNC, as well as the development of Dunning's principal hypothesis as reflected by the propositions in this paper. More specifically, these propositions will reveal for the first time the relative importance of the *O* and *L* independent variables with respect to a particular sector and host location, and which is progress that Seymour (1987) indicated would be very valuable and difficult to achieve. And in total, this answers Seymour's call to seek to significantly advance the *OLI* framework and increase our understanding of the FDI decision. The research will also contribute to method. To the authors' knowledge, this will be the first operationalisation of TCE and RBT in this

context. Furthermore, the research will yield some very important practical contributions including a global map of the relative attractiveness of the Australian market, and within this map, indications of the relative competiveness and productivity of indigenous contractors, identification of location factors that can be influenced by government and the surfacing of any misconceptions of the Australian market.

ACKNOWLEDGMENTS

This research was supported under Australian Research Council's Linkage Projects funding scheme (project number LP0989743).

REFERENCES

Abdul, A.A. (1995) Examination of the eclectic paradigm as applied to International contracting-with emphasis on the internalization dimension, *Engineering, Construction and Architectural Management,* 2(2): 105-120.

Anderson, E. and Gatignon, H. (1986) Modes of foreign entry: a transaction cost analysis and propositions, *Journal of International Business Studies,* 17(3): 1-26.

Bridge, A.J. (2008) Market structures in air conditioning maintenance activity. In *25th ARCOM-Conference Proceedings*, 79, University of Glamorgan.

Bridge, A.J. and Tisdell, C. (2004) The determinants of the vertical boundaries of the construction firm, *Construction Management and Economics*, 22: 807-825.

Cameron, F. (2008) High bidding costs – not competition blamed for building woes, *Australian*, 18 April.

Caves, R.E. (1996) *Multinational firms and economic analysis*, 2nd Ed. Cambridge University Press.

Chen, C. (2008) Entry mode selection for international construction markets: The influence of host country related factors, *Construction Management and Economics*, 26: 303-314.

Chen, C. and Messner, J.I. (2009) Entry mode taxonomy for international construction markets, *Journal of Management in Engineering*, 25(1): 3-11.

Chen, C. and Messner, J.I. (2011) Permanent versus mobile entry decisions in international construction markets: Influence of home country and firm-related factors, *Journal of Management in Engineering*, 27(1): 2-12.

Cuervo, J.C. and Pheng, L.S. (2003a) Ownership advantages/disadvantages of Singapore transnational construction corporations, *Construction Management and Economics*, 21: 81-94.

Cuervo, J.C. and Pheng, L.S. (2003b) Significance of location factors for Singapore transnational construction corporations, *Engineering, Construction and Architectural Management*, 10(5): 342-353.

de Valance, G. (2003) Market structure, barriers to entry and competition in construction markets. In *CIB W55-Conference Proceedings*, 819-828, Singapore.

Dunning, J.H. (1989) Multinational Enterprises and the growth of services: Some conceptual and theoretical issues, *The Service Industries Journal*, 9(1): 5-39.

Dunning, J.H. (2002) *Theories and paradigms of international business activity*, Edward Elgar.

Dunning, J.H. and Lundan, S.M. (2008) *Multinational enterprises and the global economy*, 2nd Ed. Edward Elgar.

Grimsey, D. and Lewis, M.K. (2004) *Public Private Partnerships: The Worldwide Revolution in Infrastructure Provision and Project Finance*, Edward Elgar.

HM Treasury (2010) *National Infrastructure Plan*. London.

Hepworth, A. (2010). Costs threaten to stymie infrastructure projects, *Australian Financial Review*.

Hodge, G.A and Greve, C. (2009) *PPPs: The Passage of Time permits a Sober Reflection*, Institute of Economic Affairs (March). Blackwell Publishing.

KPMG (2010) *PPP Procurement: Review of Barriers to Competition and Efficiency in the Procurement of PPP Projects*, KPMG Corporate Finance (Aust) Pty Ltd.

Layton, A., Robinson, T. and Tucker, I.B. (2009). *Economics for Today*. 3rd Ed., Cengage, South Melbourne.

OECD (2006) *Infrastructure to 2030: Telecom Land, Transport, Water and Electricity*.

Pheng, L.S. and Hongbin, J. (2006) Analysing ownership, locational and internalization advantages of Chinese construction MNCs using rough sets analysis, *Construction Management and Economics*, 24:1149-1165.

Pheng, L.S. and Hongbin, J. (2004) Estimation of international construction performance: Analysis at the country level, *Construction Management and Economics*, 22:277-289.

Porter, M. (1985) *Competitive advantages: Creating and sustaining superior performance*, Free Press.

Porter, M. (1990) *Competitive advantages of the nation*, Free Press.

Rahman, A., Bridge, A.J. and Rowlinson, S. (2010) The determinants of multinational contractors' willingness to bid for Australian public sector major infrastructure projects: Towards deploying the eclectic paradigm of internationalization, In Y. Wang, J. Yang, G.Q.O. Shen and J. Wong (Eds.) *Proceedings of 2010 International Conference on Construction & Real Estate Management*, December 1-3rd Brisbane.

Runeson , G. and de Valence, G. (2008) The new construction industry, In Ruddock, L. (Ed.) *Economics for the Modern Built Environment*, Taylor & Francis.

Rugman, A.M. and Verbeke, A. (2005) Towards a theory of regional multinationals: A transaction cost economics approach, *Management International Review.* 1 (Special Issue): 5-17.

Seymour, H. (1987) *The Multinational construction industry*, Croom Helm.

World Economic Forum. (2010) *Paving the Way: Maximising the Value of Private Finance in Infrastructure.* New York.

Yin, R. (1994) *Case Study Research: Design and Methods*, Sage Publications.

The XYZ of the Living Curriculum

Roger Birchmore and Linda Kestle
Faculty of Technology and Built Environment
Unitec Institute of Technology, Auckland, New Zealand

ABSTRACT

Using literature, the preferred learning environments of the generational groups X, Y and Z are examined. A first year, Bachelor of Construction course, Team Management is mapped against Unitec's Living Curriculum, which is then mapped against the generations' preferences. The course is then analysed using the Unitec's student evaluation system, the "Rate my Course" website, lecturer observations and student assignment reflections. Investigation shows that in terms of a learning environment, characteristics of Generations X, Y and Z are not always distinctly different but the theme of increasing urgency for outcomes runs through most strongly. Team Management maps closely to the Living Curriculum requirements but this does inherently produce high student satisfaction. The Living Curriculum delivered through the course, does align with generations' desires but contradictions are apparent. Recommendations for the future focus on balancing the potential contradictions.

KEYWORDS

Generation X, Y, Z, learning styles, living curriculum

INTRODUCTION

Two of Unitec's drivers are to become recognised for innovation in teaching and learning and enhancing the student experience. A strategy to achieve this is to embrace a living curriculum and E-learning principles. It is important to consider how the range of generations at Unitec will respond and interact with these principles. The aim of this paper is to explore how the generations' learning preferences align with the living curriculum by examining student experiences of a single degree course.

The living curriculum

The term Living Curriculum is not unique to Unitec and is used widely by many educationalists (Guyette 2004, Reilly 2007, Squires 2005). The "living" term emphasises the dynamic nature that grows and changes to the needs of communities. Its pedagogical roots lie in the social constructivist thinking of the Russian psychologist Lev Vygotsky. This influences pedagogy by the belief that people learn best by constructing their own

understanding and solutions to problems through discourse with peers and a broader community. Daniels (2005) and Pass (2004) provide commentary on the approach, extending to roles of teacher and assessment. Social constructivism is a stark contrast to traditional behaviourist educational philosophies involving expert directed learning through demonstration and instruction. Constructivism in itself is not innovative, established many years ago, but provides foundations from which Unitec's Living Curriculum builds.

Unitec's Strategic Plan comprises Key Drivers:

- Meeting the needs of Communities
- Enhancing the Student Experience
- Innovation in Teaching and Learning
- Being an Excellent Business

The most prominent outcomes required from Innovation in Teaching and Learning driver is the introduction of the Living Curriculum. The Curriculum Design Policy states:

"Unitec programmes will have a living curriculum that:

1. *involves complex conversations*
2. *is curiosity/inquiry led, and stimulating*
3. *is practice-focussed – educating students „for work, in work, through work'*
4. *is socially constructed – self-sufficiency and collaboration are equally valued, and together they help nurture resourcefulness and resilience*
5. *blends face-to-face and web-based learning*
6. *is research-informed*
7. *has a discipline base, and is also interdisciplinary*
8. *develops literacy's for life-long learning*
9. *includes embedded assessment."*

   (Curriculum Design Policy 2009)

Criteria 1, 2 &4 have the strongest connection to constructivist thinking. Comparing these criteria to existing courses and characteristics of relevant generations will inform and develop our pedagogy

The team management course

This is a compulsory, first year, first semester course delivered to 75 students on the Bachelor of Construction. The course outcomes, delivery method and assessment mechanisms are a result of incremental development and have not been specifically chosen with the living curriculum in mind.

Learning outcomes are:

1. Investigate problem solving models using group interactions.

2. Examine models of thinking skills.
3. Distinguish factors which impact on productivity, learning and performance
4. Examine professional relationships and group interactions.

These are achieved through a project completed in randomly formed groups of 5, 25 and 75.This requires the assembly of three small buildings to the timber framing stage to meet NZS 3604 and safety standards. Groups of 5 construct part of the timber frame. 5 groups then combine to assemble the parts into a completed structure. The class of 75 is challenged to complete all three assemblies within a 2hr time frame. The buildings are then used for training of plumbing students in cladding and flashing skills and then used as utility sheds.

Supporting lectures and workshops cover:

- Problem solving models, Creative thinking, Critical reading;
- Communication Theory: Verbal, Non-verbal, Oral and Graphical Communication, Interpreting Industry Documentation, Communication Technology, Communication from Different Cultural Perspectives, Structured Writing, Referencing;
- Group roles and Team Behaviour, Group Processes and development leadership, meetings, communication networks.

Assessment comprises:

- The submission of a group business report outlining a pre construction and safety plan. 20%
- A group verbal presentation reflecting on problem solving tools used and the interrogation of building documentation. 20%
- The group assembly of the building within set quality standards. 10%
- An individual reflective journal type report analyses the group behaviours and potential improvements. 50%.

Individuals are awarded a fraction of the total group mark depending upon their performance within the group. This performance is measured against team-working criteria agreed by each group early on in the course. Communication outside of face to face workshops is through a web based shell with project based questions handled through an electronic Request for Information form (RFI).

LITERATURE REVIEW – EDUCATING THE GENERATIONS

Exact boundaries of the different generations appear blurred (Kelan & Lehnert, 2009) and the broad ranges are tabulated below. A number of writers refer to a generation lasting 20 years, but Tulgan (2000) argues that as a result of the speed of communication and change, the period over which groups have meaningful and distinct characteristics is

reducing. Extremities of the ranges are noted in Table 1 with some commonly occurring narrower ranges in brackets.

Table 1 – Summaries of generational boundaries

Generation	Born	Age Now
X	1961-81 (64-78)	50-30
Y	1982-2000 (78-87)	29-11
Z	2000-2011 (94-2004)	11 &under

Much of generational analysis focuses on how to sell or manage people in the workplace. Tulgan (2000), Sheahan (2005), Erickson (2008) are relevant examples of such work. Educational content focuses on workplace training or children at primary or secondary school. Conference and journal papers have a broader applied educational focus (Dyson 2008, Kelan & Lenhert 2009). Dyson (ibid) notes weak connections between generational research and educational research. Jorgensen (2003) rejects the generational differences arguing that combined effects of demographic trends, democratisation, globalisation and technology have contributed more to individuals needs.

Generation X

Tulgan (2000) illustrates older generations' generally negative views of X'ers using adjectives such as "slackers, sponger, low pay low status, short attention". Tulgan (2000, p.39) doubts "whether any generation can be captured by a single set of adjectives". Reflection of one's own students questions whether primarily North American and European based research applies across national and cultural boundaries. Sheahan (2005), agrees that pigeon holing groups is not valid, but claims his generation to have specific "underlying traits".

Educational relevant characteristics seem to be:

- Comfortable with career path change.
- Adaptable, socialises easily, likes to leave valuable results.
- Likes team work but values personal acknowledgement.
- Seeks positive feedback not just negative
- Collaboration encourages risk taking.
- Not short attention span but information sinks
- Brought up with computer and video entertainment.
- Keen to learn, Learn by doing
- Value flexibility.

- Requires well defined assignments then to be left alone to solve.
- Resents time wasting

Generation Y

Manville and Schiel (2008, p.24) identify:

The downside is that their career expectations often race ahead of their current abilities. Generation Y members are impatient to get ahead. Managers find that this generation needs lots of feedback and guided supervision. This group has come of age in a 24/7, "on demand" personalised environment. Face-to-face teaching is still critically important.

The quotation above indicates strong alignment with Generation X characteristics particularly in the areas of speed of results feedback and guidance. The need for guidance does not prevent them from challenging. Shaw & Fairhurst (2008, p.373) quote "that access to that practically limitless pool of information makes Millennials particularly demanding and questioning." Rose (2007) observes Gen Y's attention span is short due to the exposure to technology, have a desire for instant gratification and will form teams at will.

Howe and Strauss (2003) outline seven core traits naming confidence, being conventional and team orientation, as the most important for higher education. McCrindle (2002) observes that they value peer opinion more than parents or authority figures and that they seek role models and mentors rather than instructors. This reinforces the role of a lecturer as an advisor rather than a disciplinary expert. Extensive television and internet marketing has made then sceptical about universal truths and acknowledge a wide range of beliefs are acceptable. Similar to Generation X they value membership of teams but seek wider connections at peer group and community levels. Dyson (2008) outlines how an alternative, remote school environment that nurtured the development of a specific community was successful for previously disengaged students. Sheahan (2005) describes them as resourceful, aligning with McCrindle's view (2002) that they thrive on a challenge. Sheahan (ibid) says they expect change, are pragmatic and have no time for peripheral issues. They seek out meaningful tasks. Work is a means to an end. These characteristics align with the resentment of time wasting shown by Generation X'ers. He goes on to identify further similarities by describing them as independently dependent. A desire for feedback is also consistent but speed of response is now introduced. Erickson (2008) tabulates preferred operating styles of Y's which align strongly with these concepts. The table also compares how most corporations actually work highlighting in places conditions at opposite ends of the spectrum. Kelan & Lenhert (2009) outline that they understand that jobs are not for life and reflect that they seek an education that provides transferable skills and recognise that this might be an ongoing process.

Combining this with this Sheahan's (2005) observation that they are used to being entertained leads to demands that training must be relevant, interactive personalised, embedded in regular activities as well as entertaining.

Generation Z

According to the bands, generation Z's would not currently be studying at tertiary institutions. Some are not clear yet that a distinct generation has emerged and sources clump teaching tips for both generations together (McCrindle & Wolfinger, 2009, Ivanova 2010, Cox 2010). There is recognition that the details are still emerging, and extra care must be taken not to draw conclusions that are primarily linked to their age rather than genuinely to their generation. Consistently the advice is that they are even more familiar with technology and develop wide communities without ever meeting many of the members face to face. Jones, Jo, & Martin (2007) propose that individual student support may be provided by Ubiquitous Agents which are software based virtual entities providing assistance thought communication at any time needed. McCrindle & Wolfinger, (2009 pp116) reinforce the need for generic learning by stating that "the average half life of a science degree is six years." The increasing use of technology is reflected in the speed that students can access information and the media used to learn involving blogs, social networks and content embedded in gaming environments. Exposure to all the information via a wide range of media makes them discerning customers. Trunk (2009) introduces a clear differentiator from previous generations proposing that one generation can react to its parent generation. She proposes that Generation Z may not be team players and may prefer to be self directed.

LITERATURE SUMMARY

There appears to strong overlaps with the age ranges and not surprisingly, individual characteristics between the generations. None of the authors overtly weight one characteristic more strongly than others. Some overlapping and interdependent themes seem to span the generations and are referred to below, noting that desirable or acceptable measures change within each.

Pragmatism

The theme of increasing urgency be it for communication or to complete any task and move onto the next exciting activity appears to run through the generations. This urgency manifests itself in desires for relevant customised stimuli, efficient use of time, individual responsibility for actions balanced with the ability to check progress at will.

Problem solving

The increasing immediacy with which information can be acquired is willingly used to problem solve. Initial clear direction is required, followed quickly by space to be self directed. The desire for a network of contact appears to grow in reverse order for the need for face to face contact and the dependence on others to achieve.

Teamwork

Problem solving in teams is the norm but possible reversals may occur in Generation Z with a reluctance to work in teams.

Scepticism

Access to wide sources and ranges of information enables informed questioning of any facts before acceptance.

METHODOLOGY

Using content analysis, the authors have taken a two-fold approach to comparing the Team Management course details against demands of the generations. The first step maps the characteristics of Unitec's Living Curriculum to evidence present in the course, shown in Table 2. The selections are not exhaustive but meant to illustrate the author's perceived strong alignment with the characteristics. The second step shows characteristics of the Living Curriculum mapped against the generations in Table 3.Evidence for this mapping is drawn from examples from the delivered course which completes the connection between course outcomes and the generations. For the reasons noted in the Educating the Generations section Gen Y and Gen Z are bracketed together with specific notes where responses or needs may be different.

Responses were drawn from formal sources of student feedback mechanisms. Student use of the RFI system, individual emails from the students, the reflective journal in the individual assignment, personal observations and conversations provided informal feedback. Individual emails and reflective journals enabled identification of the generation of the correspondent.

Formal sources

Unitec Student Union's website "Rate my Course" enables students to anonymously make any observation about a course or a lecturer at any time through the course. This is publicly available although a student id is required to submit a comment. This course drew a feedback rate of 22% (16 students) score 4.8/10. Unitec also runs a Student

Evaluation of Quality (SEQUAL) at the end of each course also run electronically, but at the end of the course. This drew a feedback rate of 22%.

Informal sources

The electronic Request for Information system intends to replicate systems commonly found in industry. Whilst intended to be building focussed some of the RFI's revealed feelings about the course in general. Personal observations, student emails and assignment responses permitted interpretation of the content.

RESULTS

The results are shown in Tables 2 and 3.

Table 2 – Team management and the living curriculum

Characteristic	Evidence
Involve Complex Conversations • among students - face to face and online • with practitioners • about texts • with self -critical self-reflection	Communication with the lecturers is required to develop the brief from a set of goals to a task list & to establish role play boundaries. Communication within teams is required to agree group roles and responsibilities. Communication between groups is required to co-ordinate assembly activities. A reflective assignment is a major assessment component.
Are Curiosity/Enquiry led and are stimulating	The assignment problem requires investigating and further definition to identify boundaries and develop solutions for construction and assembly approaches
Are Practice focussed-educating students for work, in work through work	The construction is full scale, uses real materials and replicates a section of a residential construction. The challenge of organising a small team replicates the work environment closely.
Are socially constructed - self sufficiency and collaboration are equally valued,	The whole activity requires completion as a group but 50% of the course is assessed on an individual assignment
Blend face to face and web-based learning.	Workshops on core skills are combined with an electronic „Request for Information' mechanism. Students collaborate via the web to create group Safety Plans
Are research informed	Students demonstrate an understanding of fundamental problem solving and team work skills built from seminal research findings.
Have a discipline base, and are also interdisciplinary	Based in the use of NZ Construction standards but require manual, drawing and communication skills.
Develop literacy's for life-long learning	Skills in oral presentation, business report and reflective journal writing develop literary skills. The reflective journal requires the identification of skills to be developed in the future
Included embedded assessment	All workshops and lectures and in class activities are designed to trial short scale, short duration examples of the real assessment events and to assist in completion of the assessment

Table 3 – The living curriculum, team management and the generations

Characteristic	Generation X	Generation Y& Z
Involve Complex Conversations • among students – • face to face and online • with practitioners • about texts • with self -critical self-reflection	Should have no difficulty operating within groups required by the assignment. Might engage in broader conversations exploring the detail of the assignment before beginning than Gen Y& Z Should respond to the opportunities to chose how to construct and assemble the buildings as long as broad parameters are clear	To appeal conversations must be focused and not be seen to be unnecessary or peripheral to key content. Development of team identity through face to face interaction will be valued Likely to require justification of the broad project parameters if they limit alternative solutions. Conversations with peers required to agree solution will be the most important for Gen Y Gen Z may resist having results depend upon others in the group work components
Are Curiosity/Enquiry led and are stimulating	Challenging students who may never have used a manual tool before, to acquire new skills should appeal to keenness to learn. The flexibility of how the construction and assembly might take place will appeal to their curiosity.	The flexibility of how the construction and assembly might take place will appeal to their resourcefulness. The challenge must have sufficient direction to prevent developing a sense of time wasting.
Are Practice focussed-educating students for work, in work through work	Gen X students in tertiary study now are likely to be in a career changing situation. The real work focus of the actual project should appeal. The future use of project buildings as a training tool for plumbers and then as bike sheds will emphasise their value in the future	Creation of a real building should appeal to the desire of a challenge and emphasise a meaningful task. "Hands on" nature should appeal
Are socially constructed - self sufficiency and collaboration are equally valued,	Will appreciate the opportunity to show individual ability through the reflective journal along with the 50% weighting	Assignments require collaboration to produce a safety plan and an oral presentation. Gen Z may not want to be part of a team where marks are shared or depend upon each other's performance
Blend face to face and web-based learning.	Will comfortable using technology to help find solutions to problems and using the electronic RFI mechanism	The need to search out sensible safety plans and to utilise web based question and answer mechanisms should appeal to their comfort with technology
Are research informed	Underpinning course principles and processes with a knowledge base from wide research into team work problem solving and communication principles should appeal to their desire to be "information sinks"	Unless team work and problem solving theory is clearly applicable this could frustrate their pragmatic approach and fuel suspicion about the value of theoretical research findings to real world problems

Have a discipline base, and are also interdisciplinary	The need to combine foundation management tools, trade skills and oral communication competencies will appeal to the desire to broaden their skills	Many students see the building project as the key focus of learning rather than the vehicle for demonstrating team management skills. Interdisciplinary links will require justification to avoid perception of being unnecessarily peripheral.
Develop literacy's for life-long learning	Skills that might not be needed immediately, in particular formal business report writing align with keenness to learn new skills	The case for skills that might not be needed immediately must be made strongly to prevent frustration
Included embedded assessment	Frequent, formative feedback will be required blending acknowledgement of things done well as well as things to improve. Breaking assessment into four parts, enabling improvement in the latter parts should appeal.	Lectures and tutorials focus on theory content and skills required to complete the project, write reports and reflective journals. The business report requires the documentation of a safety plan for the project. This should appeal to their pragmatic approach where all activities are leading to assessment events. Will value faster more frequent feedback than Gen X

Student profile

According to the age criteria noted in Table 1, the class of 71 students comprise:

1 Baby Boomers (born before 1960)

12 Generation X

58 Generation Y

The results below represent the bulk of the formal student feedback received that has been received and collated under subheadings that link back to key characteristics of all three generations. Quotes are transcribed as written.

Pragmatism

> *"Totally agree with the Dept of construction in putting an emphasis on building something building/construction related. Not just cardboard bridges" (2009 assignment)*
>
> *"The mark schedule could also be improved; many of the points were very broad and hard to define."*
>
> *"Poorly thought out mark schedules."*
>
> *"Great learning curve for students and lectures after the muck up on the initial construction day."*

"For a tertiary subject it often felt like an overly nit-picky primary school class. The building exercises were a good idea but marks were distributed unfairly and teams were very uneven. Definitely needs more organisation on the lecturer's part."

"A good course and the intentions of the course were potentially very good, but it suffered from being too often disorganised."

"Some of the web links [the lecturers] have in the notes were changed in 2003."

"Poorly thought out recommended texts. Timeframe for paper content far too short. Complete lack of needed course information. Wrong and poor lecture information provided."

The pragmatic nature of the generations is demonstrated very strongly. This formal written feedback is further supported with strong informal lobbying to reduce the time to construct and assemble the buildings.

Frustration with mark schedules was surprising. The mark schedule outlining detailed components for each mark was required to be included with submissions demonstrating of its use as checklist. On occasions this was omitted, along with key components of the assignment.

The disorganisation and "muck up" referred to which drew many informal verbal responses involves inaccuracies with drawings and the delivery of incorrect quantities of materials hindering progress on the first construction day. The lack of information referred to, illustrates a negative response to problems designed to encourage exploration of a problems scope and also to enable a range of potential solutions.

A concern about the imbalance of the manual skills of the student teams is expressed on numerous occasions, despite only 10% of the marks being allocated to the physical construction and assembly.

Teamwork

"I did not realise how much work it takes to work in a team"

"Conflict is important….focusing on finding a solution, not blaming"

"I learned the importance of listening"

"This session provided me with a great introduction on how to manage and be part of a large team"

"The phrase people skills finally made sense"

"The only problems I had were with the team allocation - however there is little which can be done to improve this"

"Random allocation of students to teams doesn't really work."

"This course was very helpful in providing the basis for getting the best out of a team and running team meetings. Most of that learning came in the individual report in which I learnt a lot. The problems encountered during the construction phases were no different to those on any other project site."

"The students showed a lack of interest, and were prone to politicize the situation. This showed in the lack of interest when we tried to get a health and safety committee organized. Only two people showed up and contributed".

The students demonstrate comfort with working in teams and in their assignments students articulated some very valuable learning about the key outcomes. However pragmatism ruled and when teamwork threatened progress or marks dissatisfaction rose quite quickly. A bonus mark for the fastest completion is quoted widely as being a reason why on assembly day, only the skilled students contributed trading off the involvement of the wider team members.

Scepticism

"I respect your thoughts on what you think goes on in the real world but in the building industry that I am involved in, at no time would I accept this brief or task such that you have submitted. I would go away and simple throw it in the bin and think what a waste of my time."

The above response via email was from a Gen Y student. Others who claimed to have significant experience felt the project contained uncertainties not present in their experience of the real world. This was balanced by a Gen X's view in response to the comment:

"My experience is that you don't have to work in the industry very long before you come across difficult, ill-informed or unspecific clients "

The same Gen Y student went on to observe:

"And as of having to fill out so called RFI's what is wrong with just emailing directly to you or your pairs? I believe this is just another case of paper pushing."

Informally, inaccuracies with drawings and material deliveries were challenged by Generation Y students as being at odds with real construction experience, despite the incomplete material delivery being a very real interaction with a materials supplier. A number of other parameters set in the assignment were challenged. The elimination of the use of power tools due to safety reasons was questioned.

Problem solving

"Unpacking and checking of the timber packet was not advised as a required task until Construction day."

"Being told the forklift wouldn't be available until 10:30am on assembly day. Then being available for the whole time.

"The nails running out on Construction day 1"

Whether factually accurate or not this illustrates both pragmatism and some unspoken assumptions about how far students were expected to define the parameters of the problem and search out their solutions.

REFLECTIONS ON STUDENT RESPONSES

The anonymity of most responses prevent matching views to generations and analysis under the headings do not reveal clear generational boundaries. This is not unexpected as the literature analysis summary observes that the boundaries between generations are blurred and characteristics are not mutually exclusive. A 22% response rate is also not large enough predict the feelings of the whole class. However, the theme of urgency appears to run strongest with concern being expressed about apparent lack of organisation and lack of clarity with regard to some of the tasks being set. Problems designed to enable a multitude of solutions were sometimes interpreted as disorganisation implying some impatience with the problem definition stage. This reinforces the observations that whilst conversation and enquiry led challenges gain student engagement, clear boundaries limiting the scope of problems need to be set. Anticipating the uncertainty they may feel, putting it into context and tacitly linking it to desired characteristics of their generation and the real working environment may reduce discontent.

Documenting the assignment in more detail to improve clarity may simply create more words to interpret differently and a facilitated question and answer session in a face to face mode or via electronic social networking technology may prove more successful.

Students were very comfortable with challenging or criticising any feature of the course they thought required it and did so with a confidence that often exceeded their experience. This aligns with Shaw and Fairhursts' (2008) findings of McDonald's graduate trainees, observing:

"A growing tendency to identify external factors as contributing to outcomes(particularly negative outcomes) means that training programmes will receive increasing levels of criticism from participants if they fail to effectively develop them, rather than participants acknowledging that they could have worked harder or shown more commitment"

One very positive aspect of the challenging nature was a granted request for the organisation of a "roof shout" to celebrate the successful conclusion indicating a strong appreciation of the need to recognise team performance and the collective class achievement.

The need for links with a wide community outside of the class is not overtly strong in the course, limited to the need to consider Unitec health and safety policies. Contrary to the literature, its absence does not draw negative comment. Students tended to focus inwards on their own team of 5 or their building team of 25 rather than seek much interaction across the class of 75. This resulted in some inefficient use of shared resources on assembly day.

CONCLUSION

The literature review identifies strong overlaps between the generations' characteristics. Headings used for discussion in the literature do not appear consistently across the three generations being investigated. The authors have proposed Pragmatism, Teamwork, Problem Solving and Scepticism as headings that facilitate cross generational analysis. The course maps closely to the Living Curriculum. In turn, Unitec's Living Curriculum maps closely many of the desired characteristics of the generations noted in the literature. However this closeness does not insulate the course from student dissatisfaction. Pragmatism and the need for urgency appear to build with the generations and increasingly dominate student engagement with the course. There is low tolerance for broad problem solving activities where they feel their time is wasted and this manifests itself in scepticism for the overall task and the value of some details. This also runs through teamwork where students engage enthusiastically until it appears to threaten efficiency or equity. This characteristic may be exaggerated when educating Generation Z students.

The pragmatic demands can be at odds with the reflective nature of the living curriculum and need for complexity demanded by problem solving challenges, team work based activities and suitable intellectual challenges of an undergraduate qualification. Experiential, practice based learning environments might also inherently challenge students to grapple with issues that will take time to solve. Analysing student feedback of other courses under the headings of Pragmatism, Teamwork, Problem Solving and Scepticism will identify if these findings apply widely. If consistency is found then they can be used as useful guidelines to help balance the complexity and uncertainty required by the level of qualification with the need for urgency required by current and future generations.

REFERENCES

Cox, R. (2010) Practical Tips for Generation Y and Generation Z Teachers, Youth Empowerment seminars, (Online), http://www.yess.co.nz/PracticalTipsForGeneration YandZTeachers.html (17 December 2010).

Curriculum Design Policy (2009) Academic Policy and Procedures Manual, Unitec Institute of Technology, Auckland, NZ: (n.p.).

Daniels, H. (ed.) (2005) *An Introduction to Vygotsky*, 2nd edition, London: Routledge

Dyson, M. (2008) Educating Generation Y in Alternate settings: What seems to work, Australian Association for Research in Education, Proceedings of the Annual Conference of AARE, Freemantle, 2007, (Online), www.aare.edu.au/07pap/dys07422.pdf (1December 2010).

Erickson, T. (2008) Plugged In. *The Generation Y Guide to Thriving at Work*, Boston MA: Harvard Business Press.

Guyette, E. (2004) Vermont Social Studies Project, (Online), http://www.vermontsocialstudies.org/vssp/HTML_SITE/Living.html (20 January 2011).

Howe, N. and Strauss, W. (2003) *Millennials Go To College: Strategies for a New Generation Campus: Recruiting and Admissions, Campus Life, and the Classroom*, Washington, DC: American Association of Collegiate Registrars and Admissions Officers.

Ivanova, A. (2010) Improving the UI of Interactive Training Simulators to address the Y/Z-Generations, Proceedings from the, International Conference on Computer Systems and Technologies - CompSysTech'10 Vol 471, (Online), portal.acm.org/ ft_gateway.cfm?id=1839450&type=pdf (17 December 2010).

Jones, V., Jo, J. and Martin, P. (2007) Future Schools and How Technology can be used to support Millennial and Generation-Z Students, Proceedings from the 1st International Conference of Ubiquitous Information Technology and Applications, February 12-14, 2007, (Online), www.webkb.org/doc/papers/icut07/icut07_JonesJoMartin.pdf (21 January 2011).

Jorgensen, B. (2003) Baby Boomers, Generation X and Generation Y? Policy implications for defence forces in the modern era, *Foresight*, Volume 5, Issue 4, U.K.: Emerald Group Publishing Ltd.

Kelan, E. and Lehnert, M. (2009) The Millennial Generation: Generation Y and the Opportunities for a Globalised, Networked Educational System. Beyond Current Horizons, (Online),
http://www.beyondcurrenthorizons.org.uk/the-millennial-generation-generation-y-and-the-opportunities-for-a-globalised-networked-educational-system (17 January 2011).

Manville, G. and Schiel, G. (2008) Generation Y is wired up and ready for action so what is the problem? *Times Higher Education Supplement*, 14th August 2008, (Online), http://www.timeshighereducation.co.uk/story.asp?storyCode=403177&sectioncode=26 (5 December 2010).

McCrindle, M. (2002) Understanding Generation Y. Learning to Learn, (Online), http://www.learningtolearn.sa.edu.au/Colleagues/files/links/UnderstandingGenY.pdf (5 December 2010).

McCrindle, M. and Wolfinger, E. (2009) *The ABC of XYZ: Understanding the Global Generations*. NSW: University of NSW Press.

Pass, S. (2004) *Parallel Paths to Constructivism. Jean Piaget and Lev Vygotsky*, USA: Information Age Publishing.

Reilly, P. (2007) You Are the Living Curriculum, Ed Tech Journeys, (Online), http://preilly.wordpress.com/2007/04/28/you-are-the-living-curriculum (20 January 2011).

Rose, J. (2007) Designing Training for Gen Y Learning Style and Values of Generation Y, (Online),
http://www.suite101.com/content/designing-training-for-gen-y-a18773 (17 December 2010).

Shaw, S. and Fairhurst, D. (2008) Engaging a new generation of graduate. *Education & Training*, Vol. 50 No. 5, 2008, pp. 366-378, UK: Emerald Group Publishing Limited.

Sheahan, P. (2005) *Generation Y. Thriving and Surviving with Generation Y at Work*, Victoria, Australia: Hardie Grant Books.

Squires, D.A. (2005) Aligning and Balancing the Standards-Based Curriculum, Thousand Oaks, CA: Corwin Press.

Trunk, P. (2009) What Generation Z will be like at work, Penelope Trunk's Brazen Careerist, (Online), http://blog.penelopetrunk.com/2009/07/27/what-work-will-be-like-for-generation-z (20 December 2010).

Tulgan, B. (2000) *Managing Generation X*, W.W. New York: Norton & Company.

An Australian/UK Comparison of Contemporary Teaching and Learning Technologies

Sara J Wilkinson
Faculty of Business & Law
Deakin University, Melbourne, Australia

Dr. Mark Shelbourn
School of Architecture, Design and Built Environment
Nottingham Trent University, Nottingham, United Kingdom

ABSTRACT

The last decade has delivered substantial changes in construction and property education in Australia and the UK. There has been an increase in the number of courses offered in built environment education and the profile of a typical student has changed. In both countries students are under pressure to balance study and work due to the higher costs of living and education. This has placed demands on providers to deliver teaching and learning which meets student, industry and professional needs. Simultaneously there has been an increase in the application of technology in the business and corporate world which has resulted in increased efficiencies and new challenges. This paper evaluates changes in construction and property education courses to embrace new technology. The focus is on the delivery of innovative teaching and learning materials and the interaction between students, staff and the community. Results from questionnaires from new and existing students at Deakin University and Nottingham Trent University were used alongside examples of teaching and learning as illustrative case studies, the emphasis is placed on pushing the boundaries of the conventional built environment education process. The findings show that by embracing technology there can be a „win-win' scenario for students, staff and industry stakeholders. Whilst courses adopt varying levels of technology, it seems inevitable that educators must evolve the delivery of education to become efficient and effective as the century progresses.

KEYWORDS

construction, property, education, e-technologies, distance learning

INTRODUCTION

The components in any learning situation are the student, the teacher/lecturer, the subject, the teaching environment and the method of delivery. These are all inter-related and individual which makes it difficult to identify the one factor that makes for effective

learning or effective e-learning. Research shows when traditional teaching and learning methods are employed, students lack motivation and fail to progress beyond rote learning (Lavelle, 1992). The lack of motivation appears to be independent of intelligence (Day and Berlyne, 1971). A conclusion is that students should be stimulated during the process to optimise their attention, performance and learning. However this is not the whole picture, whilst stimulation is the lecturer's responsibility; much rests with the student and their desires.

Little has been published into the feasibility of Computer-Aided-Learning (CAL) for Building and Construction assessment or in the creation of courseware on the subject (Shelbourn et al., 2001). This paper describes current use and student perceptions and use of technologies that support CAL at Deakin University in Australia and at Nottingham Trent University (NTU) in the UK. The thoughts of students in the use of the supporting technologies across both institutions are discussed.

STUDENT ENGAGEMENT

There have been changes in construction and property education in Australia and the UK over the last decade, for example the increased number of courses being offered. The expansion continues in Australia; however the Global Financial Crisis of 2008 has lead to UK budget cuts in 2010 which threaten some courses.

Moreover the profile of a typical student has changed. With changing demographics students are largely derived from Generation Y or Gen Y born between 1982 and 2000 (Crindle, 2002). Broadly speaking characteristics that set Gen Y apart from other generations are:

1. Pursuit of personal satisfaction
2. More entrepreneurial savvy and less concerned with permanence
3. Not as influenced by authority and role models
4. Peer group is important – learning how to operate in a group, connected to friends
5. More visual, kinaesthetic learners who want to avoid information overload (especially print)
6. Not compartmentalised (partitioned) a mosaic of expectations – all parts of their lives are woven
7. Values and self esteem need to be met in a workplace and in their learning.

These characteristics impact on learning and teaching styles. "The traditional chalk and talk won't work with this generation. Our communication style is structured, yet they want freedom. We stress learning, they like experiencing. We react, they relate. We focus on the individual, while they are socially driven" (Crindle, 2002). Not all Generation Y will embody all of the characteristics and they vary from person to person, however the

broad concept holds true. The differences in characteristics between generations are compounded further in the tertiary sector where most teaching staff belong to the baby boomer generation.

Students are under pressure balancing study and work with high living and education costs. In Australia most students work casually or part-time, whereas in the UK it is less common for students to work during term-time. This may change as education costs will increase substantially in the UK, following the Browne Report (2010). With the Bradley Review in Australia, the sector is set for change post 2012 as the caps on universities for student numbers is removed and the free market prevails. There is the belief that some consolidation will occur with less viable courses closing. The need to attract, engage and retain students has never been more challenging.

Working students benefit from flexible study options. Globally there are issues with attendance which demonstrates lack of engagement with studies or time management and work-life balance issues. In Australia lectures are scheduled in two hour blocks; a long time in which to attract, engage and retain interest and attention. The UK model involves a one hour lecture followed by a one hour seminar. During lectures staff compete with technology in the form of laptop computers and smart phones to an extent where many ask: *is the face to face lecture losing its impact, and should we look to other forms of delivery?* Furthermore the style and content of communications with students needs to be relevant to a generation who are visually educated and this involves researching the most appropriate format for those we purport to educate (Crindle, 2002). In short; a quality outcome is dependent on our understanding of our students' generation. Course providers are evolving more flexible study options to accommodate Gen Y needs and this paper examines the nature of these options and the students' perceptions of the use of technology to enhance education.

STUDENT ENGAGEMENT

Student feedback allows lecturers to understand whether efforts to improve the educational experience lead to improvement (George and Cowan, 1999). Both institutions use end of module questionnaires to feedback student satisfaction consistent with international practice (Kahn et al., 2003). The weaknesses of the approach, is that it rarely results in a modification for that cohort and depends on uncorroborated opinion. Finally it may be based on feedback from a limited number of students with others affected by questionnaire fatigue (Gibbs, 1982). Questionnaire feedback can provide an uninformative view of what is occurring (Gibbs, 1982); for example, the data may not be relevant to a particular module (Heywood, 2000). At worst feedback is perceived as „form

filling' without direct benefit and merely complying with quality procedures (McDowell, 1991).

Whilst the benefits of feedback studies are well documented, appropriate information must be generated (Gibbs, 1982). It is vital to obtain the feedback in a manner that enables students to voice opinions (Hounsell et al., 1997). Students need to provide reflective, constructive opinions to preclude the emergence of a blame culture with a focus on the learning experience (McDowell, 1991) and how it might be improved. With an emphasis on understanding how students perceive and value different aspects of the course improvements are possible - here the focus was on use and experience of technology in learning. At Deakin University, the experience of web supported unit teaching and learning materials provided on Deakin Studies Online (DSO), the real time lectures via the internet (through eLive) and the pre-recorded lecture (Camtasia) technology. At Nottingham Trent University (NTU) the focus was on the use of the Nottingham Trent University Workspace – NOW, a bespoke version of the Desire2Learn (D2L) online learning environment. NTU uses Camtasia technology to produce online material for off campus external students. A considerable body of research posits how useful student feedback can be (Marton et al. 1984; McDowell 1991; Gibbs 1982). Though many lecturers concentrate on the content of lecture materials with reference to feedback, there is much to be learned about how students manage approach and structure to their learning.

Not all student issues can be accommodated in teaching and delivery modes, partly due to external factors, such as professional body requirements, physical resources of the university and the human resources of the faculty. However it is important that the educational infrastructure and course delivery mode takes student perceptions, needs and the barriers to learning into account (Crindle, 2002). Previous studies demonstrate that student feedback leads to improved performance (McDowell, 1991).

TECHNOLOGY AND LEARNING

Computers are „powerful tools' to enhance learning and can make „good teachers' creating a strong educational case for usage (Cuthell, 2002, Barker et al., 1985). Computer assisted learning has been used widely in the tertiary sector for many years and is known as computer-based learning (CBL), computer managed learning (CML), e-learning, on-line learning, and Blackboard. At Deakin University Blackboard is known as DSO. NTU has used D2L technology since 2007. This paper is concerned with the use of the software programmes DSO running on a „Blackboard' platform (Blackboard, 2008), eLive (Elluminate, 2008) and Camtasia Studio (Camtasia, 2010). From a UK perspective

the use of the NOW, Camtasia, and Microsoft Live Meeting are the main focus in gaining the student experiences for enhancing their learning.

The arguments for computer technology are that learning quality is enhanced and instruction is improved (Barker et al., 1985). Other benefits are supplementing traditional methods, accelerating learning, experimenting with course development. CAL provides remedial instruction, individualised instruction, enrichment materials, on demand instruction and achieves higher teaching standards, (Barker et al., 1985; Joliffe, 2001; Cuthell, 2002). Blackboard can be used in all of these ways (Blackboard, 2008) via DSO, where eLive facilitates delivery of synchronous lectures via the internet (Elluminate, 2008) and Camtasia Studio software allows staff to pre-record lectures for download when convenient. At Deakin University DSO, eLive and Camtasia Studio are used in some of the ways noted above. Furthermore students now enter tertiary education with experience of CAL from primary and secondary schools, are familiar with IT in learning and have expectations about CAL and the quality of materials (Barker et al., 1985).

The web can be used to deliver learning events and provide an archive for students unable to attend (Joliffe et al., 2001), and eLive was used at Deakin partly for this purpose. Since 2008 all property units use eLive technology to deliver some lectures. An advantage is that students can individualise their learning thus improving the student experience (Burke and Rumberger, 1987). In 2009 pre-recorded lectures were piloted to provide further flexibility and in 2010 this provision was extended to other units. The post graduate course is externally supported with weekly pre-recorded lectures and self paced tutorial exercises. Outside of core teaching, IT can transform the teacher from subject specialist to a broader director of studies role as students take more responsibility for their learning. This aspect is a core goal of the programs at Deakin, based on the belief that students need to develop skills as independent lifelong learners.

Other benefits of IT-based tools include discussion facilities such as chat rooms and a variety of learner administrative information (Joliffe et al., 2001). Whilst the DSO sites host chat rooms, provide announcements and notices and set out trouble shooting materials for learners, eLive enables student chat to occur in „breakout rooms' created on the site. Joliffe et al. (2001) argued there must be some face-to-face interaction between the student and lecturer for the maximum advantage to be derived from IT based learning materials, and eLive events occur five times (out of twelve) each trimester (table 1). In the graduate course face to face interaction occurs via optional video supported tutorial sessions using eLive technology in weeks 1, 6 and 12, in addition to telephone and email contact.

Table 1 – Deakin University lecture delivery mode

Week number	Undergraduate	Postgraduate
1	On campus	Pre-recorded lecture, live video seminar
2	On campus	Pre-recorded lecture
3	eLive	Pre-recorded lecture
4	On campus	Pre-recorded lecture
5	eLive/ Pre-recorded lecture	Pre-recorded lecture
6	On campus	Pre-recorded lectures, live video seminar
7	eLive	Pre-recorded lecture
8	On campus	Pre-recorded lecture
9	eLive/ Pre-recorded lecture	Pre-recorded lecture
10	On campus	Pre-recorded lecture
11	eLive/ Pre-recorded lecture	Pre-recorded lecture
12	On campus	Pre-recorded lecture, live video seminar

What are the disadvantages student learning of IT? There are concerns about over reliance and dependency on IT (Burke and Rumberger, 1987). It is vital to use IT ‚appropriately', to consider the needs of the students and to balance IT based materials and traditional methods (Barker and Yeates, 1985; Crindle, 2002).

There can be misconceptions about technology in teaching; it can be time consuming producing the learning materials (Joliffe et al., 2001). Thus if a provider is seeking to reduce staff preparation and teaching time, substantial development in CAL may not be the way forward (Joliffe et al. 2001). This was considered in the development of materials at Deakin. Much focus on CAL material has been with the Master's programmes at NTU where there is a support team for lecturers to develop CAL material. The experience of NTU staff with this team has not been a success, although the e-learning team were the experts there was no flexibility in their approach to the development of materials, with one lecturer stating; "if it is not their way (the e-learning team) then there is no way – why should I bother?" The time to develop such material is often underestimated with the lecturer expected to develop the CAL material and carry out their day-to-day work.

Furthermore the lecturer needs IT knowledge and discipline knowledge to design an effective learning environment for students (Joliffe et al., 2001). The teaching staff had some experience of teaching software but additional training was undertaken and there was a decision to commence at a low level and to build up. A further issue is teaching materials may be static and do need regular updating. Although this is not the case with all courses, many lecturers use online technology to make lectures and information available to students in real time and then the lecture notes are uploaded onto the DSO and NOW sites for subjects.

Other problems arise when users have equipment with limited capacity to download materials. Joliffe et al. (2001) noted that some materials require users to have „state of the art' PCs and browsers. Finally, in order to make the most of effective learning IT-based materials and the most effective use of IT, lecturers and students need training which requires time and resources (Joliffe et al., 2001).

RESEARCH QUESTIONS

To compare student perceptions and the use of technologies to supplement and/or enhance the student experience, a number of questions are addressed:

- How technology is used in the two institutions?
- What are the students' perceptions of technology whilst studying?
- What are the students' expectations of these technologies?

RESEARCH METHOD

Questionnaires were used to gather quantitative and qualitative data at Deakin and NTU; a well known and frequently used method. Naoum (2006) describes quantitative data as "objective" in nature, with the results being "hard and reliable; …tangible, countable, senate features of the world" (Bouma and Atkinson, 1995). On the other hand qualitative data is "subjective" in nature (Naoum, 2006) with an emphasis on "meanings, experiences, descriptions etc." The questionnaires used in this paper to gather the raw data were different in structure and length, but they were all designed and developed following the principles described by De Vaus (1996; 2001) and Naoum (2006). The surveys used were the NTU Pre University Student perception questionnaire 2009, the NTU wide student satisfaction survey 2010 about NOW and surveys of Deakin University Property and Real Estate students.

RESULTS

How technology is used

In 2008 a three year bachelor degree in property and real estate (PRE) commenced at Deakin University with 61 students. The way students perceive IT in teaching is affected by their composition and social background. Deakin students are primarily local, with others coming from rural and regional Victoria. Over 60% of the cohort is mature age or non-year 12. The PRE units include students from other disciplines including commerce, construction management, arts and science.

At undergraduate level, there are three primary ways staff interacts and engages students. The traditional approach is face-to-face on-campus in lecture theatres followed by face-

to-face tutorials, although there is sometimes overlap between the modes – for example within a lecture there may be a problem-based exercise. The third mode is delivering lectures over the internet via the program eLive (Elluminate, 2008). These three delivery modes were employed to create synergy (i.e. acknowledging the strengths and weaknesses of each mode) and to provide multiple learning approaches and flexibility.

When designing the delivery mode there were options, such as using eLive to deliver the lectures over the internet. Synchronous eLive lectures are delivered to students, either based on-campus using university computers or off-campus at work or home (Elluminate, 2008). It is a convenient mode of accessing lectures for part-time or working students. As with a typical lecture, PowerPoint is used to introduce materials and theoretical concepts. Depending on how the lecturer wishes to use the technology, the students can type in questions, make comments on screen or write on the slides. Students can use microphones, with up to six people conversing simultaneously. There is access to URLs and the ability to play video files which some lecturers find useful.

Camtasia allows lecturers to record and create a full motion video presentation or tutorial. It can be published in the format of choice, at Deakin MP4 format enables students to download the materials onto iPads, iPhones, and PCs. The teaching and learning materials comprise PowerPoint format with audio and inserted video clips. The advantage is that students can pause, rewind and replay segments. Furthermore students are able to see the application of software and websites in „real time' and literally follow the lecturer's mouse as key relevant software is demonstrated.

After consultation with PRE staff and Faculty teaching advisers, a number of approaches were adopted. For undergraduates eLive sessions commence with a topical or unit-related question for students to reflect upon. The lecturer sees all participants as they log in. High levels of visual materials were used as a catalyst for discussion adopting a style Gen Y favours, and students are frequently asked to examine images to consider certain aspects. A polling tool enables participants to answer questions anonymously; questions may be posed as closed or multiple choice options. Participation rates are high, higher than found in the face-to-face lectures given to the same cohorts. PowerPoint slides are available on the DSO before sessions.

With pre-recorded lectures a question and answer style is adopted where questions are posed on the text of the PowerPoint and the audio provides the answers; such an approach requires students to view and listen in order to note relevant information. The recorded approach advantages students with English as a second language who can replay lectures as many times as needed for a full understanding. At undergraduate level a mix of pre-recorded lectures are used in years two and three of the course in weeks five, seven, nine and eleven. Pre-recorded lectures were deemed to be a technology overload for first year

students and were part of the philosophical approach of gradually introducing technology throughout the course.

Students' perceptions of the technologies

Overall positive perceptions about technology in teaching and learning prevailed at Deakin. Crindle's (2002) comment in respect of flexibility and convenience being important to Gen Y students was found to be true. Many students commented on the „ability to revisit recorded lectures' and to take on new materials „and review the lecture again at your own pace. I found this method of delivery very good'. Others commented that eLive recordings were „convenient and well taught'. Some students could extract more content from recorded sessions by revisiting the materials, „I was able to gain more information from eLive and write more information than the face to face lecture' as the distractions of the lecture theatre were sidelined.

A third reason favouring recorded materials was the ability to balance study and work and to give students choice. The experience of using the technology is positive and enjoyable which confirms that the quality of the experience is important (Crindle 2002). One stated that the eLive was a „creative and much liked way of providing a lecture', another noted eLive was „a great thing, love the variation it provides and keeps the course interesting.' The findings are that expectations have risen in terms of teaching and learning materials, and traditional approaches are seen as less innovative and interesting.

Not all students embraced the technologies. There were issues with the quality of downloads partly due to University and student equipment. Students need access to fast broadband internet for optimum quality and speed. A negative perception was the reliability of technology which is partly related to the comment on quality. Some found live links dropped out during transmission. Another frustration was the speed with which some lecturers uploaded materials onto subject websites as expectations, whether realistic or otherwise were unmet. Others preferred face to face contact above external provision which contradicts Crindle's claim that convenience is the main driver for Gen Y (2002). One student stated that they found it difficult to „learn and understand in this forum' but they did not articulate the reasons they found the learning harder. A summary of the findings is shown in table 2. When the lecturers analysed the amount of time students visited and spent on the unit DSO websites there was considerable variation, some had high and regular usage others rarely logged on and did not visit all parts of the site. As a result these students were disadvantaged in that they did get gain access to all of the teaching and learning materials provided by the lecturer.

Table 2 – Perceptions of technology use in property at Deakin University

Positive perceptions	Negative perceptions
Convenience Greater flexibility Better quality teaching and learning experience Improves note taking Ability to balance study and work commitments Creative experience	Technology unreliable Sound quality can be poor when used with older equipment Prefer to have option of face to face or eLive Difficult to learn from this method

Technology expectations of incoming students

In 2009 the School of Architecture, Design and the Built Environment (ADBE) at NTU conducted a survey with 83 students (a response rate of 22%) who were either in the Sixth Form at School (48.5%), College (17.6%), at a Further Education College (27.9%) or already at a University (5.9%). The respondents were 64% male and 36% female. The aim of the survey was to gather knowledge and understanding of these students expectations of university life, so that ADBE can better manage the transition into the University environment. Amongst the questions asked were:

1. How much do you use computers?
2. How confident are you in the following use of technology at university?
3. Do you have access to your own computer at home?
4. Do you have access to broadband at home?
5. Will you have access to your own computer university?

It is the intention to use these results to show the expectations of students to use technology during their time learning and studying at NTU.

For question 1 the options for answers were “Never”, “Sometimes”, “Often” or “Very Often”. The results of the survey showed that Microsoft Office was the most commonly used technology, used “very often” with a score of 38.6%. The next most popular was Social Networking for studying with friends (25.3%). Those technologies that were “Never” used were firstly a quite specialist piece of software for creating videos etc. The second, and perhaps more telling result, was that 37.3% of those asked “never” use “Your School website for getting information about your studies or other school activities”. This has potential problems as many institutions rely on such websites to give students information as well as CAL material. Table 3 shows the results from the question; how confident or not confident the students are in using different technology at university?

Table 3 – Student confidence on using technology

Confident in using technology	Not Confident in using technology
Discussion boards, wikis, blogs Contacting staff and students by email Using a virtual learning environment Learning new software applications Sharing your work with students and staff	Video conferencing

There is confidence with student's ability to use almost all of the technology in all aspects of their university life, apart from the video-conferencing technology. This could reduce the usefulness of CAL material as face to face interaction is important to the success of IT in teaching and learning. The ability of the student to use such technology will become more common place as they are introduced to it at an earlier age.

The final three questions concern the students' access to basic computing technology and broadband to use such technologies. Of the respondents 96.4% have access to their own computer at home. 92.8% of the respondents will have access to their own computer at university too. The same number also has access to broadband at home. These results show that the students will have access to such technology that both Deakin and NTU rely heavily on to give student information and e-learning material.

NTU NOW satisfaction survey

In 2010 NTU conducted a number of surveys to determine staff and student satisfaction of using e-learning at the university. The student survey was conducted with outgoing students in May 2010. The ADBE School students were the least satisfied with the e-learning experience of NOW at 55% – the average across the university being 66%. It would seem from these results that the School has much to learn.

The overall usage of NOW was 81%, with student usage classed as frequent with more than two usages per week. Half of all the students felt that the age of the computers detracted from their overall satisfaction when using computers in the library, and this figure fell to just below half when asked about their satisfaction elsewhere in the university.

In terms of using NOW to access content for their learning, only 2% had no content whatsoever, with the remainder receiving content via NOW. 69% of all students agreed that they were satisfied with the ease of use of NOW. Only 38% of students were satisfied with the amount of online discussion activities that are available through NOW. Only 39% of students were satisfied with the amount of online feedback provided via NOW. Satisfaction rates for the submission of online assignments and reading lists was about two thirds of all students. Just over half of all students were satisfied with the amount of links to external sources. Students' comments regarding NOW were mostly about the lack

of knowledge on behalf of staff, the lack of mandatory training courses in the first year of studies, navigation difficulties, and a lack of communication with tutors in NOW. Students were keen to be able to personalise the calendar, so that they could include important dates and deadlines for activities outside of lecture and seminar times.

The students mostly felt that the usage of NOW by staff was the key factor affecting their satisfaction with e-learning. They felt that usage was inconsistent across staff, thus setting differing standards of usage, which students felt confusing. They wanted more online assessments, discussion activities, online feedback, and online submission. Most other comments related to the general usability of NOW and the fact that they did not have a mandatory training course. The study findings suggest that students at NTU are positive about e-learning tools, but feel their satisfaction is let down by the skills of teaching and learning staff, although they are keen to point out that where exemplary usage is evident their inspiration and satisfaction with their studies increases. The key findings were:

- The computer facilities meet current student needs
- Less satisfied with training and support – confusion over who to contact
- NOW is used by the majority of students on a daily basis
- Age of computers was a problem for students – especially the lack of support for smart phones and tablets
- Students satisfied with NOW, however they want staff to be better trained, and they want to be able to personalize the system, i.e. calendars
- Want more online discussions, submissions, and assessments
- They want a mandatory first year training module – some wanted this to be online, others wanted staff to complete

Perhaps the most important point made by the students, and should be taken away from this survey is that *"…exemplary staff usage (of NOW) inspires my studies…"*

CONCLUSIONS

There are similarities in the ways in which technology is used to enhance the teaching and learning experience in both institutions. Both institutions use blackboard supported technology to upload course materials and to communicate to students. Both institutions use Camtasia software to pre-record lecture materials for students. Both institutions have used support from teams with CAL materials though the experiences of the NTU staff were less satisfactory than the Deakin staff.

There is an issue with students usage of DSO and NOW with some students and this may be a responsibility of the university and lecturers to demonstrate unit or subject websites in lecture time so that students become more familiar with their layout and appearance

and the content of the sites. Lecturers should not presume students familiarity with DSO or NOW and other CAL materials.

Overall there is much to be commended in the development of recorded and on-line teaching and learning materials. Students value the flexibility such an approach gives them as well as the ability to re-listen to materials. The issues surrounding technology limitations and reliability need to be addressed within the university.

A key finding is that the lecturers need to provide a clear explanation of the way in which the materials are intended to be used and how the students should use them. Furthermore students expectations should be realistic in terms of what lecturers are able to do within reasonable timeframes, as is often the case it is the gap in communication and expectation wherein the problem the lies. Overall there are high levels of confidence in the use of technology, which is a result of younger people having grown up with technology.

REFERENCES

Angelo, T.A. and Cross, K.P. (1993) *Classroom Assessment Techniques. A handbook for college Teachers*. 2nd ed. San Francisco, Jossey-Bass.

Barna Research Group Teenage Attitude Study, October 2001, www.barna.org accessed 3rd November 2010.

Barker, P. and Yeates, H. (1985) *Introducing computer assisted learning*. Prentice Hall UK International, London. ISBN 0 13 477308 X.

Bouma, G. and Atkinson, G. (1995) *A Handbook of Social Science Research: A Comprehensive and Practical Guide for Students*. Oxford University Press.

Browne, J. (2010) *Securing a Sustainable Future fir Higher Education*. Available from http://hereview.independent.gov.uk/hereview/report/ - last visited 30/11/2010.

Burke, G. and Rumberger, R.W. (Eds) (1987). *The future impact of technology on work and education*. Falmer Press, Lewes, UK. ISBN 1-85000-083-2.

Camtasia website accessed 1st November 2010. http://www.softwarecasa.com/camtasia-studio.html.

Crindle, M. (2002) *Commissioned Research Project January 2002*. The Australian Leadership Foundation.

Cuthell, J.P. (2002) *Virtual learning: the impact of ICT on the way young people work and learn*. Ashgate Publishing Ltd., Aldershot, England. ISBN 0 7546 1776 9.

Day, H.I. and Berlyne, D.E. (1971) Intrinsic motivation. In Lesser, G. (ed) *Psychology and Educational Practice*, Glenview, Illinois: Scott Foresman.

De Vaus, D.A. (1996) *Surveys in social research*. UCL Press ltd., London.

De Vaus, D.A. (2001) *Research Design in Social Science*. London, Sage.

George, J.W. and Cowan, J. (1999) *A Handbook of Techniques for Formative Evaluation: Mapping the Student's Learning Experience*. Kogan Page.

Gibbs, G. (1982) *Eliciting student feedback from structured group sessions*. Oxford Brookes University.

Heywood, J. (2000) *Assessment in higher education: student learning, teaching, programmes and institutions*. London: Jessica Kingsley Publishers. ISBN: 978-1-85302-831-1.

Hounsell, D., Tait, H., and Day, K. (1997) Feedback on courses and programmes of study. University of Edinburgh.

H.M.S.O. (2003) *The UK Government White Paper on Education*. DfE, London.

Joliffe, A., Ritter, J. and Stevens, D. (2001) *The on-line learning handbook. Developing and using web-based learning*. Kogan Page Ltd, London. ISBN 0 7494 3208 X.

Lajoie, S.P. and Derry, S.J. (Eds). 1993. *Computers as cognitive tools*. Lawrence Erlbaum Associates, Hove and London. ISBN 0 8058-1082-X.

Lavelle, D. (1992) Promoting student learning and motivation via a systematic introduction to the use of IT. In Sloan, B and Schofield, D. (eds), proceedings of the computer-based training in property and construction conference, University of Salford, September 1992, pp.7-15.

Kahn, P. and Baume, D. (2003) A Guide to Staff and Educational Development. Routledge, ISBN 0749438819.

McDowell, L. (1991) *Course evaluation: Using students' experiences of learning and teaching*. The Educational Development Service, Newcastle Polytechnic.

Monteith, M. (Ed). (1998) *IT for learning enhancement*. Swets & Zeitlinger Publishers, Netherlands. ISBN 90-265-1524-3.

Naoum, S.G. (2006) *Dissertation research and writing for construction students*. 2nd edition. Butterworth Heinemann, UK.

Robson, C. (1993) *Real World research. A resource for social scientists and practitioner researchers*. Blackwell Publishers Ltd., Oxford.

Russell, M., Bebell, M., Cowan, J. and Corbelli, M. (2003) *An AlphaSmart for each student: Do teaching and learning change with full access to word processors?* Computers and Composition, Elsevier.

Shelbourn, M.A. (2002) *A Computer-Aided-Learning application to train inexperienced Building Surveyors in Building Pathology using Virtual Reality*. PhD Thesis Research Centre for the Built and Human Environment, University of Salford.

Shelbourn, M., Aouad, G. and Hoxley, M. (2001) Multimedia in Education – New Dimensions. *Automation in Construction*, Vol.10, No.2 Jan 2001 pp.265-274, ISSN 0926-5805.

Camtasia website accessed 1st November 2010. http://www.softwarecasa.com/camtasia-studio.html

http://www.decs.sa.gov.au/learningandwork/files/links/generation_summary.pdf.

Estimating the Useful Life of Buildings

Professor Craig Langston
Institute of Sustainable Development and Architecture
Bond University, Gold Coast, Australia

ABSTRACT

Obsolescence is a phenomenon that is widely discussed in the literature, although rarely in relation to buildings. In this paper parallels are drawn between obsolescence, depreciation and discounting in order to develop a new method for predicting the impact of building obsolescence based on measurable context factors. These factors have physical, economic, functional, technological, social, legal and political characteristics. Useful life is defined as discounted physical life, where the rate of discount is determined from predicted future obsolescence. As part of the method, a new tool for determining the physical life of buildings is presented. Using an adaptive reuse paradigm to compare predicted useful life with actual useful life, a large number of case studies is analysed retrospectively. The findings demonstrate that the proposed method is robust and that the concept of discounting physical life using obsolescence as a discount rate is valid.

KEYWORDS

obsolescence, physical life, useful life, discounting, adaptive reuse

INTRODUCTION

Buildings are major assets and form a significant part of facility management operations. Although buildings are long lasting they require continual maintenance and restoration. Eventually, buildings can become inappropriate for their original purpose due to obsolescence, or can become redundant due to change in demand for their service (Johnson, 1996). It is at these times that change is likely: demolition to make way for new construction or some form of refurbishment or reuse (Langston and Lauge-Kristensen, 2002).

Making better decisions about built assets will significantly improve our sustainability performance and deliver economic, social and environmental benefits to property owners and investors. In particular, the reuse of valuable resources will offset the need to destroy existing buildings and will contribute positively to climate change adaption initiatives that are increasingly urgent. An understanding of how long buildings last contributes to this discussion.

The aim of this paper is to develop a new method for predicting a building's useful life based on an assessment of its physical life and its annual rate of obsolescence. This forecast can be determined initially during design and periodically re-evaluated or monitored as actual events unfold. A unique physical life calculator is employed to arrive at a baseline value. This value is then discounted by a derived obsolescence rate per annum to predict useful life and calculate the ratio of useful to physical life. The approach adopts a large number of adaptive reuse case studies to evaluate retrospectively whether the proposed framework has real world validity. The paper indeed demonstrates that the method is robust. The ability to effectively model useful life enables more sustainable decisions to be made, in the context of both new construction and existing building interventions.

BACKGROUND

The ISO-15686 series on service life planning for buildings and constructed assets is a useful resource on building durability. However it is more applicable to building components and systems than entire buildings. The estimated service life of any component is calculated as its theoretical life multiplied by a series of factors that are each scored in the range 0.8 to 1.2 (1 = no impact). The factors comprise (a) quality of components, (b) design level, (c) work execution level, (d) indoor environment, (e) outdoor environment, (f) usage conditions, and (g) maintenance level. Whilst a building is a sum of the parts, such parts can be replaced and hence renewed, leaving the basic structure to determine overall life expectancy. Other literature on service life discusses the effect of external and internal actions on building durability (e.g. Douglas, 2006), and principally identifies location, usage and design as the main parameters. This is underpinned by a large amount of technical research.

Obsolescence is the inability to satisfy increasing requirements or expectations (Iselin and Lemer, 1993; Lemer, 1996; Pinder and Wilkinson, 2000). This is an area under considerable stress due to changing social demand (Kintrea, 2007), and brings with it environmental consequences. Yet obsolescence does not mean defective performance. Douglas (2006) makes the further distinction between redundancy and obsolescence. The former means „surplus to requirements', although this may be a consequence of obsolescence. Nutt et al. (1976:6) take the view that *"... any factor that tends, over time, to reduce the ability or effectiveness of a building to meet the demands of its occupants, relative to other buildings in its class, will contribute towards the obsolescence of that building"*. A few researchers have included political changes to zoning, ascribed heritage classification and other imposed regulatory change also as a form of obsolescence (e.g. Campbell, 1996; Gardner, 1993; Luther, 1988; Kincaid, 2000).

Economic considerations are often dominant in decisions concerning obsolescence in buildings (Baum, 1991). These relate fundamentally to ensuring that the income stream remains greater than the cost stream, and indeed greater than other alternative opportunities of similar risk level. Failure to generate a regular operating surplus renders a building economically obsolete. Such obsolescence can offer advantage, however, as it instigates new investment in more productive and technically advanced infrastructure, which has higher income and hence higher operating surplus potential. The capital investment in delivering the new infrastructure is written off over many years and provides some residual value at the end of its economic life if it is on-sold.

Barras and Clark (1996) argue that relative price factors, and in particular the price of capital investment compared to labour in maintenance and repair activities, determine the speed with which capital goods become obsolete. A rise in real wages or other running costs, a reduction in the production price of capital works or a fall in the rate of interest will all tend to increase the rate of replacement investment, and hence lower the average age of capital stock.

Haapio (2008) states that reliable data for forecasting obsolescence are rarely available. Usually estimates are based on designer or client experience and judgement. Where products are replaced and discarded before their service life has finished, the remaining service life is wasted. As Aikivuori (1996) attests in her study of private sector housing refurbishment, obsolescence-based refurbishment clearly occurs earlier than deterioration-based refurbishment. Therefore future obsolescence deserves more attention during design, including the benefits of buildings that display long life, loose fit and low energy characteristics.

CONCEPTUAL FRAMEWORK

Obsolescence may be defined as a loss of utility of an asset due to the development of improved or superior products or services, although not utility loss due to natural deterioration or decay. Nevertheless, accelerated deterioration from a lack of proper maintenance and servicing and expected renewal could be regarded as equivalent to physical obsolescence. In addition to accelerated deterioration, obsolescence can be driven by economic, functional, technological, social, legal and even political factors (e.g. Seeley, 1983; Douglas, 2006; Mansfield, 2000).

Buildings, like other assets, can become obsolete over time. Buildings both deteriorate and become obsolete as they age. A building's physical life, which may be interpreted as its structural adequacy or safety, is effectively reduced by obsolescence, resulting in a useful life somewhat less than its expected physical life.

The concept of obsolescence is not dissimilar to depreciation, but in the latter case value is used rather than utility (performance) to describe the effect. Depreciation is defined as a non-cash expense that reduces the value of an asset as a result of wear and tear, age or obsolescence, and involves setting aside money to replace it when its useful (effective) life is reached. Depreciation is normally calculated using either a diminishing value or straight-line method; the former approach reflects a negative exponential or decay curve.

Parallels can also be drawn to the technique of discounting, which reduces the value of an asset today to take account of the real opportunity cost of money in the future. Discounting also reflects a negative exponential curve over time. Depreciation and discounting both share a common objective of measuring „decay' in initial values.

The rate of decline caused by obsolescence, just like opportunity cost, is not necessarily a regular (fixed) amount each year, but could be assumed as such in order to make the calculations more manageable in practice. It needs to consider the various types of obsolescence, either by using the more dominant cause and ignoring the others, or adopting the combined effect of all causes. It is likely, as is found with discounting, that the components of the rate work in opposite directions, and therefore a stabilising (central tendency) effect is produced.

The following equations (1-3) describe the basis of the proposed conceptual framework for estimating the useful life of buildings. A scale of 5 is adopted here, where 5 is defined as both maximum asset performance (new) and end of life cycle (before redevelopment).

$$V_p = 5 - \frac{L_p^2}{5} \quad (1)$$

where:

V_p = *asset performance (based on building decay)*
L_p = *physical life (expressed on a 0-5 scale)*

$$V_u = 5 - \frac{L_u^2}{5} \quad (2)$$

where:

V_u = *asset performance (based on building obsolescence)*
L_u = *useful life (expressed on a 0-5 scale)*

$$L_u = \frac{5}{(1 + O_a)^{L_p}} \quad (3)$$

where:

L_u = *useful life (expressed on a 0-5 scale)*
L_p = *physical life (expressed on a 0-5 scale)*
O_a = *annual obsolescence rate (expressed as a decimal)*

A fixed scale is necessary so that comparisons between different buildings having different lives can be made and classified. However, any scale could have been used. These equations can be presented in a graphical format as shown in Figure 1.

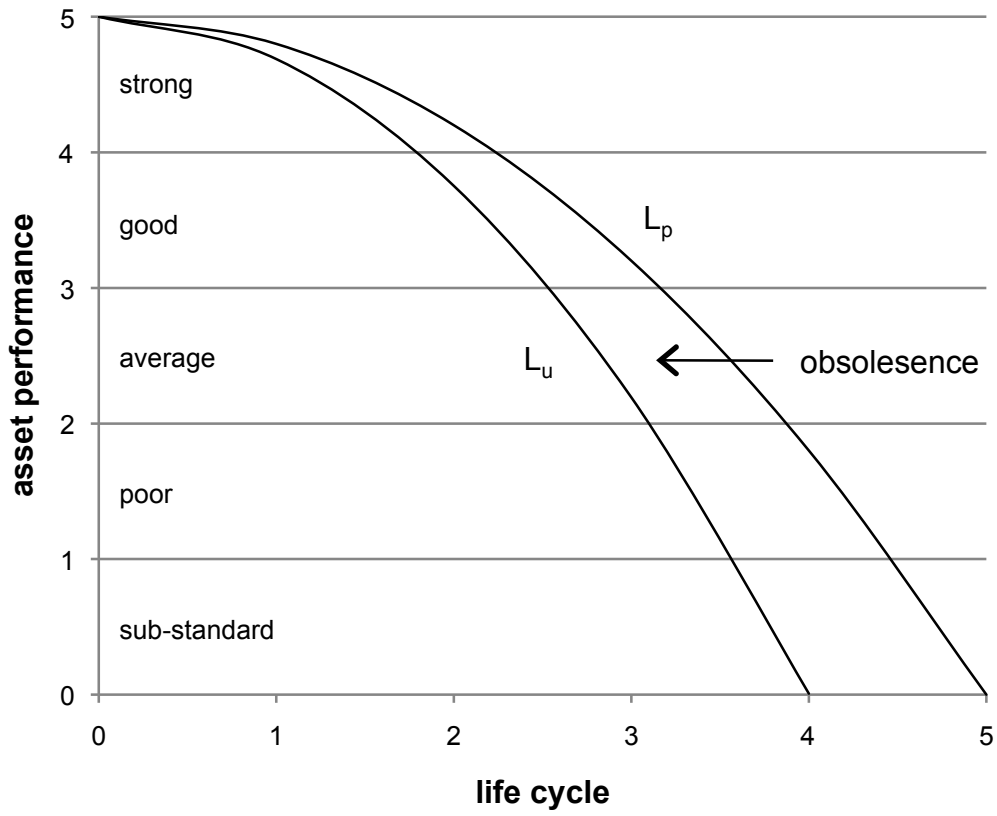


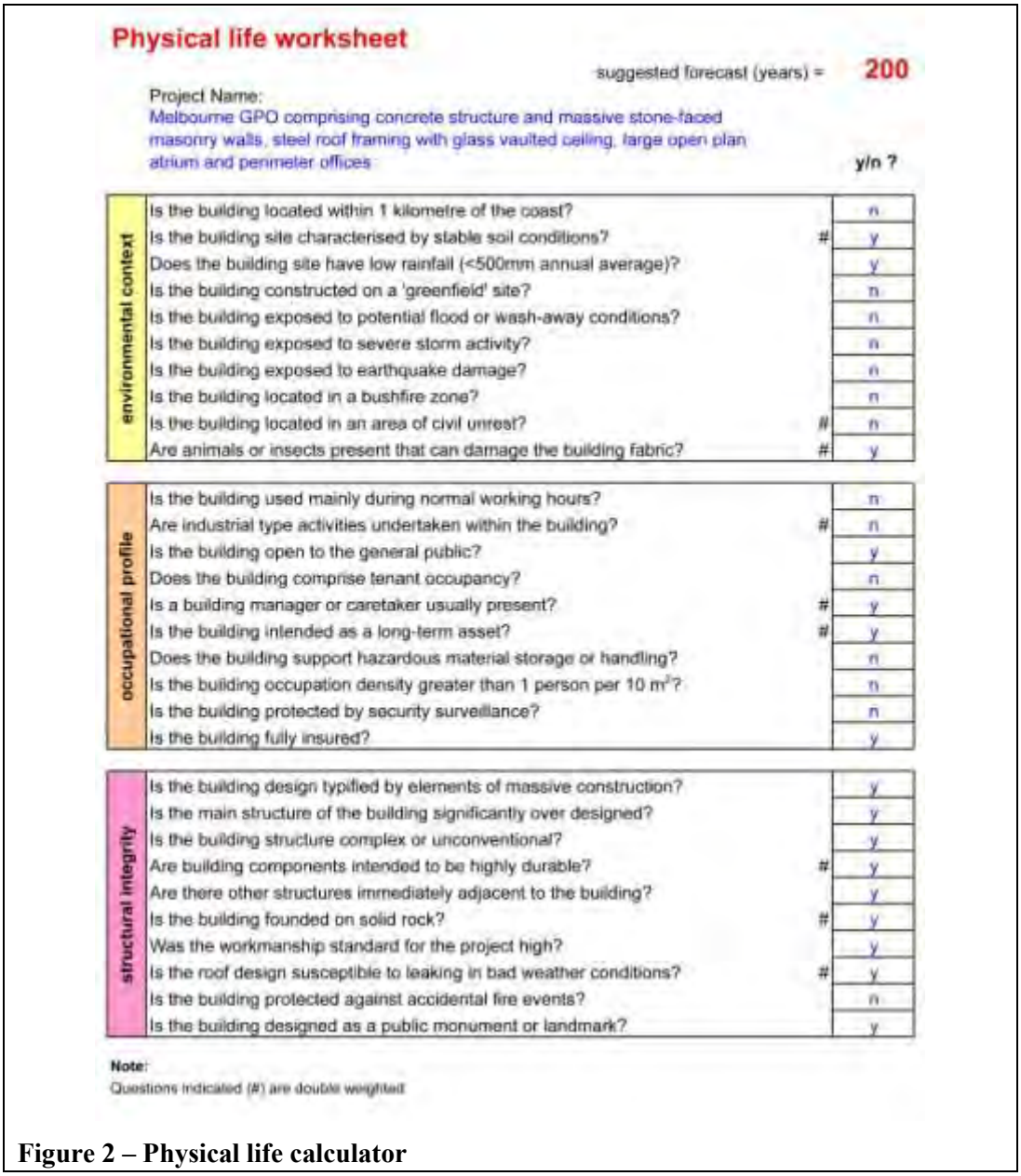
Figure 1 – Conceptual framework

So useful life is defined as discounted physical life. The ratio of useful life to physical life provides insight into the impact that obsolescence has on a building over its effective life, regardless of the accuracy of the estimate of physical life, and the lower the ratio the greater is the potential asset performance loss. The asset performance curves can be reset or partially reset through capital investment or other intervention, excluding normal maintenance and repair. For simplicity, only one asset cycle is shown here, but it is acknowledged that over the total life cycle of a project many asset cycles might occur.

According to Equation 3, to estimate useful life (L_u) it is necessary to determine both physical life (L_p) and the annual obsolescence rate (O_a). Equation 3 is in fact a traditional discounting formula. To obtain the useful life in years, simply determine the ratio of L_u:L_p and multiply it with the physical life in years.

PHYSICAL LIFE CALCULATOR

To assist in the forecast of physical life in years, an Excel calculation template has been developed. A series of questions gives insight into the longevity of a building according to three primary criteria: environmental context (location), occupational profile (usage) and structural integrity (design). Each category is equally weighted, and comprises ten questions requiring simple yes/no answers. Where information is unknown, a blank answer (no response) is ignored in the calculation. Three questions under each primary criterion are double weighted due to their relative importance. Figure 2 presents the physical life calculator using the Melbourne General Post Office (GPO) as an example[1].



Physical life worksheet

suggested forecast (years) = **200**

Project Name:
Melbourne GPO comprising concrete structure and massive stone-faced masonry walls, steel roof framing with glass vaulted ceiling, large open plan atrium and perimeter offices

			y/n ?
environmental context	Is the building located within 1 kilometre of the coast?		n
	Is the building site characterised by stable soil conditions?	#	y
	Does the building site have low rainfall (<500mm annual average)?		y
	Is the building constructed on a 'greenfield' site?		n
	Is the building exposed to potential flood or wash-away conditions?		n
	Is the building exposed to severe storm activity?		n
	Is the building exposed to earthquake damage?		n
	Is the building located in a bushfire zone?		n
	Is the building located in an area of civil unrest?	#	n
	Are animals or insects present that can damage the building fabric?	#	y
occupational profile	Is the building used mainly during normal working hours?		n
	Are industrial type activities undertaken within the building?	#	n
	Is the building open to the general public?		y
	Does the building comprise tenant occupancy?		n
	Is a building manager or caretaker usually present?	#	y
	Is the building intended as a long-term asset?	#	y
	Does the building support hazardous material storage or handling?		n
	Is the building occupation density greater than 1 person per 10 m^2?		n
	Is the building protected by security surveillance?		n
	Is the building fully insured?		y
structural integrity	Is the building design typified by elements of massive construction?		y
	Is the main structure of the building significantly over designed?		y
	Is the building structure complex or unconventional?		y
	Are building components intended to be highly durable?	#	y
	Are there other structures immediately adjacent to the building?		y
	Is the building founded on solid rock?	#	y
	Was the workmanship standard for the project high?		y
	Is the roof design susceptible to leaking in bad weather conditions?	#	y
	Is the building protected against accidental fire events?		n
	Is the building designed as a public monument or landmark?		y

Note:
Questions indicated (#) are double weighted

Figure 2 – Physical life calculator

[1] information provided courtesy of Williams Boag Architects (Melbourne) and via site inspection

Some questions are worded so to deliver a positive score, while some are negative and others neutral (positive or negative). The type of question is distributed evenly throughout the template. The calculation algorithm assumes a base of 100 years and then adds or deducts points (years) according to the responses to questions. It is similar in concept to the *Living to 100 Life Expectancy Calculator*[2] that predicts human life span based on extensive medical and empirical data. Some conservatism is applied to the estimate and the forecast is rounded down to one of the following outcomes: 25, 50, 75, 100, 150, 200, 250 or 300 years. The template is unsuitable for temporary structures or for iconic monuments that both require specialist judgment.

The construction of the calculator has been informed from a broad survey of literature (unspecified), recent ISO-15686 standards and personal experience. It is founded on an adaptive management principle (Gregory et al., 2006; Linkov et al., 2006) that purports to develop a model and then evaluate its robustness through subsequent field-testing and observation. While the results of this testing appear promising, definitive validation arguably can only occur by comparison of estimates with reality, where the latter is measured as the duration of the building before its collapses. But as this is rarely witnessed, certainly through natural causes, field-testing and observation are the best validation methods available to us.

ANNUAL OBSOLESCENCE

The annual rate of obsolescence is just as unlikely to be a constant value per annum as is the case with a conventional discount rate. It will fluctuate due to a raft of unforeseen events and is therefore impossible to predict accurately. But there is a convenience in the assumption that the annual rate is a constant, as has been our history with the discounting technique for over 150 years. The compound decline in values that flow from this approach mirror the natural rates of decay in buildings as has been understood in the asset management literature for some time (e.g. Leong, 2004).

Obsolescence has been variously described and categorised. In this paper, obsolescence is defined as a combination of physical, economic, functional, technological, social, legal and political factors. The annual rate of obsolescence is moderated by these factors in much the same way that discount rates are moderated by interest rates, inflation, taxation, proportion of equity to borrowing, specific price escalation, affordability and the like (Langston, 2005). But contrary to discounting, obsolescence factors are not directly measurable in the marketplace.

[2] see *http://www.livingto100.com*

To overcome this problem, a series of surrogate estimating techniques has been used based on tangible facts. These are summarised in Table 1. Each factor is assessed on a scale of 0 to 20, where 0 indicates no negative influence and 20 indicates significant negative influence, using interim scores of 5, 10 and 15 as appropriate. In the case of the political factor, positive support through planning incentives can lead to a score between -20 (favourable) and +20 (unfavourable), where a zero score is described as apathy.

Table 1 – Surrogate estimating of obsolescence attributes

	method of measurement
physical	examination of maintenance policy and performance, specifically the annual budget allocation for routine maintenance and repair
economic	geographic location of a building relative to a major city, central business district or other primary market or business hub
functional	extent of flexibility embedded in a building's design, as evidenced by annual churn costs
technological	building's reliance on high levels of energy in order to provide occupant comfort
social	relationship between building function and its marketplace, such as reliance on external income, or trends in demand or relevance of service
legal	quality or standard of the original design, as evidenced by its initial cost per m^2
political	level of public and local community interest surrounding a project

To explain further, a generous annual maintenance budget would indicate that the building is being well looked after, and hence the physical obsolescence factor would be set at zero. If little attention to maintenance was evidenced or expected, then the physical obsolescence factor would be set at 20. Using the same approach, a building sited in the central business district of a major urban centre, an open plan or flexible floor plan, a green building, an owner-occupied building with strong market connections, a high quality building, and a site with an absence of heritage or planning controls/ restrictions in place would each score well (obsolescence factor = 0). It should be noted that environmental obsolescence is subsumed into technological, social, legal and political factors and therefore is not measured separately.

The annual obsolescence rate is taken as the sum of the scores of each factor divided by the physical life and expressed as a decimal. For example, if the sum of the scores is 100 and the physical life is estimated at 100 years, then the annual obsolescence rate (i.e. discount rate) is 1% or 0.01 per annum. The same score for a 50-year life would lead to an annual obsolescence rate of 2% or 0.02 per annum.

VALIDATION

Whilst the above approach can be demonstrated on any new building project, it can only be validated retrospectively. Case studies of completed adaptive reuse projects were selected as the method for this validation since they generally document the history of each project including discussion of the reasons behind their obsolescence. It was decided to identify as many completed adaptive reuse projects as practicable and to undertake a retrospective evaluation of them to discover the proximity of the forecasts of useful life to reality. No restrictions were introduced other than temporary structures and ancient monuments were to be avoided (as the physical life calculator is not applicable for these project types). The robustness of the method would be measured by the correlation between predicted useful life and actual useful life, where the latter would be objectively determined as the date of adaptive reuse less the date of the original construction (or last major refurbishment).

An Internet search was conducted to identify suitable projects and to uncover the necessary information to enable the „model' to be populated with data. Where a project did not have sufficient information available (i.e. 80% of the calculator questions and all 7 obsolescence factors known) or either the date of construction or the date of adaptive reuse was unavailable, it was discarded.

After an extensive online search in 2008, a total of 64 projects were identified and compiled into a database for further analysis. Many more were found but key information was not readily available. A few projects were local to the author and investigated by site visit. The total number of adaptive reuse projects globally is unknown. The selected projects covered a range of building typologies and locations and spanned from an actual useful life between 8 years (built in 2000) and 265 years (built in 1740). The average year of original construction was 1898 and the average year when the project was adaptively reused was 2001, giving a mean difference of 103 years.

A summary of the database showing the results is provided in Table 2. The projects have been sorted into increasing order based on the percent difference between predicted and actual useful life (as shown in Column J). The Melbourne GPO project, used to demonstrate the physical life calculator previously, is included in this table as Project #57.

Table 2 – Retrospective study summary

A	B	C	D	E	F	G	H	I	J
1	Richmond	1852	n/a	2003	150	0.30	96	151	-36.42
2	Cambridge	1920	n/a	2004	100	0.60	55	84	-34.52
3	New York	1850	n/a	2004	150	0.27	101	154	-34.42
4	Seattle	1890	n/a	2001	150	0.47	75	111	-32.43
5	San Antonio	1940	n/a	2007	100	0.75	48	67	-28.36
6	Seattle	1926	n/a	2001	100	0.60	55	75	-26.67
7	Cleveland	1890	n/a	2002	150	0.37	87	112	-22.32
8	Dorchester	1810	n/a	1986	200	0.18	141	176	-19.89
9	Beacon	1927	n/a	2003	100	0.50	61	76	-19.74
10	Adelaide	1869	1876	1989	150	0.33	91	113	-19.47
11	Hong Kong	1932	n/a	2007	100	0.50	61	75	-18.67
12	Madrid	1914	n/a	2004	100	0.25	74	90	-17.78
13	Los Angeles	1926	n/a	2007	100	0.40	67	81	-17.28
14	Beechworth	1867	n/a	1997	200	0.30	110	130	-15.38
15	Richmond	1909	n/a	2004	150	0.40	82	95	-13.68
16	Minneapolis	1878	1928	2004	100	0.40	67	76	-11.84
17	Georgetown	1765	n/a	1960	200	0.08	172	195	-11.79
18	Bexhill-on-Sea	1935	n/a	2008	150	0.57	65	73	-10.96
19	Melbourne	1882	n/a	2001	150	0.23	106	119	-10.92
20	Richmond	1918	n/a	2001	100	0.30	74	83	-10.84
21	Beijing	1740	n/a	2005	250	0.02	238	265	-10.19
22	New York	1920	n/a	2006	100	0.25	78	86	-9.30
23	Richmond	1913	n/a	2003	150	0.40	82	90	-8.89
24	Washington	1892	n/a	2002	150	0.27	101	110	-8.18
25	Salt Lake City	1904	n/a	2003	150	0.33	91	99	-8.08
26	Hong Kong	1906	n/a	2003	150	0.33	91	97	-6.19
27	Georgetown	1796	n/a	1962	200	0.13	156	166	-6.02
28	Richmond	1905	n/a	2007	150	0.30	96	102	-5.88
29	Melbourne	1939	n/a	2000	100	0.55	58	61	-4.92
30	Bath	1790	n/a	2004	250	0.08	205	214	-4.21
31	Launceston	1868	n/a	2001	200	0.23	128	133	-3.76
32	Richmond	1902	n/a	2006	150	0.27	101	104	-2.88
33	Geelong	1911	n/a	1996	150	0.40	85	85	0.00
34	San Diego	1924	n/a	2008	200	0.23	84	84	0.00
35	Norwich	1855	n/a	2006	250	0.20	152	151	0.66
36	Halifax	1907	n/a	2007	150	0.27	101	100	1.00
37	Philadelphia	1877	n/a	2001	200	0.23	128	124	3.23
38	Los Angeles	1906	n/a	2003	150	0.27	101	97	4.12
39	Cambridge	1887	n/a	2008	200	0.23	128	121	5.79
40	Auckland	1914	n/a	1998	150	0.33	91	84	8.33
41	Sydney	1892	n/a	2002	200	0.25	121	110	10.00
42	Carisle	1891	n/a	2001	200	0.25	121	110	10.00
43	Brunswick	1928	n/a	2007	150	0.37	87	79	10.13
44	Perth	1880	n/a	2001	200	0.20	134	121	10.74
45	Los Angeles	1925	n/a	2007	150	0.33	91	82	10.98
46	North Adams	1890	n/a	1999	200	0.25	121	109	11.01
47	New York	1918	n/a	2008	150	0.27	101	90	12.22
48	Seattle	1927	n/a	2008	150	0.33	91	81	12.35
49	Pittsburgh	1879	n/a	1976	150	0.20	111	97	14.43
50	New Haven	1932	n/a	2003	150	0.40	82	71	15.49
51	Richmond	1897	1920	2003	150	0.30	96	83	15.66
52	Sydney	1894	n/a	1985	150	0.23	106	91	16.48
53	Richmond	1920	n/a	2006	150	0.27	101	86	17.44
54	Chicago	1913	n/a	2002	200	0.30	110	89	23.60
55	London	1947	n/a	2000	100	0.40	67	53	26.42
56	New York	1890	1957	2007	100	0.40	67	50	34.00
57	Melbourne	1859	1919	2004	200	0.28	116	85	36.47
58	Barcelona	1962	n/a	2003	75	0.40	56	41	36.59
59	San Francisco	1917	n/a	2002	150	0.17	117	85	37.65
60	Canberra	1976	n/a	2003	100	0.95	39	27	44.44
61	Chicago	1922	1932	2007	200	0.30	110	75	46.67
62	Canberra	1927	n/a	1998	200	0.33	105	71	47.89
63	Canberra	1927	n/a	2003	200	0.28	116	76	52.63
64	Gold Coast	2000	n/a	2008	50	1.10	29	8	262.50
	Mean:	1898		2001	154.3	0.34	98.09	99.67	5.42

A *Project ID*
B *Location*
C *Date or Original Construction*
D *Date of Previous Major Renewal*
E *Date of Adaptive Reuse (Completion)*
F *Predicted Physical Life (years)*
G *Annual Obsolescence Rate (%)*
H *Predicted Useful Life (years)*
I *Actual Useful Life (years)*
J *Percent Difference (columns H and I)*

The physical life calculator produced a range of outcomes from 50 years to 250 years. Given all projects were adaptively reused it is not surprising that shorter lives were not found. No project scored 300 years either but several were close. The diversity of outcomes seemed reasonable and in all but a few cases an appropriate forecast was achieved. The mean physical life estimated in this study was 154.3 years.

Obsolescence rates were assessed according to the previously described criteria and summed. The total was then divided by the physical life estimate to give an annual rate of obsolescence. The mean value was 0.34%. The highest annual rate found was 1.10% and the lowest was 0.02%. The coefficient of variation across all projects was 53.09% and therefore demonstrated significant dispersion. These figures are used in much the same way as a conventional discount rate, albeit they are smaller in magnitude, to translate physical life into predicted useful life.

Predicted useful life was then computed using a derivation of Equation 3. These results were compared to actual useful life as determined by the difference between the date of adaptive reuse completion and the date of original construction. Where a major renovation occurred between these two dates, the renovation date was in lieu of the original construction date. Actual useful life has been overestimated as no cognisance was taken of the duration of the adaptive reuse site processes, which in all likelihood would span several years on large projects. Similarly, a few projects lay dormant for many years before a decision was taken to revitalise them, and this time has not been subtracted (as often it was unavailable). It is considered that the overestimation of actual useful life is probably in the order of 5%.

The mean predicted useful life was 98.09 years. The mean actual useful life was 99.67 years. The proximity of these two figures was encouraging. However, the percent difference between estimated and actual was calculated for each case study, and this varied between -36.42% and +262.50%. While the mean difference was just +5.42%, the absolute value of the differences led to a true mean of 22.51%. Overall the ratio of predicted useful life to physical life was 63.57% indicating that approximately one-third of physical life remained when these projects had become obsolete. This was confirmed by a subsequent study that showed the mean ratio was 63% across ten generic building archetypes (Langston, 2011).

To validate the reliability of the model, predicted and actual useful life were compared using linear regression. The line of best fit was computed as $y=0.9527x$. In fact, if actual useful life was reduced by about 5% to account for inherent overestimation, the line of best fit would have been $y=x$ thus indicating a 45^{o} line or perfect comparison. The degree of scatter is illustrated by an R^2 of 0.72013, which is a high value and suggests a tight relationship. If the line of best fit is assumed to be $y=x$, then R^2 falls to just 0.69971,

which is a truer indication of reliability. While a correlation between predicted and useful life is on face value illogical, the use of regression employed here demonstrates quantitatively the accuracy of the method, as shown graphically in Figure 3.

The validation approach does not distinguish between the reliability of the physical life calculator (in predicting L_p) and the reliability of the annual obsolescence rate process (in predicting L_u). However, it does show quite clearly that the combined approach leads to realistic outcomes, and in the spirit of adaptive management this should be taken as significant. Further testing and model refinement will obviously occur over time, both by the author and undoubtedly by others, and until sufficient time has elapsed the findings at this stage may be considered preliminary.

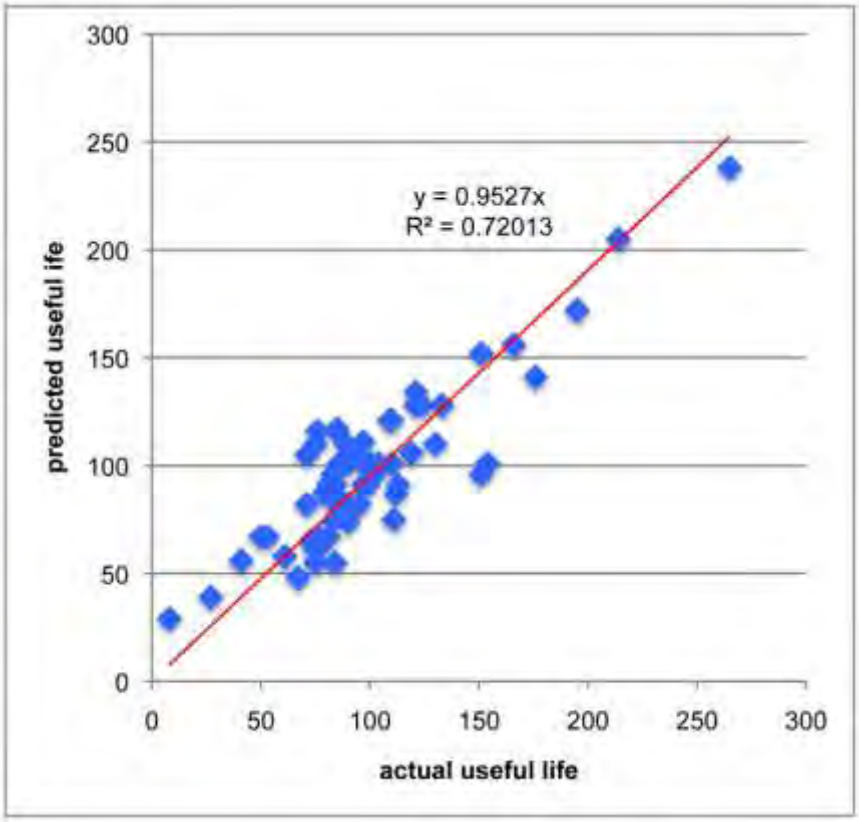


Figure 3 – Validation of useful life forecast

DISCUSSION

This paper describes a method for estimating useful life and tests it quantitatively against history. In the case of the physical life calculator, its design appears arguably contrived and a simplification of reality given the complexity of the problem and the underlying issues. Models are only as good as their performance, and to date empirically this appears reasonable. In time, given more evidence of accuracy, the approach could be tuned and

allowed to predict physical life to a finer level. Yet the prediction of physical life can still be made via expert opinion, and the calculator is but a tool to assist and provide some independent advice if required.

In the case of annual obsolescence, the advocated approach makes four important assumptions. First, that a maximum scale of 20% is used to judge the impact of each obsolescence factor over the building's physical life. Second, that this rate of reduction is uniform each year. Third, that each obsolescence factor is equally weighted. Finally, that obsolescence rates can be summed across categories, as opposed to selecting the most significant factor and ignoring the rest. These matters are discussed further below.

Models, by definition, are intended to simulate reality. To do this they make assumptions that simplify the complexity of the final product while maintaining reasonable forecasting accuracy. In this research, surrogates for each obsolescence factor have been sought that are both objective (measurable) and readily available for use in practice. The accuracy of the model is judged by its forecast of the outcome, and provided this is robust, the inner workings of the model are (by definition) validated. More information on these surrogates can be found in Langston (2008). It is also fair to say that other surrogates could be invented and applied within the overall framework.

The range of impact for each factor and its equal weighting are obviously capable of adjustment. This has not happened yet, and so far appears unnecessary. Range and weighting are of course related, so increasing the range for one from 0-40% would be the same as doubling its weight compared to the remaining obsolescence factors.

The notion of a regular annual obsolescence rate compared to a variable rate over time is selected purely for convenience. Similar decisions apply to the use of diminishing depreciation and discounted cash flow calculations. While more complex algorithms are possible, the difficulty in using them outweighs the additional accuracy that might be expected. Furthermore, it is not well understood in the literature how the passage of time impacts on obsolescence, and it may indeed be impossible to predict annual variations at all.

The question of summation of obsolescence factors is interesting. It can be argued that if economic obsolescence is considered the most influential, then the building is obsolete as soon as its economic life is reached. Therefore, only economic obsolescence matters. But in this paper the position is advanced, if we are to measure obsolescence objectively, that it is necessary to break it down and unpack the issues. It is argued here that economic obsolescence cannot be considered in isolation to issues of accelerated deterioration, functional change, technological advancements, social relevance, legal compliance or political interference – they are all related. By measuring each, a sense of the whole is determined. To compartmentalise one aspect is to reduce its richness and oversimplify the

drivers. For example, Bottom et al. (1999) concludes in relation to a study of office buildings in London that building design quality characteristics and tenant organisation work practice typologies can be used to explain functional performance as perceived by occupiers. The cross-relationships are compelling. Others may disagree.

CONCLUSION

Useful life can be predicted. Through the application of surrogates that can suitably reflect the impact of physical, economic, functional, technological, social, legal and political obsolescence, physical life estimates can be "discounted" to determine a building's useful life. Such an approach offers advantage in being able to better predict possible adaptive reuse potential, or indeed just to make informed decisions about the timing of building upgrade or decommission. The ratio of useful life to physical life, argued in this paper at around 63% (or roughly two-thirds), is a useful heuristic that may help to compare the performance of different building typologies or investment options.

This research makes an important contribution to the literature and provides a platform for more advanced modelling of building performance and adaptive reuse intervention. The benefits of this work to sustainability and climate change adaptation are undeniable as the construction industry, at least in the developed world, continues to move from a paradigm focused on new-build to one of refurbishment and reuse.

REFERENCES

Aikivuori, A. (1996) Periods and Demand for Private Sector Housing Refurbishment, *Construction Management and Economics*, 14(1), 3-12.

Barras, R. and Clark, P. (1996) Obsolescence and Performance in the Central London Office Market, *Journal of Property Valuation and Investment*, 14(4), 63-78.

Baum, A. (1991), *Property Investment Depreciation and Obsolescence*, Routledge.

Bottom, C.W., McGreal, W.S. and Heaney, G. (1999) Appraising the Functional Performance Characteristics of Office Buildings, *Journal of Property Research*, 16(4), 339-358.

Campbell, J. (1996) Is your Building a Candidate for Adaptive Reuse?, *Journal of Property Management*, 61(1), 26-29.

Douglas, J. (2006) *Building Adaptation* (Second Edition), Butterworth-Heinemann.

Gardner, R. (1993) The Opportunities and Challenges Posed by Refurbishment, in proceedings of Building Science Forum of Australia, Sydney, 1-13.

Gregory, R., Failing, L. and Higgins, P. (2006) Adaptive Management and Environmental Decision Making: A Case Study Application to Water Use Planning, *Ecological Economics*, 58(2), 434-447.

Haapio, A. (2008) Environmental Assessment of Buildings, PhD Dissertation, Helsinki University of Technology, Finland.

Iselin, D.G. and Lemer, A.C. (eds) (1993) *The Fourth Dimension in Building: Strategies for Minimizing Obsolescence*, Committee on Facility Design to Minimize Premature Obsolescence, Building Research Board, Washington DC: National Academy Press.

Johnson, A. (1996) Rehabilitation and Re-use of Existing Buildings, in *Building Maintenance and Preservation: A Guide to Design and Management* (Second Edition), E.D. Mills (editor), Architectural Press, Oxford, 209-230.

Kincaid, D. (2000) Adaptability Potentials for Buildings and Infrastructure in Sustainable Cities, *Facilities*, 18(3/4), 155-161.

Kintrea, K. (2007) Housing Aspirations and Obsolescence: Understanding the Relationship, *Journal of Housing and the Built Environment*, 22, 321-338.

Langston, C. (2011) On Archetypes and Building Adaptive Reuse, PRRES2011 Conference, January, Gold Coast, Australia.

Langston, C. (2008) The Sustainability Implications of Building Adaptive Reuse (keynote paper), CRIOCM2008, Beijing, Oct/Nov, pp.1-10.

Langston, C. (2005) *Life-cost Approach to Building Evaluation*, Elsevier.

Langston, C. and Lauge-Kristensen, R. (2002) *Strategic Management of Built Facilities*, Butterworth-Heinemann.

Lemer, A.C. (1996) Infrastructure Obsolescence and Design Service Life, *Journal of Infrastructure Systems*, 2(4), 153-161.

Leong K.C. (2004) *The Essence of Asset Management: A Guide*, United Nations Development Program, Malaysia.

Linkov, I., Satterstrom, F.K., Kiker, G., Batchelor, C., Bridges, T. and Ferguson, E. (2006) From Comparative Risk Assessment to Multi-criteria Decision Analysis and Adaptive Management: Recent Developments and Applications, *Environment International*, 32(8), 1072-1093.

Luther J.P. (1988) Site and Situation: The Context of Adaptive Reuse, in *Adaptive Reuse: Issues and Case Studies in Building Preservation*, R. Austin (editor), Van Nostrand Reinhold, 48-60.

Mansfield, J.R. (2000) Much Discussed, Much Misunderstood: A Critical Evaluation of the Term „Obsolescence', *The Cutting Edge 2000*, London: RICS Research Foundation.

Nutt, B., Walker, B., Holliday, S. and Sears, D. (1976) *Housing Obsolescence*, Hants: Saxon House.

Pinder, J. and Wilkinson, S.J. (2000) Measuring the Gap: A User Based Study of Building Obsolescence in Office Property, *The Cutting Edge 2000*, London: RICS Research Foundation.

Seeley, I.H. (1983) *Building Economics: Appraisal and Control of Building Design Cost and Efficiency* (Third Edition), Macmillian Press.

Evaluating the Social, Economical, Cultural and Heritage Impacts of the "Revitalising Historic Buildings through Partnership Scheme" in Hong Kong

Dr. Esther Cheung
College of Humanities and Law
HKU SPACE, Hong Kong, PRC

Prof. Albert P.C. Chan and Dr Kim-wah Chung
Department of Building and Real Estate
Hong Kong Polytechnic University, Hong Kong, PRC

Dr. Chi-pang Lau
Department of History
Lingnan University, Hong Kong, PRC

Dr. Bingqing Zhai and Miss Zhiru Wang
Department of Building and Real Estate
Hong Kong Polytechnic University, Hong Kong, PRC

ABSTRACT

Hong Kong has undergone a rapid transformation from a small fishing village to one of Asia's top commercial cities. With the booming economic development that it has undergone, heritage has been criticised as largely neglected. To respond to this criticism proactively, the Hong Kong Special Administrative Region (HKSAR) Government introduced a *Revitalising Historic Buildings through Partnership Scheme* in October 2007 which is considered as an innovative social public-private partnership (PPP) scheme. In this scheme the Government will pay all initial costs related to the renovation of these buildings for subsequent renting to service providers of social enterprises and will not expect the service providers to shoulder these costs. The facilities will also be rented to the service providers at a nominal or heavily subsidised cost. In return the service providers will operate their own social enterprises using their own funds. The objectives of the scheme are: 1) to preserve and put historic buildings into good and innovative use; 2) to transform historic buildings into unique cultural landmarks; 3) to promote active public participation in the conservation of historic buildings; and 4) to create job opportunities particularly at the district level. It is hoped that pumping in public expenditure to upgrade these historic buildings will in turn generate jobs, uphold conservation principles, and also subsidize the social enterprises in running their businesses which may not otherwise remain feasible without financial support. However, since the scheme's introduction, there has been much criticism of the selecting procedures for the service providers (e.g. Concern by the Chinese Artists Association regarding the

use of the North Kowloon Magistracy). How successful the scheme is in achieving the stated objectives is a question yet to be answered. Therefore, this study aims to evaluate the effectiveness of the scheme in terms of its social, economical, cultural and heritage impacts at different stages of development, namely, sustainability of economic benefits, renovation / conservation of historic buildings, and management and operation of the social enterprises. Recommendations for improvement will be made based on the findings of this study. This public policy research (PPR) project has recently been funded by the Research Grants council (RGC) of Hong Kong. This paper provides an overview of the funded research in terms of its background, aim and objectives, and the research framework. The significance and value of conducting this PPR project will also be discussed.

KEYWORDS

social enterprises and entrepreneurship, conservation of cultural heritage, social public-private partnership (PPP).

INTRODUCTION

Conservation of historic buildings requires special care and expertise. If this work is not done properly, invaluable and significant heritage of our culture may not be replaced once damaged or lost (Lam, 2003). Redevelopment of historic buildings is common in Western countries e.g. the redevelopment of the Treasury Building in the United Kingdom which is a grade II listed building constructed approximately a century ago (Partnerships UK, 2009a). Hong Kong has also recorded a history of delivering similar projects. For example, the Nan Lian Garden in Diamond Hill (Nan Lian Garden, 2009). During the 1980s the government contemplated a new town plan for the district, of which the garden formed part. The garden was built as a designated park with an area of 35,000 square metres; it is also a showcase of traditional Chinese culture, reminiscence of the ancient architecture of the Tang dynasty. Since its opening in November 2006, management of the park has been entrusted to the adjacent Chi Lin Nunnery by the government.

Yet, cultural and historical projects may sometimes be difficult to deliver due to the lower economic returns involved. In these cases the private sector appears to be less interested (Waters, 2009), making it necessary to rely on public sector funding. An example of this is the proposed West Kowloon Cultural District (WKCD) project, located in the West of Yau Ma Tei on the Kowloon Peninsula of Hong Kong. The project had been long awaited due to repeated delays and controversies (South Morning China Post, 2008). Back in April 2001, the HKSAR Government invited the private sector to submit conceptual plans for the 40 hectare waterfront site at the southern tip of the Western Kowloon reclamation

into an integrated arts, cultural and entertainment district under the mode of a social PPP (Mok, 2005). Since then there has been continuous debate over the best suitable financing modality which should be adopted. A number of uncertainties in this project doomed it to be highly criticized. One of the main problems was that residential development would have to be included in the package to make the deal more attractive to the private sector. Running of the cultural activities alone was unable to attract private sector financing due to the lower economic returns.

The debate over the financing modalities finally came to a halt when the Legislative Council of the HKSAR Government approved HK$21.6 billion to fund this project (Wu, 2008). In Hong Kong, government financial support is not a concern as it is one of the few jurisdictions that not only has zero debt but also a plentiful fiscal reserve of approximately HK$500 billion (HKSAR, 2009). Therefore the HKSAR Government has always been happy to pay for projects upfront. Given that the private sector is less interested in social PPP projects due to the lower economic returns and the plentiful financial reserves of the HKSAR Government, there appears potential for an innovative form of PPP where social PPP projects are financed by the Government. In traditional PPP projects the financing tends to come from the private sector. Government funding would allow these projects to be delivered which otherwise may not be possible. In addition, the advantages of private sector expertise and innovation can also be maximized through this partnership arrangement.

Under the *Revitalizing Historic Buildings through Partnership Scheme*, projects are funded by the government, eliminating the problems and difficulties related to funding. The service providers of this scheme must be non-profit making organizations with prior experience in the area proposed. Service providers are invited to submit proposals for using these buildings to provide services or businesses in the form of social enterprises. In their submissions, they should propose detailed plans to demonstrate how these buildings would be preserved, how their historical significance can be effectively utilized and also how the enterprises would operate to show financial viability and benefit to the community. The successful service providers will be awarded a one-off financial package to support the renovation of the buildings, paying only nominal rent for the buildings and also be given a one-off grant for the initial costs. The maintenance works will be conducted solely by the service providers themselves (Development Bureau, 2009a). Currently, the Development Bureau of HKSAR has already identified eleven buildings suitable for this scheme. The service providers for six of these projects have already been selected including Lui Seng Chung, the Lai Chi Kok Hospital, the North Kowloon Magistracy, the Old Tai O Police Station, Fong Yuen Study Hall and also Mei Ho House. The other seven projects are still in progress and it is anticipated that selection of service

providers will be arranged soon (including the Old Tai Po Police Station, the Blue House Cluster in Wan Chai, Former Fanling Magistracy, Old House at Work Uk Village and also Stone Houses in Hau Wong Temple New Village) (Development Bureau, 2009b; Development Bureau, 2009c). Unfortunately the HKSAR government has received much criticism over the appropriateness of the service providers selected as in the following case. The Chinese Artists Association had proposed to use the North Kowloon Magistracy as a centre for Chinese opera. But their bid was unsuccessful and instead an American service provider was selected. According to the Legislative Council papers the Savannah College of Art and Design was selected for a number of reasons. They require less government funding, they are experienced in the preservation of historic buildings, and, lastly, synergy with other revitalization projects in the district will be created (Sing Tao Daily, 2009). Despite this rationale, the appropriateness of the selected service provider is doubted, as many feel that local organizations should be given higher priority.

Therefore, there is a need to evaluate the effectiveness of this scheme in terms of its social, economical, cultural and heritage impacts at different stages of development, namely, sustainability of economic benefits, renovation / conservation of historic buildings, and management and operation of the social enterprises. This will in turn demonstrate to the general public and relevant stakeholders the successfulness of the scheme in achieving the desired goals.

RESEARCH AIM AND OBJECTIVES

This research study aims to evaluate the effectiveness of the "Revitalizing Historic Buildings through Partnership Scheme" in terms of its social, economical, cultural and heritage impacts at different stages of development, namely, sustainability of economic benefits, renovation / conservation of historic buildings, and management and operation of the social enterprises.

The specific objectives of this research study include:

1. To monitor whether sustainable economic benefits (such as an increase of job opportunities and profit for the service providers) are achieved by the social enterprises.
2. To assess whether the historic buildings are renovated and conserved in a manner that preserves culture and heritage.
3. To evaluate the social impacts of the scheme on the general public, with specific reference on their views towards government policies and their experiences as users to these historic buildings.

RESEARCH FRAMEWORK

Given the unique nature of the *Revitalizing Historic Buildings through Partnership Scheme*, research methods adopted from one single field was believed to be insufficient to achieve the objectives. Combined research efforts will be adopted for this study. The techniques which will be adopted range from those used for construction management, economical, social science and heritage studies. In particular, the techniques adopted will include a comprehensive literature review, content analysis, interviews with relevant stakeholders, empirical questionnaire surveys with the community, telephone survey and face-to-face interviews of the general public.

At the beginning of the study, an extensive literature review will be first conducted. All previous studies related to the research done by others will be consolidated, thereby enriching the understanding of current practices and experiences. The literature will be sourced from international refereed journals, international refereed conference proceedings, books, websites, magazines, newspapers, and so on. This desktop study will provide the background for the research and also form the framework for the development of the empirical questionnaires.

In this research, content analysis will also be employed. Content analysis is frequently adopted to determine the major facets of a set of data, by simply counting the number of times an activity happens, or a topic is depicted (Fellows and Liu, 2008). The first step in conducting content analysis is to use electronic database search engines such as Scopus to identify the literature to be analysed. The second step is to determine the form of content analysis to be used, whether qualitative or quantitative. The choice is dependent on the nature of the research project. In qualitative content analysis, emphasis is on determining the meaning of the data (i.e. grouping data into categories). Quantitative content analysis extends the approach of the qualitative form to generate numerical values of the categorized data (frequencies, ratings, ranking, etc.) which may be subjected to statistical analyses. Comparisons can be made and hierarchies of categories can be examined (Fellows and Liu, 2008).

This study will adopt a qualitative content analysis approach. Figure 1 describes the methodology.

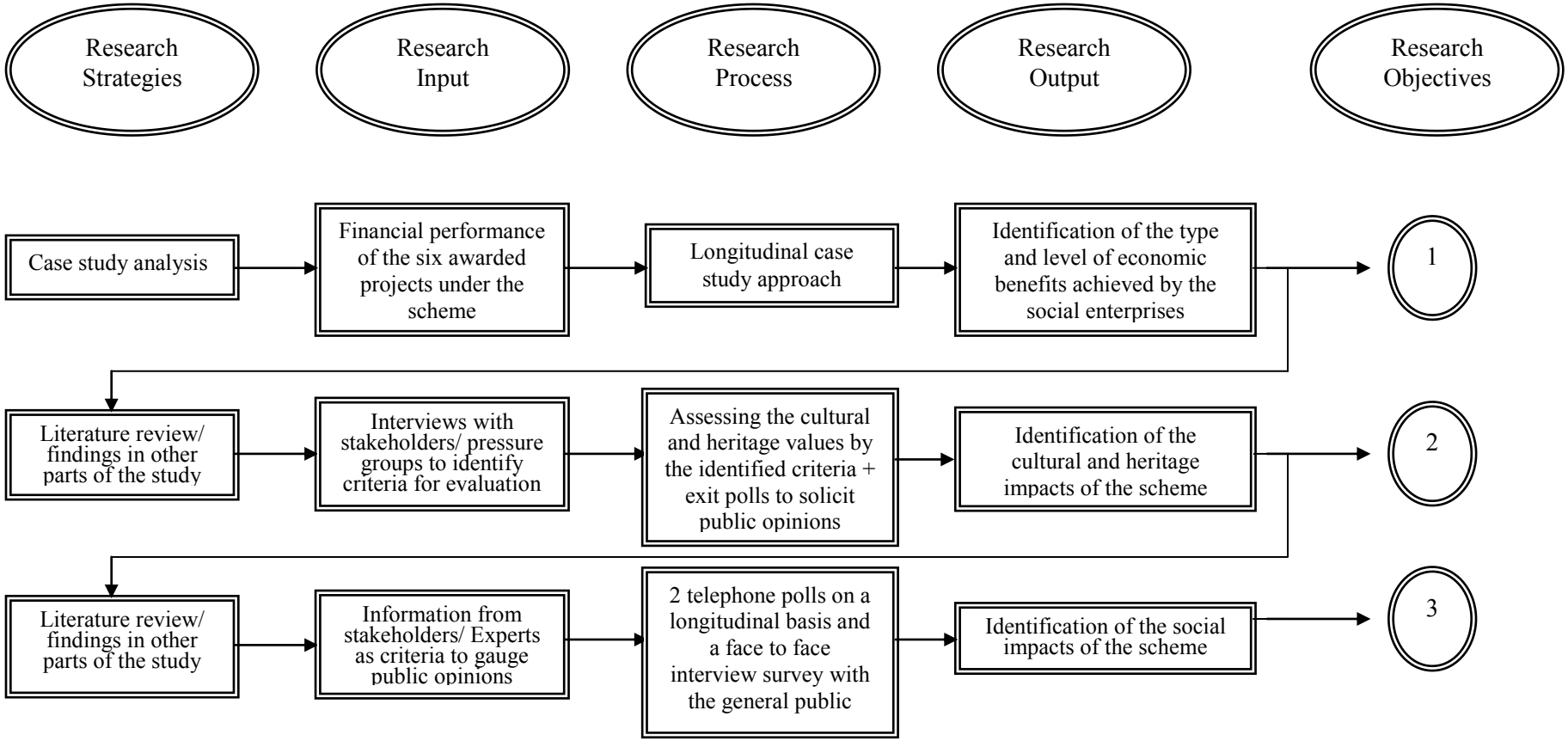


Figure 1 – Research framework

Objective 1: to monitor whether sustainable economic benefits are achieved by the social enterprises.

To monitor whether economic benefits are achieved by social enterprises, a longitudinal case study approach will be adopted to assess the financial performance of those six historic buildings under the scheme which have already been awarded. A common methodology will be adopted for each case. Each case study will collate information from different stakeholders regarding the financial performance in terms of the number of employees engaged both full-time and part-time, the profit made by the service provider, other economic benefits achieved by the stakeholders, and the risks and difficulties faced. In each case, the researchers will look for patterns of approaches, processes, satisfaction, motivation, communication, relationships and difficulties within each project and seek similarities and differences between the cases. The aim will be to look at the cases both individually and collectively. The financial performance of each project will be examined. The approach adopted for each case study project will be mapped and the decision-making process in the selection of particular approaches and processes will be documented. The analysis will be conducted with procedural regularity and consistency. The qualitative data to be generated will be analysed using both the exploratory techniques developed by Morgan (1994) and a reputational approach (Seymour and Fellows, 1999).

Objectives 2 & 3: to assess the cultural, heritage and social impacts of the scheme.

To assess the conservation works of the service providers, the research team will follow the international principles as set out in the Charter of Venice (International Council on Monuments and Sites), the Burra Charter (ICOMOS Australia), and the Principles for the Conversation of Heritage Sites in China (ICOMOS China). In practice, the research team will examine the building works of each historic building against a checklist of authentic architectural features. The checklists, which are composed in compliance with the current statutory requirements under the Buildings Ordinance, will reflect the unique conditions of the historic buildings and the levels of architectural authenticity that need to be retained. The conservation works will be studied, on the one hand, in light of the historical features of the buildings to see if proper procedures and treatments are carried out to preserve the cultural and heritage merits.

Nevertheless, on the other hand, it is not uncommon to find conflicts and fierce arguments prevail in the community concerning how historic sites should be preserved. This manifests that existing policy may not be totally effective to convince a significant

sector of the community, while the voices of local appeals may find it hard to channel through the administrative and consultative processes. Public dialogue on the proper way of policy making and implementation in preservation of historic and cultural heritage may not be smooth, resulting in the lack of legitimacy in policy and leading to conflicts or even confrontations. In order to trace the background of these different considerations, the research team is going to conduct informant interviews with policy makers, government officials, members from statutory committees, as well as representatives from concerned groups (including grassroots organizations, political parties, and etc.).

The research team, in light of findings from the above, will also undertake some stocktaking research on existing strategies, or best practice, from other international cities to shed light on what should be a proper, or balanced, approach to accommodate the divergent appeals and the special characteristics of the local context in preservation of historic heritages.

To assess the real impact of preservation efforts on the public and how it serve to retain cultural heritage, in what way these efforts are building up community spirit and to develop local identity, it would be necessary to gauge the social impacts of the scheme by community survey. The project herein proposes to conduct telephone polls on the general public to collect their views on relevant government policies and their familiarities with the scheme. Telephone poll would be an efficient and cost effective way to achieve this objective.

The survey will cover the land-based households that are installed with residential telephone lines in Hong Kong. It will be conducted on a sample selected in accordance with a scientifically designed sampling scheme, and will include a minimum of one thousand successfully interviewed cases of person aged between 18 and 65. The interview and data input processes will be administered through the Computer-Assisted Telephone Interviewing (CATI) system (version 4.2).

A pilot survey of at least 30 cases will be conducted for the telephone poll survey. Each part of the questionnaire will be fully tested in the pilot survey. The CSPS will document the findings of the pilot survey and make recommendations and necessary amendments as required to improve the survey operation and questionnaire design.

The treatment of unsuccessful telephone interviews will be strictly defined and monitored. In practice, a telephone number is called at different times of the day and on different days to increase its likelihood of being a successful case. Those unsuccessfully contacted telephone numbers will be tried at least six times on different days and times before a non-contact status is assigned.

For the time slots of data collection, three sessions per day will be arranged (morning, afternoon and evening) in order to speed up the data collection process. To explore the

perceptions of people who are going to use to those historic sites and to gauge how users evaluate the effects of the preservation efforts, exit polls are also proposed to complement the telephone polls. Interviewers are going to conduct a face-to-face interview survey with structured questionnaires. As the sampling list of users is unclear and the research team has little information on the number of users to these historic buildings, a quota sampling methods of respondents will be employed.

The research team will set up certain observation locations in the historic buildings and users of the designated areas will be invited to participate in the survey. At least 100 users in each building will be interviewed.

CONCLUSIONS

Similar to other major cities around the world, economic development in Hong Kong has been criticised as running at the expenses of the historical, social and cultural elements of the city. Therefore, the conservation of these elements has become increasingly important. In addition, creating a sustainable business environment for social enterprises to take care of disadvantaged groups are seen as responsibilities of government. Given the current situation there is much potential for re-using historic buildings, renovated at government expense, for subsequent use by social enterprises. However, accountability is always an issue in the deployment of public funding. If public funding is not deployed properly, it could easily lead to public criticism. This research study aims to evaluate the effectiveness of the *Revitalizing Historic Buildings through Partnership Scheme* in terms of its social, economical, cultural and heritage impacts. If the scheme is implemented successfully, there will be an increase of job and business opportunities. In addition, this will also help uplift the local cultural and arts society, preserve heritage, provide facilities and services of a wider spectrum for the general public, increase tourism potential and also help educate the general public in Hong Kong.

ACKNOWEDGEMENTS

The work described in this paper was fully supported by a grant from the Research Grants Council of the Hong Kong Special Administrative Region, china (Project No. PolyU 5002-PPR-10).

REFERENCES

Development Bureau. (2009a). *About the Maintenance Scheme*, http://www.heritage.gov.hk/en/maintenance/about.htm (accessed on 20 August 2009).

Development Bureau. (2009b) *Batch I of Revitalisation Scheme*, http://www.heritage.gov.hk/en/rhbtp/batch1_scheme.htm (accessed on 14 August 2009).

Development Bureau. (2009c) *Batch II of Revitalisation Scheme*, http://www.heritage.gov.hk/en/rhbtp/batch2_scheme.htm (accessed on 14 August 2009).

Dickey, J. and Watts, T. (1978) *Analytic techniques in urban and regional planning*, McGraw-Hill, New York.

Fellows, R. and Liu, A. (2008) *Research methods for construction (3rd Edition)*, Blackwell Science, Oxford, United Kingdom.

HKSAR. (2009) *香港便覽 -公共財政* (English translation: Hong Kong Factsheet – Public Finance), http://www.gov.hk/tc/about/abouthk/factsheets/docs/public_finance.pdf (accessed on 15 July 2009).

Lam, S.L. (2003) *Conservation of Historical Buildings in Hong Kong*, Architectural Services Department, HKSAR.

Mok, C.S. (2005) *Privately Financed Infrastructure Projects*, MSc Thesis, The University of Hong Kong, Hong Kong.

Morgan, G. (1994) Imaginization, Sage – London.

Nan Lian Garden. (2009). *Nan Lian Garden*, http://www.nanliangarden.org (accessed on 16 March 2009).

Partnerships UK. (2009a) *Case Study: Redevelopment of the Treasury Building, Government Offices Great George Street (GOGGS)*, http://www.partnershipsuk.org.uk/PUK-Case-Study.aspx?Region=&SubRegion=&Project=11418 (accessed on 27 July 2009).

Seymour, D.E and Fellows, R.F. (1999) *Towards a Culture of Quality in the UK Construction Industry*. Proceedings, CIB W92, Profitable Partnering in Construction Procurement, edited by Stephen Ogunlana, E & F Spon, pp511-520.

Sing Tao Daily. (2009) 八和要「申冤」披露方案作公論, (English translation: Chinese artists association should let public judge its proposal), *Sing Tao Daily*, 23 February 2009.

South China Morning Post. (2008) Now we Need Action on the Arts Hub Project, *South China Morning Post*, 19 June 2008.

Waters, F. (2009) West Kowloon cultural district: financial alchemy through PPP. *Presentation at the CIB TG72 Symposium on Revamping PPPs*, Hong Kong, 28 February 2009.

Wu, E. (2008) HK$21.6b approved to bankroll arts hub. *South China Morning Post*, 5 July 2008.

Inducting Students Into Academic Integrity: Conceptual Design of an Online Learning Module

Thayaparan Gajendran, Anthony Williams and Debbie Booth
Faculty of Engineering and Built Environment
The University of Newcastle, Australia

ABSTRACT

Academic Integrity (AI) is one of the central facets of student learning and can impact significantly on students' post-education life. Educational institutions have a central responsibility for developing a positive academic culture through policies and mechanisms that address and foster AI in their institutions. However, in practice, even where institutions have adopted formal AI mechanisms, some students still develop a poor understanding of the essential facets of AI, leading to unintentional AI breaches. Moreover, some students find it hard to contextualise the university-wide AI policies as part of their discipline. In addressing this issue, some universities have developed online, discipline-specific AI modules to enhance students' AI understanding. This paper discusses a discipline-specific online Academic Integrity Module (AIM) developed for built environment students at the University of Newcastle (UoN). The module was designed within the Blackboard environment to provide an online and interactive form of AI learning. Whilst the AIM draws heavily on AI policies at UoN, it contextualises this information as part of the built environment discipline and enables students to engage in self-paced AI learning and self-assessment.

KEYWORDS

Blackboard, academic integrity, online module, induction and university policy

INTRODUCTION

Academic Integrity (AI) is a central facet of higher education and potentially impacts on students' post-educational life as an employee, employer and citizen (Nonis & Swift 2001). Educational institutions therefore take a central responsibility in nurturing a positive learning environment and culture of AI (Duggan, 2006; Park, 2004). From the substantial body of academic literature on AI (McCabe, Trevino, and Butterfield, 1999; Hendershott, Drinan, and Cross, 2000; Park 2003; McCabe and Pavela 2004; Murdoch University 2005; Scanlan, 2006), several aspects can be identified that are key to embedding AI in educational institutions, including:

- fostering a genuine understanding of AI concepts among students;
- assisting students with support mechanisms that enable students to identify AI breaches; and,
- developing AI policies that discourage/penalise AI breaches.

Most often, universities focus on the latter aspect, developing university-wide AI policies that are then formalised within program curriculum. However, recent studies of AI have noted that even where formal AI policies are adopted, some students continue to demonstrate poor understanding of the essential facets of AI, leading to unintentional AI breaches (Manson, 2006; Ellery 2008; East 2005; Hayes and Introna 2005; Marshall and Garry 2006).

Due to the complexities of teaching AI, some studies suggest that educating students about AI via generic AI learning modules can be ineffective (Macdonald and Carroll, 2006). Indeed, AI policies often focus on generic value areas such as honesty, fairness, trust, responsibility and respect (see UoN, 2008a), which can be potentially difficult to translate into academic practice, particularly as part of certain disciplines and for those from diverse cultural backgrounds (Leask, 2006). Moreover, generic discussion of AI may not adequately develop students‘ understandings of the discipline-specific situations that can give rise to academic fraud. For example, construction students may:

- use copyrighted project drawings from work without appropriate permission in their university coursework;
- use the outputs of their paid consulting work without client‘s permissions
- use established formulas in structural/geotechnical/estimating calculations without recognition of the source
- self plagiarise by reusing the part of the assignments submitted previously in other assignments
- unconsciously collude in doing a estimating or measurement (calculation) assignments, where the boundaries of collaboration and collation are difficult to draw.

It is argued in this paper that education of AI is best contextualised within a specific disciplinary context (McGowan & Lightbody, 2008; Macdonald and Carroll, 2006). This paper identifies the AI issues faced by the built environment students at the School of Architecture and Built Environment (SABE) at the University of Newcastle and reports on an initiative that developed a discipline-specific online AI module to address AI issues.

AI ISSUES AND CHALLENGES

The SABE delivers an undergraduate Bachelor of Construction Management (BCM) program through both on-campus and online, distance-learning modules (Williams, Sher and Brewer 2008). The SABE has consistently paid attention to embedding information literacy and AI into its curricula. However, with the restructuring of its programs in 2006, AI concepts were introduced as a component of a first year, semester one course. AI concepts were delivered to on-campus students through face-to-face classroom lectures, and via lectopia, mp3 audio files, and PowerPoint presentations for distance learners (see Sher and Gajendran, 2008). Moreover the concepts were supplemented by a university-level web-based resource developed by the university library (see UoN 2004).

From 2007, the student numbers in the BCM program expanded exponentially, due to an increase in regular intake and the introduction of mid-year enrolments. This increase included more students commencing their studies with advanced standing (i.e. TAFE qualifications, international articulations etc). An unconscious assumption was made by the SABE academics that students commencing their studies with advanced standing would have adequate exposure to AI concepts from their previous education, and therefore not be disadvantaged by missing the first year course on AI. Moreover, it was assumed that the AI concepts and policies embedded in the course outline, documents and resources would reinforce students‘ AI understanding and familiarity with university AI policy. Yet, it rapidly became clear that these assumptions were misleading and that many students were not equipped with appropriate AI understanding, with increasing cases of what can be described as ‗unintentional‘ AI breaches. The official position that these students should have studied the available AI resources on the university website offered little support or guidance to students and was of significant concern to staff.

The fading distinction between ‗unintentional‘ and ‗intentional‘ plagiarism in AI policies generally (i.e. all treated as plagiarism), encouraged the BCM discipline to take a pastoral care role in preventing students from unintentional AI breaches through effective AI education. Prevention of unintentional AI breaches could save significant amounts of time spent by academics, administrative staff and students in dealing with AI breaches. The SABE‘s response was to develop an approach that engages students in active learning about AI to address these gaps in student knowledge.

ANALYSIS OF AI ISSUES

To develop an informed approach to these AI issues, the SABE undertook an analysis of the AI situation across the school; exploring three particular AI aspects (see Table 1). Published documents, including the course outlines and website materials were used to analyse the gap in AI learning.

Table 1 – Status analysis of AI key concepts in the context of UoN

No	Aspect	Status	Observations
1	Students' understanding of AI	AI skills are taught in first year, first semester. If students enrolled in advanced courses (with credit), it was their responsibility to familiarise themselves with AI material. However, the level of understanding of AI concepts was generally poor as commencing students lacked the initiative to educate themselves on AI.	- There is a need to improve AI understanding, particularly for students with advanced standing - An interactive tool for students to engage with AI would be beneficial during their studies
2	Student support mechanisms	A range of AI support mechanisms were available to students at the time, including academic and technical support mechanisms: Academic Support; - Student Academic Conduct Officers (SACO) to assist students with regard to AI queries and disciplinary actions - Program Conveners and Lecturers to advise students on AI Matters (via both face-to-face and electronic mediums) - Faculty Librarian to assist with resource handing and referencing Technical Support; - Availability of electronic text-matching software to identify plagiarism - Referencing management software for appropriate referencing	- The available support mechanisms provide some assistance to both on-campus and distance students - However, it was evident that most students avoided seeking academic support unless found to be in breach of AI policy - While students regularly used the technical support mechanisms (i.e. text-matching software), they did not review the originality reports of the software, thereby overlooking important AI learning opportunities - There is a need for more interactive and engaging learning and support mechanisms to build students' understanding and knowledge of AI
3	The policies and procedures	AI issues are covered by two key university level policies as follows: - *Student AI Policy (UoN 2008b*) – aims to reinforce the importance of integrity and honesty in an academic environment - *Student AI Procedure (UoN 2008c)* - aims to support the implementation of the Student AI Policy. This policy establishes the roles of staff and SACO in relation AI breaches. It also stipulates the processes to be followed when an AI breach is suspected.	- The policy documents define a number of key concepts relating to AI and stipulate the processes to be followed when a case of academic dishonesty is suspected - The policy neither stipulates how AI concepts should be taught to students nor the required level of learning.

The analysis of relevant AI materials, mechanisms and procedures suggested that the primary issue contributing to AI breaches by students is a general lack of understanding of AI concepts (see also Allan et al. 2005; Emerson et al. 2005). This paper reports on the design and development of an AI Module, that intends to actively engage students in AI learning. This module can address the AI knowledge gap, among commencing students, particularly those students with advanced standing.

DEVELOPING AN AI MODULE

In order to guide the development of an AI program, the SABE identified six key aims of such a program in conjunction with the literature (see Park, 2003; Macdonald and Carroll 2006), to:

- enable students, irrespective of entry into the program, to learn about AI concepts;
- provide consistent AI learning experiences to on-campus and off-campus students;
- allow students access to a collection of discipline-specific AI material at any time during their course of study;
- facilitate student learning, self assessment and evaluation of students‘ level of understanding of AI concepts through the provision of appropriate feedback;
- enable a record of students‘ level of accomplishment as a summative assessment, which aids in the determination of possible AI breaches; and,
- provide contextually relevant AI learning experiences for all students.

To address these aims effectively, the SABE proposed and developed an online AI module (AIM). The module includes a self-assessment capability and is accessible to all students in the school though Blackboard (BB) (an online educational portal). It is argued in this paper that the module presents an effective means of bridging the gap between the policies and practices of AI in universities.

THE PEDAGOGICAL UNDERPINNING

The AIM proposed by the SABE was informed by pedagogical design and underpinned by ―Contextualised Personalised Integrated Learning (CPIL)” (McGowan & Lightbody, 2008). CPIL is characterised by:

- personalised, self-paced and just-in-time learning, (Vonderwell, Liang, and Alderman, 2007);
- contextualised integrated learning environment (integrated AI policy, resources, program and graduate attributes) (Singh, 2003); and,

- contextualised student self-evaluation and learning through diagnostic-summative assessment with formative feedback (Gaytan and McEwen, 2007).

To support this pedagogical design, the AIM employs an online diagnostic/summative assessment strategy, incorporating extensive formative feedback. Diagnostic assessment encourages students to complete the module enabling self-diagnosis of their level of understanding of AI concepts. This module also serves as a summative assessment due to its inclusion of milestones—this means that students need to pass the module with a score of 100% to graduate. To actively achieve this, students are provided with unlimited attempts to pass the module, working through the formative online text-based feedback provided on completion of each attempt. Students can obtain additional formative feedback, if required, though academic support networks within the university (e.g. SACO, library, program conveners, course coordinator etc). Through this approach, the module also serves as an induction for students to develop their independent learning ability.

This type of personalised learning experience provides the flexibility for students to effectively engage with AI concepts. Moreover, the unlimited availability of the module throughout a student's entire study program enables ongoing support and development of AI learning. The objective of the pedagogical design is to provide students with appropriately contextualised and formally integrated AI knowledge, skills and resources.

Moreover, the AIM contributes to the learning experiences that help to create a scholarly student and graduate culture. Indeed, this particular AIM was designed to align with the SABE course and program objectives and the Graduate Attributes Policy of the UoN (UoN 2009). The ability of students to enhance an AI culture will contribute enormously to their academic performance and prepare them to develop scholarship and community when they graduate (two listed graduate attributes in UoN policy[i]). It is argued that the contextualisation, design and implementation of this module provide a novel approach to creating a positive AI culture.

THE DESIGN OF AN AIM

In designing the AIM, BB was proposed as a viable platform due to its stability and already established use at the university. Indeed, the SABE had significant in-house skills/capabilities in the development, maintenance and modification of BB, which provided an effective and easy to use framework for an online AIM. Moreover, BB is the University's primary online learning system so extending the use of BB builds students knowledge of the platform.

Two key aspects formed the basis of the module's design: (a) technical design (including identification of appropriate BB tools for delivery); and, (b) content design.

Technical design

The use of BB to design and access the AIM enables the use of various BB tools for delivery of the module. Three primary tools – *Test Manager*, *Gradebook* and *Survey Manager* – are used to aid the design and delivery of the module. The *Test Manager* enables construct threads that incorporate discrete content, associated assessment questions and feedback. This enables delivery of one concept at a time and then assessment of the level of understanding of each concept. Moreover, undertaking revisions to the content and questions within *Test Manager* is straightforward.

The *Gradebook* tool provides details of completion rates for assessments, with specific details for each student about the number of attempts for each question and the time taken to complete the module. This enables easy identification of issues relating to question format or student engagement, as well as providing a record of milestone activity for each student. Both *Gradebook* and *Test Manager* offer progress monitoring of student engagement and record of achievement.

The *Survey Manager* tool provides a process for obtaining student feedback about the module. The key difference between the *Test Manager* and *Survey Manager* is that the latter offers anonymity for the respondents providing feedback. The premise is that when anonymity is offered, respondents will provide more open and honest feedback. Together, the three tools provide a useful monitoring, assessment and feedback system for the AIM.

Furthermore, the UoN provides a link between BB and the student enrolment system – NUSTAR. Once enrolled, a student will be provided with personalised access to the BB platform which then provides an ongoing record of each student‘s achievement and engagement in courses. For students enrolling in SABE, the AIM is immediately available in BB, along with other course materials. This existing link with the enrolment system facilitates the delivery of the module and then provides an ongoing record of each student‘s engagement with the AIM.

Content design

The key issue that dominated the content design of the AIM was how to teach and assess fundamental AI values expressed in UoN AI policy, such as honesty, fairness, trust, responsibility and respect (UoN 2008b; Clemenson University 2010). As previously discussed in this paper, AI values are notoriously difficult to teach—but perhaps even harder is the assessments of students‘ understanding of AI values. The UoN AI policy for students (see UoN 2008a) attempts to provide a more detailed definition to guide assessment of AI via notions of ‗academic fraud‘ and ‗plagiarism‘. Academic fraud is defined as ―a form of academic dishonesty that involves making a false representation to gain an unjust advantage‖ (UoN 2008b), that can include:

- falsification of data;
- using a substitute person to undertake, in full or part, an examination or other assessment item;
- reusing one's own work, or part thereof, that has been submitted previously and counted towards another course (without permission);
- making contact or colluding with another person, contrary to instructions, during an examination or other assessment item;
- bringing material or device(s) into an examination or other assessment item other than such as may be specified for that assessment item;
- making use of computer software or other material and device(s) during an examination or other assessment item other than such as may be specified for that assessment item; and,
- contract cheating or having another writer compete for tender to produce an essay or assignment and then submitting the work as one‘s own.

Plagiarism is defined as ~~“t~~he presentation of the thoughts or works of another as one's own” (UoN 2008b), and includes:

- copying or paraphrasing material from any source without due acknowledgment;
- using another person's ideas without due acknowledgment; and,
- collusion or working with others without permission, and presenting the resulting work as though it was completed independently.

Although the university-wide policy provides a useful starting point and framework for AI learning, we argue that students develop a better understanding of academic misconduct through contextualising the above issues within their own discipline. Therefore the AIM developed for the SABE contextualised the above AI issues within the architecture and building disciplines.

Moreover, the design of AIM has undergone a number of revisions triggered by student and staff feedback. The module now consists of 18 questions organised into four key AI concepts linked to relevant resources to explain and provide examples of AI. These resources are sourced and linked to the university library‘s InfoSkills Tutorial (see UoN 2004) which provides up-to-date AIM content and information on changes to university AI policy. Students are required to successfully complete all questions in order to pass the module, with unlimited attempts permitted. Using the adaptive release feature in BB, those students who need to revise incomplete or incorrect answers can now do so without revisiting the entire module, which saves time and focuses students‘ engagement with the module. This design groups questions and resources into sections—with progress from one section to the next governed by the successful completion of the previous section.

Therefore, when students answer a question in a module incorrectly, they only need to repeat that section, rather than revising the entire module.

THE STRUCTURE OF AIM

The following provides a review of the AIM structure and how it appears on BB. Each of the four sections of the AIM are reviewed, providing details on the questions and examples of the BB layout., including the feedback form provided to students at the completion of each section.

Section 1: Academic integrity, plagiarism and academic dishonesty, finding and evaluation information

This section deals with the importance of AI concepts and University of Newcastle policies students are subject to during their candidature, and criteria for evaluating information for academic purposes. This section includes 3 questions, which are linked with relevant university policies and resources (see Figure 1). Questions focus on students developing understanding of what is academic dishonesty and judging themselves whether a particular course of action might result in being them accused of academic dishonesty. This provides a good start by signifying the need for developing good understanding of AI concepts, specifically the defense of lack of knowledge of AI concepts is not an excuse for breach of AI.

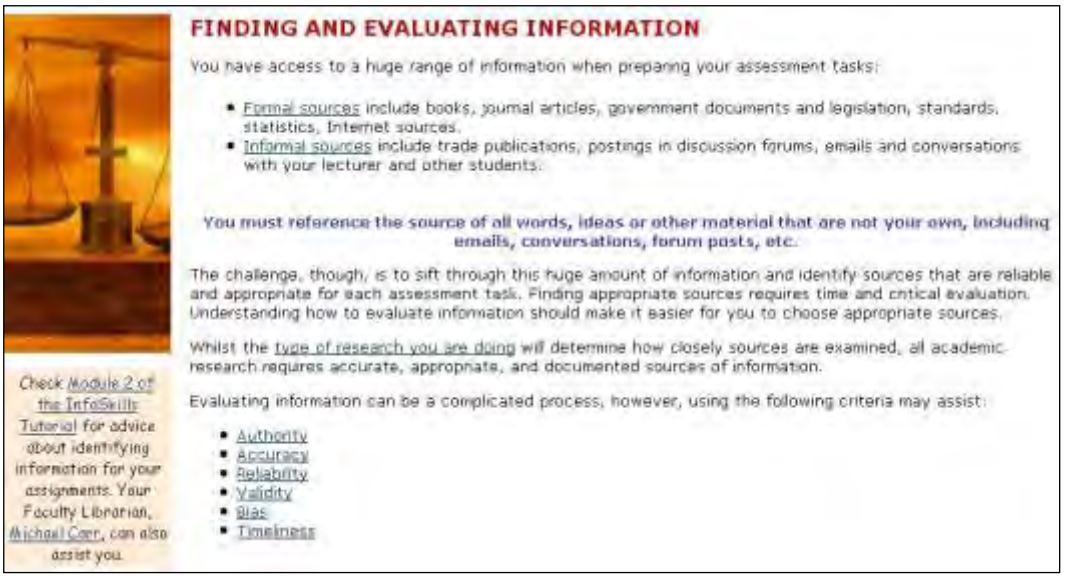


Figure 1 – Illustrated use of embedded links to University Library's InfoSkills Module

Section 2: Referencing

This section deals with the importance of referencing academic work, when and how to reference, self-citations and common knowledge. The section includes 8 questions and again these are linked to relevant materials to help build student‘s knowledge of referencing. The key focus of this section is educating students on appropriate referencing to avoid possible plagiarism: i.e. different approaches to referencing borrowed ideas and acknowledging them in an appropriate manner. The questions provide scenarios with both appropriate and inappropriate referencing practices for students for identify the right ones from the wrong ones.

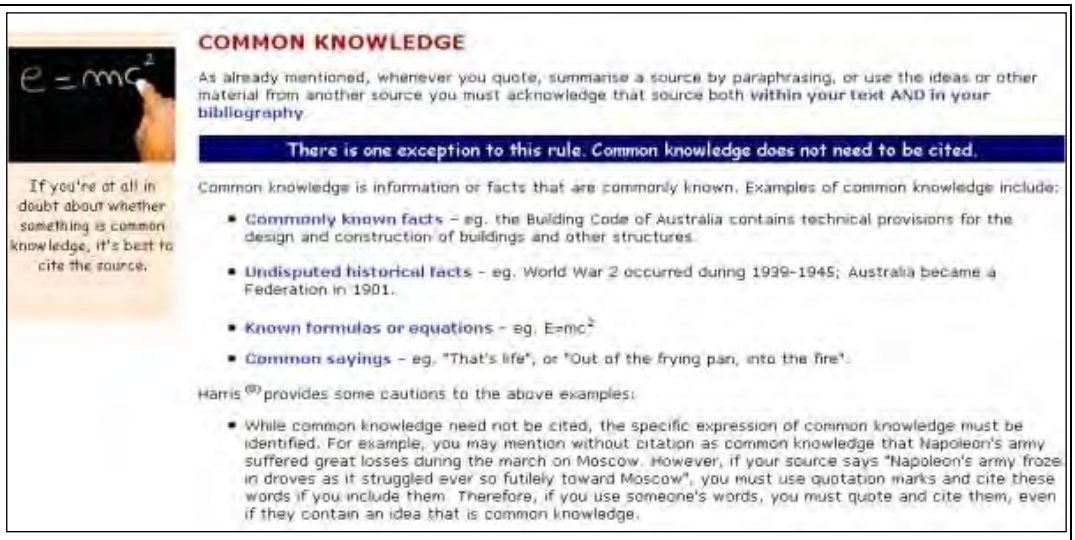


Figure 2 – The contact delivery screen with in BB system

Section 3: Common elements of reference list

This section deals with APA Referencing Style and looks at common elements included in reference list entries for books, book chapters, journal articles and internet resources. The APA Referencing Style is discussed and relevant materials are linked to this section via InfoSkills. This section includes 5 questions. Figure 3 illustrates how questions assessing student understanding of AI concepts are contextualized in discipline specific scenarios. The past students‘ assignments are used as example for assessing students‘ ability to identify referencing list elements. Therefore the scenarios and questions are contextualized within the building built environment context.

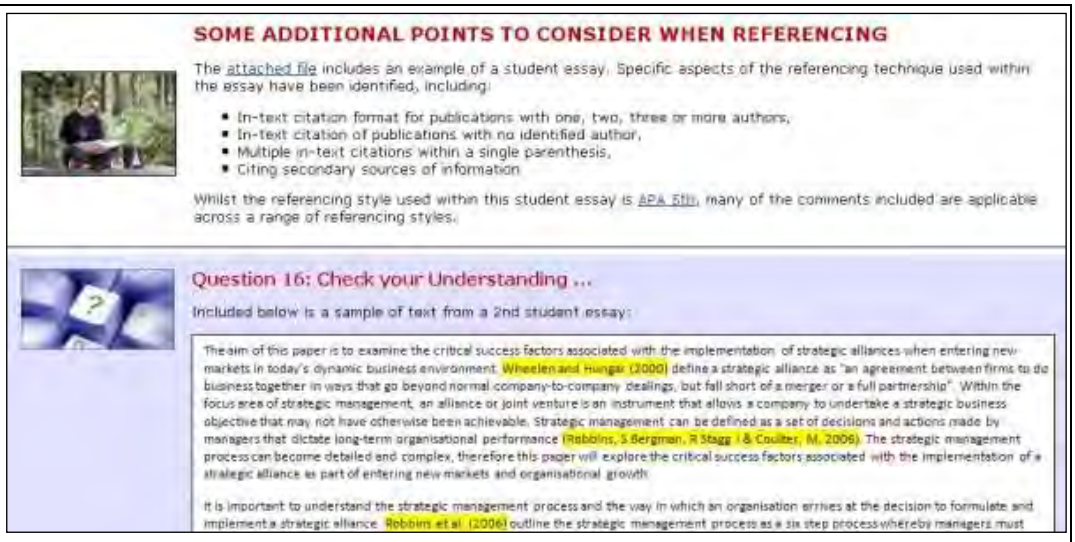


Figure 3 – Referencing question simulated within the context of student assignment

Section 4: Working with others, group work and collusion, and breaches of academic integrity

This section includes 6 questions. This section in part deals with the issues associated to group work practices. Educating the students about the fine line between the group work/collaboration and collusion is often challenging. This section also deals with tools used for plagiarism detection and prevention. Use of Turnitin to check plagiarism and interpreting the originality reports are also discussed in this section. Finally the penalties and actions relating to breaches of academic integrity are presented. Figure 4 provides an illustration of how students are exposed to penalties of AI breaches.

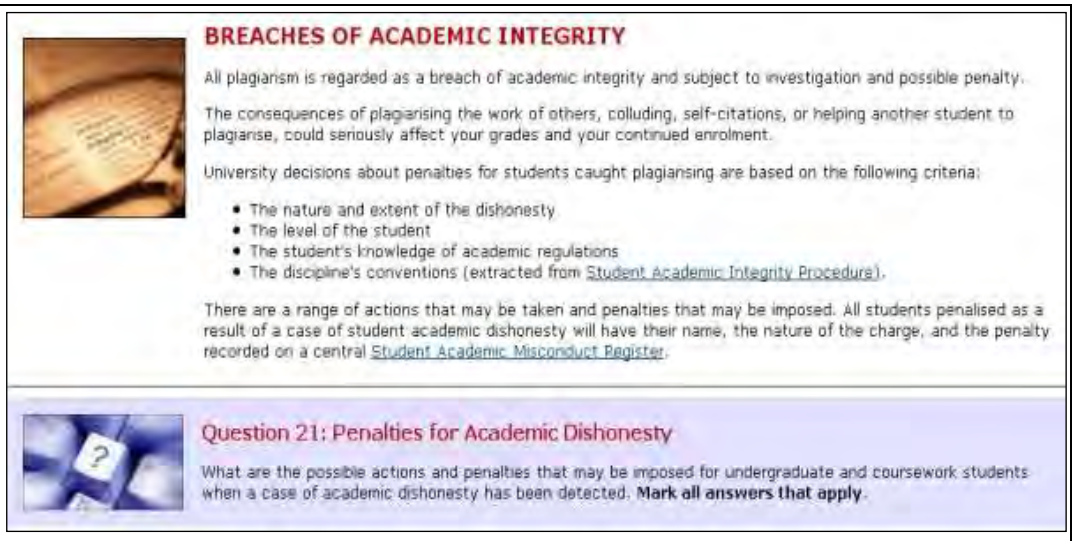


Figure 4 – Question that draws attention to penalties and actions for breaches of academic integrity.

Feedback: student results and additional information

On completion of each section, students are given feedback on how they performed as a means of providing formative assessment. If they do not achieve 100% for a section, they need to redo the section until they get the full score to proceed to the next section, with unlimited attempts provided for each section—thereby assuming a mastery learning approach. At the completion of the final section students are also provided with further assistance on AI matters, which they may choose to pursue if they perceive the need (see Figure 5).

Common reasons students give for plagiarising ##	Where to find help ...
I don't understand what I'm expected to do to avoid plagiarism!	• Check the University's Student Academic Integrity Policy • InfoSkills Module 4 – Writing and Plagiarism
But you said 'work together'!	Misunderstanding the boundaries of groupwork and collaboration • Check - Solving Group Work Problems, and Introduction to Group Work: A Guide for Students
I didn't know that I couldn't re-use my own work!	The Policy defines self-plagiarism as "reusing one's own work that has been submitted previously and counted towards another course (without permission)." See also: • InfoSkills – Reusing work ...
I can't work out what is, and isn't, "common knowledge"!	The concept of common knowledge can be a little tricky - take a look at: • InfoSkills - Using common knowledge And, remember, if you are unsure about whether something is regarded as common knowledge, it's best to reference the source.
But isn't information on the Web public knowledge and not subject to copyright?	Material on the Internet may not be copyright free or available in the 'public domain'. • See: Copyright and the Internet

Figure 5 – Example of additional assistance to external sources of information included in AIM

CONCLUSION

The AI issues faced by universities are complex and not always effectively addressed solely by devising formal AI policies. Students often continue to misunderstand the concepts and practices of AI despite the institutionalisation of AI policies. In this paper, it is argued that discipline-specific AI learning modules may present an additional way of delivering AI concepts to students that is engaging and easy to learn. The SABE at UoN found that the development of a discipline-specific online academic integrity module provided an effective solution to deal with AI issues in their school—one that addressed the lack of understanding of AI common to commencing students, particularly advanced standing students. The AIM was delivered and monitored through the Blackboard online platform, using tools that not only aided in the delivery of content, but also enabled self-assessment and feedback. While the contents of the AIM closely followed the university-wide AI policy and other relevant institutional resources, the questions were

contextualised within the architecture and built environment disciplines. This approach allowed AI learning to be formally embedded in the assessment process and actively integrated into student learning.

REFERENCES

Allan, G., Callagher, L., Connors, M., Joyce, D. and Rees, M. (2005) Some Australasian perspectives on academic integrity in the Internet age. *EDUCAUSE*. Auckland, New Zealand.

Duggan, F. (2006) Editorial: Plagiarism: prevention, practice and policy. *Assessment & Evaluation in Higher Education*, 31 (2), pp. 151-154.

East, J. (2005) "Proper Acknowledgment?" *Journal of University Teaching & Learning Practice* 2(3).

Ellery, K. (2008) Undergraduate plagiarism: a pedagogical perspective. *Assessment & Evaluation in Higher Education*, 33 (5), pp. 507-516.

Emerson, L., Rees, M.T. and Macky, B. (2005) "Scaffolding Academic Integrity: Creating a Learning Context for Teaching Referencing Skills." *Journal of University Teaching & Learning Practice* 2(3).

Gaytan, J. and McEwen, B.C. (2007) Effective Online Instructional and Assessment Strategies. *American Journal of Distance Education*, 21 (3), pp. 117-132.

Hayes, N. and Introna, L.D. (2005) "Cultural Values, Plagiarism, and Fairness: When Plagiarism Gets in the Way of Learning." *Ethics & Behavior* 15(3): 213–231.

Hendershott, A., Drinan, P. and Cross, M. (2000) Towards enhancing a culture of Academic Integrity. *NASPA Journal*, 37 (4), pp. 587-597.

Lanier, M.M. (2006) Academic Integrity and Distance Learning. *Journal of Criminal Justice Education*, 17 (2), pp. 244-261.

Leask, B. (2006) Plagiarism, cultural diversity and metaphor—implications for academic staff development. *Assessment & Evaluation in Higher Education*, 31 (2), pp. 183-199.

Macdonald, R. and Carroll, J. (2006) Plagiarism—a complex issue requiring a holistic institutional approach. *Assessment & Evaluation in Higher Education*, 31 (2), pp. 233-245.

Manson, K. (2006) Student Integrity. *The Business Review*, 6 (1), pp. 297-300.

Marshall, S. and Garry, M. (2006) "NESB and ESB students' attitudes and perceptions of plagiarism." *International Journal for Educational Integrity* 2(1): 26-37.

McCabe, D.L. and Pavela, G. (2004) Ten (Updated) Principles of Academic Integrity: How Faculty Can Foster Student Honesty. *Change: The Magazine of Higher Learning* 36 (3), pp. 10-15.

McCabe, D.L., Trevino, L.K. and Butterfield, K.D. (1999) Academic Integrity in Honor

Code and Non-Honor Code Environments. *The Journal of Higher Education*, 70 (2), pp. 211-233.

McGowan, S. and Lightbody, M. (2008) Enhancing students' understanding of plagiarism within a discipline context. *Accounting Education: and international journal*, 17 (3), pp. 273-290.

Murdoch University. (2005) "Audit of Academic Integrity and Plagiarism Issues in Australia and New Zealand", available at http://www.tlc.murdoch.edu.au/project/acode/ (accessed 1 December, 2010).

Nonis, S. and Swift, C.O. (2001) An examination of the relationship between academic dishonesty and workplace dishonesty: A multicampus investigation. *Journal of Education for Business*, 77 (2), pp. 69-77.

Park, C. (2003) In Other (People's) Words: plagiarism by university students—literature and lessons. *Assessment & Evaluation in Higher Education*, 28 (5), pp. 471-488.

Park, C. (2004) Rebels Without a Clause: towards an institutional framework for dealing with plagiarism by students. *Journal of Further and Higher Education*, 28 (3), pp. 291-306.

Scanlan, C.L. (2006) Strategies to promote a climate of Academic Integrity and minimize cheating and plagiarism. *Journal of Allied Health*, 35 (3), pp. 179-185.

Sher, W. and Gajendran, T. (2008) Evaluation of modes of electronic delivery of construction management courses, *Proceedings of the 19th Annual Conference for the Australasian Association for Engineering Education*, Yeppoon.

Singh, H. (2003) Building Effective Blended Learning Programs. *Educational Technology*, 43 (6), pp. 51-54.

The Centre for Academic Integrity. (2010) "Fundamental values project", available at http://www.academicintegrity.org/fundamental_values_project/index.php (accessed 14-12-2010, 2010).

UoN. (2004) "Information Literacy and Academic Integrity Tutorial", available at http://www.newcastle.edu.au/service/library/tutorials/infoskills/).

UoN. (2008a) "Academic Integrity at the University of Newcastle", available at http://www.newcastle.edu.au/service/academic-integrity/ (accessed 20 November, 2010).

UoN. (2008b) "Student Academic Integrity Policy", available at http://www.newcastle.edu.au/policy/000608.html (accessed 20 November, 2010).

UoN. (2008c) "Student Academic Integrity Procedure", available at http://www.newcastle.edu.au/policy/000609.html (accessed 20 November, 2010).

UoN. (2009) "Graduate Attributes Policy", available at http://www.newcastle.edu.au/policy/000836.html (accessed 20 November, 2010).

Vonderwell, S., Liang, X. and Alderman, K. (2007) Asynchronous discussions and

assessment in online learning. *Journal of Research on Technology in Education*, 39 (3), pp. 309-328.

Williams, T., Sher, W. and Brewer, G. (2008) From distance to online to blended: A programme's journey, *EE2008: The International Conference on Innovation, Good Practice and Research in Engineering Education Conference Proceedings*, Loughborough University, England.

[i] Two of the three Graduate Attributes as stipulated by Policy- 000836

- Community responsiveness: an attitude or stance towards society- Graduates will be enabled to play effective and responsible roles as members of local, national and global communities. They will have a capacity for perspective forming and an appreciation of the philosophical and social contexts of their disciplines. They will have the ability to engage in constructive public discourse to sustain communities.
- Scholarship: an attitude or stance towards knowledge and learning-Graduates of the university will have a scholarly attitude towards knowledge and learning, demonstrated in a commitment to the expansion of knowledge and a respect for intellectual integrity and the ethics of scholarship. As scholars with an international perspective, they will be enabled to apply logical, critical and creative thinking to the advancement of knowledge and understanding through a capacity for rational enquiry and self-directed learning. They will be able to communicate their knowledge effectively.

Orienting Distance Learning Students Commencing the Bachelor of Construction Management Program: Designing an Online Module

Thayaparan Gajendran, Willy Sher, Annemarie Dosen, Anthony Williams and Wyn Jones
School of Architecture and Built Environment
The University of Newcastle, Australia

Andrew Yardy
Centre for Teaching and Learning
The University of Newcastle, Australia

ABSTRACT

Literature has shown that orientation programs for commencing students play a significant role in preparing students for their university life. Usually, universities conduct on-campus orientations to welcome and introduce students to university life – including the academic, social, and recreational aspects of it. However, these do not assist students who commence or continue their studies via distance learning mode. Nowadays, online learning is becoming more and more popular, and is often combined with part-time work. Distance learning (DL) students' needs differ from those of on-campus students, and the generic orientation programs designed for on-campus students may not address their needs. Furthermore, DL students familiar with traditional face-to-face teaching environments require additional support when they enrol in an online and problem based learning program because they need to adjust their approaches to learning. This paper reports on the design of an Online Orientation Module for the Bachelor of Construction Management (BCM) program in the School of Architecture and Built Environment, University of Newcastle. This degree is offered through problem based – mixed mode delivery. The paper discusses the concept, content, technical design issues, and the operational delivery of the module.

KEYWORDS

orientation, Blackboard, distance learning, online learning

INTRODUCTION

The School of Architecture and Built Environment, in the University of Newcastle, offers the Bachelor of Construction Management (BCM) program via 'mixed mode delivery' based on Problem Based Learning (PBL) pedagogy (Williams, Sher and Brewer 2008). 'Mixed mode' is an approach that delivers programs simultaneously to on-campus and

distance learning students (Sher and Gajendran, 2008; Sher, Brewer, Gajendran and Williams, 2008). The distance-learning component is solely offered online. The flexibility of the online mode with the PBL approach has proven to be attractive to students. The appeal of the program is two-fold. Firstly, all commencing BCM students have the flexibility to work and study simultaneously (Williams, Sher and Simmons, 2009), as evidenced by the significant increase in enrolments in the years since the inception of the DL BCM degree. Secondly, any enrolled student has the flexibility to switch to between the learning modes during the course of their studies.

Although the structure of the program offers a significant level of flexibility, it became evident to staff that the students enrolled in the DL program (both commencing and those switching from the on-campus program) required considerably more assistance on non-course related matters than their on-campus counterparts. Moreover, the nature of assistance sought by the DL students relating to academic or course matters was different to that requested by on-campus students (supported by Stevens and Switzer, 2006). Help was requested in understanding aspects such as the course delivery approach, learning environment and use of technology (similar observations made in Wozniak et al, 2007). Their needs included clarification on overall pedagogy, work-study-family balance, administrative and university policy issues (similar observations made in Kanuka & Jugdev, 2006). Upon reflection, staff felt that the constant demand for their attention emanated from an overall lack of understanding on the part of DL students about their roles as learners (supported by Bergmann and Raleigh, 1998).

Anecdotal evidence suggested that DL students who had been enrolled for several years remained unaware of some of the basic facilities and support offered by the university. It was also apparent that students were deeply rooted in the learning approaches they were familiar with, and were not-attempting to change their behaviours. Staff considered that most of these issues could be addressed via a detailed briefing. However, with the geographic dispersion of commencing distance-learning students, the challenge was how and when to communicate the supporting information to students. The School of Architecture and Built Environment commissioned an online module, which was to be made available during commencement orientation, to address the challenges facing the DL student's transition to online university study. A development of this module was funded by a grant administered by the Centre for Teaching and Learning at the UoN. This paper reports on this initiative by presenting: an analysis of the problems inherent in orienting DL students, content requirement analysis/system options of an online orientation module, technical design and specification, and content design of the module.

INVESTIGATION OF THE CURRENT ENVIRONMENT

Our initial analyses of the profile of students entering the BCM program as well as of the current approach to on-campus orientation provided insights to the problem and indicated possible solutions. Although the age spectrum of students enrolling in BCM ranges from school leavers to mature age students, a significant proportion of the distance-learning students are mature aged. In 2010, 63 percent of students enrolled in the BCM were non-school entrants. A considerable number of students have prior learning experience (including TAFE qualification(s) or course(s) completed for other on-campus programs), which has influenced and informed their learning attitudes and behaviours.

Consequently many of these students are not familiar with learning online, PBL and self directed learning. As already mentioned, many of these students have studied before, and as a result miss out on a first year, first semester course that introduces them to such approaches. Furthermore, a significant proportion of the intake has not been exposed to studying at a distance or online before. For this reason, many students are ill-prepared for the challenges they face, including basic activities (such as communicating with their lecturers), every-day activities (such as sourcing materials from the library), and applying for 'special circumstances' (which they need to do if they cannot submit an assignment on time). On-campus students are briefed about these issues during orientation week and in lectures. However, DL students have, to date, remained unaware that they can access the numerous support services offered by the university and consequently do not capitalize on them. Many deal with issues in an ad-hoc manner through emails, discussion board postings and phone calls. These are demanding of staff time, and the repetitive nature of their questions in part prompted the development of this online orientation module. The review of literature shed some light into some alternative approaches designing online orientation modules (see McCain and Miller 2008; Wozniak et al. 2007; McVay 2000; Miller and Pope 2003; Scagonoli, 2001; Bozarth, Chapman, and LaMonica, 2004).

CONTENT REQUIREMENTS ANALYSIS

DL students' learning journey is complicated by the challenges faced in managing their time (work/study), commitments, and their lack of understanding of the problem based online learning environment used. Changing their entrenched attitudes to self regulation / learning style and their expectations further compound these challenges. Once all these challenges have been recognized, students still need to identify strategies that will assist them in achieving their desired learning outcomes. Their lack of exposure to university policies also poses challenges in terms of understanding esoteric terminology and processes. The online orientation module helps students respond to these challenges and

avoids frustration on their part. It also reduces the number of repetitive queries staff receives from DL students and should also reduce attrition resulting from poor decision making by students.

It became apparent that the most appropriate time to induct students to online learning is during their commencing semester. Changing their attitudes and equipping them with an awareness of the skills required for online learning should occur during the early stages of their learning. If this does not happen early in their academic careers, these become difficult to change.

Therefore, the school embarked on an initiative to design and deliver an online orientation module for DL students. The existing on-campus orientation materials were pooled together to identify deficiencies relating to orienting DL students. New materials were developed to bridge the gaps identified. The module was developed with an appropriate blend of new and existing materials to suit the needs of DL students.

PEDAGOGICAL AND MODULE ORGANISATION REQUIREMENTS

Designing the nature and form of a module that is attractive and engaging for students was challenging. The brainstorming secessions held by the development team included aspects such as what content to incorporate, how to disseminate it, and how to gauge students' understanding of concepts. Five pedagogical requirements were identified and they are presented below. These requirements are coded P-1 to P-5 to ease cross-referencing to subsequent sections.

- P-1. The module needed to be designed to introduce concepts at a pace that students could digest. Clustering concepts into themes and introducing similar aspects of university life increased the accessibility of the materials. For example orienting students to aspects Problem Based Learning (PBL) was presented as one theme or unit. However, PBL is better contextualized within the themes of 'Managing expectations' and the 'Learning Environment'. Highlighting students' commitments to engage with PBL can assist them in managing their expectations. Moreover, students' understanding of their academic goals and an evaluation of their study, work, family and social responsibilities can help them to make realistic commitments. Similarly, information on how to approach a PBL course, in terms of facilitation and assessment was pooled under the 'Learning Environment' unit. The organisation of the units within the module was designed to assist a linear and logical learning progression. This enables students to deal with one clear learning concept at a time.
- P-2. Acknowledging that assessment drives learning (Biggs, 1999), a formative assessment tool was incorporated at the end of each unit to consolidate students'

understanding. This was designed in a hierarchical manner, with units containing sub-units. Successful completion of a quiz acts as a gateway to subsequent units.

- P-3. Strategy is to release on-line units once students had attempted the quiz. This will provide a basis for students to interact with the material in a module.
- P-4. The module content should be delivered in different multi-media formats. Choosing the most appropriate form of content delivery – e.g. Text (including interactive text), Audio, and Video (including animations) is critical for engaging students (see the Technical Requirement sections for more details on this).
- P-5. The navigation of content should be easy. Therefore, the screen designs suited the limited screen size of laptops to avoid significant scrolling.

THE TECHNICAL DESIGN

The orientation module was developed through an innovative approach of the University of Newcastle's virtual learning environment, Blackboard. This approach relied heavily on a combination of Blackboard's assessment and content management tools to facilitate the pedagogical design discussed previously. The strategic use of Blackboard in concert with an external content presentation service (Scribd[1]) produced an effective resource that is specifically aligned to the needs of commencing students new to online learning. Moreover, this approach ensured the initiative's sustainability beyond the initial development phase.

For many students, the orientation module would be their first exposure to (a) university study and (b) learning using an online learning environment such as Blackboard. In order to provide students with an effective and supportive experience, the majority of the module content was delivered using Blackboard 'Learning Units' which control the manner in which students navigate web pages. This feature enables students to progress step-by-step through each unit in the same way they would engage with a physical book (requirement P-1). This approach also enabled staff to present content in smaller, discrete learning experiences (requirement P-5). Also, the Blackboard pages have been tested using a variety of internet browsers.

To further accommodate the needs of commencing students and reduce information overload, each of the six units is released progressively using Blackboard's Adaptive Release rules. When students first enter the module they are provided with access to the Introduction module. On completion of a unit, students are presented with a quiz (requirement P-2), which they need to attempt (requirement P-3) before they are allowed to progress further. Students have to demonstrate mastery of the content of a unit before

[1] Scribd is a the world's largest social reading and publishing company (see http://www.scribd.com/)

progressing to the next unit. For example, they need to master the content related to managing expectations before they can progress to the learning environment unit.

In recent years, videos and animations have enriched web interaction and learning due to their dynamic capabilities. Their ability to convey a message through movement differs from the monotony of text and imagery and consequently the mixed media approach we have adopted makes the content more interesting and engaging. Videos in particular, add a personal tone to interviews and messages, and animations can simplify and add element of fun to interactions, resulting in more enjoyable learning experience. However, the module was design to be accessible by students, with medium performance computers. The minimum specification for computers to access the module was stipulated.

TECHNICAL ISSUES

Standard specifications for all web-based media were considered for a versatile technical design. The specifications applied ensured that the content was accessible to low technology setups and considered Internet connection speeds, download quotas and browser compatibility. The framed HTML nature of the Blackboard environment as well as having to accommodate the minimum screen sizes of small laptops were factors that influenced the visual sizes of media we adopted. All media were embedded within HTML code to reduce the likelihood of materials being illegally copied and distributed.

Considering all the above, three technical specifications were stipulated as presented below. These specifications are coded T-1 to T-3 to allow cross-referencing to subsequent sections.

- T-1. Images¬ & Text – Embedded into Scribd document. Raster images as JPEG format, Vector images saved as jpeg. Scribd document layout designed in Microsoft Word with its size not to exceed 1024 px x 350 px.
- T-2. Animation – Adobe Flash (SWF) embedded into HTML at 15 frames per second.
- T-3. Video – 640px x 360px, Flash Video Format (FLV) streamed from a server and played through an embedded FLV Player. Video compression not to exceed 2Mb/minute of video.

MODULE CONTENT AND STRUCTURE

The aim of the orientation content is to prepare students for their online learning studies. Before the first learning unit starts, there is an introduction explaining the software requirements and how to navigate through the module. The module has been designed by clustering essential orientation information into discrete units. All units start with an animation as an introduction. Based on the requirements analysis described above, six

key areas of content were identified: Introduction, Getting Started, Learning Environment, Learning Support, Policy @ Newcastle and Social Environment and Feedback.

Learning unit 1 – introduction

This unit includes a welcome message by key university people (academics and administrators) and introduces students to various aspects of their university life. The use of video recordings personalizes the introduction of staff and engages the students. This unit provides distance-learning students with similar information to on-campus students about key university roles. Messages from the Head of Discipline, Pro-Vice Chancellor, Head of School, Program Convener, Assistant Registrar (Academic), and School Executive Officer are included in the unit.

Learning unit 2 – getting started

This unit is focused on managing the expectations of students. It provides information and strategies to help them organize and manage their work-study-family-social demands to avoid them developing unrealistic expectations. Students often struggle to manage their studies. Explaining how important time management and planning is might help, as many students do not appreciate the time required to review materials online, engage in tutorials, and complete the various assignments required of them. This unit also exposes students to the university's expectations. Completing this unit alerts students to the need to manage their workload, and might influence some to study fewer subjects. Distance learning requires considerable online activity, and familiarity with a diverse range of software assists students markedly. Therefore, this unit also assesses students' computer literacy skills and highlights the skills they may need to develop to engage in online studies.

Learning unit 3 – learning environment

The BCM program is delivered in mixed mode. Commencing students who are not familiar with the teaching and learning environment often struggle to get started with their studies. This unit informs students about online learning strategies that support their learning. It also provides information that assists them to adapt to Problem Based Learning. It presents the terminologies, procedures and strategies associated with the BCM program's mode of delivery. The unit starts with a description of the learning environment, followed by five videos explaining different aspects of the learning environment.

Learning unit 4 – learning support

This unit provides information that helps students enhance their learning. It refers them to the resources provided by the university through the Teaching & Learning Centre. An introduction to the library resources available for DL students is presented through a video clip. Another video clip shows the Student Academic Conduct Officer (the academic responsible for dealing with cases of alleged plagiarism). This helps students familiarize themselves with key academic integrity issues underpinning their studies.

Learning unit 5 – policy @ Newcastle

Some students do not have a clear understanding on how university policies impact on their university life. This unit exposes them to the key policies that provide a legislative framework that supports them through their studies. Most students are overwhelmed by the university's policy maze. This unit targets selected policies including applications for credit, enrolling/withdrawing from a course, academic integrity, complaints, appeals against final results, and special circumstances.

Learning unit 6 – social environment and feedback

This unit introduces students to all teaching staff and the on-line student guidance mentor (Williams 2009). It also provides ways for students to meet and engage other distance learners in matters of interest. Finally, it invites feedback on the orientation module. At the end, students are provided with a downloadable list of important contacts as well as links to teaching and learning support facilities offered by the University of Newcastle.

VISUAL DESIGN OF THE MODULE IN THE CONTEXT OF PEDAGOCIAL AND TECHNICAL REQUIREMENTS

Images of selected screen shots from the Online Orientation Module are presented below to illustrate the range of different technical and pedagogical requirements. They also illustrate how the module provides an engaging environment by including a variety of digital formats. All screen shots were taken from a 15" lap top screen, and this demonstrates how the visual design enables easy navigation on small screens (Requirement P-5).

Figure 1 illustrates how similar themed contexts were pooled into learning units and how the sub-structure within the learning units were organised into logical sequences. This provides an example of how P-1 and P-2 were integrated within the Blackboard environment.

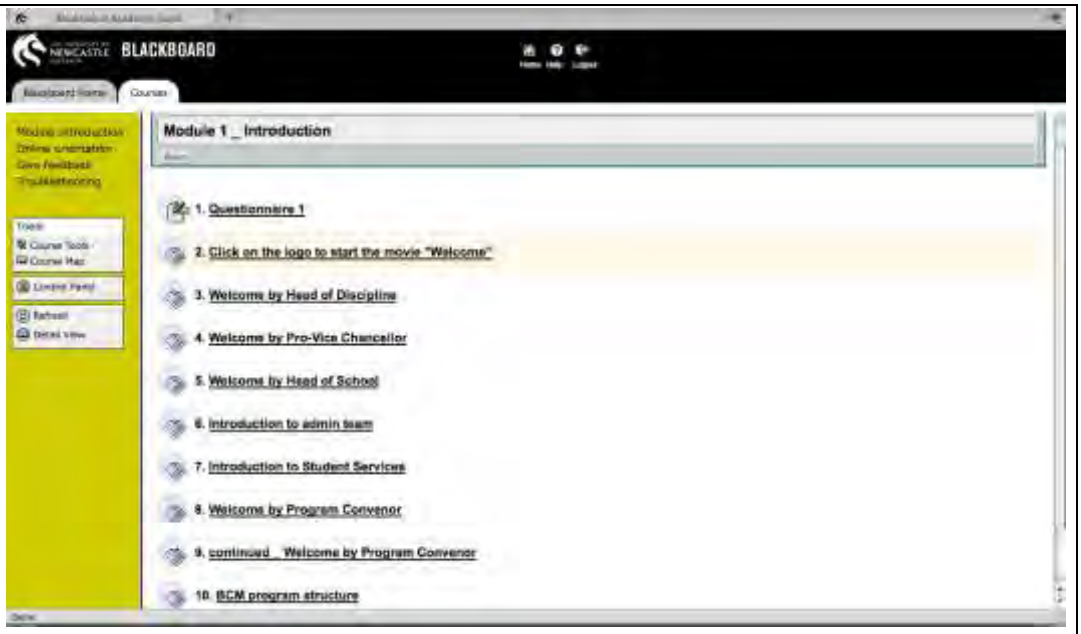


Figure 1 – Illustration of how the context was structured within learning units

Figure 2 illustrates how a Blackboard quiz was used to assess students' understanding of the content relating to the learning environment. Completion of the quiz was used to trigger the adaptive release of the succeeding learning unit. This screen illustrates how P-2 and P-3 were delivered in the design of the online orientation module.

Figure 2 – Illustration of how quiz was used to self assess students' understanding

Integrating Scribd within Blackboard for easy navigation of content is illustrated in Figure 3. This example shows how T-1, P-4 and P-5 were integrated in Blackboard. The Scribd documents allow pages to be turned over on screen.

Figure 3 – Illustration of how Scribd documents were used to present text within BB

How animations were utilized in Blackboard and used as an introduction to each learning unit is illustrated in Figure 4. This shows how T-2, P-1 and P-4 were integrated within Blackboard.

Figure 4 – Illustration of how animations were used to introduce each learning unit

Figure 5 illustrates how videos produced in house were integrated into Blackboard. A number of video clips were used in the online module to deliver key messages. This illustrates how T-3, P-1 and P-4 were integrated within Blackboard.

Figure 5 – Illustration of how videos were embedded into BB to deliver key messages

CONCLUSIONS

Effective transition of commencing students to the university environment is critical to retaining them and maintaining their satisfaction. Universities channel significant effort into designing and delivering orientation programs for on-campus students but these are largely inaccessible to DL students. Designing a university wide orientation program that addresses the concerns of all on-campus as well as DL students is a challenge. DL students miss out on critical information and assistance that may transform their approach to university life. This paper reports on the design of an online orientation program, developed to orient DL students in the BCM at UoN. The requirements analysis identified five pedagogical requirements and three technical requirements. The design of the module fulfilled all the requirements. The content was clustered into six learning units and was delivered via multiple formats, including multi media. Quizzes were used to test students understanding of key concepts impacting their university life.

REFERENCES

Bergmann, M. and Raleigh, D. (1998) Student Orientation in the Distance Education classroom, Proceeding of the annual conference on distance teaching & Learning.

Bozarth, J., Chapman, D.D. and LaMonica, L. (2004) Preparing for Distance Learning: Designing An Online Student Orientation Course. *Educational Technology & Society*, 7 (1), pp. 87-106.

Kanuka, H. and Jugdev, K. (2006) Distance education MBA students: an investigation into the use of an orientation course to address academic and social integration issues. *Open Learning*, 21 (2), pp. 153-166.

McCain, L.A. and Miller, K.L. (2008) Creating an IT Orientation Video for New Students at Indiana University, SIGUCCS'08.

McVay, M. (2000) Developing a Web-based Distance Student Orientation to Enhance Student Success in an Online Bachelor's Degree Completion Program, Nova Southeastern University, p 121.

Miller, M.T. and Pope, M.L. (2003) Integrating Technology Into New Student Orientation Programs At Community Colleges. *Community College Journal of Research and Practice*, 27, pp. 15-23.

Scagonoli, N.I. (2001) Student Orientations for Online Programs. *Journal of Research on Technology in Education*, 31 (1), pp. 19.

Sher, W. and Gajendran, T. (2008) Evaluation of modes of electronic delivery of construction management courses, Proceedings of the 19th Annual Conference for the Australasian Association for Engineering Education, Yeppoon.

Sher, W.D., Brewer, G.J., Gajendran, T. and Williams, A.P. (2008) Mixed-mode delivery of construction management degree programs, Conference Proceedings: BEAR 2008: Building Resilience, Heritance Kandalama, Sri Lanka.

Stevens, T. and Switzer, C. (2006) Differences between online and traditional students: A study of motivational orientation, self-efficacy, and attitudes. *Turkish Online Journal of Distance Education-TOJDE*, 7 (8).

Williams, A.P. (2009) The impact of virtual mentoring on first year engineering students, Proceedings of the 20th Annual Conference for the Australasian Association for Engineering Education, Adelaide, SA.

Williams, A.P., Sher, W.D. and Simmons, C.A. (2009) Balancing changes to construction education in the 21st century: Exploring the challenges construction educators face in Australia', 34th Australasian Universities Building Educators Conference (AUBEA 2009), Barossa Valley, SA.

Williams, T., Sher, W. and Brewer, G. (2008) From distance to online to blended: A programme's journey, EE2008: The International Conference on Innovation, Good Practice and Research in Engineering Education Conference Proceedings, Loughborough University, England.

Wozniak, H., Mahony, M.J., Pozzica, J. and Koulias, M. (2007) How do students 'get leaning'? Unexpectedly diverse pathways in an activity based, online orientation site, Proceedings ascilite Singapore.

Disaster Recovery: The Role of Pre-Planning and Temporary Housing

George Zillante, William Howie and Jian Zuo
School of Natural and Built Environments
University of South Australia, Adelaide, Australia

ABSTRACT

Disasters, both natural and unnatural are capable of destroying cities in a matter of seconds. The built environment of a city can take years to develop and within moments be taken away. Disasters obviously have enormous human costs, but for those who survive there are huge amounts of work to restore what was taken away. This research focuses on identifying how the construction industry is currently dealing with the disaster recovery projects. A questionnaire survey was conducted in order to understand stakeholders' perceptions on disaster recovery. Particular focuses were placed on the role of preplanning and temporary housing during the disaster recovery process. The results found that both temporary housing and preplanning play a critical role in a speedy recovery from disaster and more importantly to improve the resilience of the community to disasters.

KEYWORDS

disaster recovery, pre-planning, temporary housing, Australian temporary housing

INTRODUCTION

Disasters occur across the world, and there is often little or no warning the disaster is coming. Once they strike they often leave in their path much damage to the natural and built environments. Research published by The Centre for Research on the Epidemiology of Disasters shows the catastrophic effects of disaster that the following losses occurred as a result of disasters: (1) more than 235,000 people killed; (2) 214 million people affected; (3) economic cost of $190 billion in year 2008 (CRED 2009). Recovery is defined as „the coordinated efforts and processes to effect the immediate, medium and long term holistic regeneration of a community following a disaster' (Norman, 2006). It encompasses: (1) minimization of any escalation resulting from the disaster; (2) regeneration of the wellbeing of individuals; (3) taking opportunities to meet future needs; and (4) reducing exposure to future hazards and the associated risks. Similarly the Emergency Management Act 2004 defines recovery as the means and measures taken during and after an emergency to assist the re-establishment of normal life (Government

of South Australia 2009). It includes: restoration of what is damaged and provisions of new to replace that which is destroyed. Clearly following a disaster there must be sufficient recovery efforts so as to rebuild and repair what has been destroyed. This recovery effort requires cooperation between community and Government, and will heavily rely on the construction industry in the rebuilding phase.

LITERATURE REVIEW

Temporary housing

Disasters have the ability to destroy much of the built environment, and this includes the homes in which people live. Once a part or a whole town is destroyed in this way, the question arises of what to do with the people who have been misplaced by the disaster. Hayles (2010) pointed out that housing recovery will go through four stages, i.e. emergency shelter, temporary shelter; temporary housing and permanent housing. Of the four stages outlined, temporary housing can be seen as a vital stage as it bridges the gap between the initial shelter and reconstructed permanent housing. Tas et al. (2010) stressed that these four stages should be carried out seamlessly so that the transition can be kept as brief as possible.

According to Johnson (2007, p.436), the temporary housing is both "a stage in the process of rehousing after a disaster", and "a physical type of housing stock used by families during the post-disaster period". It is evident that temporary housing is a vital step in reconstruction. How long the temporary housing is to be utilised before a return to permanent housing can and does differ from event to event, however regardless of the length of time it is required for, the temporary housing stage is vital. Also, as Johnson (2007) implies, the temporary housing system is within an immediate and broader environment and will ultimately contribute to not just the immediate recovery but the long term reconstruction and recovery of the broader community.

It is becoming increasingly difficult to ignore the effect on success levels within housing recovery projects that community involvement has. The involvement of the community in temporary housing projects has been shown to have positive effects; however it is systematically problematic (Ganapati & Ganapati 2009). Through examination of two questions surrounding this area in a case study on temporary housing projects in Turkey following the 1999 earthquakes, Ganapati & Ganapati (2009) found that through too narrowly defining the ‚public' invited to participate many key stakeholders were neglected, meaning their input was missed and therefore the benefits they could instil in the project were ignored. Similarly, Spaling & Vroom (2007) found that purposeful participation in the reconstruction process by the community provided an opportunity for

the project beneficiaries to be involved in the decision making where they may otherwise have not had a say.

For community involvement to be successful in temporary housing projects it needs to occur at the correct stage. When participation occurs at a late stage of the project there can be frequent problems either with the process or outcomes of the project. Conversely when their involvement is implemented in the upfront stages there can be important impacts on the project which carry long-term advantages to themselves and other stakeholders (Davidson et al. 2007). Furthermore the amount of community involvement in a project should be in accordance with the extent allowed by the scale and context of the particular situation, and therefore is not simply an all or nothing approach (Lawther 2009).

Preplanning

Previous studies into the effect of government legislation into reducing the impacts of natural disasters have highlighted that improved codes and legislation can have significant effects on disaster reduction (Spence 2004). However, the difficulty of applying such codes and legislations can often be too complex. Spence (2004) argues that simpler codes with deemed to satisfy approaches could in many ways be a step forward.

One problem associated with government legislation and reconstruction projects is that the legislation applied to routine construction, but little provisions made for areas of reconstruction. That is the legislation is not equipped to cope with emergency situations, Rotimi et al. (2008) highlighted the following effects of legislation on reconstruction:

- Loss of momentum in reconstruction projects due to restrictive legislation and lacking government commitment
- Inability to apply pragmatic solutions to real-time reconstruction problems resulting in loss of commitment
- Difficulties in achieving project deliverables and inability to accelerate the process
- The impairment of community recovery/quality of life

There appears to be a relationship between areas highlighted as potential disaster risk areas, and higher insurance premiums creating a trend which is increasingly seeing higher levels of poor site selection and development planning (Comerio 2004). Conversely, Spence (2004) argues that there is considerable potential for insurance schemes to enforce codes and legislations by requiring these items as preconditions for insurance.

An in depth and integrated approach is required within the construction decision making process, and resilience needs to be built in to planning, design and construction processes.

Bosher et al. (2007) argued that in order to reduce the destruction of disasters, greater emphasis and awareness needs to be added to systematically building in resilience into construction. Similarly, the planning of disaster relief efforts is a vital component of the projects success. As effective relief and recovery from disaster requires a more comprehensive and quicker response than is required for traditional projects, planning the efforts before they are undertaken is vital, as „failing to plan is planning to fail' (Rapp, 2009, p.19).

To date there have been various methods introduced to coordinate disaster recovery methods. There is a consensus within disaster management organisations that collaborative and coordinate approaches are necessary for successful recovery but there is little agreement at present to the means of achievement. It is argued that Habraken's theory of a hierarchical control model provides a sound basis for the development of an approach to disaster management (Hewitt et al. 2008). According to Hewitt et al. (2008, p. 2), Habraken's hierarchical control model defines the hierarchy of "the physical structure of the urban environment" whereas "built form and human agency exert control over the process of change, with the degree of control corresponding to their level within the hierarchy".

To minimize the effect of disasters in terms of monetary costs, it is vital to ensure that the built environments ability to withstand disasters is maximised, and that they are resilient. Gingie et al. (2010) highlighted the importance of highlighting gaps where the built environment is weakened in order to ascertain where enhancements are necessary. Through disaster risk assessment, training, framework and developing skill and knowledge in disaster mitigation and reconstruction, these gaps can be found and lessened. The common gaps found by Gingie et al. (2010) include deficiencies and complexities in legislation, inadequate funds, and lack of community participation.

RESEARCH METHODOLOGY

The purpose of this study is to investigate the disaster recovery process from the replanning and temporary housing perspective. The surveys were distributed to organisations operating within the following fields:

- Government
- Non-Government Organisations
- Consultants – Architectural and Engineering
- Contractors
- Planners
- Industry Bodies

- Emergency Recovery Authorities
- Disaster Recovery Authorities

The survey questionnaires were distributed to those in charge of the organisation in the first instance, general manager/managing director or similar for their allocation to relevant personnel at their discretion. The organisations selected were based on their experience with reconstruction and recovery projects. In particular experience with temporary housing, and or pre-planning activities and government legislation was preferable. Survey questions were generally closed, with further questions for explanation and further information provided. Initial contact to participant organisations was made through telephone and email. Follow up emails and phone calls were required to encourage the responses. 120 questionnaires were sent out and 42 were received.

RESULTS

Community involvement in temporary housing

The amount and type of community involvement within temporary housing projects is a vital aspect, and will contribute to the amount of success the project experiences. Respondents were asked to rank the levels of involvement as they felt appropriate. Results were shown in Table 1. Majority of respondents stated there should be some community involvement to some degree. The vast majority believed the involvement would need to be dependent on the circumstances of the project and for it to be successful needed to be purposeful.

Table 1 – Community involvement in temporary housing

	Responses	**Ranking**
Limited	**2**	3
None	**1**	4
Purposeful	**14**	2
Dependent on individual circumstances of the project	**25**	1

According to respondents, the location for the temporary housing is as an area that requires involvement from the local community and council; however it is vital for the coordinating authority in charge to get the temporary housing established as quickly as possible in most instances. Therefore the amount of community involvement may be limited due to this factor. Comments made by respondents in the questionnaire are:

> „local input to living conditions is vital to ensure acceptance and longevity of the project';
>
> „hands on by affected person's aids in both the physical and personal recovery aspects'; and

„in extreme circumstances the community may be unable to make decisions, and in these extreme circumstances the Government needs to step up and take over the decision making'.

Management of temporary housing projects

Good management of any construction project is vital to its success, when considering the importance of time as in temporary housing projects, this is amplified severely.

Table 2 – Management approaches

	Responses	**Ranking**
Centralizing Management Approach	**23**	1
Ad Hoc Organisational Structure	**0**	4
Habrakens Hierarchical Control Model	**14**	2
Owner Driven Management	**5**	3

As shown in Table 2, there were mixed views as to which management system is best for temporary housing projects. There were certain approaches that were however clearly favoured by the respondents with centralizing seen as the preferred approach and an ad hoc model as least preferred. An owner driven approach was also regarded as an appropriate management method for temporary housing to allow the future inhabitants to take ownership of their dwellings.

The extensiveness of the disaster can affect the ability of the community to make decisions immediately after the disaster. This was reflected in the majority of results, and the reasoning behind the respondent's choices. There was a strong view amongst respondents that a centralizing approach should be preferred to ensure that administering procedures are tried, tested and proven, and can be refined with each disaster. Similarly to the level of community involvement, there was a belief between respondents that the management system should and will be determined by the actual incident; and that duration, weather, degree of damage, volume, geography, community resilience and capacity will affect the decision on management type.

Most respondents agreed that an ad-hoc arrangement was unsuitable and could potentially lead to the detriment of the project. Lessons learnt from previous projects should be incorporated in to the planning and management, that way with each project tried and tested methods can be incorporated within the management.

Re-use and recycling potential of temporary housing

There is general consensus from survey respondents that there is a great potential for the recycling and or re-use of temporary housing. There were a variety of views on how best to go about this and what steps needed to be taken to allow for it.

As shown in Table 3, respondents viewed rehabilitating for re-use and relocation as the most suitable approaches to deal with temporary housing. In contrary, salvaging materials and their subsequent reuse is not a preferred option. Respondents explained in the questionnaire that the temporary housing units are often not designed to last for a long time frame.

Table 3 – Reuse alternatives

	Responses	**Ranking**
Salvage and re-use materials	**2**	4
Upgrade to be used as permanent housing	**10**	3
Relocation for similar usage	**16**	1
Rehabilitation of the housing for re-use	**14**	2

An example was provided by one respondent whereby historically America has re-used and upgraded its temporary housing stocks to be used as permanent housing for low socio-economical housing in housing estates. Potentially if the temporary housing is at a standard that is compliant it could be re-used in this type of situation as it would make sense to re-use it in this instance.

Government legislations and preplanning

Generally there was a common theme amongst survey respondents that the amount and complexity of Government Legislation was a hindrance on reconstruction projects. It was suggested that there is a requirement for more pre planning for disaster, particularly bushfires as one survey respondent stated „more pre-planning by the Government for bushfires is essential, as indications suggest they will become more frequent.

Table 4 highlighted the effect of Government Legislation and pre planning efforts on the reconstruction process. Respondents are of the view that the complexities of Government Legislation often causes the delay of the overall project, and that pre-planning will greatly improve and expedite the reconstruction project. Further studies is required to identify the direct examples where legislation as a hindrance to a recovery response through a qualitative approach.

Again there was an idea that the amount of government legislation should be dependent on the individual circumstances of the disaster and resulting reconstruction project requirements. Furthermore one survey respondent highlighted the approval and procurement stages as ones in which Government Legislation is typically a hindrance, and stated „emergency procedures should allow people charged with building temporary housing to waive (within reason) the normal procurement approval processes'.

Table 4 – Complexities of government legislation

Statement	Response					Ranking
	Strongly Disagree	*Disagree*	*Neutral*	*Agree*	*Strongly Agree*	
The complexities of Government Legislation hinder the reconstruction process.	0%	40%	0%	40%	20%	7
Approval and certification for reconstruction projects should not be subjected to the same requirements as regular projects are to allow for speedy recovery.	20%	0%	20%	40%	20%	6
The current legislation is inadequate in terms of pre-planning and mitigation of disasters.	10%	30%	20%	30%	10%	8
Failing to plan is planning to fail in reconstruction projects.	0%	0%	10%	40%	50%	1
A well thought out and thorough plan will contribute to a successful reconstruction project.	0%	0%	0%	80%	20%	2
Planning for disasters should be implemented throughout all types of construction in a more meaningful way.	0%	0%	20%	60%	20%	3
Disaster risk reduction should have a more integrated role in construction professionals.	0%	0%	20%	60%	20%	4
There should be separate legislation for reconstruction projects due to time constraints and urgency.	0%	10%	30%	40%	20%	5
At current the level of integration of disaster risk reduction within construction is inadequate.	20%	20%	50%	10%	0%	9

There was a strong view from respondents that more legislation was required in the pre planning and mitigation of disasters. Further legislation like the BAL Ratings is required to allow home builders to mitigate against the risks of disasters. The Bushfire Attack Level (BAL) is the new building standard assessment which has six levels of risk, from low to flame-zone. The six levels of BAL ratings determine whether or not a temporary house is suitable for re-use as permanent housing. One respondent stated that „people and Government circumstances change, and we have very inflexible policies in regard to temporary housing which require review in the near future'. Therefore it may be prudent to conclude that rather than new legislation being implemented, a review of the parties involved may be the first step to improve the reconstruction process and remove the hindrances that exist in the current environment.

CONCLUSIONS

A disaster is an event which requires external system due to its overwhelming nature above and beyond that of the local capacity. Disasters can be natural; fire, landslide, floods, hurricanes etc. or manmade such as terrorism. They are capable of destroying the natural and built environment in a matter of minutes, leaving behind a long road to recovery. The recovery process is an arduous process, and the construction sector has an important role to play in this process. This research adopted a quantitative approach to investigate the role of temporary housing and preplanning in disaster recovery process. The results showed that there should be a certain level of community involvement in both temporary housing and preplanning. In terms of reuse and recycle potentials of temporary housing, rehabilitation for reuse and relocation for similar usage are perceived as most appropriate approaches. Similarly, there is room for improvement for the government legislation to avoid the delays of recovery process whereas preplanning plays a critical to make a community disaster resilient.

REFERENCES

Bosher, L., Dainty, A., Carillo, P., Glass, J. and Price, A. (2007) „Integrating disaster risk management into construction: a UK perspective', *Building Research and Information*, Vol. 35, No. 2, pp. 163-177.

CERD. (2009) Annual Disaster Statistical Review 2008, Centre for Research on the Epidemiology of Disasters, June 2009.

Comerio, M. (2004) „Public policy for reducing earthquake risks: a UK perspective', *Building Research and Information*, Vol. 32, No. 5, pp. 403-413.

Davidson, C., Johnson, C., Lizarralde, G., Dikmen, N. and Sliwinski, A. (2007) „Truths and myths about community participation in post-disaster housing projects', *Habitat International,* vol. 31, pp. 110-115.

Ganapati, N. and Ganapati, S. (2009) „Enabling participatory planning after disasters', *Journal of the American Planning Association*, vol.75, no. 1, pp41-59.

Ginige, K.N., Amaratunga, R.D.G. and Haigh, R.P. (2010) Enhancing capacities for disaster mitigation and reconstruction in the built environment, in: CIB 2010, 10th - 13th May 2010, University of Salford.

Government of South Australia. (2009) South Australia Emergency Management Act 2004, Adelaide, Australia.

Hayles, C. (2010) „An examination of decision making in post disaster housing reconstruction', *International Journal of Disaster Resilience in the Built Environment*, Vol.1, No.1 pp.103-122.

Hewitt, J., Potangaoa, R., and Wilkinson, S. (2008) „The role of urban change hierarchies in post-disaster recovery management', Building Resiliance, I-Rec 2008.

Johnson, C. (2007) „Strategic planning for post-disaster temporary housing', *Disasters*, Vol.31, no.4, pp. 435-458.

Lawther, P. (2009) „Community involvement in post disaster re-construction – case study of the British Red Cross Maldives Recovery Program', *International Journal of Strategic Property Management*, vol.13, pp.153-159.

Norman, S. (2006) „New Zealand's holistic framework for disaster recovery', *The Australian Journal of Emergency Management,* vol.21, no.4, pp.16-20.

Rapp, R. (2009) "Complex Urgency: Recovering From Katrina and Wilma", Cost Engineering, 51(12), pp.19-24.

Rotimi, J., Wilkinson, S., Myburgh, D. and Zuo, K. (2009) „Legislation for effective post-disaster reconstruction', *International Journal of Strategic Property Management*, Vol. 13, pp.143-152.

Spaling, H. and Vroom, B. (2007) „Environmental assessment after the 2004 tsunami: a case study, lessons and prospects', *Impact Assessment and Project Appraisal*, vol. 21, no.1, pp. 43-52.

Spence, R. (2004) „Risk and regulation: can improved government action reduce the impacts of natural disasters?', *Building Research & Information*, Vol. 32, pp.391-412.

Tas, M., Tas, N. and Cosgun, N. (2010) „Study on permanent housing production after 1999 earthquake in Kocaeli (Turkey)', *Disaster Prevention and Management*, vol.19, no.1, pp.6-19.

A Conceptual Framework of Web 2.0-based Interactive Portal for Improving Learning and Teaching in Construction Curricula

Patrick XW Zou and Xiangyu Wang
Faculty of the Built Environment
University of New South Wales, Sydney, Australia

ABSTRACT

This paper presents a conceptual framework of a web 2.0-based Portal, which will be a repository of thousands of construction project digital images accessible with an interactive interface. This paper also discusses the advantages, design schema and contribution to knowledge base of using this Portal for teaching staff and students. This repository conceived from educational literatures aims to provide full access to construction-related digital materials. The Portal will be adopted in the real educational environments, in particular, construction technology courses and its effects will be evaluated through interviews and surveys via a pre-test-post-test methodology.

KEYWORDS

construction education, construction technology, digital image, Web 2.0, learning portal

INTRODUCTION

A good deal of investigation and development is underway in the Australian universities into the possibilities for effective and efficient online learning and online assessment, which is a natural outcome of the increased use of information and communication technologies (ICT) to improve learning and teaching. There are many reasons why online learning and online assessment have been being adopted by the Australian universities. As more and more students seek flexibility in their courses, it is unavoidable that there will be growing expectations for flexible learning and assessment. Further, many teaching staff are seeking to diversify assessment tasks to cover more assessable skills and giving more timely and informative feedback to students along their progress. However, they are experiencing a large number of technical and pedagogical issues.

During the past decade, digital images, by replacing analogue images, have become a major element in the rapidly evolving educational landscape, but how does the use of these new digital formats contribute to the changing practices in teaching and learning in construction higher education? How to develop a database that is dynamic, editable and searchable by students? The main purpose of the conceptual framework presented in this

paper is to build both a knowledge base of such practices and an active online community (a Portal) for teaching staff and students using digital learning materials that includes images, text, video clips, animations etc.

Generally, the extents and sizes of individual collections of digital images and digital texts are usually large. Most teaching staff would save images on their own computers, in the format of picture files or in PowerPoint, and unfortunately they do not have enough time, resources, knowledge and expertise to organise and manage these images. This fact raises technical support issue. The University of California, Berkeley study (Harley 2006) noted the need for an effective tool that could create and manage personal digital libraries, aggregating and integrating heterogeneous resources for re-use. The authors believe that most teaching staff could be adrift until these technical promises can be fulfilled. There is a clear connection between inadequate technical support and underuse of digital learning materials such as images provided by both teaching staff and students.

A review of the relevant studies of the use of digital images for teaching and learning yields the following three particular projects: Pennsylvania State University's "Visual Image User Study" (VIUS) (2003) examined the needs of digital image users across its campuses in order to design an effective image delivery system; The UC at Berkeley's "Digital Resource Study" (Harley 2006) focused on how to produce better and more well-used digital resources; RLG's smaller study, "Out of the Database, Into the Classroom," reported on its efforts at improving the usability of its own Cultural Materials image database. However, there are no noted research efforts in using digital images to enhance the learning and teaching in construction higher education.

THE NATURE OF CONSTRUCTION TECHNOLOGY COURSES

To improve learning and teaching of construction technology courses, firstly we have to understand the features of construction technology courses and argue why digital images are particularly important for students' learning and understanding. The learning aims and learning outcomes should be the main focuses. The typical courses in construction technology knowledge domain aim to help students develop knowledge in relation to the technologies and processes used for building construction, including foundations, structure skeletons, cladding (enclosure), interior fitouts, material handling strategies and formwork selection. They also aim to develop students' critical, creative and analytical skills, with particular application to the decision-making or problem-solving processes involved in the construction of buildings (Zou 2007a). The major learning outcomes in a construction technology course include demonstrating an in-depth understanding of construction processes and technologies, evaluating such processes and technologies and develop and apply solutions to practical problems, and demonstrating the ability to

specify and manage the construction processes and applications of various construction technologies and selection of construction materials (Zou 2007a). The major challenges of teaching construction technology courses are related to the course's practical emphasis, including comprehending the complexity of buildings and the interactions between different elements and components of buildings, understanding and making wise decisions about and choices from many alternatives (including materials, technologies and processes) for a particular practical scenario, and solving technical problems during the process of construction (Zou 2007a). The course also presents the teachers with practical challenges, particularly in relation to helping students apply their theoretical understanding of detailed construction processes to enhance their practical understanding and skill development. The practical nature of the course has therefore driven the introduction of visual aids teaching strategies.

PERCEIVED AVANTAGES OF USING DIGITAL IMAGES PORTAL IN TEACHING AND LEARNING

The proposed Digital Image Portal could be an open access free interactive online space for teaching staff, tutors and students to have access to construction-related digital images for the following purposes: preparation of lecturing notes, texts and quizzes, students' assignments and projects, interactions with students, class presentations, student review, after-class discussion, or for any other purpose. There will be a number of advantages for teaching staff to use digital images portal in teaching. The Portal particularly could enable teachers to develop more engaging visual aids to support more straightforward explanations of teaching materials, especially for abstract concept and process in construction technologies. The portal could also allow students to contribute to the learning experience, and provide them the best possible support for ongoing and future studies. Each digital image could be tagged with a number of pre-defined keywords that categorize them into different subjects based on the nature and contents of the digital images. A powerful database could be used to store and categorise the images. Users can search the desired pictures through entering different keywords, or combination of keywords. More interestingly, users can edit, upload and add images to the database as well as an author, which makes the Portal more like a Wikipedia, an authoring tool, not only acquiring information but also authoring and contributing information that can be shared and used by others.

Digital images could help make subject areas understandable for students. In construction, good images can greatly improve the accessibility of most construction methods concepts. Digital images could also provide ease of use in assignments and quick availability after field trips or labs. In addition, students will be able to sharing their

own project images they took on their own or during class visits to construction sites. They will be able to upload and share the photos of a construction site and construction progresses they have taken in their project-based learning/case study.

With the help of the Portal, more images will be accessible. The portal could provide a large variety and volume of images that teaching staff can use and retrieve. For instance, teaching staff are able to involve students' firsthand observations for construction curriculum. Moreover, the Portal could make the teaching process more efficient. It also provides greater interactivity as a result of greater variety of material and images.

THE PROPOSED CONCEPTUAL FRAMEWORK

The conceptual framework proposed in this paper aims at the following three main aspects: improving students' understanding and learning, pedagogical innovation, and online assessment. Before the framework was conceived, the authors investigated the graduate attributes defined at University of New South Wales (UNSW 2003) in order to best align the spirit of the framework with the graduate attributes. Graduate attributes are the qualities, skills, and knowledge a university community agrees that its students should develop during their time with the institution (UNSW 2003). Two graduate attributes were identified, which, by adopting the Portal, they can be enhanced, which were also emphasized by Zou (2008) in his article "Working together to achieve graduate attributes of our students":

1. *Analytical and problem-solving skills:* To demonstrate these qualities to an employer, the students emphasised the importance of effective decision-making, particularly in challenging situations. They thought that assignments with real-life relevance and applications would be most helpful as a means for developing these qualities during their studies. The project-based learning approach is identified to be an appropriate method for students to gain analytical and problem-solving skills.
2. *Knowledge of contents:* To demonstrate content knowledge, students could discuss relevant examples from their experience and studies as well as provide accurate solutions to problems faced by the employer. They also thought that hands-on, practical examples of industry problems in class, as well as workplace visits and guest lecturers from industry would help them develop these skills. Participants also emphasised "in-depth information about particular theories in the discipline". The project-based photo repository in the Portal provides the appropriate, concrete and touchable resources of creating such real and practical context for students to better understand and learn the knowledge behind a specific abstract concept or process.

The framework was conceived to improve the above two students' skills. The Portal can improve students' learning outcomes and experiences, especially "project-based learning" and online assessment, which will be used to drive and motivate students with self-learning. The online resources developed from this project will be used to help student learning such that to take the online assessment tasks and conduct online discussions.

Information and communication technology (ICT) has been widely used in education in recent years in terms of online resources, interaction and communication (Alexander, 2006; Kolo & Breiter, 2009). The use of digital portal can significantly improve students' learning outcomes and experiences as shown in the conceptual framework depicted in Figure 1. It aims at improving students' learning experience and outcomes via the online learning platform, which stores and shares online resources among students. Furthermore, the platform also collects data from students' learning style, learning behaviour and learning outcomes and therefore builds a student database, which can provide a personalised database to each individual student.

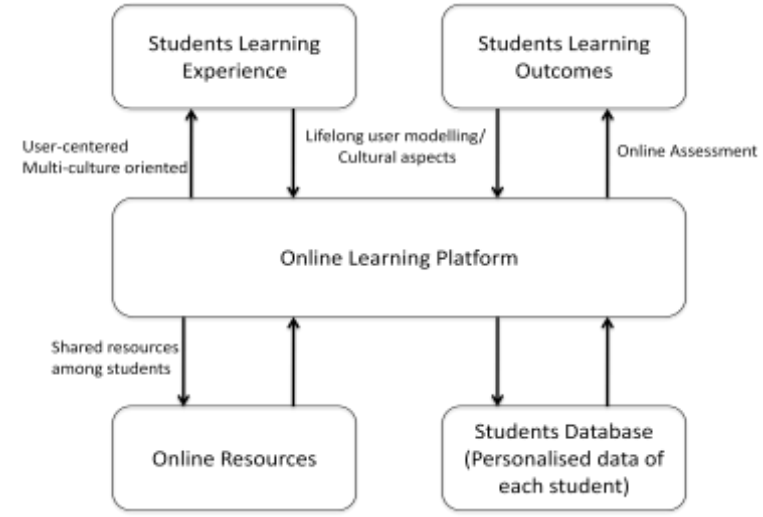


Figure 1 – Proposed framework of the interactive online learning portal

The Portal will be an open access free interactive online space for teaching staff, tutors, and students, to have access to construction project-related digital images for the following purposes: preparation of lecturing notes, students' assignments and projects, interactions with students, class presentations, student review or study, texts and quizzes, after-class online discussion or for any other purpose. As mentioned in previous section, there will be a number of advantages for teaching staff to use digital images portal in teaching. In particular, the Portal particularly could enable teachers to develop more engaging visual aids to support more straightforward explanations of teaching materials, especially for abstract concept and process in construction technologies. The portal also

could allow students to contribute to the learning process, and provide them the best possible support for ongoing and future studies.

The fundamental feature of the conceptual framework is its user-centred (i.e. student centred). For example, at the very bottom layer of the portal, it captures and stores "student database which is personalised data of each student); it also allows students to share resources among themselves. At the top layer, the portal aims at student learning experience and outcomes by encapsulate the principles of "user-centred" and "multi-cultural-oriented" as well as life-long user modelling.

The Portal can also be an effective communication and collaboration platform for teachers to be a facilitator rather than an instructor to guide the student learning. The teaching staff can also use the Portal to frame questions of worth exploring, to structure meaningful tasks, to monitor students' learning progress, and to give timely and informational feedbacks.

This portal, apart from providing technical learning materials and resources, could also become a "fun" tool for students because they have the ability to add, edit and customise the learning contents. This means students interests and engagement to learning will be increased. Further, visual images can hold students better, as an old says goes "an image is equivalent to a thousand of words" and digital images are more accessible. According to the UNSW Guidelines on Learning that Inform Teaching (UNSW 2003b), effective learning is supported when students are actively engaged in the learning process, while activities that are interesting and challenging, but which also create opportunities for students to have fun, can enhance the learning experience; and students learning can be better supported by the use of multiple teaching methods and modes of instruction.

Application and implications

As mentioned in previous section, one of the learning objectives in construction technology courses is to demonstrate an in-depth understanding of construction processes and technologies. In order to facilitate the development of students' practical understanding and skills, it was found that site visits, and real life case studies are very important. Site visit gives students direct experience of the professional and disciplinary context of the contents they are studying in construction technology courses. However, due to the increasing number of class size, and the site-safety requirements, site visits has become not feasible and realistic. Spicer and Stratford (2001) studied the student perceptions of a virtual field trip to replace a real field trip. They concluded that students were extremely positive about the potential of the virtual field trip to provide valuable learning experiences. Under the circumstances where real site visits are not accessible

and realistic, virtual site visits through a serials of digital images in the Portal to form „virtual site visits' is very promising which is much better than words/texts.

The Portal could include and integrate e-text, illustrations, images, computer animations, video clips and online quizzes. For example, a serial presentation/slide show of pictures could allow students to view and understand the process of erecting the formwork needed in building construction. Students can pause, stop or re-play the demonstration as many times as they like. E-text descriptions could also be provided within the demonstration to help students understand the contents better. Because the demonstration in the Portal is a visual medium for hands-on interactive experience, it encourages active engagement and a practical rather than a theoretical perspective.

However, adopting the proposed Portal means a shift of the focus of the course. Particularly, teachers have to reconsider their pedagogy while transiting the course to digital images-oriented. For instance, teachers might have to spend more time redesigning and even revamping their classes to make them digital in both course materials and teaching and learning process.

Development of online assessment tasks and submissions

The Digital Image Portal could be used to develop online assessment tasks. It is commonly agreed that assessment is the single most powerful driver on learning in higher education. Assessment plays a central role in student learning whatever the mode of learning is. It is widely accepted that well-designed learning activities aligned with learning objectives are useful strategies contributing to successful learning and teaching in construction technology and management studies. Assessment focusing on lower-level cognitive skills such as true/false or multiple choice responses is prevalent used in online assessment but is questionable in a higher education environment. As mentioned before, the "real" project-based experience is much emphasized in construction technology courses which can be well communicated via digital media (the Portal). Therefore adopting the Portal as students' rich resources for project-based learning is envisaged to be effective in enhancing students learning and assessment. The Portal can help to devise richer online assessment tool to develop higher order cognition such as critical evaluation. The use of Portal-based online assessment to assess learning outcome toward subject objectives can take many forms including: Publication of documents on the web; Labelling of on-line pictures; Manipulation of online graphs; Completion of online quizzes.

It is also believed that project-based assignments are considered effective in demonstrating learning of technical contents. Unfortunately, most of the existing online assessment tools do not incorporate the conception of project-based assessments so far.

The proposed Portal could offer great potentials to present students with more complex pre-defined scenarios through the use of interactive resources (images, sound, simulation, and animation). The key point is to draw image resources from the Portal and then use them to devise more reflective and well-grounded questions for students to answer. From the perspective of students, their learning outcome can be better matched to the learning objectives through this way. The Portal could provide a reservoir for teachers to draw their appropriate images to help students to better understand the context of their test questions while designing the questions. This way, the answers provided by student are more reflective of their learned knowledge and those images associated with the questions can leave them deep understanding of the questions themselves, which in turn is an implicit way of learning as well.

PROPOSED METHODOLOGY FOR PORTAL DEVELOPMENT AND EVALUATION

The next step of this research includes three aspects: 1. to develop the portal, 2. to apply the portal to actual courses teaching and learning, and 3. to evaluate the effectiveness of the portal. This section provides brief discussion of such future work - the development methodology of the Portal and the evaluation methodology for the learning effectiveness via the Portal.

Portal development methodology

The growing amount of multimedia content and the heterogeneous access points of the conventional Web 1.0-based content management system (e.g., WebCT and Blackboard) inhibit efficient search and navigation, making it difficult for learners to find relevant contents. Conventional e-learning systems such as WebCT and Blackboard struggle with heterogeneity and the distribution of content and metadata over several repositories. The systems currently in use dominantly do not consistently support desirable features such as full-text search across all media types, or browsing based on taxonomies that adapt to new content. Furthermore, the rapid development of Web 2.0 technology has brought us from Web 1.0 into the era of Web 2.0 which is a more interactive and social technology platform, more suitable for collaborative learning. Early research and practice in e-learning for construction was mainly based on Web 1.0 platforms such as WebCT and Blackboard, where students experience, practice and demonstrate the technical, process and managerial aspects of the construction activities through static, non-interactive, non-intelligent web workspace.

What is particularly timely about the potential development of social technology for learning and teaching at the moment is the recent development in Web 2.0 technology is

very popular now. Students are familiar with Web 2.0 technology such as Facebook, Google Docs, and Google wave, (students' computing literacy is ready) and therefore, our education system should catch up with their progress, which is critical. These technologies can be easily and intentionally configured to allow third-party customization to be created and embedded into the current pedagogy. Furthermore they are increasingly supported online by a significant and committed community of users and developers.

The core technology driving the design of the Portal is the semantic web. They are adopted to improve searchability (e.g., by semantically interrelating content) and to enhance the usability and attractiveness of content by combining the collective expertise of the learning and teaching community. The Portal will support:

- the organisation and composition of learning material
- search and reuse of multimedia contents
- discourse about learning materials
- collaboration between teachers by applying Web 2.0 technology

This Portal will help teaching staff and students to personalise and socialise content management, as well as assess and improve content quality. The Portal will enable each learner of a personal workspace in which each learner is able to manage the collaborative creation and sharing of content, and the search for related content. The development of the Portal will adopt SIOC (Semantically-Interlinked Online Communities) which provides methods for interconnecting discussion methods such as blogs, forums and mailing lists to each other.

Portal evaluation methodology

To assess the impact and effectiveness of the innovative Portal-based learning and teaching strategies, both standardised and customised surveys may be used. The standardised survey is the ones being used by universities, such as the Course and Teaching Evaluation and Improvement (CATEI) survey used by The University of New South Wales. The customised surveys means the ones specifically designed to evaluate the effectiveness of the Portal towards students learning. The previous study by Zou (2007) provides a base for designing the customised survey, details is presented in next paragraph.

In order to gain a good understanding of the students' perception and experience on the Portal-based learning and teaching, two customised surveys will be conducted. The first survey (pre Portal implementation survey) will be conducted before the implementation of the Portal based learning. The second survey (a post Portal implementation survey) will be carried out immediately after the implementation of the Portal based learning. This research method was successfully used by Lindh and Soames (2004) and Zou

(2007b). In order to allow the students to express themselves freely in the survey, they will remain anonymous throughout the research. The software SPSS (Statistics Package for Social Science) will be used to analyse the data and its significance.

It is also suitable to conduct focused student group workshop and discussion sessions to gather relevant qualitative data. Furthermore, "action research" methodology may also be used from teacher perspectives.

CONCLUDING REMARKS

This paper has discussed the advantages, and schemas of designing a Portal for learning and teaching construction technology courses in university education. The paper, through presenting a conceptual framework, also discussed how the Portal may be designed, developed and used by teachers and students. The objective of the proposed Portal-based learning is to improve student learning experience and outcomes by adapting new generation ICT (e.g. Web 2.0 and social semantic webs). Clearly, the main contribution of the proposed conceptual framework is its adaption and application of the emerging new generation ICT, in which students are in favour of, into university education.

Future research work include actual development and implementation of the proposed e-portal, using thousands of photos the authors have accumulated from their teaching of the relevant construction technology courses, and the evaluation of its effectiveness in students learning experience and outcomes. Once the portal is developed and validated, it is possible for its much wider application worldwide, through open access or selected partnering universities.

ACKNOWLEDGEMENTS

The authors would like to thank Rui Wang for her help during the process of writing this paper.

REFERENCES

Alexander, B. (2006). Web 2.0: A new wave of innovation for teaching and learning? *Educause Review*, 41(2), 32-44.

Harley, D. (2006, April). Use and Users of Digital Resources: A Focus on Undergraduate Education in the Humanities and Social Sciences. Centre for Studies in Higher Education, UC Berkeley. Retrieved August 6, 2006 from http://cshe.berkeley.edu/research/digitalresourcestudy/report/.

Kolo, C. and Breiter, A. (2009) An integrative model for the dynamics of ICT-based innovations in education. *Digital Culture & Education*, 1(2), 89-103.

LTU UNSW. (Learning and Teaching Unit University of New South Wales) (2003a) Guidelines on learning that inform teaching at UNSW. Available online: http://www.guidelinesonlearning.unsw.edu.au/guidelinesHome.cfm

LTU UNSW. (Learning and Teaching Unit University of New South Wales) (2003b) UNSW Graduate attributes. Available online http://learningandteaching.unsw.edu.au/content/LT/course_prog_support/unsw_grad_att*s. cfm?ss=2*

Spicer, J. I. and Stratford, J. (2001) Student perceptions of a virtual field trip to replace a real field trip. *Journal of Computer Assisted Learning*, 17 (4), pp. 345-354.

Stein, D. (1998) Situated Learning in Adult Education, ERIC Clearinghouse on Adult Career and Vocational Education, Columbus OH, viewed 31 August 2006, <http://www.ericdigests.org/1998-3/adult-education.html>.

Ramsden, P. (1992) Learning to Teach in Higher Education, Routledge, London.

Visual Image User Study. (2003) Retrieved July 13, 2005, from Pennsylvania State University, University Libraries Web site: http://www.libraries.psu.edu/vius/.

Zou, P.X.W. (2008), "Working together to achieve Graduate Attributes of Our Students", *CEBE Transactions*, 5(1) 25 – 42.

Zou, P.X.W. (2007a) "Practical Solutions to Practical Problems in Learning and Teaching Undergraduate Construction Technology Courses" *UNSW Compendium of Good Practice in Learning and Teaching*, Issue 5, June 2007, 23-43.

Zou, P.X.W. (2007b) a longitudinal study on e-learning for construction Management Education, *Journal for Education in the Built Environment*, 2(2), 61 – 84.

Secondary School Students in Construction Higher Education

Annemarie S. Dosen and Willy Sher
Faculty of Engineering and Built Environment
The University of Newcastle, Australia

June Hingston
Callaghan College
Newcastle, Australia

Anthony Williams
Faculty of Engineering and Built Environment
The University of Newcastle, Australia

ABSTRACT

Progressing from school to university presents high school students with a range of daunting challenges. In recent years universities have found it difficult to attract students from secondary school with increases in university cohorts being dominated by older students. This paper describes a program to attract school students to built environment disciplines by providing them with opportunities to enter a gifted and talented scheme. The scheme involves the delivery of a first year built environment university course to a limited number of year 10, 11 and 12 students. It aims to attract high-achieving school students (especially females) to these programs and allow them to complete a first year course in tandem with their secondary school studies. The paper describes the pilot implementations of the scheme, the ways in which the students engaged with their studies, and the support they received from the university and schools. The paper summarises student and staff feedback and concludes by identifying the generic strategies that supported this initiative.

KEYWORDS

Secondary school, transition to university, attracting students, built environment education.

INTRODUCTION

In 2010 the University of Newcastle and the NSW Department of Education and Training entered into a partnership to provide opportunities for secondary school students to study construction related higher education courses. A „Career Acceleration Program' (CAP) was offered to high school students who were committed to a career in construction. The

CAP was conducted in conjunction with Callaghan College. The College is a multi-campus NSW DET secondary school located in the northwest corridor of Newcastle. It is committed to delivering opportunities for all students to succeed in a caring environment and consists of Wallsend Campus for Years 7-10, Waratah Technology Campus for Years 7-10 and Jesmond Senior Campus for Years 11-12. The college has approximately 2400 students and over 300 staff, spread over the three separate campuses. The CAP provides a pathway for students from the eight high schools participating in the Newcastle Community Trade Training Centre (NCTTC) to complete first year university courses whilst attending school. The CAP was successfully piloted during Semester 1, 2010. It was delivered again in Semester 2, 2010 and is being offered again in 2011. The manner in which the CAP was managed and delivered is described below.

PROJECT METHODOLOGY AND PURPOSE

Students find the transition between secondary school and university to be tumultuous. A wide range of degree programs is available to them, and they find it confusing and challenging to make their choice. Their experience and understanding of these programs is, in many cases, not well-informed. They frequently select a degree program based on limited research and with only a superficial understanding of the cultural or gender contexts of their choices. If students are gifted and talented, their choices are even more fraught. Not only do they have an even broader array of career options to choose from – they need to contend with the extra pressures placed on them by the high expectations of their family and peers.

This project was designed, in part, to provide students with experiences that broaden their horizons during this decision-making period. The aims of the project were to:

- provide a diverse range of study options to gifted and talented school students;
- expose female students to non-traditional pathways in higher education;
- demonstrate to students the diversity of career pathways that exist within the built environment;
- expose students to online learning experiences; and
- evaluate the potential of such a program to a wider community.

There are few published studies reporting experiences of high school students studying at university. Those that were located relate to summer school activities were high school students were involved in various activities in universities' science faculties (Atwater, Colson, & Simpson, 1999; Bleicher, 1996; Knox, Moynihan, & Markowitz, 2003). There is thus little precedent against which the CAP may be considered.

Application Process

The number of students admitted to the CAP was limited to six in each semester. Recruiting and selecting students was important to both partners. Particular attention was paid to publicising the CAP, recruiting students, and managing the various activities involved. The recruitment process involved students completing an application form and attaching their latest school report. Shortlisted students were then interviewed. The criteria used to select applicants were based on the characteristics of successful university students and included their:

- commitment to a career in architecture, construction and the built environment;
- ability to complete the course in addition to School Certificate or Higher School Certificate studies;
- commitment to completing the course requirements;
- time management skills;
- ability to work independently and collaboratively;
- appropriate communication and technology skills; and
- problem solving skills.

Students' perceptions of their abilities to address these criteria were provided to the interview panel. These were explored by the panel during the interview and formed the basis upon which offers were made. The selected students were then enrolled at the University of Newcastle. They paid a fee of $400 to cover the management of the program whilst the School of Architecture and the Built Environment paid the remainder of fees. Scholarships were available for students from low socio-economic backgrounds.

Newcastle Community Trade Training Centre

The NCTTC recently received $13.5million from the Commonwealth Government to upgrade vocational training facilities in the participating high schools as shown in Figure 1. The CAP provides students with opportunities to fulfil their academic potential, help with career decisions, and potentially leading to credit for future university studies. It is managed by Callaghan College, but is open to students from all NCTTC schools.

The project promotes careers in architecture, construction and the built environment, and provides an accelerated pathway to students' career goals. The CAP was promoted to students in Years 10, 11 and 12 in October and November of 2009. Five students participated in the Semester 1 pilot in 2010. Three students were in Year 10, one in Year 11 and one in Year 12. Only one female student participated in the program. The students who enrolled in the program were chosen through a formal interview process. In Semester 2 five Year 10 male students were selected to participate in the program.

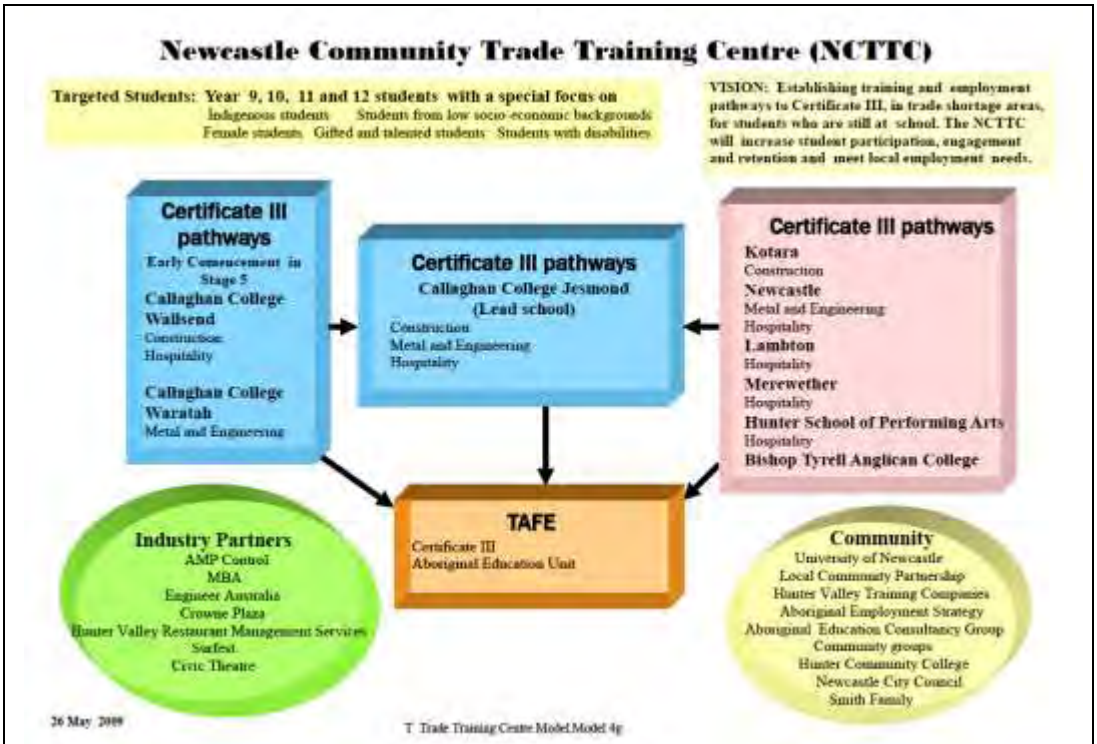


Figure 1 – Pathways available through the Newcastle Community Trade Training Centre (Source: NCTTC Governance Committee, 2009)

The University course

The CAP was first piloted in Semester 1, 2010 with students enrolling in a first year semester 1 course entitled *Construction Ecology 1* (Hingston, Sher, Williams, & Dosen, 2010). It was offered again in Semester 2, 2010 with students participating in *Communication in the Built Environment 2*. This course aims to develop students' basic understanding and technical abilities in designing and communicating using digital media. No previous experience in that field is required. The learning objectives of this first year course include students:

- developing techniques in the use of standard architectural Computer-aided Design (CAD) packages to a basic level of competence and creating 3D CAD models of simple architectural or building designs;
- generating 2D architectural sketch design documentation of a design from a CAD model;
- generating design documentation using CAD suitable for council certification, tendering and construction drawings;
- generating working drawings using CAD to enhance plans and automatic sections, elevations and details;
- creating appropriate 3D views of a CAD model to present the design of a building for critical appraisal; and

- generating design presentations that demonstrate a good use of layout principles.

These skills are the basic mode for communication in the building industry.

Communication in the Built Environment 2 is offered to first year architecture and construction management students, and is often taken as an elective by other students. It is offered in a blended-mode, with on-campus students attending lectures (1 hour / week) and face-to-face tutorials (2 hours / week). Distance learners work electronically by listening / viewing recordings of lectures and by completing tutorial exercises (which are supplemented with online help files which incorporate step-by-step instructions). All students have access to dedicated Blackboard learning management system web pages including electronic discussion boards. The postings on these discussion boards provide students with valuable help, as they are able to ask questions and comment on the input of others. The course coordinator monitors all discussion board postings. It frequently occurs that a query posted by one student is answered by another.

Learning activities are structured around an introduction to CAD, the development of a CAD model and its refinement. The course is assessed in a variety of ways as shown in Table 1. The first assignment (A1 parts A and B) were tests in Blackboard that monitored students' general progress as well as their ability to work with the basic commands of the software (ArchiCAD and Adobe Photoshop). The second and third assignments are individual projects. Students had to select one of six family homes for which they received an incomplete set of drawings. For assignment A2 they were required to analyse and develop missing information (e.g. elevations) based on the information provided. Finally, they had to create a CAD model of their project and generate a complete set of drawings. Assignment A3 focused on the presentation of their project – the plan layout and the quality of their digital design (i.e. their rendered images).

Table 1 – Assessment items and weightings

Assessment Item	**Contribution**
A1 part A _ Online quiz	5%
A2 _ CAD modelling project	40%
A1 part B _ Online quiz	5%
A3 _ Digital design and layout	50%

The Blackboard learning management system

Use of the Blackboard online learning environment was the key to the CAP. It provided students with the flexibility to avoid timetable clashes between school and university activities, as well as with other school-based activities e.g. excursions, exams etc. In addition, it provided students with the challenge of managing their time and study

strategies. Distance-learning is not a foreign concept to secondary school students but the opportunity to study an online course at the university level is novel.

LESSONS FROM THE PILOT IMPLEMENTIONS

The pilot implementations of the CAP have not been without challenges. A reflective meeting after the Semester 1 CAP identified a need for more meetings with the students, particularly at the beginning of the course. These became an integral part of the Semester 2 CAP, with the high school principal meeting with students on a regular basis. In addition, students were advised to attend face-to-face tutorials wherever possible. The Year 12 student found it difficult to cope with the demands of their HSC as well as the CAP, and Year 12 students have now been excluded from the program. Communication between the course coordinator and the students has also been more frequent and communication with the in-school mentors has improved. A role statement for the mentors needs to be developed.

The school principal's perspective

This CAP is different to other acceleration programs delivered by the University of Newcastle in that the focus is on career development in vocational education and training areas. It provides a seamless pathway to university for gifted and talented students to careers in architecture, construction and the built environment. As students complete a university course before finishing school, they are encouraged to continue their education at university. Students also have a good introduction to the University of Newcastle and the standard of work expected. All of the students in the Semester 1 and 2 CAP indicated that, on leaving school, they intended to continue their studies at the University of Newcastle. Another unique feature of this program was that students completed the course through online learning. There was no need for them to attend University lectures or tutorials (although some students did attend these activities).

Students were very excited to be included in the program, but very apprehensive at first. They were assigned a school mentor to assist them with their study program. They also had the support of a program coordinator from Callaghan College. A preliminary meeting was held at the University for the students and their parents. At this meeting the students were provided with an overview of the Blackboard Learning Management System and the course and assessment expectations. The students also had another meeting with the course coordinator and the school principal towards the end of the program.

The Callaghan College principal found the support from university staff to be "outstanding". All involved worked as "a really effective team" enhancing the CAP experience and supporting the students. The benefits for the participating students were

considerable. They relished the challenge and were very proud to have successfully completed the course. One parent reported that her son had been changed through his participation in the course and that his self esteem, self confidence and organisational skills had greatly improved. In a survey of Semester 2 parents, all of them rated the program as excellent and said that they would recommend this program to others.

Student results

A program such as the CAP can only be judged when it is tested or by its results. The students' final grades are thus an important measure of success for the program. It must be remembered that these students had to adapt to university expectations whilst studying independently. The following are their results:

Semester 1

- Year 10 students – all male – two Passes and one Distinction.
- Year 11 student – male – Credit.
- Year 12 student – female – Pass.

Semester 2

- Five Year 10 students - all male –two Distinctions, two Credits and one Pass.

Feedback from students

Students completing the program echoed the observations of Taylor who noted that "the majority of (participants) expressed confidence, enthusiasm and satisfaction over the transition process and early career experiences." Taylor (2004). The following are some of their observations:

- *"Great opportunity".*
- *"Really enjoyed the program and found it challenging. The work was time consuming but I had no difficulty managing the work".*
- *"I needed help with the first assignment so that I knew the standard that was expected".*
- *"The discussion board on Blackboard was useful. I didn't feel confident enough to post a question but I liked to read the comments from the other students".*
- *"I really enjoyed the course. I will use this subject in my Degree".*
- *"This program has impacted on my subject choice, career goals and self-confidence".*
- *"The course was really good and exciting. It gave an introduction to the University environment and atmosphere and I recommend it to other students... It was really informative and knowledge providing. The Blackboard was really exciting".*

- *"The course has definitely been a positive experience. It has been a good introduction to the University of Newcastle. I would highly recommend this course to other students".*
- *"The benefit of the program was having an understanding of a career path before taking that path".*
- *"The course has greatly benefitted me and has been a fantastic experience that I will never forget. I would highly recommend this course to other students who would like to succeed further in their studies".*
- *"This course was a great experience in the University atmosphere. It gave a good overview of expectations and required skills to complete the course".*
- *"This course provides a good introduction to the University experience and a good link between high school and the university."*

Feedback from the Project Officer

A Project Officer was employed by Callaghan College on behalf of the NCTTC, working one day per week on this program as well as on others. On completion of the Semester 1 pilot, the Officer made several observations about the CAP, including that the initial orientation and related paperwork needed to be completed prior to start of the course. Students needed to ensure they were registered on the University's website and enrolled in the correct course prior to the start of semester. Students should email the course coordinator and familiarise themselves with Blackboard. In addition, students should sign a form confirming that they have read and understood when assignments are due. Hand-in dates for the assignments were highlighted in their University information pack but students needed to be aware that if they are completing a University course they had to take ownership of submission dates. Parents also needed to be aware of this.

Further points identified by the Project Officer included the need for a support person (mentor) to be identified prior to the start of the course. This person should be based at the student's own school and should receive a letter outlining the CAP and what their involvement in it was.

Students should contact the course coordinator regularly to let them know how they are progressing. They should also contact mentors prior to and after each assignment. After each assignment the Program Coordinator from Callaghan College should have a follow-up discussion with each student individually or as part of a group to see how they are coping and how they found each assignment.

Feedback from school mentors

Callaghan College arranged for students to be supported by mentors at their respective schools. The following are a selection of the comments they made:

- *"The students need someone to hold their hand from the start. They are not familiar with how to navigate on Blackboard and its role and purpose other than tutorials and assessment and its capacity in relation to communication channels need to also be explored. While some support material was provided on how to correctly reference work- knowledge about what is a reliable source and what is considered acceptable was a big learning curve. Students consider that Google and Wikipedia are OK! Greater support is needed in this area." (Mentor 1)*
- *"I made regular contact with my students. On each occasion they said that they were making good progress and didn't require any extra assistance." (Mentor 2)*
- *"The student that I was supporting was from a disadvantaged background and had difficulty accessing a computer with sufficient memory for the CAD program. I was able to organise a computer for him to access and he worked in the University library". (Mentor 3)*

Feedback from University

The CAP provided an ideal opportunity for universities to reach out to local schools. Publicising the CAP raised awareness of built environment courses to staff and students at these schools. The interactions with Callaghan College have been warm and constructive, and have encouraged closer participation between those involved (this paper being evidence of such interaction). The University will continue to support the College and the NCTTC wherever it can.

Both *Construction Ecology 1* and *Communication in the Built Environment 2* are offered on-line and as electives, and resulted in minimal additional workload. Some additional support for CAP students was provided, but rather than being onerous, staff were heartened by the enthusiasm of the students and Callaghan College staff.

NEXT STEPS

As a result of the experience gained during these pilot implementations, the CAP is continuing in 2011. Up to six students will be offered places in Semester 1 and 2. They will enrol in the same two courses described above.

The assignment tasks and the mode of delivery develop students' problem-solving skills. They work autonomously and develop a spirit for teamwork by helping each other (both in online discussions and in face-to-face tutorials). This introduces them to the university

environment and supports them in transitioning between high school and university. Notwithstanding these opportunities, it was found that the students needed to develop other skills such as time management and being better organised. An online orientation and induction will help students gain an appreciation of what is expected at university and will become a requirement for future students.

CONCLUDING COMMENTS

The trials of the CAP have proven to be a success from a number of perspectives. That the school students were able to succeed at university level is an achievement in itself. However, this is even more noteworthy as the students were working predominantly by themselves and in an online environment. The confidence they have gained will stand them in good stead for their future endeavours. From the University's perspective, the CAP provided an excellent opportunity to reach out to local schools and raise awareness of the varied opportunities available in the built environment. Announcements at school assemblies and meetings ensured that the construction industry (so often associated with muddy boots, and unattractive working conditions) was seen in a different light. The promotion of the CAP program in schools has raised the profile of careers in architecture and the built environment. There was a 30% increase in the number of applications for the 2011 program. Another extremely positive outcome from the University's viewpoint is the intention of the students to continue their studies at Newcastle University.

REFERENCES

Atwater, M., Colson, J., and Simpson, R. (1999) *Influences of a university summer residential program on high school students' commitment to the sciences and higher education*. Journal of women and minorities in science and engineering, 3, 155-173.

Bleicher, R.E. (1996) *High school students learning science in university research laboratories.* Journal of Research in Science Teaching, 33(10), 1115-1133.

Hingston, J., Sher, W., Williams, A., and Dosen, A. (2010) *A Pathway from School to University — Reaching Down to Build Up*. Paper presented at the 21st Annual Conference for the Australasian Association for Engineering Education

Knox, K.L., Moynihan, J.A., and Markowitz, D.G. (2003) *Evaluation of Short-Term Impact of a High School Summer Science Program on Students' Perceived Knowledge and Skills*. Journal of Science Education and Technology, 12(4), 471-478

NCTTC Governance Committee. (2009) Submission to DEEWR for Trade Training Centre funding.

Taylor, A. (2004) *Entering Industry: A case study of links between a vocational program and the building and construction industry*.

Project Objectives – A Confused Concept

David Baccarini
School of Built Environment
Curtin University, Perth, Australia

ABSTRACT

Project objectives are a core concept within the field of project management. This paper reports research findings that attempts to identify understandings of the term „project objectives". Firstly, a review is undertaken of key project management literature pertaining to the concept of project objectives. Secondly, a survey is conducted of 37 members of the project management community. The research highlights a myriad of definitions of the term „project objectives". The most common definition is that project objectives refers to the time and cost objectives of the project. However, there is some support for distinct alternative interpretations, namely that project objectives refers to the deliverables of the project, or to the project's benefits. It is concluded that the project team needs to have a consistent understanding of project objectives to avoid miscommunication. Alternatively, the term „project objectives' should be avoided and less ambiguous terms used, such as deliverables, benefits and time and cost objectives

KEYWORDS

project objectives, PMBOK®, logical framework method

INTRODUCTION

Many definitions of „project' are in terms of achieving project objectives. For example, Field & Keller (1998) describe a project as *'organised work towards a pre-defined goal or objective"* The British Standards Institution (2000) characterises a project as "*undertaken to achieve an objective"*. A project's end is reached when the project objectives have been achieved; or when the project is terminated because its objectives will not or cannot be met (PMI, 2008). Definitions of the project management process also utilise the concept of project objectives. For example, project management is managing "*processes and people in the pursuit of achieving project objectives" (*Pinto & Kharbanda 1995). Similarly, project management is the management of "*resources for a relatively short-term objective" (*Kerzner, 2003), and "*project management teaches that to achieve the desired project objective one must go through a specific process"*" (Morris, 1988).

An „objective' is something towards which work is to be directed (PMI, 2008). Dictionary definitions of „objective' include *(dictionary.com, 2010):* "*something that one's efforts or actions are intended to attain or accomplish; purpose; goal; target*". So, at its most fundamental meaning, an objective is something that is an end being worked towards through a set of means.. Project objectives have been defined as the „*results to be achieved through the performance of a project*' (Portny et al., 2008). This broad sense of „objective' as being a target could result in „project objective' having differing interpretations.

RESEARCH OBJECTIVE

The potential lack of consistent understanding of the key concept as „project objectives' can lead to miscommunication between project stakeholders and consequent mismanagement of their expectations. This suggests that research into the project management community's understanding of the important concept of „project objectives' is worthwhile in order to identify common or diverse interpretations. So the research objective is to investigate whether there is a common understanding of the core project management of „project objectives" in the literature and in the project management community. Furthermore, if there is a common interpretation, what is it?; and is there are conflicting interpretations, what are they and is there a dominant paradigm?

KEY LITERATURE (note: underlining is author's emphasis)

Guide to Project Management Body of Knowledge (PMBOK®) (PMI, 2008)

The subject of a project management body of knowledge is of such importance that the *International Journal of Project Management* devoted a complete issue - Vol 13, No. 2, April 1995 - to this topic. In August 1987 PMI published The *Guide to Project Management Body of Knowledge* (PMBOK®) and revised in 1996, 2000, 2004 and 2008. PMBOK® is an American National Standard (ANSI 99-001-2008) and there are over 3 million copies in circulation. It is one of the most influential texts in defining the project management process. So, if one is seeking to analyse the definition of the term „project objectives', one logical source would be PMBOK.

For such a key concept as 'project objectives', it would be expected that PMBOK® would provided a definition and a consistent and clear understanding of the concept. Its glossary does not define „project objectives' but does define „objective' as *"something toward which work is to be directed"* (PMI, 2008). It acknowledges that a project's end is reached when the project's objectives have been achieved; or when the project is terminated because its objectives will not or cannot be met (PMI, 2008). PMBOK®'s

emphasis on the primacy of project objectives is evidenced when its states that the project manager is responsible for "*accomplishing a project's objectives"*

Project Objectives - deliverables and requirements

Gray & Larson (2008) define project objectives in terms of the project's deliverables, for example project objectives could be an apartment complex or software package. PMBOK® (PMI, 2008) notes the project manager is responsible for "*delivering a project's objectives within scope, schedule, cost and quality*". This implies that ‚project objectives' are synonymous with project deliverables. PMBOK® notes that *‚all projects have a purpose or objective ... where the objective is a service or result"*. This again reinforces the interpretation that project objectives refer to project deliverables, because PMBOK® defines a deliverable, inter alia, as a service or result.

PMBOK® states that the work breakdown structure is "*a deliverable-orientated hierarchical decomposition of the work to be executed by the project team to accomplish the project objectives and create the required deliverables"*. Confusingly, PMBOK® now seems to imply that project objectives and deliverables are two separate concepts i.e. deliverables lead to the accomplishment of project objectives. This confusion begins to reveal a lack of clear definition for the core project management concept of ‚project objectives" within one of the most influential texts in the field of project management.

Deliverables have requirements. Requirements can be defined as a condition or capability that must be met or possessed by a project deliverable to satisfy a contract, specification, standard, or other formally imposed document (PMI, 2008).A requirement is something the deliverable must do or the quality it must have (Robertson & Robertson, 2006). So where project objectives are interpreted as defining the deliverables, then the project objectives should also encompass the requirements of these deliverables. However, PMBOK® seems to suggest that the concept of project objectives does not encompass the requirements of the deliverables. It states that project management "*often requires tradeoffs among project requirements and objectives",* thereby implying that requirements are a separate concept to project objectives.

Similarly, PMBOK® notes that requirements management should trace "*requirements to project objectives"*, again implying that requirements and project objectives (i.e. deliverables) are separate concepts. The collection of requirements is described by PMBOK® as the "*process of defining and documenting stakeholders' needs to meet the project objectives",* yet again implying that requirements and project objectives (deliverables) are separate concepts. Finally, and somewhat confusingly, PMBOK® then seems to suggest that project objectives and requirements are synonymous: "*clear descriptions of the project objectives are developed, including the reasons why a specific*

project is the best alternative to satisfy the requirements. In summary, one definition of the concept of project objectives is that it refers to the project deliverables and, perhaps, the requirements of these deliverables.

Project objectives - time, cost, quality/performance

PMBOK® (PMI, 2008) states that project objectives „*can include scope, schedule, cost, or performance*". The prevalence of project objectives being defined in terms of three components - cost, time and quality/performance (e.g. Meredith & Mantel, 2006) – has led them to be commonly referred the „triple constraints' or „ „iron triangle' (Atkinson, 1999). Many definitions of project management are expressed in terms of these three project objectives e.g. *achieve the project objectives on time, and to the specified cost, quality and performance*" (British Standards Institution (2000). PRINCE2 (OGC, 2009) defines project objectives as „time cost, quality, scope, risk, and benefit performance goals". So, in summary, there is a interpretation in the literature of project objectives referring to the time, cost and quality objectives.

Project objectives – stakeholder satisfaction

Project stakeholders are individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion (PMI, 2008). Project success can be measured in terms of the degree of achievement of project objectives (Belout, 1998). So stakeholder satisfaction could be viewed as a project objective - "*The triple constraint has been accepted wisdom throughout much of the profession for decade. In the past several years, however, this unholy trinity has frequently been joined to a fourth constraint - stakeholder satisfaction*" (PMI, 1998). Tuman (1986) observes that "*The days when we could define success in terms of cost, schedule and technical objectives are gone. We must address a much wider range of needs, concerns and issues which are presented to us by a diverse mix of project stakeholders*". Therefore project objectives can be defined as achieving stakeholder satisfaction.

Logical Framework Method (LFM)

The Logical Framework Method (LFM) represents a school of thought that provides a more expansive interpretation of the concept of project objectives. USAID (US Agency for International Development) developed LFM in 1970 to improve project management of international development projects and accountability to Congress. LFM uses a top-down approach to formulate a „hierarchy of project objectives' such that at any given level the lower project objectives are the means to satisfying the next higher level of

project objectives. The LFM hierarchy of project objectives can be decomposed as follows:

Project objective - strategic alignment

All projects arise from a need to fulfil specific strategic objectives (Turner, 2009). The sponsoring organisation's strategic plans provide the rationale for the project, so strategic alignment is one level of project objectives. The strategic alignment articulates the strategic rationale behind the project and describes long-term impact of the project.

Project Objective – Benefits. Benefits are another form of project objective. Benefits are the required change realised by using the project deliverables.. As benefits are often only realised after the project has been completed, it is easy for projects to focus solely on creating the project deliverables (OGC, 2009). The project benefits can be a hard (e.g. financial) and/or a soft (e.g., satisfaction). The project benefits provide the means towards the strategic goal and determine the required project deliverables. The project should not include deliverables that do not enable benefits to be achieved (OGC 2009).

Project objective – deliverables

Deliverables are another form of project objective. The project deliverable is any unique and verifiable product, result, or capability to perform a service (PMI, 2008). Deliverables must meet prescribed requirements.

Project objective – process

The process refers to the resource inputs and clusters of key project tasks required to deliver the deliverables. The project process should be conducted in a quality manner eg no rework, happy team, efficient use of resources. Project objectives can compass consideration of how efficiently a project process has been managed (Baccarini, 1999). ISO 10006 (2003) provides a good example of quality aspects of the project management process. So, project objectives can be defined as undertaking the project process in a quality manner.

In summary, this brief review of the literature pertaining to the concept of project objectives highlights a diverse range of interpretations. Project objectives could refer to:

- traditional iron triangle of time, cost and product quality; or,
- deliverables and perhaps its requirements; or,
- quality of the project process; or,
- to a wider scale of interpretation that encompasses the project benefits and strategic alignment.

This diversity of meanings for the concept of project objectives suggests that research into the project management community's understanding of the important concept of „project objectives' is worthwhile.

RESEARCH DESIGN

Survey

A survey was conducted in July 2010 at an Australian Institute of Project Management (AIPM) seminar. AIPM claims to be the premier body for project management in Australia (AIPM Strategic Plan, 2010-2015). The author was the seminar presenter and the advertised topic was "Project Objectives- What are they?" Prior to making the presentation, the audience were given the following survey question: "Think of one project you are presently or recently worked on – What were two project objectives?". The participants were not provided with any definition of the term „project objectives. 37 completed surveys were returned. All stated two project objectives. One respondent recorded three objectives.

Content analysis was used to analyse the responses. Content analysis is a documentary method that aims at a qualitative and/or quantitative analysis of various forms of existing data like verbal, visual and written communication. It can be used as a quantitative technique to determine time, frequency or duration of an event, It aims at studying the content of the documents. (Grinnell and Unrau 2010). Content that is visible, straight and obvious involving counting frequencies of appearance of the research unit is called manifest content; and content that has an underlying meaning and messages that are inferred or hidden, which need to be registered is called latent content. (Sarantakos 1998) This research uses content analysis to study both manifest and latent content. A qualitative approach is used to analyse and record the latent content by reading between lines and registering the implied meanings; and a quantitative approach is used to analyse and record the manifest content in the form of frequency tables to present the ranking of findings.

RESULTS AND DISCUSSION

The participants were asked one demographic question – what industry do you work in: engineering/construction/property; or other (please state). 31 worked in engineering/construction/property; 3 in IT; and 3 in consulting. So, overwhelming, the research sample were from the engineering/construction/property industry. Content analysis was conducted and the literature was used to provide a structure for categorising

responses. Tables 1 and 2 records the 75 responses from the 37 respondents in five categories derived from the literature.

Table 1 – Project objectives: detailed responses

TCQ (Total 42)	Deliverable (15)	Benefits (10)	Project Process (5)	Stakeholder (3)
• time (19) • budget (18) • quality (5)	• promote product • sustainable infrastructure • new energy analysis tools • achieve 6-star green rating • regulation compliance • meet noise regulations • replace electrical infrastructure • server refresh • sub-division • better product • iconic facility • disaster recovery facility • identify contamination	• profitability (2) • maintain client relationship • future client opportunities • future growth opportunities • stimulate economy • hold events • maintain product • more efficient • reduce energy consumption	• develop team skills • minimise variations • safety • how to build it • how to procure builder in remote location	• stakeholder satisfaction

Table 2 – Project objectives: categorisation summary

Project Objectives – Concept	**#**	**%**
Time/Cost/Quality	42	56
Deliverable	15	20
Benefits	10	13
Process	5	7
Stakeholder Satisfaction	3	4
Total	75	100

An overall reading of the results indicate that there exists a diverse range of interpretations of the concept of project objectives. This was also reflected in the literature where, for example, PMBOK®(PMI, 2008) presented alternative interpretations and the LFM provided a more expansive elucidation of the concept of project objectives. The survey responses indicate a similarly wide variety of understandings from the traditional time-cost-quality iron triangle through to business benefits.

Time/cost/quality

It is perhaps not surprising that the most common understanding of project objectives is in terms of the typical objectives of time, cost and quality/performance (56% response rate). In particular there is strong interpretation of project objectives in terms of delivering on time and within budget. It is possibly not unexpected that project quality had a low frequency of response (5) as a project objective, because the project objective of quality is more difficult to define than time and cost - *"a project is said to be successful if the work is finished to time, to cost and to quality ... but very few people understand what they mean by good quality in the context of projects*" (Turner, 2009).

Deliverable

The results show that 20% of respondents define project objectives in terms of what the project will deliver e.g. disaster recovery facility, land sub-division. This matches one of PMBOK's perspective that project objectives refers to project deliverables. It does seem unnecessarily confusing that as definitions of „deliverable' are relatively consistent in the literature - e.g. PMBOK® defines „deliverable' in its glossary - that some people use the more vague term of project objectives to mean deliverables. As the term deliverable is clear and unambiguous, then when one is describing a deliverable, it would seem desirable that it be labelled as a deliverable and not as a project objective.

Benefits

The results show that 13% of respondents define project objectives in terms of the benefits realised by using the project deliverables e.g. reduce energy consumption, improved efficiency. Deliverables are produced by the project process to achieve business benefits. This interpretation of project objectives is a higher level, sponsor or user oriented perspective Benefits should be specified by the users of the deliverables (OGC, 2009). One possible reason for the relatively low number of respondents defining project objectives as benefits could be that they are the producers of deliverables (eg engineers, construction contractors) rather than the ultimate users. This could result to a producer-oriented perspective of delivering projects to time and cost, and less of a sponsor/user perspective that is focused more on post-project benefits realisation. The term „benefits' is consistently defined in the literature such that it has led to the creation of a project process named „benefits management". This suggests that as the term benefit is commonly understood and entrenched within the benefits management process, then when one is describing a benefit, it should be labelled as a benefit and not as the more vague term of project objective.

Project process

The results show that only 7% of respondents define project objectives in terms of the processes undertaken during the project. E.g. develop team skills, minimise variations. This process perspective for project objectives focuses upon the how efficiently the project is managed and refers to the quality of the project management process (e.g. ISO 10006). A high number of respondents did not viewed the achievement of a efficient quality project process as a project objective so this suggests an opportunity to raise the awareness of this possible project objective within the project management community.

Stakeholder satisfaction

Interestingly, only three respondents viewed stakeholder satisfaction as a project objective. The survey results suggest that the respondents, who are representatives of the project management community, are strongly locked onto a traditional perspective project objectives. It could be implied that where respondents stated project objectives in term so meeting time, cost and quality objectives or deliverables or benefits, that by inference successfully achieving these project objectives should result in stakeholder satisfaction.

CONCLUSIONS

Project objectives are a core concept within the field of project management and prevent within the literature. However, it would found that the literature has a variety of interpretations of this concept. The survey results clearly show a diverse range of meanings for the core project management concept of „project objectives'. This suggests that when the project team and stakeholders are discussing project objectives, it would be prudent for the project manager to set out a definition of project objectives in order to avoid miscommunication and misaligned expectations.

To extend this further, a strong case could be made that the nebulous term „project objectives' should not be used in any project management documentation and more apparent terms such as time/cost/quality objectives, project deliverables and benefits should be used. Not only should this avoid misunderstandings but also provide clearer thinking and focus when project objectives are articulated within project management plans. This should then prevent any project objectives section of project management plans contain a mishmash of intertwined diverse concepts of deliverables, requirements, time/cost/quality, process quality, and stakeholder satisfaction criteria. If each of these aforementioned project objectives are kept separately within project management plans, all concerned will benefits by a more apparent articulation of what is being described.

REFERENCES

Atkinson, R. (1999) Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria, *International Journal of Project Management* 17(6), 337-342,

Baccarini, D. (1999) The logical framework method for defining project success. *Project Management Journal*, 30(4), 25-32

Belout, A. (1998) Effects of human resource management on project effectiveness and success: toward a new conceptual framework. *International Journal of Project Management*. 16(1). 21-26

Field, M. and Keller, L. (1998) *Project management*. International Thomson Business Press, London.

Grinnell, R. and Unrau, Y.A. (2010) *Social work research and evaluation: foundations of evidence-based practice.* Oxford University Press, New York:

Gray, C.F. and Larson, E.W. (2008) *Project Management- the Managerial Process*. Irwin McGraw-Hill, Boston.

ISO [Internal Organisation For Standardization]. (2003) *ISO 10006: Quality Management - Guidelines for Qulaity Management in Projects*.. ISO. Geneva

Kerzner, H. (2003) *Project management: a systems approach to planning, scheduling and controlling*. 8th Ed.Van Nostrand Reinhold, New York.

Meredith, J. and Mantel, S.J. (2006) *Project management: a managerial approach.* John Wiley, New York

Morris, P.W.G. (1988) Managing project interfaces - key points for project success in Cleland, D.I. and King, W.R. (eds.) *Project management handbook.* Van Nostrand Reinhold, New York.

OGC [Office of Government Commerce]. (2009) *Managing Successful Projects with PRINCE2*. 5th ed. TSO, London

Pinto, J.K. and Kharbanda, O.P. (1995) *Successful Project Managers.* Van Nostrand Reinhold, New York.

PMI [Project Management Institute]. (2008) *A Guide to the Project Management Body of Knowledge (PMBOK®), 4th Edition.* PMI, Newtown Square, PA

Portny, S., Mantel, S.J., Meredith, J.R., Shafer, S.M. and Sutton, M.M. (2008) *Project management*, Wiley, New York

Robertson, S. and Robertson, J. (2006) *Mastering the requirements process,* Addison-Wesley, Upper Saddle River, NJ

Sarantakos, S. (2005) *Social research*. Houndmills, Basingstoke, Hampshire.

Tuman, J. (1986) Success modeling: a technique for building a winning project team. *PMI Annual Seminar/Symposium*, Montreal. 94-108

Turner, J.R. (2009) *The handbook of project-based management - improving the processes for achieving strategic objectives*. McGraw-Hill, London.

Action Research into Online Publishing

Göran Runeson
Faculty of Design, Architecture and Building
University of Technology, Sydney, Australia

ABSTRACT

Action research is a suitable tool for research into the management of change in an organisation or community. While it combines the researcher and the change agent, and therefore incorporates the views and opinions of the researcher, it can help to shed light on problems that are not susceptible to other approaches. In this case, the action is the change to on-line publishing of the *Australasian Journal of Construction Economics and Building* that had achieved a very small circulation in a conventional format. The aim is to increase the availability of the journal without increase the costs. The various actions involved in changing the mode of operation are examined through their impact, to the extent that they can be isolated. The conclusion is that the actions have been beneficial, overall and in respect of the aims of increasing availability without increases in costs.

KEYWORDS

electronic publishing, scientific publishing, open access

INTRODUCTION

Action research is a branch of qualitative study. It centres around the study of impact of actions where the researcher may be both the initiator and the assessor of the action. This involvement in the project that is being researched distinguishes the action researcher from the traditional disinterested spectator of conventional science (Chalmers, 1982; Punch, 2005). The potential for this involvement to influence the perception of the outcome is acknowledged or even considered vital for achieving the aim of providing a guide for successfully initiating change in an organisation or community (Elden and Chisholm, 1993; Stringer, 2004). While there are various forms of action research, the model adopted here can be described as a spiral going from a plan to action to critical reflexion to revision of plan to action etc. as shown in Figure 1.

Action research is suitable when it is not possible to control or even enumerate all variables and where the research process cannot be standardised. In such cases where it is not possible to use a control group, action research provides a flexible and responsive research alternative.

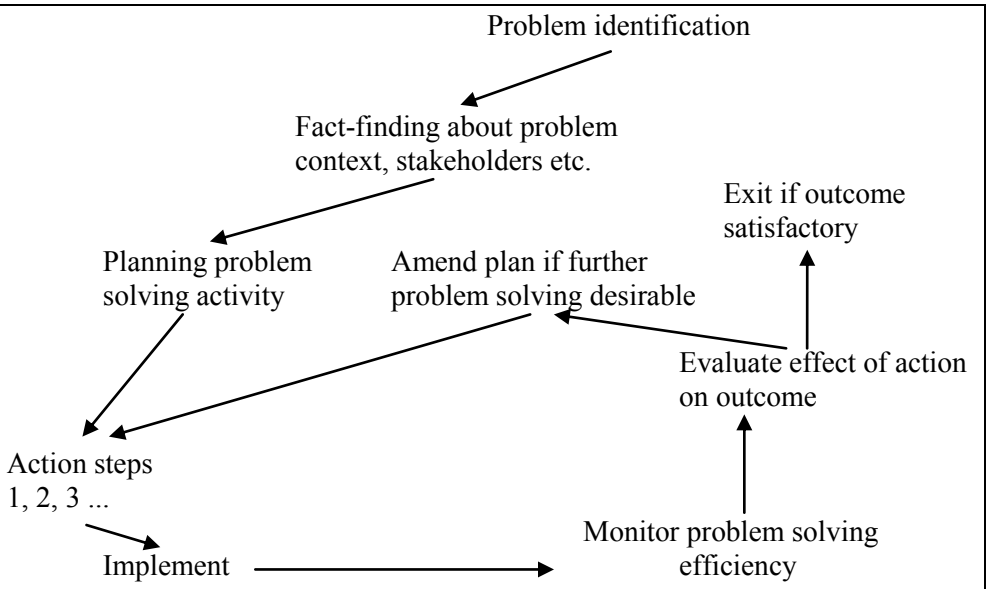


Figure 1 – Action research model (adapted from McKay and Marshall 2001)

Research problem

The purpose of this project was, and continues to be the testing of various alternative strategies open to the *Australasian Journal of Construction Economics and Building* management aiming to increase the availability of their journal without increase the costs of publishing. The various actions involved in changing the mode of operation from hard copy only to free on line access are examined through their impact on the various aspects of the journal, to the extent that they can be isolated. Where actions have turned out to have undesirable effects, they have been reversed or modified. The outcome of the research itself is a set of actions that will achieve the aims of journals facing the same challenges.

THE RESEARCH PROJECT

The situation before the start of the project was a journal that after nine years and despite good academic quality had a paid circulation of only about 20 subscribers with a somewhat greater number given away to various forms of contributors. The editorship rotated among the various Schools of Building in Australian Universities, with an inevitably loss of continuity. Despite high subscription fees and voluntary editors, the low circulation meant that even with only two issues per year, the professional organisations that sponsored the journal were required to contribute financially. The aim of the actions was to increase the circulation without loss of quality or increase in costs.

An additional problem was that after being ungraded but with a good reputation the journal was ranked as a B grade journal in the 2010 ERA ranking, just as the first changes

were being implemented. These rankings have a tendency to be self-fulfilling and it was obvious that this was certainly going to have a major impact on the supply of good quality papers. In fact, in the long run this has the potential to kill the journal.

It was envisaged that the solution to the problems was to go to a free access electronic publication, which was a concept totally outside the experience of every-one involved with the journal. The project that evolved was typical for action research: a plan consistently re-formulated as the outcome of each action was evaluated (Wadsworth, 1998; Dick, 2001). The broad series of issues that needed plans resulting in observable actions included:

- Selecting a publisher
- Establishing the infrastructure required
- Determining a format for the journal
- Ensuring a good supply of papers

Selecting a publisher

Selecting a publisher was by far the least complicated and uncontroversial choice. It would have been possible to just set up a website, but the advantages of using a publisher with a computerised manuscript management facility, technical expertise and experience in promoting e-publishing were too obvious to miss. While there are several electronic publishers, offering similar packages, *UTSePress* offered it all together, for free, with geographical proximity and extensive support.

Technically, geographical proximity should not be an issue, as all aspects of the journal is handled over the internet, but in retrospect, the opportunity to attend regular meetings with other editors, where common problems are discussed, felt like an important source of information as well as a safety net. *UTSePress* publishes 14 journals in various disciplines, almost all of them started in the last five years, and there is a lot of recent experience to benefit from. With that comes also a lot of opportunities to realise how woefully under-resourced the journal is. Most of the journals are the efforts of teams of three to ten people, with a range of specialties, evident in multimedia offerings, complex layouts and special issues.

Establishing the infrastructure required

Chronologically, appointing a continuing editor was the first decision, but functionally it is part of the structure of the journal. It's too early yet to establish the impact of having a continuing editor, but it would have been difficult to establish the journal under the system of rotating editorship as in the first nine years in the life of the journal. Setting up the journal within the manuscript management facility adds a new layer of complexity to

being an editor. I'll look later at the implication of this and other actions on the work load of the editor.

The infrastructure included an editorial board, reviewers, proof readers and editorial assistant. The editorial board was determined primarily by what was required to become an A grade journal, i.e. it should contain a substantial number of the leaders in the discipline. This virtually ensures that the majority of the editorial board members have very little interest in or incentive to contribute apart from accepting the status still attached to being a member of an editorial board, as they are busy in other roles. A small number of members were selected as being young and on their way to leadership positions in the discipline in the hope that they would be prepared to do more. So it turned out. After each issue, I have communicated with the board members about various problems with their potential solutions, and the 25 per cent that have responded is either from this group or is an Australian that has had a long involvement with the journal. As a result, I have resolved to change policy and introduce a limited tenure for board members as a means to increase the numbers of these two groups on the board. I think it is important to have a board that is involved and that promotes the journal at every opportunity.

Having said that, there is little agreement on what the members are expected to do. In some journals, they do all or most of the reviewing or contribute to the editing, they may in some cases, more or less actively, be required to promote the journal but mostly, they are supposed to be a guarantee of quality by attaching their name to the journal. A less frequent but important job is to arbitrate between the editor and authors when there is a conflict. More formal board meetings or special roles for the members are rare.

The reviewers as a group, are a major problem, even for this journal where most of the reviewers have voluntarily requested that they be listed as reviewers. One of the reasons is that the journal needs so many. With current rejection rates, every successful paper requires 15 to 25 reviewers, with right fields of expertise and it is a difficult job that requires dedication. As a competitive argument to promote the journal I had decided to publish every approved paper within five months of submission. Technically, this should not be a great feat. The review should not take more than four weeks, the rewriting two weeks and the layout, proof reading etc one week. That is less than two months. Given publication every quarter, the total maximum possible time is five months but the median should be three or four.

There are some reviewers that perform to a very high standard, but they are in a minority, maybe 25 per cent. The most common response is to arrogantly ignore to answer the request, probably about 30 per cent. Next, of about equal frequencies are the positive response followed by eternal silence, the short review: "it stinks", the ego-centred review:

"he hasn't quoted my paper so he can't possibly be accepted" or, from the person who has not listed any particular interests: "this is not my field'. The problem with these responses is that they successfully work towards prolonging the review period. This means that they work against the performance indicator that I have used as the most important way to promote the journal - the short time between submission and publication.

One of the problems with being committed to a rapid turn-over of papers is that every little non-performance by a reviewer requires an immediate response by the editor. This is time consuming and labour intensive. This decision alone probably accounts for half to two thirds of the work load and is a constant source of frustration. On the upside is that so far, only one paper has exceeded the five months and only marginally.

The most efficient way to deal with the people who don't respond at all or responded but don't submit a review seems to be, not a reminder or a carefully worded polite email explaining why I don't like what they do. Rather it seems to be to tell them that I've removed them from the register of reviewers and then accept their explanation of how the computer hard disk had failed or how they had been on study leave in places where there were no computers. Follow up requests for reviews to these people have normally been dealt with within days.

For the rest of the problem reviewers, there seems to be no efficient way to utilise them. There is little evidence of the request for a review being seen as an expression of confidence or an opportunity to help shaping the future of the discipline. Rather it is a disturbance where the less effort spent, the better.

The problem with taking a hard line with reviewers – or as I prefer to look at it, to look after the interests of authors - is that those that do perform risk being called upon more often. Given the problems with peer review, there are undeniable advantages with a small group of good performers: timely and considered reviews but it may also lead to some insularity. A compromise that seems to work is to use two proven performers together with one less well known. However, even with proven reviewers, the differences in perceptions are such that most papers must also be reviewed by the editor to ensure consistency in recommendations. Just quoting the reviews would cause considerable confusion among authors when reviewers demand mutually inconsistent amendments.

Determining a format for the journal

E-publishing is very flexible, and there are several possible formats available. One that utilises the flexibility of on-line publishing to the limit is to publish each paper as it becomes available. From a logistic point of view, this is probably the easiest model, and it also reduces the time for authors between submission and publication.

Technically, it is also possible to reduce the time between submission and publication further by subjecting the papers to a rough screening only before they are uploaded into a temporary section. Comments can then be invited, either from any interested reader or from a selected group as to the merits of papers and if the paper is of a sufficient quality to be accepted and allocated to an issue. This would amount to a different form of peer review, although it is easy to see how the process could be manipulated. Issues and volumes can then be created as different criteria are satisfied, either based on subject matter or on chronology of submission.

The most common model, however, is one that doesn't utilise the flexibility but resembles conventional publishing with a specified number of issues each year, each issue containing a specific number of papers. In a conservative environment like academic publishing, this model maximises the probability of achieving a high ranking as it becomes directly comparable to conventional journals. It is also easier to promote as each new issue becomes a distinct event.

It was decided that at least until the journal is more firmly established, the latter model should be followed, but that within the format, flexibility should be utilised by establishing a forum for discussion between issues. This forum has, so far, been a complete failure, which is probably the strongest indicator we have so far, that more innovative models of publication would currently not necessarily be successful. However, as e-publishing becomes more accepted, and there are strong indicators that it will be the norm, rather than the exception in the near future, the advantages that it has in forms of reading tools, multi-media capability and flexibility are likely to become much more appreciated or even demanded. The journal will continue a careful introduction of new features as we go along.

Journal rankings depend on the quality of the research they report, but it is evident that auxiliary aspects, such as the layout of the journal, the reputation of the members on the editorial board or citations are used as proxies. That would mean that there is no room for any other types of papers, although most journals carry book reviews. The possibility of segmenting the journal into different section has been used to introduce a third type of papers, referred to as "Viewpoint". These are papers that do not report original research, are not peer reviewed but deal with issues of general interest to the discipline. While they so far have not resulted in a debate within the journal, authors of viewpoints have been contacted directly by readers and have a positive perception of their usefulness.

Other "innovations" in line with the emphasis on the needs of the authors, has been a change in the required control of copy right. Before going on line, the journal like almost every other paper journal had a copy right agreement that basically transferred most of the rights to the journal. In the title of his book, *Free Culture: How Big Media Uses*

Technology and the Law to Lock Down Culture and Control Creativity, Professor Lessig (2004) suggests the problems with this kind of copyright and the book provides a fascinating account of the impact this kind of copyright and how media can control cultural works.

In place of this, the journal has elected to use a Creative Commons Attribution Agreement. This means that authors who publish in the journal retain copyright and grant the journal right of first publication. The work is simultaneously licensed under a Creative Commons Attribution Licence that allows others to share the work - to read, download, redistribute, include in databases, and otherwise use - subject only to an acknowledgement of the work's authorship and initial publication in this journal (Wilson, 2005). Authors are also able to enter into separate, additional contractual arrangements for the non-exclusive distribution of the journal's published version of the work (e.g. post it to an institutional repository or publish it in a book), with an acknowledgement only of its initial publication in this journal. Under conventional copy rights, this is illegal (Bjork et al. 2010).

While so far no-one has reported this as a reason for selecting the journal (or any other journal with a similar arrangement) over conventional journals, it should be a crucial issue for authors that want the widest possible distribution of their work. The copy right is there essentially to secure pecuniary rights, in this case for the journal, and by doing that, they restrict the circulation of ideas to maximise the value of their copyright. Most academic writers have little or no pecuniary interests in their research papers. What is important to them is the spread of their ideas and that they are acknowledged as the original author. Conventional copy right therefore in the majority of cases work against the interest of the original author while the creative commons attribution agreement allows the author to make his writings as widely available as possible (Bjork et al. 2010). There have also been several studies showing that openly available articles are cited more by peers (Hajjem et al. 2005, Norris et al. 2008, Evans 2009).

Ensuring a good supply of papers

A journal stands and falls with the quality of the papers it publishes. Assuming that it has a reasonable selection process this means the quality of the papers submitted to it. There are two impacts here - the decision to go on-line as an open access journal and the publication of the ERA ranking several months before the first electronic issue - that may be responsible for the catastrophic decline in submissions of good papers from outside Australia, starting some three months before the first electronic issue.

No more than ten years ago, academics did almost all their reading from paper journal issues, while now, most are reading from a downloaded digital copy. Part of this change

has been the proliferation of open access journals (Willinsky, 2005), at the end of 2009 numbering some 6000, covering some 8.5 % of the total output of scientific papers. This is the so called Gold Open Access, which is published without any restrictions. An additional 11.9 per cent are available as Green Open Access, i.e. available as open access a year after publication in a journal with restricted access. This means that a total of 20.4 per cent of all scientific papers are available on free access (http://www.doaj.org/).

It is difficult to establish the impact of the decision to go on-line. There are feelings among some potential authors, voiced by the chair person of the ranking committee for the discipline, that it is less prestigious to publish in an exclusively electronic journal, and that electronic journals cannot be ranked A or A*. The latter is wrong, at least to the extent that in other disciplines there are many examples of electronic top ranking journals. It can also be argued that free access online journals opens up a totally new readership, particularly in developing countries that would attract many authors that regard this as important to publish in such journals.

The decline in the supply of international papers started also before it was announced that the journal would go online exclusively.

The evidence points to the decline in submission of international papers being the direct result of the publication of the ERA ranking where the journal was ranked B. In the last year before the ranking was released 40 per cent of the papers came from Australia, 29 per cent from Africa, 6 per cent from Europe and 25 per cent from Asia (primarily HK, Malaysia and Thailand). In the period after the release, the corresponding figures are 62 per cent from Australia, 28 per cent from Africa, 3 per cent from Europe and 7 per cent from Asia. This is obviously going to be very difficult to turn around as it is primarily outside the control of the editor. A strong promotion in Australia seems to have been quite successful and the emphasis is now on promoting the journal in Asia and Europe through personal requests to colleagues and through the editorial board members.

It was always obvious that the ERA ranking was going to be self-fulfilling but the speed and the magnitude of the impact on the submission of international papers is surprising. In a way, it should not matter, as the international papers can be replaced by good Australian papers, but it is difficult to promote the journal as truly international with no international papers to back it up.

The promotion, which has been successful in Australia, has concentrated on three things. Firstly, it has emphasised the need for Australia to have a respected journal, with all the spin-off this mean in terms of involvement for people in Australian institutions. The remaining two aspects have been used internationally as well as in Australia and include an extremely short period from submission to publication and a great number of registered readers.

Despite problems with referees and in particular specialist referees such as statisticians with completing their reviews on time, the time has been kept under five months with one exception, not counting a couple of instances where authors have taken so long to make necessary amendments that they have missed the next issue. For authors that think they have got something to say, particularly if there is an ongoing discussion, the speed of publication should be a powerful argument to use the journal.

The final argument is the size of the readership. With almost 300 registered readers, we compare well with most journals in the field, most of which have less than 100 subscribers. While registrations and subscriptions are not directly comparable, the free access provides another powerful incentive. With free access to the full text of the articles, there are advantages also for a casual reader who discovers a paper through the many search avenues open to readers. What this means is that by placing a paper in the journal, it becomes available to a wider range of readers than most alternatives.

READERSHIP

Before the change to online publishing, the readership of the journal was almost exclusively Australian. Stray copies found their way to Singapore and Malaysia but a substantial proportion of the papers would have come from places where the journal was not available. This situation has now been reversed. The readership is much more widely distributed than the sources of papers. Australia, including NZ, still dominates with 45 per cent of the total, followed by Asia 27 per cent (including 4 per cent from the Middle East), Europe 18 per cent (about half from UK), Africa 17 per cent and the Americas 3 per cent. Given the solid interest in Asia and Europe, it would seem that with an upgrading to A or A*, there is no reason why the journal should not be able to increase its attraction as a place to publish most things. On the other hand, there is still sufficiently readership in Australia, NZ and Singapore to justify a limited number of papers of special interest to the region.

A source of surprise is that very few of the readers are practitioners. Virtually a hundred per cent work at universities or research institutes. This may indicate that it would be desirable to stress the non-academic segments of the journal, primarily the viewpoint, but also the book reviews, to get professionals to register.

CONCLUSION

Close observation of the impact of actions designed to change the way a journal is published has provided us with information that would be of considerable interest to anyone contemplating a similar action. Consistent with the aims of the research project,

there is now also an action plan covering all issues except reviewing where various revisions of action plans have been met by moderate success only.

On the whole, the aims of the change over from paper only to free access electronic publication have been reached. The readership has increased from 20 subscriptions to some 300 registered readers. The journal is now published four issues per year instead of two, but despite this, the cost to the sponsors has not increased.

It is impossible to isolate the impact on the supply of papers as the change-over coincided with the publication of the ERA ranking, but there is no evidence that the support in Australia has declined.

The change-over has also made it possible to be more responsive to the needs of primarily authors but also readers. However, the changing environment for academic publishing caused by the ERA ranking has caused problems that are not related to the management of the journal, and may in the long run prove terminal.

The remaining issue is the reviewing where different approaches have failed to solve the problems of quality and reliability.

There is no evidence that either readers or authors are interested in the new flexibility offered by electronic publication. The opportunities for interactive reading, multimedia presentations and commentary have not been utilised as yet, in the way that they are in some of the UTS ePress publications in the social sciences.

The findings presented here are tentative as the time frame is too short to identify, with high levels of confidence, trends, random events and permanent changes.

REFERENCES

Björk, B.C., Welling, P., Laakso, M., Majlender, P. and Hedlund. T. et al. (2010) Open Access to the Scientific Journal Literature: Situation 2009. PLoS ONE 5(6): e11273. doi:10.1371/journal.pone.0011273http://www.plosone.org/article/info:doi/10.1371/journal.pone.0011273 Accessed 20 March 2011.

Chalmers, A.F. (1982) *What Is This Thing Called Science*, University of Queensland Press, Brisbane.

Dick, B. (1997) Rigor and Relevance in Action Research, http://www.scu.edu.au/schools/gmc/ar/arp/rigour.html, accessed 20 March 2011.

Dick, B (2002) „Postgraduate programs using action research', *The Learning Organization*, Vol 9 no 4 pp 159 – 70.

Dick, B. (2001) Action research: action and research, in Sankaran, S, Dick, B, Passfield, R & Swepson, P. eds.) *Effective Change Management Using Action Learning and Action Research: Concepts Frameworks, Processes, Applications*, Southern Cross University Press, Lismore, pp. 21-27.

DOAJ, Directory of Open Access Journals, Homepage http://www.doaj.org/2010) accessed: 20 March 2011.

Elden, M. and Chisholm, R.F. (1993) „Emerging varieties of action research: introduction to the special issue', *Human Relations*, Vol 46, pp 121 – 42.

Evans, J.E. and Reimer, J. (2009) „Open access and global participation in science'. Science, Vol 20: no 1025. http://www.sciencemag.org/cgi/content/short/323/5917/1025. Accessed 20 March 2011.

Hajjem, C., Harnad, S. and Gingras, Y. (2005) Ten-year cross-disciplinary comparison of the growth of open access and how it increases research citation Impact. *IEEE Data Engineering Bulletin*, Vol 28: pp 39–47. http://eprints.ecs.soton.ac.uk/11688/ accessed 20 March 2011.

Lessig, L. (2004) *Free culture: How big media uses technology and the law to lock down culture and control creativity*, Penguin.

McKey, J. and Marshall, P. (2001) „The dual imperatives of action research', *Information Technology & People*, Vol 14, no I, pp 45 – 57.

Norris, M., Oppenheim, C. and Rowland, F. (2008) The citation advantage of open-access articles', *Journal of the American Society for Information Science and Technology*, Vol 59: 1963–1972.

Punch, K. (2005) *Introduction to Social Research*, (2nd ed), Sage Publications, Thousand Oaks.

Stringer, E. (2004) *Action Research in Education*, Pearson, NJ.

Willinsky, J. (2005) *The Access Principle: The Case for Open Access to Research and Scholarship*, MIT Press, Cambridge, Mass. USA.

Wilson, K. (2005) „Open access publishing: free journals online, *Online Currents*, Vol.20 Issue.5, June.

Regulatory Theory Applications Underpinning the National Licensing System for Educational Requirements in Property Licensing

Hera Antoniades
Faculty of Design, Architecture and Building
University of Technology, Sydney, Australia

ABSTRACT

In July 2008, the Council of Australian Governments (COAG) agreed to establish a national licensing arrangement for seven occupational areas, including the building and property sector licensing, with respect to builders, property agents, conveyancers and valuers. The aim of these reforms is to establish a more uniform licensing system within these jurisdictions. Currently, these licensing requirements are managed under the auspices of individual state and territory Offices of Fair Trading. However, despite uniformity in the choice of regulator, the licensing provisions themselves are not uniformly designed, or enforced. For example, in New South Wales, the regulation of property agency is part of the Property Stock and Business Agents Act 2002, and the associated regulations. The purpose of this research paper is to analyse the different State and Territory laws and regulations applicable to the educational requirements for property agency licensing and to explore appropriate governance requirements for a uniform model of educational qualifications. The paper uses regulatory theory applications to evaluate the current educational requirements for the property licensing systems operating within Australia. It is argued that a national model for educational qualifications for licensing is feasible; however, transitional rules will need to be implemented to allow each jurisdiction the opportunity to phase-in the recommended changes gradually.

KEYWORDS

builders, education, governance, national licensing, property agents

INTRODUCTION

In July 2008, the Council of Australian Governments (COAG) agreed to establish a national licensing arrangement for seven occupational areas, including building and building-related occupations, valuers and property agents. The aim of these reforms is to create a more uniform licensing system across state and territory borders and provide "for a more mobile workforce" (COAG, 2008). At present licensing is managed under the auspices of individual state and territory Offices of Fair Trading and these individual

regimes have followed historical patterns reflecting the ad hoc and inconsistent development of the regime. It is argued that this lack of consistency is counter-productive to the development of a seamless property market throughout Australia and can lead to inefficiencies and gaps in consumer protection.

So whilst each jurisdiction established regimes that mandated compliance with the legislation each State and Territory also enacted differing provisions, requirements and penalties. Currently, licence holders are required to hold separate licences in the appropriate state or territory where the work is being performed. In 1992, the Mutual Recognition Act was introduced to facilitate the movement of property agents around Australia by recognising licences granted in one jurisdiction as suitable for another jurisdiction. For example a licensed agent in New South Wales, would be able to work as a licensed agent in Victoria. However, there were still limitations and barriers imposed, such as education qualifications, which hindered property agents to move around freely within Australia. It is envisaged that with the introduction of the National Occupational Licensing System (NOLS), licence holders will be able to work in any state or territory with a single national licence.

The purpose of this research paper is to analyse the different State and Territory laws and regulations applicable to the educational requirements for property agency licensing and to explore appropriate governance requirements for a uniform model of educational qualifications. Property agency licensing includes, real estate agents, business agents, strata managing agents, stock and stations agents, and auctioneers. Therefore, valuation licences are not considered a part of the property agency cluster, but fall into the general area of property licences, with different legislative controls and requirements. The paper commences with a discussion of the purpose and intent of the National Licensing System, and then leads into the next part of the paper which uses regulatory theory applications to evaluate the current licensing system and the educational qualification requirements operating in Australia.

THE NATIONAL LICENSING SYSTEM – PURPOSE AND INTENT

The Council of Australian Governments (COAG) commenced in 1992 and is the peak intergovernmental forum in Australia. Its members consist of the Prime Minister, the Premiers of each of the six states, the Chief Ministers of the Two Territories and the President of the Australian Local Government Association. The function of COAG, according to their website, “initiates, develops and monitors implementation of policy reforms that are of national significance” and which “require co-operative action by Australian Governments”. Assistance is also given to COAG through institutional arrangements such as Commonwealth-State Ministerial Councils, Intergovernmental

Agreements and national strategies (NLA for Specified Occupations 2008). Together, these arrangements comprise the core of Australia's governance arrangements for the design and implementation of uniform regulation. According to the business web dictionary, governance is defined as the "establishment of policies and continuous monitoring of their proper implementation". Hence the forum provided by the COAG facilitates the drawing together of stakeholders such as the State and Territory governments in a way that supports co-operative decision-making.

The COAG has chosen the development of the National Licensing System (NLS) as part of its regulatory reform agenda. As a consequence, the COAG aims to „remove overlapping and inconsistent regulation between jurisdictions" (NLA for Specified Occupations 2008) for seven occupational areas, including property sector licensing, with respect to property agents, conveyancers and valuers. It is anticipated that these changes (NLA for Specified Occupations 2008 and 2009), will lead to many positive outcomes, such as:

- Improved business efficiency and the competitiveness of the national economy
- Reduced red tape
- Improved labour mobility and enhance productivity

The NLS will be administered by an established National Licensing Board (NLB) which will bear the responsibility of the NLS legislation. All jurisdictions will receive the benefit of the services from the NLB who will delegate the operation of the licensing services. The benefits anticipated with the establishment of the NLB will be to minimise disruptions in the transitional and implementation stages of the proposed reforms. The NLB will be responsible to the Ministerial Council for Financial Federal Relations (Regulation Impact Statement April 2009). Essentially under the new reforms, licensees will be able to operate throughout Australia on a single and uniform licence.

Victoria has been selected as the host jurisdiction for the NLS legislation. Therefore, once the legislation has been passed by the Victorian Parliament, the remaining States and Territories will be required to adopt the same laws within their own jurisdictions. Thus it is envisaged that the NLS legislation will define the "structure and functions" of the licensing system operating in Australia's property sector by means of co operative national legislation (Regulation Impact Statement April 2009).

ISSUES WITH THE CURRENT PROPERTY LICENSING SYSTEM

At present, there is little consistency regarding property licensing in the various jurisdictions. Accordingly a property licensee is unable to work throughout Australia without holding valid licences in each jurisdiction. Different State and Territory regulatory bodies are responsible for the administration, entry criteria, and ongoing

conduct requirements for licensees. Moreover, each body has varying requirements with respect to fundamental licensing matters such as compliance and disciplinary procedures, updated registers of licensees, educational qualifications and continuing professional development requirements. Importantly licences which are issued in the property services sector for property agents, business agents, strata managing agents, and stock and station agents have different parameters, scope of work and entry requirements.

For example, the table below, identified as Table 1, indicates the range of fees applicable to four occupational licences, across Australia. The fees set out in the table include the cost for a licence in the first year and also on a continuing basis. These fees are taken from the highest and lowest cost within each particular licence category.

Table 1 – Range of fees for licences

Building Individual building contractor (new)	$333.00 to $1,010.65
Electrical Individual electrician/qualified supervisor	$ nil to $350.00
Property Individual real estate agent (new)	$262.40 to $1,060.50
Maritime Master Class 3 (new)	$29.14 to $304.66

Source: 2009 Offices of Fair Trading within each jurisdiction

As indicated above in Table 1, there is no consistency with the licence fee structure and there are similar issues with the licence nomenclature and also the duration of the licence. The existing licence administration fees structure obviously lends itself to a range of complex and time consuming problems.

Businesses and consumers are ultimately bearing the burden of these various direct and indirect compliance costs and differing regulatory requirements. Some businesses hold multiple licences across Australia, in order to carry out their work, and these costs can be very significant (NLS for Specified Occupations 2008).

Furthermore, these direct and indirect costs contribute to a greater proportion of the total costs for small to medium sized businesses. The number of businesses affected is growing at a faster rate than the growth of the business economy. For example, in Table 2, the construction industry business growth represents a large majority of the people employed in the industry and requiring some form of licence within their own jurisdiction.

This table indicates the fast growth over the last few years for employed tradespeople, who in New South Wales must hold appropriate licences for each category of their work. Similarly, if these tradespeople also wish to work in another state or territory, the appropriate licence for that jurisdiction must also be held by the tradesperson.

Table 2 – Construction industry

Dates	Type of employment	Employed staff	Business growth
1st July 2003 to 30th June 2007	Tradespeople	Less than 20	45.9%
1st July 2003 to 30th June 2007	Licensed Contractors	Less than 20	11.3%

Source: 2009 Offices of Fair Trading within each jurisdiction

Table 3 shows the percentage growth of businesses that operate in more than one jurisdiction. Interestingly both Construction and Property indicate a huge growth of businesses who operate in more than one jurisdiction and therefore are burdened with the additional task of licences and compliance costs for every jurisdiction.

Table 3 – Construction and property industry

Dates	Industry	Two jurisdictions	More than one jurisdiction
1st July 2003 to 30th June 2007	Construction	19.9% growth	30% growth
1st July 2003 to 30th June 2007	Property	10.4% growth	22% growth

Source: Australian Bureau of Statistics

It could be reasoned that even though property has sustained a 22% growth (as indicated in figure 3 above) the introduction of "mutual recognition" within the jurisdictions, for property licences would have eased the burden of compliance and lack of uniformity.
However, a licence issued in one jurisdiction can be the equivalent of a number of different licences in another jurisdiction. For example, in New South Wales there are separate licences for Real Estate Agent, Business Agent, Strata Managing Agent, Stock and Station Agent, and Auctioneer, yet to undertake the same scope of work in Victoria only one licence is required for a Real Estate Agent and Business Agent. So whilst mutual recognition does exist, because of the varying licensing regimes, each individual is required to apply for separate licences, pay the prescribed fee and meet the different skills and non-skill requirements in each jurisdiction. This raises concerns over the unnecessary costs, demanding and repetitive work required to sustain current licences.
Therefore, businesses working in multiple jurisdictions must comply with the regulatory requirements of each jurisdiction. Table 4 is a summary of the various licences available to property agents in each of the states and territories.

Table 4 – Property industry: licence categories in each jurisdiction

Occupational Area	NSW	VIC	QLD	WA	SA	TAS	ACT	NT	TOTAL
Property	14	1	10	5	2	4	7	11	54

Source: National Licensing System for Specified Occupations: Consultation Regulation Impact Statement October 2008

The term "property" in Table 4 includes property agents, business agents, strata managing agents, stock and station agents, conveyancers and valuers. This can consist of different licence categories, classes and subclasses, and licence endorsements.

There are currently 103,435 licences held in the property area, across Australia. (NLS July 2009). The Productivity Commission has estimated that if the NLS reforms were to proceed there would be an economic benefit of between $1.5 billion and $4.5 billion (Regulation Impact Statement April 2009).

Table 5 indicates as at 28th March 2008, a listing of the categories and licences and/or certificates held in each category for New South Wales, for the property industry.

Table 5 – Property industry: licence categories in each jurisdiction for New South Wales

Real Estate Agents	14,821
Stock and Station Agents	2,882
Business Agents	2,748
Strata Managing Agents	1,373
On-Site Residential Property Managers	124
Corporations	5,058
Certificate of Registration	17,088

Source: Regulation Impact Statement October 2008 and April 2009

In contrast to the information above for New South Wales in Table 5, the state of Victoria requires only one licence for the category of real estate agent and business agent.

A COMPARATIVE ANALYSIS ON EDUCATIONAL REQUIREMENTS FOR PROPERTY LICENSING FOR EACH JURISDICTION

Generally, those who work in the property industry buying, selling, leasing and negotiating in property transactions must be either licensed or hold a certificate of registration. A licensed property agent, under the Property Stock and Business Agents Act 2002 is a person who for reward is able to "negotiate or induce a range of property transactions including a sale, purchase, exchange and leasing" (Office of Fair Trading,

NSW, May 2008). A certificate of registration holder must work under the authority of a licensed property agent.

Table 6 is a compilation of relevant acts and regulations for property licensing across the Australian jurisdictions.

Table 6 – Property industry: governance for each jurisdiction

JURISDICTION	GOVERNANCE
NSW	Property Stock and Business Agents Act 2002 and the associated Regulations
VIC	Estate Agents Act 1980
QLD	Property Agents and Motor Dealers Act 2000
WA	Real Estate and Business Agents Act 1978 and Regulations 1979
SA	Land Agents Act 1994
TAS	Property Agents and Land Transaction Act 2005
ACT	Agents Act and Regulation 2003
NT	Agents Licensing Act and Regulations 2009

Source: Each jurisdictions Office of Fair Trading December 2010

Each jurisdiction has its own provisions regulating property agents and licensing entry requirements; and these provisions have a mix of similarities and differences with each other. Competency based qualifications have been gradually introduced for occupational licensing. The National Training Information Service provides to the property industry the units of competency for the various sectors. Each jurisdiction has a training authority to oversee the implementation of the units of competency. Competency has been described as "the application of knowledge and skill in order to achieve the performance standard required for some specified workplace activity" (Office of Fair Trading, July 2008).

Therefore, broad similarities amongst the regimes are the requirement for all individuals, for any type of licence category, to complete units of competency from the Property Services Training Package (CPP07). In addition, each jurisdiction states that the underpinning knowledge, within these units of competency, must be based on the relevant laws within the appropriate state or territory. The units of competency are very prescriptive within each jurisdiction. There are compulsory core units, compulsory common units and compulsory elective units. Depending on the type of licence, and duties to be performed the number of units varies from 4 core units to 10 core units. For example, as shown in Table 7, to obtain a business agents licence in New South Wales, an individual must complete 8 core units and 4 elective units, being a total of 12 units. However, if the same individual wanted to obtain the education qualifications for a real estate agents licence the individual would not necessarily be required to complete 24 units. In this instance there is only one common core unit for these two licences, and so

the individual would need to complete 4 core units; however because there are 2 common elective units the individual would need to complete 17 elective units.

Table 7 – Units of competency for New South Wales licences

	CORE	ELECTIVE	TOTAL
Real Estate Agent	5	19	24
Business Agent	8	4	12
On site residential property manager	10		10
Stock and station agent	12	9	21
Auctioneer – stock and station	14	9	23
Auctioneer – real estate	7	19	26
Buyers agent	4	5	9

Source: Office of Fair Trading New South Wales December 2010

The data in Table 7 only relates to property agency licensing. This does not include licensing requirements for valuation work or licensing for a conveyancer.

In contrast Victoria has only one licence category, with a total of 24 units of competency. Of these 24 units, 21 are common units with the Real Estate Agents licence requirements in NSW, but only 4 are common units with the Business Agents licence requirements in NSW. The reason for these differences relates to the prescriptive approach by New South Wales to nominate relevant units of competency relating to each licence category.

However, it can be argued that New South Wales adopts a more selective approach when nominating relevant units of competency. Modules such as appraise a business; list business for sale; negotiate sale and manage sale to completion or settlement; obtain prospects for listing; promote and market listed business; work in the business broking sector are all specifically written for the business agency sector to acquire specialist knowledge of the industry. In comparison Victoria approaches the educational requirements from a generic perspective and has one common licence for all categories. An advantage with one common licence is less paperwork and less red tape, and the educational requirements are streamlined and simplified. A disadvantage of this method, though, is the loss of specialised knowledge for each category of licence. Hence it could be viewed that the educational requirement in New South Wales offers the consumer the best advice and expertise for the discipline in which the agent is licensed.

Western Australia and Queensland also had similar units of competency with Victoria and New South Wales, however not one state had identical units of competency for any of the licence categories. A further anomaly was the qualification link to the units of competency. New South Wales and Victoria mandate the minimum qualification to be a Certificate IV with the relevant units of competency; whereas Queensland, Western Australia, Tasmania, and the ACT prescribe a Diploma level of qualification for licensing. Furthermore Western Australia and Victoria also had the units of competency

embedded in some of their property courses offered at University. These varying educational qualifications are further complicated when assessed against each jurisdictions differing licence categories.

The analysis disclosed only one common compulsory core unit in all states and territories. The unit of competency, CPPDSM4006A, Establish and manage agency trust accounts, is a compulsory core unit in all states and territories for licensing purposes, where the licence category requires the agent to handle trust money. Trust money is broadly classified as money held by an agent on behalf of a property owner, tenants, purchasers, and other stakeholders. Trust Accounting is the recording, classification, reporting and analysis of all trust money received by an agency on behalf of their principal (Antoniades 2010). Therefore, the provisions in trust accounting are an important governance mechanism that aims to protect consumers.

Continuing professional development also featured predominantly with all of the states and territories. There were however, varying topic areas listed and different credit points allocated against each licence category. Additionally, Western Australia was the only state which required an individual to also submit their financial statements with their licence application.

There is scant literature written in Australia, examining the educational licensing requirements for occupational licensing. However, during the last 100 years, regulatory policy has been developed to exemplify the standards for social responsibility and ethical behaviour between property agents and their principal. The development of educational licensing requirements, which was only introduced approximately 35 years ago, was considered a suitable solution to help raise the standards in the property profession.

REQUIREMENT FOR REGULATION

The concept of occupational licensing is underpinned by regulation theory. Academic research has identified two basic schools of thought emerging from regulatory policy, as the positive theories of regulation and the normative theories of regulation (Jamison and Berg 2008). The positive theories of regulation include an examination of "why regulation occurs", and "group theory that describes the roles of stakeholders interest in regulation". The government's solution with regulation requirement is to address the stakeholders individual interest such as consumer protection and ethical behaviour by property agents. To this end the government has introduced minimum educational requirements and continuing professional development. So with regards to real estate licensing regulation, the property owners, tenants, and purchasers would represent the stakeholders.

From a normative perspective the regulators encourage competition where feasible, and minimise the costs of information asymmetries. Additionally, the regulatory agency is intended to improve consumer confidence and welfare. Because of differences in the governments objectives and the real estate agency the government will adopt instruments or policies to achieve their objective. In the scenario of consumer protection, the government has introduced legislation and penalties to deter fraudulent behaviour of the agent. So the question arises, whether in New South Wales, information asymmetries has been considered for real estate licensing provisions. Normative theories require the regulator to provide the stakeholder with information about the sector.

In a research paper undertaken by Akerlof in 1970, the author stated that "The necessity for occupational licensing has traditionally been justified on the basis of asymmetric information. The asymmetry arises when buyers are unable to differentiate the various services offered for sale in the market on the basis of quality." Therefore, for the purpose of this research paper, we could surmise for example that the asymmetry arises when property stakeholders are unable to determine whether or not the person they are dealing with is a holder of an appropriate licence or certificate of registration.

Prior to 2002, property stakeholders in New South Wales had no access to information regarding the licensing status of the person that they were dealing with. But provisions now under the 2002 Property Act require the Office of Fair Trading, NSW, to maintain a public register for licensing checks on property agents and certificate of registration holders. Therefore, prior to 2002, the government had information advantage, with regards to who held a licence or certificate of registration. This is generally referred to as information asymmetry. In New South Wales, from 1st September 2003, licence and certificate of registration information available to the public includes the name and business address of the holder, the category of the licence or certificate, the licence or certificate number, date of issue and expiry, and disciplinary action taken against the licence or certificate holder. Currently most states and territories have gradually introduced legislation, similar to New South Wales, where a public register of licence holders is now available.

Agency theory relationship is based on trust, and involves the consumer engaging a person to act on their behalf. One party is designated as the agent, and acts for and on behalf, or is a representative for the other party, designated the principal (Ross 1973). The regulatory impact for property agents is to ensure correct compliance with the legislation. Therefore, meeting the educational requirements initially to obtain the real estate licence is the first step, and each year following, the agent must undertake continuing professional development.

Since the early 1930's the real estate brokerage industry throughout the United States has been stringently regulated with a great deal of variance in the licensing requirements within each state. An article in 1971 by Amdur highlighted the need for real estate agents regulation for the state of Texas, USA, citing increases in the population and the volume of land exchanged through agents as a contributing factor. Furthermore, the continuous increasing of licences issued to agents identified the need for a more stringent regulation to regulate the "relationship between real estate agents and the public". The licensing regulation in Texas was initially incorporated in 1939, where as in comparison to New South Wales licensing was regulated from the late 1800's and formalised in the early 1900s, followed closely by the majority of the other Australian states and territories.

In a research paper undertaken by Jamison and Berg in 2008, the authors contended that governments establish regulation of utilities to "improve sector performance", and debated whether this implied to control market power and /or to facilitate competition, or to protect operation and customers from politically-driven decisions. However, it can be said that regulation of any industry requires a "control mechanism" from the regulator. In the case of occupational licensing, there does appear a trend to use educational requirements as the vehicle to determine acceptance of a licence and the ongoing renewal process for the licence.

CONCLUSION

This research paper set out to evaluate the current educational requirements for property licensing. The analysis disclosed that each jurisdiction has its own provisions for the regulation of property agents and the relevant licensing entry requirements; and these provisions have a mix of similarities and differences with each other. One of the major problems identified with the differences in the educational requirements was the relationship with the different category of licences and the selection of the units of competency. For instance, New South Wales has 14 licence categories and Victoria has one licence category. Furthermore each state is able to select units of competency from the National Property Services Training Package.

It was argued that one common licence would result in less paperwork and less red tape, and the educational requirements could be streamlined and simplified. However the disadvantage to this approach could be the loss of specialised knowledge for each category of licence. Therefore, if the national licensing system were to be implemented, it would be necessary to maintain appropriate educational standards for new licences, and the maintenance of skills through the expansion of continuing professional development.

The analysis disclosed CPPDSM4006A, Establish and manage agency trust accounts, as a compulsory core unit in all states and territories for licensing purposes, where the licence

category requires the agent to handle trust money. However, there were no other common units of competency identified.

In conclusion a national model for educational qualifications for licensing is feasible; however, transitional rules will need to be implemented to allow each jurisdiction the opportunity to phase-in the recommended changes gradually. Underpinning the success for the national model will be the introduction of a single national licence to work in any state or territory.

REFERENCES

Akerlof, G. (1970) „The Market for Lemons: Qualitative uncertainty and the Market Mechanism'. *Quarterly Journal of Economics*, 488-500.

Agents Act and Regulation. (2003) ACT (State).

Agents Licensing Act and Regulations. (2009) Northern Territory (State).

Amdur, A.R. (1971) „The Real Estate License Act – Synopsis, Elaboration and Comments', *South Texas Law Journal* pp 269-290.

Antoniades, H. (2010) *Real Estate Trust Accounting*. 7th Edition, Accounting Real Estate Publications, Sydney.

Australian Bureau of Statistics, *ABS 8165.0: Counts of Australian Businesses including entries and exits*, June 2003-June 2007: Businesses by Industry Division by Single State/Multi State, by Employment Size Range, Australian Bureau of Statistics.

Council of Australian Governments. (2008) *National Licensing System for Specified Occupations: Consultation Regulation Impact Statement*, COAG, ACT.

Council of Australian Governments, (2009), *National Licensing System Regulation Impact Statement for Specified Occupations*, COAG, ACT.

Council of Australian Governments. (2009) *National Licensing System for Specified Occupations, Decision Regulation Impact Statement*, COAG, ACT.

Council of Australian Governments. (2009) *National Licensing System: Frequently asked Questions*, COAG, ACT.

Council of Australian Governments, National Licensing https://www.govdex.gov.au/ confluence, viewed 24th August 2009.

Estate Agents Act. (1980) Victoria (State).

Jamison, M.A & Berg S.V. (2008), „Annotated reading list for a body of knowledge on infrastructure regulation', University of Florida, Public Utility Research Centre.

Land Agents Act. (1994) South Australia (State).

Mutual Recognition Act. (1992) (Commonwealth).

Office of Fair Trading. (2004, December) *Discussion paper - Regulation of commercial property agents under the property stock and business agents act 2003*, NSW Office of Fair Trading, Sydney.

Office of Fair Trading. (2010) *A year in review 2008-2009 Fair Trading: serving consumers and traders in NSW*, NSW Office of Fair Trading, Sydney.

Property Agents and Land Transaction Act. (2005) Tasmania (State).

Property Agents and Motor Dealers Act. (2000) Queensland (State).

Property Stock and Business Agents Act. (2002) and the Associated Regulations, New South Wales (State).

Real Estate and Business Agents Act. (1978) and Regulations 1979, Western Australia (State).

Ross, S. (1973) „The Economic Theory of Agency: The Principal's Problem'. *American Economic Review*, Vol 63, No 2, pp134-139.

Capstone: Sweet and Sour Experiences

David Copray and Jim Smith
Institute of Sustainable Development and Architecture
Bond University, Gold Coast, Australia

ABSTRACT

Capstone subjects are a feature of many built environment degrees. At Bond University the property, urban development, urban planning, construction management and quantity surveying specialisations share the integrative Capstone subject. Capstone students are given unique projects from industry clients who are interested in involving and releasing the capabilities of final year students on a multi-dimensional project involving facets in the areas of town planning, environmental, financial, construction, sustainability, design, social and administrative capabilities and which can be completed in 13 weeks. The project is assessed by the capstone staff as having a high research content as well as practical relevance and not just being a descriptive approach of a static situation. Students work in groups of 2, 3 or 4 (size depending on the task) with some groups working on the same client problem that has a number of dimensions and other groups working on an individual project where one analysis is sufficient. Emphasis is given to scope definition and the understanding as well as targeting of the client needs through a thorough literature review, data collection involving a range of techniques depending on the situation, analysis of the data and conclusions and recommendations. Client response to date after three years has been positive with clients requesting more involvement with this subject. Clients to date have included a major local property developer, Delfin Group, Mirvac, Billabong and Queensland Health. The positive experiences of Capstone are highlighted in this paper, which include high quality multi-disciplinary reports and presentations with student groups appreciating the benefits of integrated learning based on original research with a real project for a large private organisation. Capstone projects however can also be associated with a number of problems, possibly endemic, mainly based around the organisation of the work and from the attitudes of some of the student participants. The authors present a „warts and all' view and discussion of capstone projects for the benefit of academics and organisations involved in these projects. Possible solutions to some of the problems are also proposed for further discussion at the conference.

KEYWORDS

capstone, integrated projects, problems benefits

WHAT IS CAPSTONE?

Based on the literal meaning of the word capstone in relation to built environments, one may conclude that capstone projects are "fixed on top of something" (Oxford University Press, 2011) and indeed this characterization delivers a remarkable resemblance to the practical role that such projects play in the educational sector. Based on the origin of the word and its elementary contemplation of the finishing elements of a particular piece of work, the concept has been extended to include not only built edifices, but also processes and activities of any kind that are in formal completion. It is this exact purpose that Capstone Projects fulfil in the world of education.

Perhaps most closely comparable to the commonly prepared tour de force required to qualify as a master craftsman in traditional occupations such as carpentry, Capstone Projects in higher education represent an ultimate application of the combined qualifications, skills and competencies that students have attained throughout their respective degrees. Regardless of the specific field, such projects should incorporate an element of practical relevance as well constituting an academic challenge above and beyond that of the often rather conceptually confined individual subjects or classes that form the components of the degrees. In a holistic and integrated fashion, such projects challenge students to demonstrate the wholehearted comprehension of the particular fields of practice, requiring a review and synthesis of the entire spectrum of acquired knowledge from their degrees. In doing so, Capstone Projects not only act as a peaking experience that allows students to increase their awareness for all things acquired throughout their degrees in synergy, but also provide a platform for the active transition from academia and education into the professional workforce.

> *A growing number of universities in Australia and internationally have considered the need to provide students with a 'crowning' academic experience that brings together the knowledge of an academic discipline or inter-disciplines and student transition to the world of work.* (Holdsworth et al. 2009)

As far as the history of capstone is concerned, Gardner, et al. (1998) collected the senior year or senior year experiences (capstone) from various authors, including Levine (1998) and Cuseo (1998). These practices were noted as providing an appropriate vehicle for final year students to reflect, integrate, assess and summarise their course experiences. In fact, these courses placed great emphasis on the capstone or senior seminar experience.

Capstones are not new. Some evidence indicates that they were used as early as the eighteenth century where they were used to integrate philosophy and religion (Levine, 1978). In the 1970s Levine (1978) conducted a survey on the methods and goals of capstones and found their incidence in the universities surveyed at a low 3%, but they

could be found in 5% of institutions nationally (in the USA). Cuseo (1998) also reviewed experience with senior seminars and capstones in the USA. This work centred on analysing capstones in terms of their types, goals and form of experience. Henscheid (2000) in a national US study conducted a desktop study of various databases and discovered that most capstone courses were connected and coordinated by a particular academic discipline or department. A related national survey identified nearly 900 instances of capstone subjects in US colleges and universities. These capstones were identified as falling into one of five types:

(a) *Discipline and Department Based* (majority of capstones) – these summarise learning within a discipline or major.

(b) *Interdisciplinary* (second most common) – these synthesise and integrate interdisciplinary features of the courses.

(c) *Transition* (third in popularity) – these prepare students for employment, graduate school and life after university and often involve career staff and external professionals.

(d) *Career Planning* (least common) – these encourage professional engagement using university career staff and others.

(e) *Other* (smallest group) – ones that do not fit into the types above and often these span courses, majors and often aim at addressing university goals.

The capstone at Bond University would primarily fall into the interdisciplinary category noted above, but there is also an element of career planning involved with the professional and industry engagement facilitated by the projects selected. Furthermore, given the involvement of students with external professionals as well as potential future employers in the scheme of the capstone project at Bond University, it may also be seen to reflect an element of transitionary nature, thereby striking another of Henscheid's categories. The practical necessity of stepping beyond this classification and facilitating extended and further integrated projects will be illustrated in the later sections of this paper.

CAPSTONES IN AUSTRALIA (A SHORT REVIEW)

There are a number of documented capstones in Australia, not all of which are in the built environment:

- Flinders University, Adelaide in some graduate courses. See http://www.flinders.edu.au/teaching/quality/teaching-methods/teaching-final-years.cfm

- Curtin University, Perth in the Business School. See http://www.business.curtin.edu.au/business/current-students/unit-and-course-information/business-capstone-unit
- Swinburne University, Melbourne in the Business School. See http://www.future.swinburne.edu.au/student-life/why-swinburne/capstone-projects/

A study from the University of Melbourne has documented (Holdsworth et al. 2009) several capstone projects in five Faculties:

- Project Planning Studio, Faculty of Architecture, Building and Planning;
- Business Practicum (3rd year), Faculty of Economics and Commerce
- Capstone Design projects (System Modelling & Design), Melbourne School of Engineering
- Experimental Research project (Zoology), Faculty of Science
- Knowledge Transfer Project, Case Competition (Marketing), Faculty of Economics and Commerce

The same University of Melbourne study provided details of some significant capstone subjects based on various approaches to completing the capstone at a number of other universities, many of which are overseas. The ones noted were:

- Internship Experience, London School of Economics and Political Science
- Virtual Situated Learning Environment Case Study, RMIT School of Management and IESEG School of Management, University of Lille, France
- Master of Public Administration Capstone, London School of Economics and Political Science, School of Business

Baccarini (2009, 2010) has also documented the planning and implementation of capstone projects in similar built environment educational programs to the one described by the authors at Bond University and in a similar action research approach to the one adopted in this paper.

TYPES OF CAPSTONE

Capstones can be based on a number of approaches. Moore (2008) summarised three basic ones as follows:

- Students are presented with a problem and draw upon their knowledge and research to weigh and select various data leading to a solution of the problem which is workable and intellectually defensible.
- The approach and decisions made reflect attitudes, values, feelings and beliefs characteristic of the discipline and the profession.

- The production of a project, solution to a problem and the oral and visual presentation of it, reflects a degree of skill competency as a communicator.

Holdsworth et al. (2009) describe the types of capstone that capture these approaches to include:

- Problem Based Learning (PBL)
- Project Based Learning (PjBL)
- Case Study Analysis
- Field, clinical or work placements
- Internships
- Simulations or Virtual Situated Learning Environments (VSLE)
- Travel study tours and immersion experiences
- Service Learning
- Volunteering

The number and types are diverse and aimed to satisfy the teaching objectives of specific courses and it would be incorrect to describe capstone subjects as „one size fits all'. Program coordinators and lecturers need to identify the specific aims and objectives of the capstone they wish to design for their individual course and continuously alter the program design and challenges to meet the contemporary context and the requirement to engage students purposefully within this.

The Bond University capstone subject has elements of the various types of capstone noted above and specifically it is:

- A final year, final semester subject.
- Enabling students to apply a range of knowledge and skills sets to a partially structured industry and profession based problem.
- Designed to promote program consistency and relevance of the chosen major.
- An important exercise in testing the student's communication and research skills and other graduate capabilities and attributes.
- Aimed to integrate and combine knowledge, skills and learning from previous semesters and subjects across a range of different topic areas. This allows students and lecturers to connect their previous studies and learning. (Huber and Hutchings, 2004).
- Supporting graduate career choices and prepares students for the transition between final semester studies and their employment selection.
- Providing potential employers with examples of student work in their employment related areas and demonstrates their problem-solving capabilities and performance.

- Useful and necessary for students to be confronted with a controlled real-world professional environment and one they can reflect on with their peer review and personal diaries.
- Useful for students within their groups and between groups to appreciate a sense of common purpose and working together as a community tackling a common problem.
- A means by which other staff can judge the effectiveness of their subjects in preparing students for integrated project work and the capstone provides a suitable vehicle for some staff to contribute their subject expertise to the project.

CAPSTONE AT THE INSTITUTE OF SUSTAINABLE DEVELOPMENT AND ARCHITECTURE (ISDA) AT BOND UNIVERSITY

Bond University's Institute of Sustainable Development and Architecture has developed a unique approach to the Capstone Project that seeks to synergistically combine the individually potent elements of academic rigor, professional practice and practical relevance. Through continuous refinement in the objectives and methodologies used in the selection, preparation and execution as well as critical review of the Capstone Projects, the program has arrived at a level of maturity that provides for the achievement of a variety of conceptually interlinked, yet practically often neglected, goals in education. The ISDA Capstone Projects provide benefits beyond the student and learning experience by means of contributing effectively and beneficially to real-life projects, whereby fostering closer ties between the academic and the professional spheres. This leads to a regular interplay between academia and practice creating mutual benefits for all involved.

Whilst common models of Capstone Projects rely purely on research or hypothetical reproductions of real-world scenarios, Bond University's industry oriented philosophy and its track record of successful collaborations with external organizations, businesses and entities has promoted a suitable environment for the creation of educationally focused as well as practically integrated student projects. In its 4th year (12th trimester) of operation, the Capstone Project program at Bond University has provided a platform for and continues to deliver added benefits on selected projects to a multitude of organizations, including amongst others, Gold Coast City Council, Billabong International, Queensland Health, Emerald Shire Council, Point Project Management, Delfin Lend Lease and the Varsity Lakes Community Ltd. Positive feedback from many of the project partners has demonstrated that the Capstone Projects not only provide a practically placed opportunity for applied learning to the students, but have also catered

for the requirements of the increasingly complex world revolving around the built environment.

In a recent debriefing for a Capstone Project with members from the Mirvac Group (another continuing partner for Bond's Capstone Projects), it was mentioned that:

> *... working with Bond University, under the heading of the Capstone project, provides us with vital and powerful research and knowledge. This type of intensive and objective research and analysis is often sacrificed in practice due to time and monetary constraints, but it is essential as it not only allows us to make better decisions, but in many cases provides us with the convincing supporting arguments to make more sustainable improvements to our developments.*

This statement demonstrated the distinct value that the Capstone project can provide to create better built environment outcomes and provide commercial partners with the required knowledge and research to make better decisions in the real world.

At Bond University's Institute of Sustainable Development and Architecture, the approach taken to Capstone Projects is one of multifaceted and multidimensional interaction that promotes creativity, self awareness, team working abilities, outcome oriented working and learning as well as the practical applicability and usefulness of produced results. The cornerstone in the achievement of these essential end results rests with the integration of the various built environment related disciplines to which the ISDA offers relevant degrees. These include construction management and quantity surveying, urban planning and design, urban development and sustainability, property and property valuation as well as architecture and environmental management. In a process equivalent to the professional assembly of a project team for the execution of a real-life assignment, during which students are required to promote themselves and their own abilities in an interview-like scenario, teams are designated based on aspects such as discipline of study, interests, maturity, practical experience and team-leading capacity. Whilst teams, in accordance with the Capstone Project philosophy at Bond University, are intentionally multidisciplinary in nature, they are assembled in such a way as to ideally suit the given project/s at hand and to create optimal and creative outcomes.

Representatives from the industry partner organizations are also involved in formulating the conceptual frameworks laying out the most appropriate way in which their particular set of knowledge and skills can provide the most significant contribution to the projects at hand. Given the diversity of the projects as well as the backgrounds of the individual students and groups, there is significant variation in the particular areas that will be investigated and in which students will make recommendations to the industry partners even within the same semester. Through the preparation of a detailed project scope

document prior to the practical commencement of any study, the particulars of the work that is to be executed by the students is specified. The scope also includes roles, responsibilities as well as milestones and ultimate objectives, whereby the practical feasibility and relevance of the projects is assured. This process not only provides a common understanding between partnering organizations, the academic staff and the students, but it also enables and ultimately empowers students to increase their own awareness of their capacity to contribute to real-life projects towards the end of their degree. In doing so it provides students with confidence and assurance of the worth of their studies in the achievement of their own goals in their professional careers.

Upon the completion and authorization of the scope documents and potential sectional adaption, students enter the period of focused research and analysis. During this period, academic staff provides relevant advice on the design and execution of the pertinent methodologies, relating insight in regard to information finding and synthesizing as well as the preparation of a professional semi-academic report. In this context, the term semi-academic relates to the mixture of an academic and a professional consultant report that the ultimate Capstone Project report is intended to constitute. These reports serve the dualistic purpose of informing the client of the work executed by the students as well as any recommendations that arose from such reports, whilst also epitomizing the essence of academic standards and work as learned by the students throughout their degrees. Whereas the expectations of the industry partners are commonly based around convenience and easy navigation of the reports, the academic requirements, such as appropriate referencing and formatting of the reports must not be neglected. As can be expected, the ‚problem of two masters' creates a challenging scenario that must be met with a dedicated focus towards the ultimate goal of providing synergistic outcomes in both the academic and professional realm. Whilst certain compromises may need to be made in the process of preparing reports for these multi-layered expectations, the importance is that the essence of the purposeful integration of the reports in both spheres is not compromised.

In the final stages of the Capstone Projects, the student groups are asked to find the most appropriate form of relating their information to the partnering organizations. Even though the common format is the preparation of a report and associated presentation that summarises the content of the earlier, experience has shown that by providing students with an adequate platform and an open mindset, creativity is spurred and ever new means are found to effectively communicate concepts and findings. At Bond, this has been brought about, amongst others, the construction of both virtual and physical display models, the integration of various illustrative props, interactive web-based tools as well the formation of community based activities. The diversity of communication and

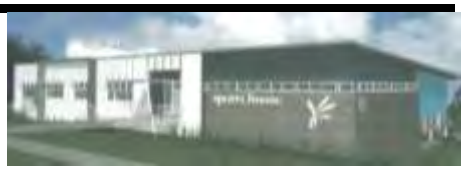
delivery methods is matched only by the diversity of student backgrounds, their creativity and the application of their skills in the respective projects.

The final completion of Capstone Projects at Bond University's Institute of Sustainable Development and Architecture involves a full project debriefing during which students are encouraged to exchange the lessons that they have learned whilst working on their individual projects as well as throughout their degrees and the practical value that they have gained from such work for their future careers in the field. At this stage, the industry partners also provide feedback on the work of the students as well as the relevance that the Capstone Project has or is likely to be associated with in the real-life built environment related projects. By means of this process, an interactive dialogue is usually generated that provides valuable insight on the linkage between academia and practice as well as the transition of students from education into practice.

A brief summary and illustration of projects completed, or in progress, to date are included in Table 1.

Table 1 – The Capstone projects

Industry Partner	Project	Illustration
Billabong	International Headquarters	 
Billabong International is a multifaceted business with active operations in various fields, including the "marketing, distribution, wholesaling and retailing of apparel, accessories, eyewear, wetsuits and hard-goods in the board-sports sector". After the recent acquisition of a significant land parcel adjoining their existing international headquarters in Burleigh Heads, Queensland, Billabong approached Bond University for the inception and preparation of integrated and sustainable development plans for a new „board-sport precinct' to be formed on the combined sites.		
Mirvac Group	Bromelton Intermodal Hub	
Representatives from the Mirvac Group, one of Australia's leading real estate groups and sponsoring partner to Bond University's School of Sustainable Development, approached Bond University for the instigation of a Capstone Project based on a current intermodal hub development at Bromelton, Queensland. Students were asked to contribute to the project in a variety of areas including sustainability, transport efficiency and planning, strategic synergies, land use planning, development staging and international benchmarking.		

Varsity Lakes Community Ltd.	Boathouse	
Varsity Lakes Community Ltd., a non-for profit organization in charge of community development and the oversight of community assets and activities in Varsity Lakes, Queensland, has collaborated with Bond University on several occasions. In a Capstone Project, students supplied valuable background research and insight to improve the delivery of a $1.8 million community sport house facility. Amongst others, students investigated building materials, strategic alliances and partnering, value adding and income generating uses on the site, funding and grant schemes as well as sustainable inclusions for the facilities.		
Gold Coast City Council	Southport/Light rail	
The strategic planning department of Australia's second largest council, the Gold Coast City Council, collaborated with Bond University on a Capstone Project relating to the master planning of one of Gold Coast's central business districts, Southport, in 2010. In the project, students were asked to evaluate a recently prepared draft master plan and make recommendations on its improvement. Students also prepared strategies to increase resident acceptance and usage of the planned light rail as well as proposals for transit oriented developments in the area.		
Point Project Management	9 Mile Development	
Members of staff from Point Project Management, including three alumni from Bond University's Institute of Sustainable Development and Architecture, are currently involved with the execution of a Capstone Project based on a development in Papua New Guinea managed by the firm for a local superannuation fund. The project, which involves the creation of a sustainable and affordable housing community close to Port Moresby, requires students to investigate matters relating to infrastructure delivery, project staging, housing designs and construction materials, project feasibility and community safety as well as active transport strategies.		

FORMAL AIMS AND OBJECTIVES OF THE BOND UNIVERSITY CAPSTONE SUBJECT

The primary aim of this subject is to demonstrate knowledge of the major streams undertaken during the individual degrees including, construction management and quantity surveying, facilities and event management, urban planning and design, urban development and sustainability, property and property valuation as well as architecture and environmental management. The teaching approach is practical emphasising sound

practice, innovation and understanding the role of the various stakeholders influencing the nature and form of development in the built environment. Emphasis is given to teamwork and integration of the disciplines within the framework of the project or problem being analysed.

Extracts from the subject outline of the capstone within the School of Sustainable Development are provided below:

> *Subject Aim*
>
> *This subject provides an opportunity to undertake an inter-disciplinary investigation of a built environment related project, bringing together a student's understanding of sustainable best practices, evaluation, design, investment analysis, planning, development, life cycle costing and financing in a real world project. Furthermore, students are encouraged to demonstrate the diversity of their knowledge gained from formal and informal learning throughout their degrees.*
>
> *Subject Objectives*
>
> *On completion of the subject students should be able to:*
>
> - *Distinguish the various stages of property development from business case, needs analysis, construction methodology, ownership of buildings and life cycle analysis.*
> - *Develop recommendations and justify using various measurable cost and other benefits or advantages.*
> - *Conduct case study investigations to justify their analysis, drawing on other sustainable buildings and research in the area of investigation.*
> - *Be able to plan and execute an integrated project.*

EXPERIENCES AND CRITIQUE

The authors have been involved with the Bond University capstone for the last three years and their experiences are summarised below as part of an action study research approach. Additionally, the capstone students are surveyed at the end of each semester for their views and opinions and these have also provided the basis of the summary provided for the sweet and sour components of the subject.

Benefits (sweet)

Capstone has the following significant benefits:

- Draws together disciplines (construction management and quantity surveying, urban planning and design, facilities and event management, urban development and sustainability, property and property valuation as well as architecture and

environmental management) to establish closer links between areas of skills, knowledge and environmental context in the various majors;

- Provides a significant and different opportunity to assess and evaluate the students' learning in a context related to their chosen majors, a professional environment and in many cases operating with imperfect information;
- Gaps in knowledge and skills become apparent in this project environment where the capabilities of the student are often tested to the limit;
- The expectation is that students work and perform at a higher level due to group activities, the involvement of external clients and the need to present a professional report based on research, analysis, evaluation and recommendations. Business engagement, which is a feature of the Bond University capstone, generates high performance due to the desire to impress the client(s) especially through the interim and final presentations to the client group.

Disadvantages (sour)

- Assessment of performance can be difficult when the project can contain several dimensions that each group may tackle uniquely and the overriding concern of the assessors (internal and external) is to remain objective and not be too prescriptive in assessing the outcomes;
- Some students find the capstone environment outside their „comfort' zone and may react badly to tackling a real world project where a „right' answer cannot be provided, nor expected. Students lacking motivation need attention and coordinators need to be mindful and vigilant that poor performing students in a group can be disruptive and early intervention measures have to be adopted to solve these emerging problems.
- Coordinators must have great sensitivity to the volatile environment as individuals and groups can feel helpless and stressed about the requirements to successfully complete the project. Previously high performing students as well as the less motivated can suffer from this problem and intervention in the form of confidence building or project and scope clarification are necessary immediately when this becomes apparent;
- Problems can emerge if regular briefings, progress meetings and progressive evaluation methods are not established in the program and assessment regime;
- In extreme cases some students may not have the capability to complete the task within a group and coordinators must have a strategy to cope with the situation to the satisfaction of all concerned;

- Students often complain of the great demands on their time for the capstone and careful management as well as timely and appropriate advice are needed to cope with these complaints;
- High expectations are embedded in the capstone project and this may disturb some lesser performing students. Early intervention and advice are essential where these comments are made by students;
- Strategies for coping with failure and problems are unlikely to be straightforward or prescriptive. Each situation has to be handled taking account of the circumstances and the individual(s) and separate resubmissions may be necessary and only in the extreme cases of non-performance would failure be accepted;
- Levels of performance between individuals and groups are always difficult to assess and specific as well as absolute levels of performance can be difficult to document in advance.

CONCLUSION

The Capstone subject is demanding of staff and student time and requires detailed management and organisation for it to succeed. The subject is a risky one in terms of its outcome as the staff cannot control a large number of the variables in the subject and the final outcome. In fact, there may be times when staff are faced with a situation where they have to rely on the goodwill of the industry sponsors of the project, the faith of the students and mine their own problem-solving skills to ensure that the project can be completed and the subject aims and objectives are achieved. Staff and students have to be versatile, flexible, forgiving and innovative if their project is to be completed to a satisfactory standard. There have been a few occasions when the road map at the start of the project briefing process has had to change as a result of exogenous factors, some benign, some serendipitous and others negative. Whilst some students may find this environment too challenging causing them to complain because they are taken out of their comfort zone for their studies, the vast majority begin to appreciate that not all projects have complete or perfect information and part of their role as professionals is to cope with this situation. This is the message students take with them into practice and in the opinion of the authors this is good training for the volatile world they will find themselves in soon enough.

REFERENCES

Baccarini, D.J. (2009) The planning of capstone projects – a case study, AUBEA Conference, 7-10th July, Adelaide.

Baccarini, D.J. (2010) The implementation of capstone projects – a case study, AUBEA Conference, 14-16th July, Melbourne.

Curtin University http://www.business.curtin.edu.au/business/current-students/unit-and-course-information/business-capstone-unit (accessed on 1 February 2011).

Cuseo, J.B. (1998) Objectives and Benefits of Senior Year Programs, in *The Senior Year Experience: Facilitating Reflection, Integration, Closure and Transition*, (ed. Gardner, J.N. and Van der Veer, G and Associates) San Francisco: Jossey-Bass.

Flinders University http://www.flinders.edu.au/teaching/quality/teaching-methods/teaching-final-years.cfm (accessed on 1 February 2011).

Gardner, J.N. and Van der Veer, G and Associates. (1998) *The Senior Year Experience: Facilitating Reflection, Integration, Closure and Transition*, San Francisco: Jossey-Bass.

Henscheid, J.M. (2000) *Professing the Disciplines: An Analysis of Senior Seminars and Capstone Courses*, Columbia, South Carolina, USA: University of South Carolina, National Resource Center for The First Year Experience and Students in Transition.

Holdsworth, A., Watty, K. and Davies, M. (2009) *Developing Capstone Experiences, Centre for Study of Higher Education (CSHE)*, The University of Melbourne. ISBN 9870734040985.

Huber, M. and Hutchings, P. (2004) Integrative learning: Mapping the terrain. Washington, DC: The Association of American Colleges and Universities. Accessed on 2 February 2011 from http://www.carnegiefoundation.org/dynamic/publications/elibrary_pdf_636.pdf.

Levine, A. (1978) *Handbook of Undergraduate Curricula*, San Francisco: Jossey-Bass.

Levine, A. (1998) A President's Personal and Historical Perspective, in *The Senior Year Experience: Facilitating Reflection, Integration, Closure and Transition*, (ed. Gardner, J.N. and Van der Veer, G and Associates. San Francisco: Jossey-Bass.

Moore, R. (2008) Accessed on 31 January 2011 from http://users.etown.edu/m/moorerc/capstone.html.

Oxford Dictionary http://oxforddictionaries.com/view/entry/m_en_gb0122560#m_en_gb0122560 (accessed on 27 January 2011).

Swinburne University http://www.future.swinburne.edu.au/student-life/why-swinburne/capstone-projects/ (accessed on 30 January 2011).

Macquarie University http://www.mq.edu.au/ltc/about_lt/assess_docs/assess_final_stud.pdf (accessed on 31 January 2011).

University Technology Sydney (UTS) http://my.feit.uts.edu.au/pages/course/undergraduate/capstone_main (accessed on 30 January 2011).

Project Procurement as a Market

Gerard de Valence
Faculty of Design, Architecture and Building
University of Technology, Sydney, Australia

ABSTRACT

When building and construction markets are analysed it is often at the project level, with markets defined by sector or structure type, procurement method or contract, size, complexity or other characteristic. Projects within a defined market are then grouped together to establish its importance, detached housing for example, or high-rise commercial. A distinction can be made, however, between a market made up of similar types of projects and the market for a single project. Such a market is created by a client as they go through the procurement process. This paper introduces the idea that procurement of a project creates a identifiable, though temporary, market for goods and services, and that such a market has distinctive characteristics that make it both interesting, as a source of testable hypotheses and further research, and important in developing our understanding of the industry and its dynamics. The research the paper reports on shows that the idea of project procurement as a mechanism for creating a market can utilise the elements of industry structure and competitive analysis that have traditionally been applied at the firm level. The paper concludes that this allows a new perspective on issues such as collusion, ruinous competition and cost uncertainty associated with the typical single price, sealed bid auction used for procurement in the building and construction industry.

KEYWORDS

construction, procurement, market, competition, auction

INTRODUCTION

Building and construction is a project-based industry. Building and construction markets are also analysed at the project level, defined by sector, building or structure type, procurement method or contract used, size, complexity or some other characteristic. Projects within a defined market are grouped together to establish its size and importance, detached housing for example, or high-rise commercial.

A distinction can be made, however, between a market made up of similar types of projects and the market for a single project. Such a market is created by a client as they go through the procurement process. This paper introduces the idea that procurement of a

project creates a identifiable, though temporary, market for goods and services, and that such a market has distinctive characteristics that make it both interesting, as a source of testable hypotheses and further research, and important in developing our understanding of the industry and its dynamics.

The research this paper reports on shows that the idea of project procurement as a mechanism for creating a market can utilise the elements of industry structure and competitive analysis that have traditionally been applied at the firm level. In particular, the extent of market power held, gained or lost by participants as the procurement process goes through the stages of pre-bid, tender, final bid and negotiation, or some variation of those stages, is an important factor. This has been recognised and discussed in previous research by Hillebrandt (2000), who was particularly interested in the client-contractor relationship pre and post tender.

The contribution this paper makes is to extend that earlier discussion by considering market power in the context of issues such as collusion, ruinous competition and cost uncertainty associated with the typical single price, sealed bid auction used for procurement in the building and construction industry.

THE MARKET FOR PROJECTS

When building and construction markets are analysed it is also often it is often based on the types of project. Such markets can be, and have been, defined by a variety of characteristics. Government statistics are typically collected by sector, and then divided into building or structure type, shown in a generalised form in Table 1. Projects within a defined market are then grouped together to establish its size and importance, detached housing for example, or commercial developments. Because the data on industry activity and output is presented in these classifications, analysis of trends and forecasts of construction work are also usually found in this format. In Australia the Construction Forecasting Council (http://www.cfc.acif.com.au/summary.asp) provides bi-annual forecasts and data by sector and building type.

Table 1 – Building and Construction Industry

Sector	Type
Residential building	Detached housing, medium density, high density, alterations and additions
Non-residential building	Private - Retail, commercial, industrial, hotels
	Public - Education, health, community
Engineering construction	Bridges, ports, rail, electricity, roads, water and sewerage, dams, telecommunications, mining

Other typologies use the procurement system or contract used, financing method, size, complexity or some other characteristic of the project. Haas (2007), while not discussing construction directly, identified 10 "complexity dimensions" and three levels of risk for projects. Masterman (2002) has an exhaustive set of lists of project and client characteristics that can be used to classify projects. The public/private client distinction is one that is widely used. Flygberg et al. (2003) argue there is a separate and distinct set of megaprojects, and that the characteristics of these projects make them a focus of research in their own right.

In a review of the research by Runeson (2000), Hillebrandt (2000) and Ive and Gruneberg (2000) on the characteristics of construction markets, de Valence (2011) found a wide range of views on the types of markets, the role of firms and relationships between firms and the products and services they provide within those markets. There was, however, universal agreement that building and construction is an industry of projects, made up of a series of markets for projects.

A MARKET FOR ONE PROJECT

Can an individual project become a temporary market in its own right? The definition of a market found in a standard economics text such as Layton et al. (2009: 80) is "any arrangement in which the interaction of buyers and sellers determines the price and quantity of goods and services exchanged". By this criterion the act of procurement is indeed a market transaction. Procurement comes from the Latin word *curare,* meaning to acquire or to take care of, and the decision to buy requires agreement on price.

The market for a single project is therefore created by a client as they go through the procurement process, regardless of the particular system or method of procurement followed. The client is the buyer of a bundle of goods and services from the contractor/s bidding or negotiating for the project, and their interaction on the scope (quantity) and price of the project is resolved when the agreement or contract is exchanged.

If procurement of a project creates an identifiable, though temporary, market for goods and services, what are the distinctive characteristics of such a market? Clearly it is not like a conventional market described in a textbook. The characteristics of markets, found in Layton for example, are the number of buyers and sellers, the distinctiveness and substitutability of products, forms of competition, barriers to entry and concentration ratio, and the information and mobility of customers.

A market with single buyer is known as a monopsony (the opposite of a monopoly with a single seller). The treatment of buyer power in economics is concerned with how downstream firms can affect the terms of trade with upstream suppliers. A buyer has monopsony power if they can reduce the price paid below competitive levels by

withholding demand. An important distinction is between monopsony power and bargaining power, or the bargaining strength that a buyer has with respect to suppliers. The lower price obtained from monopsony power is achieved by actually purchasing less, but with bargaining power is achieved by the threat of purchasing less (Inderst 2007).

There are two conditions a buyer will have to meet to have substantial buying power: it can easily switch to alternative suppliers, sponsor new entry or self supply without incurring substantial sunk costs; or it is a gateway to the downstream market for its suppliers. The ACCC report (2008: 313) identified two factors other than outside options that may also influence the conduct and outcome of bilateral bargaining between suppliers and retailers. These factors were:

- The role of information: are there information asymmetries regarding the different parties' knowledge of the other parties, for instance, regarding other parties' cost structures? An informational advantage may give rise to an advantage in terms of bargaining power.
- Coordination (tacit or explicit) among suppliers: the presence of incentives for suppliers to undercut any supplier collusion (e.g. to obtain a large order from a retailer) may increase buyer bargaining power.

The most important characteristic of a project as a market with the client as a single buyer is therefore the relative bargaining power on the buyer and seller sides of the negotiation. Unlike a monopsonist, the project client does not have extensive market power, defined as the ability to set prices. In fact, the construction client is often in a weak bargaining position because there is no market price available as a reference point when negotiating with potential suppliers.

The second key difference is the one-off nature of the project. While few projects are unique in the sense of entirely different, because the fundamental elements of a type of building are found in most buildings of that type (e.g. steel reinforced concrete floors in high-rise, wooden frames in houses) each project represents a particular set of requirements in a specific, possibly unique combination.

Two other characteristics are the opposite of conventional markets. Because of the one-off nature of the project, it follows that there is no substitute easily available to the client (especially once committed to going ahead). It is also probable that the contractor will be better informed about current prices of materials, plant and equipment, and labour than the client.

BARGAINING POWER

Bargaining power is different from monopsony power, and found in the bilateral negotiations over terms and conditions of supply between trading partners. In a

bargaining framework, buyer power is the ability to extract surplus from a supplier and differences in buyer power are reflected in differences in individually negotiated discounts. Inderst and Mazzarotto (2008: 1954) suggest a definition of buyer power as the bargaining strength that a buyer has with respect to suppliers with whom it trades, where its bargaining strength depends on its ability to credibly threaten to impose an opportunity cost if it is not granted a concession.

The traditional economic treatment of bargaining power uses the concept of outside options available to buyers and sellers, as summarised in Table 2. The ACCC (2008: 312) described these as "the outside option is the best option that either the seller or buyer can achieve if they walk away from the negotiations. These walk-away options are the minimum negotiated outcome that the respective parties will accept." The more outside options the buyer or seller has the stronger will bargaining position relative to the other party (ceteris paribus). Strong outside options for a buyer, or weak outside options for a seller, will be a major source of buyer power in a bilateral bargaining framework.

Table 2 – Outside options

Buyer's Outside Options	Seller's Outside Options
Size of the buyer	Relative size of buyer and seller
Competition upstream	Market power downstream
Relative size of buyer and seller	Financial dependency

Source: OECD (2008:40-41). See also ACCC (2008 Ch. 14)

Bargaining power cannot be exercised when suppliers are competitive, because it is not possible to push suppliers to price below marginal cost. Bargaining power can only be exercised when in its absence suppliers would exercise market power, and is a countervailing power. This implies the procurement method used when tendering for a building or construction project is a determining factor in establishing or depleting buyer power.

As an aside, this is a different approach to the transaction cost economics used by researchers such as Winch (1989) and Chang and Ive (2007a and b). Their findings on the different characteristics of various procurement systems and the importance of the hold-up problem and asset specificity when negotiating post-contract changes in specification are not directly comparable to the negotiation discussed here.

IMPLICATIONS

This idea that the extent of bargaining power is the key characteristic in the market for a project is discussed below in the context of three issues that have been suggested by other researchers as important in relation to market power in construction procurement,

collusion, ruinous competition and cost uncertainty associated with the typical single price, sealed bid auction. Because public sector clients have to use open or selective tenders as their procurement method this discussion directly concerns them, private sector clients can and increasingly do use negotiation rather than tendering when awarding projects.

A traditional tender will be a single price, sealed bid auction, awarded to the lowest priced bid. In this case there are no negotiations and thus no opportunity to exercise buyer power. The conventional rationale for this form of procurement is that the tender itself, whether open or selective, creates a competitive market between contractors. When this works it is highly effective and can be expected to result in a price that is at or close to the market price for the project (implying the successful bid is will be at the contractors marginal cost).

There are two obvious problems with this outcome however. First, competitive tendering also creates a powerful incentive for contractors to collude; because that is the only way they can increase their profits (see Brockmann 2011 for a detailed explanation and analysis of collusion in construction). As a result collusion has been widespread and endemic in the industry (see OECD 1976 and 2008). In extreme cases it becomes organised on an industry-wide basis, as in the Dutch building and construction industry (Van den Heuvel 2005). The Japanese „dango' system is another example of systemic collusion (Hasagawa 1988). In many countries there are examples of contractors, manufacturers and sub-contractors that have been caught and charged with bid-rigging, market sharing or price fixing (Transparency International 2005).

This link between the extensive use of competitive bidding and widespread collusion does not seem to have been made by clients and regulators. In Australia the ACCC sees pre mixed concrete as an ideal product for cartel arrangements and has found bid rigging, price fixing and market sharing arrangements several times. The ACCC has recently prosecuted cement firms (Queensland 2007), construction contractors (Queensland in 2009), air conditioning contractors (WA in 2008), and fire protection companies (NSW and Queensland 2000). Despite this track record there has been no discussion about reforming tendering practices, particularly in the public sector.

A second problem is the possibility that low-bid tendering competes away not just profits but the ability to invest in future development of industry capability. In his exhaustive detailing of the Dutch industry cartel Doree (2004) argued that conventional low-bid tendering causes "ruinous competition" between contractors. Such excessive competition reduces innovation and R&D, stunts industry development and leads to problems with quality, safety and compliance with the law. Controversially he concluded:

> *Industrial economics suggest that a sector of the construction industry, dominated by highly competitive price-driven public sector procurement, will have a natural tendency to drift towards ruinous competition. This situation is typically conducive to concentration and collusion (2004: 154).*

It is unusual to find an economic argument against competition, as with Doree's suggestion that increased competition might prove counterproductive in the long run. Unfortunately he does not provide an alternative procurement system, only that public sector agencies "integrity-policies and procedures are being evaluated and sharpened" and contractors' associations "enforce codes of conduct on their members" (2004: 155).

The ruinous competition argument is the extreme version of the one above, where Doree suggested that the relationship between competitive tendering and collusion has not been properly understood, and should be investigated further. While it might be the case that competitive tendering produces a race to the bottom, the fact that most contractors survive to tender another project suggests that this is not the key issue.

An alternative is that it just may be that building and construction projects have a significant degree of cost uncertainty associated with them. Cost uncertainty can come from site conditions, weather, change orders, poor quality documentation, problems in the supply chain, breakdown of plant and equipment, price changes for materials over the life of the project and so on. There are many possible factors that can affect the final price of a project, particularly when it may take a year or more to deliver. It is the reality of this cost uncertainty that leads to the idea of the „winners curse' when successful with a low-bid tender[1].

Nagle and Holden (1995: 205) point out that a bidder is much more likely to win jobs for which they have underestimated costs, and are unlikely to win those for which they have overestimated the cost. They suggest the only solution is to add a „fudge factor' to each bid to reflect an estimate of how much the bidder is likely to have underestimated costs if they actually win a bid. This argument was restated by Flygberg et al. (2003) as „optimism bias' when pricing and bidding for large projects.

Dyer and Kagel (1996) argued construction contract bidding is usually treated as a common value auction. What makes the auction interesting is that bidders have different estimates of the true value at the time they bid. If bids decrease with decreasing cost estimates, the low bidder faces an adverse selection problem, as they win only with the

[1] Drew (2011) says the term „winner's curse' was first used in a paper by Capen et al. (1971) who used it to describe the outcome of common value auctions in which large petroleum companies were competing for drilling rights. The volume of oil contained in the well underground is the same for all bidders but at the time of bidding none of the competing bidders knew its true value and some bidders eventually made a loss.

lowest estimate of the cost of construction. Thus the low bidder is likely to suffer „winner's curse', winning the item but making below normal or even negative profits.

CONCLUSIONS

The distinction between a market made up of similar types of projects and the market for a single project is not one that has been developed so far. This paper has argued a market is created by the client as they go through the procurement process, and introduced the idea that procurement of a project creates an identifiable, though temporary, market for goods and services. The discussion pointed out that such a market has distinctive characteristics that make it different from other markets.

In a market with a single buyer, as with a building or construction client, it is possible to gain market power through bargaining with potential suppliers. Such bargaining power cannot be exercised when suppliers are competitive, and can only be exercised when in its absence suppliers would exercise market power. It is therefore a countervailing power and thus constrained in its use by circumstances.

Nonetheless, it is a strange situation when an industry whose clients sacrifice the opportunity to negotiate and exercise buyer power is also seen as being too competitive. Normally these would be mutually exclusive. However in traditional low-bid tendering for building and construction projects this can be the case. From the analysis and argument in this paper that outcome can be seen as two distinct but inter-related problems.

The first problem is not the degree of competition but the prevalence of collusion. This can be explained in part by the many characteristics of the industry that facilitate collusion between contractors (see OECD 2008: 20-22 for details), but it is also a strategy contractors can resort to in order to increase profits when tendering competes away not just excess returns but also normal profits.

One reason profits get competed away to nothing, or less than nothing, is the high level of cost uncertainty for building and construction work. The eventual profitability of a project cannot be known at commencement. Cost uncertainty is an unavoidable fact in building and construction projects. There are many factors, including potential issues with the physical site, that are unknown when commencing, and supplier and subcontractor performance and prices on a project that may take a year or more to deliver while market conditions fluctuate. It is cost uncertainty that leads to the idea of the „winners curse' when successful with a low-bid tender.

This paper has argued that there has not been much previous research into the dynamics of the project as a temporary market, despite the importance of projects in the industry. The propositions that procurement creates a market, that the roles of participants in that

market, and the price and profitability outcomes have been suggested as important in developing our understanding of the industry and its dynamics. They are also interesting, as a source of testable hypotheses and further research.

REFERENCES

ACCC. (2008) *Report into the competitiveness of retail prices for standard groceries*, Australian Competition and Consumer Commission, Canberra.

Brockmann, C. (2011) Collusion and Corruption in the Construction Sector, in *Modern Construction Economics: Theory and Application,* G. de Valence (ed.) Spon, Oxford, 29-62.

Capen, E.C., Clapp, R.V. and Campbell W.M. (1971) Competitive bidding in high risk situations, *Journal of Petroleum Technology*, 23, 641-653.

Chang, C.Y. and Ive, G. (2007a) The hold-up problem in the management of construction projects: A case study of the Channel Tunnel, *International Journal of Project Management*, 25: 4, 394-404.

Chang, C.Y. and Ive, G. (2007b) Reversal of bargaining power in construction projects: meaning, existence and implications, *Construction Management and Economics*, 30: 8, 845-855.

de Valence, G. (2011) Defining construction markets, in *Modern Construction Economics: Theory and Application,* G. de Valence (ed.) Spon, Oxford, 171 - 190.

Dorée, A.G. (2004) Collusion in the Dutch construction industry: An industrial organization perspective, *Building Research & Information*, 32: 2, 146 - 156.

Drew, D. (2011) Competing in construction auctions: A theoretical perspective, in *Modern Construction Economics: Theory and Application,* G. de Valence (ed.) Spon, Oxford, 63 - 79.

Dyer, D. and Kagel, J.H. (1996) Bidding in common value auctions: How the commercial construction industry corrects for the winner's curse. *Management Science,* 42, 1463-1465.

Flyvbjerg, B., Bruzelius, N. and Rothengatter, W. (2003) *Megaprojects and Risk: An Anatomy of Ambition*, Cambridge, Cambridge University Press.

Hasagawa, F. (1988) *Built by Japan: Competitive Strategies of the Japanese Construction Industry*. New York, Wiley.

Hass, K.B. (2007) Introducing the Project Complexity Model –A new approach to Diagnosing and Managing Projects. Part 1 of 2. *PM World Today,* July Vol. IX Issue VII.

Hillebrandt, P. (2000) *Economic Theory in the Construction Industry,* Third Ed., MacMillan, Basingstoke.

Inderst, R. (2007) Leveraging Buyer Power, *International Journal of Industrial Organization,* 25: 908-924.

Inderst, R. and Mazzarotto, N. (2008) Buyer Power in Distribution, in W. D. Collins, ed., *Issues in Competition Law and Policy 3*. Chicago: ABA Section of Antitrust Law, 1953-1978.

Ive, G.J. and Gruneberg, S.L. (2000) *The Economics of the Modern Construction Sector*, Macmillan, London.

Layton, A., Robinson, T. and Tucker, I.B. (2009) *Economics for Today* (3rd Edition). Cengage Learning, Melbourne.

Masterman, J. (2002) *Introduction to Building Procurement Systems,* London, Spon.

Nagel, T.T. and Holden, R.K. (1995) *The strategy and tactics of pricing*, Prentice Hall, New Jersey.

OECD. (1976) *Collusive Tendering*, Organisation for Economic Cooperation and Development. Paris.

OECD. (2008) *Policy Roundtable: Competition in the Construction Industry*, Organisation for Economic Cooperation and Development. Paris.

Runeson, G. (2000) *Building Economics*, Deakin University Press, Deakin.

Transparency International (2005) *Global Corruption Report: Corruption in the Construction and Post-Conflict Reconstruction,* London, Pluto Press.

Van den Heuvel, G. (2005) The parliamentary enquiry on fraud in the Dutch construction industry: collusion as concept between corruption and state-corporate crime, *Crime, Law & Social Change*, 44: 133–151.

Winch, G.W. (1989) The construction firm and the construction project: a transaction cost approach. *Construction Management and Economics*, 7, 331–45.

The Potential Impacts of the "Green" Building Movement on Commercial Property Valuation and Associated University Curricula

Paul van der Kallen
Faculty of Design, Architecture and Building
University of Technology, Sydney, Australia

ABSTRACT

The development and investment sectors of the commercial property market presently struggle to validate higher development costs for "Green" Buildings. New dimensions in property market dynamics surround the measurement of green building returns. These are likely to result in some fundamental changes to the enquiries and perhaps rationale used to determine relevant valuations. This paper explores the new and evolving factors becoming increasingly relevant in the valuation of green and non-green commercial building stock as a response to sustainable performance measurement and attempts to identify the gaps in training for property valuers.

KEYWORDS

green buildings, sustainability, valuation, education, commercial property, retrofitting, energy efficiency

INTRODUCTION

International concerns over global warming and degradation of the environment generally have given rise to the "green building" phenomenon. Green Building is defined as:

> *The practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:*
>
> - *Efficiently using energy, water, and other resources*
> - *Protecting occupant health and improving employee productivity*
> - *Reducing waste, pollution and environmental degradation"*
>
> (United States Environmental Protection Agency and adopted by Green Building Council of Australia)

Buildings designed to meet performance benchmarks orientated around the above-mentioned "green" criteria are the standard for new commercial buildings globally.

A parallel strategy in achieving positive environmental outcomes in the sector is the process of "greening" existing "brown" commercial buildings. This process primarily involves "retro-fitting" existing buildings to achieve energy and water usage savings however may involve additional works such as improving indoor air quality, workplace environment or installation of carbon efficient electricity generation plant.

In Australia new premium grade commercial buildings constructed in recent years have been conceived, designed, constructed and are ultimately operated to meet high "green" performance criteria. Anecdotal evidence suggests that the additional costs involved in incorporating "green" criteria into these new buildings increases development costs by approximately 5-7% for a new building.

Minimal retro-fitting work to achieve improved energy efficient performance in a range of existing commercial buildings in Sydney was recently reported to cost from about $60 - $160 per square metre NLA. More comprehensive "exemplar project" retro-fitting costs were reported at up to $550 per square metre NLA (Churchill 2010).

Whilst there is no doubt that building or retro-fitting for improved energy efficient and other "green" performance standards adds cost, evidence that the rental and investment markets add value for "green" performance is not as apparent.

The absence of transparent market data clearly demonstrating rental or capital value price differentiation between green and non-green (brown) commercial buildings based solely on "green" performance characteristics has been and remains the subject of much research and conjecture within industry.

Academic studies seeking to quantify the same, have until recently failed to produce convincing evidence of market discrimination between prime green vs. brown commercial buildings. Whilst more recent academic studies present evidence of positive price discrimination, (Eichholtz, Kok & Quigley 2009), valuers have not relied on the results of these studies to quantitatively apply within valuations, but rather look for direct transaction based evidence sourced from recent property transactions.

This direct evidence is elusive, possibly because the sustainable characteristics of a building are intertwined with many other aspects of value reflected in transaction price / yield points. This is exacerbated by a shortage of relevant transactions in the market place for analysis. Nevertheless, many participants of the investment and development sector hold the view that valuers are not properly accounting for what should be an inherent price difference.

In part as a response to the current situation, RICS and UTS successfully applied for a grant from the NSW Department of Energy Climate Change & Water, awarded in June

2010, to develop a training program entitled "The Value of Green, Energy Efficient Buildings". The stated aim of the training program was to educate building owners, property, asset and facility managers, investors, valuers, property lawyers, leasing and sales agents and others on the value (in financial and other terms) of implementing energy efficient practices to commercial buildings.

Whilst the grant was issued primarily in relation to improving Energy Efficient practices in the commercial property sector, in a practical sense it was difficult to isolate this aspect of commercial building operation / value from more holistic "green" building performance and issues relevant to green building values in general. Through a series of interviews, discussions and focus group studies of industry stakeholders the need for additional education for practising valuers was one factor identified as a matter for the attention of relevant professional associations and educators. This paper outlines and discusses the identified gaps in knowledge relevant to valuation practice and education.

LITERATURE

Literature reflecting the underlying difficulties for valuers in respect of green building valuation has been the subject of considerable research and discussion.

This literature falls into two broad categories which follow:

Market demand

A recent study of important factors for office space decisions by tenants in Kuala Lumpur found that a survey of experts, comprising forty property consultants / leasing agents / property managers, ranked energy efficient / green buildings 60th (and last) from a list of important overall features relating to tenancy decisions and 38th (and last) from a list of important features relating to building features, services and management (Adnan 2010). Similarly, evidence that many tenants who claim to be prepared to pay more for green buildings actually act on this claim, is not apparent in the UK, Europe, USA or Australia (Sayce, Sundberg & Clements 2010).

Outside of government instrumentalities, in Australia, it has largely been tenants such as financial institutions and mining companies who have been taking up leases in energy efficient, green buildings to date. This is seen largely as a reflection of the desire to develop a greener image for the tenant entity in the marketplace (Kerrie 2010). Recent mandatory disclosure laws relating to energy efficient performance of commercial buildings are claimed as a strategy by the Australian federal government to make energy efficient performance a higher priority in property related transactions (Kerrie 2010)

The question of the depth of the tenancy and investment markets for green buildings, at a premium value to quality brown buildings, remains to be adequately identified by

transparent market data. (Lorenz & Lützkendorf 2008) suggest that inadequate description of property assets in transactional databases is contributing to difficulties in rationalising market data. (Myers, Reed & Robinson 2007) suggest that the development of tools to measure the impact of green building attributes on values as a matter for attention in identifying broad market green building value trends. Further to this, (Sayce, Sundberg & Clements 2010) and (Myers, Reed & Robinson 2007) concluded that whilst theoretically a strong link exists between value and sustainable attributes of commercial buildings, tangible supporting evidence in the marketplace is limited in nature.

Recent international research suggests a high proportion of property investors are yet to comprehensively develop sustainable corporate management policies and implementation plans. A significant proportion of investors who have do not sufficiently act on the same (Kok 2010; Kok et al. 2010). This would suggest that many in the investment market for commercial buildings do not adequately factor sustainability related building attributes into acquisition or tenancy decisions.

Incentives, policies and penalties

Approximately 2 percent (maximum) of new commercial building stock is created each year. Typically new stock is designed and built to relatively high-energy efficient and other related "green building" performance standards. Whilst the value debate largely surrounds validating a premium value for these new buildings, ultimately a greater impact of sustainability policy will be how it impacts the value of existing brown buildings.

Logically the greatest savings in energy use in the sector will come from retrofitting existing stock to energy efficient performance standards. Stimulating retrofitting activity in the sector is a presently a challenge for policy makers.

Various incentive schemes have been implemented to date in an attempt to start the ball rolling. Setting the policy balance between the use of incentives and penalties to successfully trigger substantial retrofitting activity is a central issue within the current policy debate (Manning 2010).

Practicality in carrying out retrofitting activities to occupied premises, financing related capital cost and apportioning benefits from subsequent energy savings are emerging issues for property owners and tenants. Pivo (2010) suggests that progress on sustainability in real estate will require new social capacity to better facilitate cooperation between owners and tenants.

Sustainable performance measurement, primarily the Green Star and Nabers rating systems whilst presently definitive for commercial buildings, remain to some degree in a process of evolution (Aitken 2010; Davis 2010).

Projects involving primarily energy efficient performance upgrading of older commercial buildings have been show cased by individual owners and technical consultants. Reduced outgoings, reduced vacancy, shorter letting up periods, improved rental rates and tenant retention outcomes are presented as positive outcomes. Government financial subsidies have featured in these case studies of retrofitting viability (Churchill 2010).

A range of new energy efficient building management strategies, technologies and products are also in rapid evolution (Churchill 2010). A variety of new finance initiatives designed to support owners of commercial buildings to carry out retrofitting works are being implemented and tested in the market. These include private funds as well as government related initiatives (Bocskay 2010; Frith 2010).

The Australian Carbon Trust was recently established by the Commonwealth government to assist private owners of commercial buildings with finance and advice for energy efficiency retrofitting. The trust reportedly has received $100m in seed funding from the Commonwealth Government and is in the process of assessing initial proposals from private owners (Hill 2010).

The current Gillard Government remains committed to introducing a carbon tax in 2011. This tax will be specifically designed to alter the financial status quo so that investing in energy efficient strategies will make business sense. The same government has released a consultation paper and is presently seeking submissions concerning a proposed accelerated depreciation allowance for capital costs involved with energy efficient retrofitting of commercial properties (Perinotto 2011).

The growing embracement of sustainability policy in both the government and private sector, on-going evolution in related legislation, rating systems, green lease provisions, building management and energy efficient technologies, financial incentives and finance initiatives were considered as factors likely to be contributing to a deficiency in knowledge amongst valuation practitioners, property investors and other commercial property stakeholders.

RESEARCH METHODOLOGY AND PURPOSE

A project team was formed and sought to confirm with stakeholders perceptions regarding the nature of shortfalls in current industry knowledge prior to framing final professional development course structures and specific content.

In order to achieve this outcome a three-step process was adopted. The sequence determined was:

1) *Initial industry research* – comprising informal telephone and face to face interviews with selected senior industry stakeholders

2) *Preliminary focus group study* – relatively informal and seeking to verifying Step 1 outcomes
3) *Formal focus group study* – formal and involved wider cross section of stakeholders intended to further identify the appropriate context, structure and content of proposed courses

A project team review followed each step with re-definition of proposed course structures as indicated by the feedback. Presently pilot course structures and content have been defined and are in the process of preparation. This paper addresses only those matters identified within the study considered relevant to education in the valuation profession.

INITIAL INDUSTRY RESEARCH

These discussions were relatively informal and undocumented. Feedback was that the proposed course framework was largely in line with industry's perceived training needs. As such wider-scope evidence of the need for the professional development courses in the general area's proposed were somewhat confirmed (Smith 1991, pp. 71-72).

PRELIMINARY FOCUS GROUP STUDY

The preliminary focus group meeting comprised a round table discussion between senior professionals thought to have sound insights into relevant issues surrounding the proposed course topic areas. The group was made up of two senior commercial valuers, two sustainability managers, two acquisition managers and one tenancy representative and the RICS / UTS project team.

Reflections on the focus group discussions were recorded by the project team and classified by key stakeholder groupings.

Broad themes that emerged from the discussions were:

1) Valuers are not necessarily well informed about sustainability related issues
2) Cash flow / share price risk management is a significant driving factor in investment decisions relating to developing / retro-fitting for sustainable building performance in the LPT commercial property sector
3) The underlying investment / tenancy market for a specific existing commercial building will presently impact investment decisions related to sustainable building performance
4) Valuers understanding of the commercial tenancy market may be inadequate
5) Corporate Social Responsibility (CSR) branding is a significant driver of tenancy demand for green buildings
6) Institutional investment demand for LPT shares are impacted by "green building" holdings

FORMAL FOCUS GROUP STUDY

Following the initial discussions and preliminary focus group study, a series of round table discussions with the RICS / UTS project team developed a framework for a larger formal focus group study.

A focus group is a planned series of discussions designed to obtain the perceptions of participants who have been selected due to a common interest and knowledge that relates to the topic. Whilst there is no requirement for participants to reach a consensus, analysis of the discussions provides better insights to the issue at hand. (Krueger & Casey 2009)

Focus group participants were enlisted through RICS from their membership ranks via personal invitations to participate in the study. Participants were approached based on their role in the industry and allocated to one of three groups, which broadly reflected their role. Each group had approximately 8 members and had an appointed group leader.

Groups were categorised as:

- G 1 - Valuers, fund managers, owners, buyers
- G 2 - Asset managers, building upgraders
- G 3 - Property managers, agents, property lawyers, green building performance managers

The group study involved three question rounds. Each round required the individual group to reflect on the question posed from the perspective of their professional role and record key points raised within the group.

Following each round, the each group leader presented the matters identified by their group to all participants.

The themes of each round were:

1. To clarify the extent to which energy efficiency / sustainability are presently impacting members of the focus group in their professional roles
2. To identify concerns about the future risks that energy efficiency / sustainability may present
3. To identify the “tools” required to assist in decision making going forward

FINDINGS

Using a thematic analysis, raw data from the group study was categorised into seven themes reflected in the data (Grbich 2007). Table 1 measures the incidence of the themes identified.

Whilst there is some room for re-definition of the individual themes (refer annexure 1 for raw data), there seems ample evidence that themes 1, 2 & 4 are of primary concern for value related decision makers in the commercial property industry.

Table 1 – Thematic analysis of focus group data

Theme		Weight
1	Confusion over what new information should be applied to the valuation process and how it should be applied	**24**
2	Confusion over details and impacts of relevant current legislative / market framework	**16**
3	Underpinning financial performance drives value / valuation decisions / present lack of evidence of green value premium	**2**
4	Medium / long term risks / benefits are presently somewhat uncertain	**9**
5	Benefits of building / retro-fitting for green building performance is largely a risk management strategy from a financial perspective	**1**
6	Green building market is currently impacted by Corporate Social Responsibility policies, corporate branding and other less quantifiable benefits to valuers	**2**
7	Sudden change in market forces may create opportunities for skilled professionals	**1**

The author of this paper also claims theme 3 as a predominant view held by the focus group members. Theme 3 was a central issue extracted from the preliminary discussion group meeting/s and the subject of significant non-recorded discussions within the formal focus group sessions. Ultimately this assertion is further evidenced by long-standing, well tested, valuation theory & practice and the current academic, government & industry based interest in creating a green value argument.

Themes 5 & 6 were also identified within the preliminary discussion group meeting/s and confirmed formally by the focus group sessions.

Theme 7 emerged within the formal focus group sessions.

CONCLUSIONS

A market valuation is a prediction of the amount a property will achieve for sale or lease at a given point in time. Valuations and valuation methodology reflects the way in which property market participants think about value. The framework of buyer and tenant decisions moves logically in line with market forces. Normally some lag time transpires between a new force and the resulting market reaction as evidenced in transactions. New underlying criteria likely to impact buyer and tenant decisions, and therefore market values, include:

1) Underlying tenant / investor demand for sustainable attributes in commercial buildings
2) Energy and sustainable performance measurement and reporting systems
3) Government subsidies available to developers and retrofitters
4) Finance initiatives available to retrofitters

5) Accelerated depreciation provisions for capital costs involved in retrofitting
6) Carbon tax pricing regimes and how these are reflected in outgoing / outgoing recoveries
7) Physical characteristics determining the suitability of existing buildings for retrofitting
8) Costs and technologies involved in retrofitting existing buildings

There seems little doubt that government policy is directed towards engineering a strong financial case for energy efficient and other "green" attributes in commercial buildings.

Remaining current with the myriad of related legislation, policy, incentives, finance initiatives, building technologies and management practices presents a challenge for industry and educators.

This paper has identified some factors likely to impact the value of "green" and "brown" commercial buildings, perhaps presently and certainly into the future.These evolving factors are unlikely to be adequately addressed within current valuation curricula. More research needs to be conducted as these and other related forces shape investor and tenant decisions to ensure that valuation curricula remains current.

REFERENCES

Adnan, Y. and Daud Md, N. (2010) 'Identification of Important Factors for Office Space Decision by Tenants in Kuala Lumpur city centre, Malaysia – Experts' View', paper presented to the 16th Pacific Rim Real Estate Society Annual Conference Wellington, New Zealand.

Aitken, A.G.B.C.o.A. (2010) 'Sustainability in the Built Environment - What is next for Green Star', API / ADPIA, Sydney, Australia.

Bocskay, S.-S.M.F. (2010) 'Transforming the City of Melbourne. 1200 Buildings', API / APDIA Sustainable Property Conference 2010, Sydney, Australia.

Churchill, B.W.R. (2010) 'Local Government Super, Profitable Sustainability, Portfolio Environmental Upgrade Strategy', API/ADPIA Conference November 2010, Sydney, Australia.

Davis, M. (2010) 'NABERS, Measuring real environmental performance in a real world', API / ADPIA, Sydney, Australia.

Eichholtz, P., Kok, N. and Quigley, J.M. 2009, *Doing Well By Doing Good? Green office buildings*, University of Berkley: Institute of Business and Economic Research., Berkeley.

Frith, P.V.C. (2010) 'Capital in Sustainable Property', API / APDIA Sustainable Property Conference, Sydney, Australia.

Grbich, C. (2007) *Qualitative data analysis: an introduction*, SAGE, London.

Green Building Council of Australia, http://www.gbca.org.au/resources/

Hill, R. (2010) *'Australian Carbon Trust', RICS - Riding the Carbon Wave*, Sydney Aust.

Kerrie, S. (2010) 'Laws turning our offices 'green'', *The Courier Mail*, p. 67.

Kok, N. (2010) 'The Economics of Green Building', API / ADPIA, ed. U.B.M. University, Sydney, Australia.

Kok, N., Bauer, R., Eichholtz, P. and Quigley, J.M. (2010) 'How Green is Your Property Portfolio? The Environmental Performance of Commercial Real Estate'. *Working Papers, Berkeley Program on Housing and Urban Policy*, Institute of Business and Economic Research, UC Berkeley.

Krueger, R.A. and Casey, M.A. (2009) *Focus groups: a practical guide for applied research*, 4th edn, Sage Publications, Thousand Oaks.

Lorenz, D. and Lützkendorf, T. (2008) 'Sustainability in property valuation: theory and practice', *Journal of Property Investment & Finance*, vol. 26, no. 6, pp. 482-521.

Manning, P. (2010) 'Brand new retro key to cutting carbon emissions but incentives are lacking - G-BIZ', *The Age*, p. 2.

Myers, G., Reed, R. and Robinson, J. (2007) 'The relationship between Sustainability and the Value of Office Buildings', pp. 21-24.

Perinotto, T. (2011) The $1 billion set of questions for green tax breaks: speak now <http://www.thefifthestate.com.au/archives/19668>.

Pivo, G. (2010) 'Owner-Tenant Engagement in Sustainable Property Investing', *The Journal of Sustainable Real Estate*, vol. 2, no. 1, pp. 184-199.

Sayce, S., Sundberg, A. and Clements, B. (2010) *Is sustainability reflected in commercial property prices: an analysis of the evidence base*, Kingston University, London.

Smith, H.W. (1991) *Strategies of social research*, 3rd edn, Holt, Rinehart, and Winston, Orlando, FL.

United States Environmental Protection Agency: http://www.epa.gov/greenbuilding/pubs/about.htm.

APPENDIX 1

Formal Focus Group RAW DATA

SESSION 1	THEME IDENTIFIED	QUESTION – Where are we now?
Focus Group 1 - Participant Profile Valuers Fund Managers Owners Property Buyers	1 1 1/2 1/2 1/2 1/2 1/2 2 3 3 1/2/6 1/2 1/5/6 1/2 4 4 1	- Where does the information for valuers come from? - What should valuers look at? - What have the big firms done in introducing new approaches to valuation - Case studies would be helpful - There is a lack of benchmarks - Confusion re Nabers vs. Green Star and also mandatory Disclosure - Confusion regarding who administers the schemes - Green Star and NABERS seem disjointed - Developers need a very strong bottom line (financial) case to build green buildings - Currently there is little or no perceived benefit to the value / valuer in green buildings - Should a valuer measure social or environmental benefits? – Is this a valuer's role? - Is valuing poorer assets (with less green credentials) harder than valuing highly rated assets? - Are there other benefits the valuer should take into account from either workers productivity gains or corporate / owner / tenant branding gains? - Valuer reporting needs to be more specific on green issues (in particular what are the benefits and penalties in a building due to green / lack of green issues) - Can governments speed up DA's for green projects? - Will green depreciation policies add value? - Valuers issues are tangible other issues are intangible

SESSION 2	THEME IDENTIFIED	QUESTION – What are the future risks?
Focus Group 1 - Participant Profile Valuers Fund Managers Owners Property Buyers	4 4 4 1 4/7 2/4 1 4 2/4 1/2	- Is Insurance a risk – a possible withdrawal of cover? - The future risk of the introduction of a price on carbon - The risk is really the poorer quality property - Joint RICS/API valuation standards would be helpful - A risk to valuers is the move from banks to personal appointments of valuers (rather than firms) - Mandatory disclosure is a big future risk – for a number of players including banks - We need to define what a sustainable asset is - Risk of further regulation - There is a risk of over-valuing non-green/undervaluing green assets - Design based ratings are risky

SESSION 3	THEME IDENTIFIED	QUESTION – What tools do you need?
Focus Group 1 – Participant Profile Valuers Fund Managers Owners Property Buyers	1/2 1/2 1 1 1 1 1 1/2 1/2	- A sustainable property Guide exists (DECWW) but it is 500 pages long - Existing guides are seen as separate and separated from doing the normal job - A portal for all sustainable information would be useful (Govt requirements, BCA issues etc) - A Uniform Interpretation of green attributes in needed - It would be helpful to define what information valuers need from other stakeholders. Including: From owners, banks and tenants – including Downturn / Churn, occupancy rates, OPEX/CAPEX, CAPEX forecasts and history - There needs to be a change of mind set amongst valuers - Consultancy reports - Training on ratings tools and building systems should be targeted - Training should be focused for particular stakeholders

A Panel Regression Method for Quantifying the Convergence of House Prices

Le Ma and Chunlu Liu
School of Architecture and Building
Deakin University, Geelong, Australia

ABSTRACT

The convergence among house prices has attracted much attention from researchers. Previous research mainly utilised a time-series regression method to investigate convergences of house prices, which may ignore the heterogeneity of houses across cities. This research developed a panel regression method, by which the heterogeneity of house prices can be captured. Seemingly unrelated regression estimators were also adapted to deal with the contemporary correlations across cities. Investigation of the convergence among house prices in the Australian capital cities was carried out by using the developed panel regression method. Results suggested that house prices converge in Sydney, Adelaide and Hobart but diverge in Darwin.

KEYWORDS

Convergence, panel regression, unit root test, house prices

INTRODUCTION

Variations in house prices may cause significant impacts on economy at both national and regional levels. The variations may also potentially influence in migration and investment mobility across regions. Therefore, it is important to understand whether a long run equilibrium relationship exist between house prices across a country. In other words, there is considerable value to find out whether house prices across regions will converge. The convergence in regional house prices in the United Kingdom was early studied by using the Kalman filter/time varying parameter estimation method (Drake 1995). Meen (1999) pointed out that the regional house prices should move proportionately. This supports that the differential ratios between regional house prices and a benchmark price level, such as a national price level or the price level of a dominant region, will converge to equilibrium in the long run. Much research addressed to the above issue by carrying out a time-series regression method. It can be generated that unit root tests, vector autoregression models and vector error correction models were widely used in previous research (Maysami and Koh 2000, Cook 2005, Luo et al. 2007, Chien 2010). However, those time-series regression methods fail to capture the heterogeneity of house prices,

which is regarded as an important characteristic caused by the immobility of houses. The ignorance of heterogeneity may lead to unreliable estimations of the regressions. In addition, contemporary correlations across regions cannot be captured either by an ordinary least square (OLS) estimation method applied in previous research. Holmes and Grimes (2008) introduced a panel regression method to improve the conventional unit root tests. The convergence of house prices across the U.K. was investigated. It was suggested that the panel regression method some advantages in measuring long run convergence among regional house prices.

This research used a panel regression method to establish the model for quantifying the house price convergence. The heterogeneity of house prices could be taken into account by allowing the estimated parameters in the panel system varying across regions. In order to capture the contemporary correlations between regions, a seemingly unrelated regression (SUR) estimator was adapted to estimate the model. This developed model was applied to investigate the convergence among house price indices in the Australian capital cities. The next section of this paper illustrates the methods used to test convergence. The following sections introduce the Australian house price indices used in this research, and report the convergence among house prices in Australian capital cities. The final section forms the conclusion.

A PANEL REGRESSION METHOD FOR CONVERGENCE INVESTIGATION

Convergence for a regional house price is defined as its stationary property. Once a regional house price series is confirmed as stationary, it will have a steady state in the long run. The conventional investigation method is based on the stationarity test for a time-series. The Dicky-Fuller (ADF) unit root test is one of the most widely used techniques to test the unit root of difference between the house price in a specific region and a benchmark (Dicky and Fuller 1979). Denote $d_t = p_t - p_{ot}$, where p_t and p_{0t} stand for the house prices of a specific region and the benchmark respectively, at time *t*. The stationary properties of d_t indicates the house price in that region shall move proportionally with the behaviour of the benchmark in the long run. The calculation of the test is expressed as follows:

$$\Delta d_t = \alpha + \gamma d_{t-1} + \sum_{s=1}^{q} \beta_{t-s} \Delta d_{t-s} + \varepsilon_t \qquad (1)$$

The t statistic is then employed to examine the significance of the estimated coefficient $\hat{\gamma}$, with the null hypothesis of $\gamma = 0$. The rejection of the null hypothesis suggests that

d_t is stationary, which also indicates that d_t should converge to a steady equilibrium. On the other hand, the acceptation of the null hypothesis rejects that d_t is stationary and convergent in the long run. The current value of a time-series is always correlated with the previous values. It will lead the autocorrelations between the disturbers. The series autocorrelations may cause the results of the t statistics to be unreliable. This problem can be resolved by the temporal lagged term, $\beta_{t-s}\Delta d_{t-s}$, where the subscript *s* denotes the number of lags.

Although the series correlation can be filtered by temporal lags, the heterogeneity of house prices across regions cannot be dealt with. Holmes and Grimes (Holmes and Grimes 2008) extended the techniques by introducing the panel data regression. The panel regression model ADF unit root tests is expressed as

$$\Delta D_t = \mathrm{A} + \Gamma D_{t-1} + \mathrm{B}\Delta D_{t-1} + \mathrm{E}_t \qquad (2)$$

$D_t = (d_{1t} \quad d_{2t} \quad \cdots \quad d_{Nt})'$, $A = (\alpha_1 \quad \alpha_2 \quad \cdots \quad \alpha_N)'$ and

$\mathrm{E}_t = (\varepsilon_{1t} \quad \varepsilon_{2t} \quad \cdots \quad \varepsilon_{Nt})'$, while $\Gamma = \begin{bmatrix} \gamma_1 & 0 & \cdots & 0 \\ 0 & \gamma_2 & \cdots & 0 \\ \cdots & \cdots & \ddots & \cdots \\ 0 & 0 & \cdots & \gamma_N \end{bmatrix}$,

$\mathrm{B} = \begin{bmatrix} \beta_1 & 0 & \cdots & 0 \\ 0 & \beta_2 & \cdots & 0 \\ \cdots & \cdots & \ddots & \cdots \\ 0 & 0 & \cdots & \beta_N \end{bmatrix}$.

This procedure is able to address the problems associated with the presence of cross-sectional dependency among the regional house prices. Seen from *Eq. (2)*, heterogeneity between house prices are captured different the estimated parameters across regions. Moreover, the SUR estimation assumes the error terms of different equations, ε_{it}, should be correlated with each other contemporarily. That means the variance-covariance of the error terms should be calculated by $E(\varepsilon_{it}\varepsilon_{js}) = \begin{cases} \sigma^2, t = s \\ 0, otherwise \end{cases}$. Therefore, the panel regression method is more powerful than the individual regression with an OLS method.

DESCRIPTION OF HOUSE PRICES IN AUSTRALIAN CAPITAL CITIES

This research used the House Prices Indices (HPI) to represent the house prices in Australian capital cities. The HPI of the eight state capital cities of Australia were collected from the publications of the Australian Bureau of Statistics (ABS 2009). The

period chosen was from the December quarter 1989 to the December quarter 2008. The indices are constructed by using a stratification approach. In each period the median price movement is calculated for each stratum and used to construct a stratum level price index (ABS 2005). The aggregate index is calculated by weighting together the individual stratum index, where the weights represent the relative significance of the stock of dwellings in each stratum. The indices are based on the quarterly house prices for established and newly erected dwellings and each capital city's house price indices based on 1989-90=100. The reference base of the published HPI changed for the 2003-04 financial year after the September quarter 2005 (ABS 2005). In order to maintain consistency, the old reference base (1989-90) was used in this research. The method used to convert the re-referenced data to the previous base is described as $HPI_{89-90} = w \times HPI_{03-04}$, where HPI_{89-90} denotes the house price index on the base 1989-90 = 100, HPI_{03-04} denotes the house price index on the base 2003-04 =100, and w is the converting factor. The data used in this empirical study are available from the authors upon request (Ma 2010).

CONVERGENCE INVESTIGATION FOR HOUSE PRICES IN AUSTRALIAN CAPITAL CITIES

This research used the ADF unit root test to investigate the stationarity of ratios between the HPI and the national level in the Australian capital cities. The null hypothesis of non-stationarity is performed at a 5% significance level. Three forms of ADF unit root test based on *Eq. (1)* were calculated, the results of which were reported in Table 1. Three forms include a test containing no intercept or trend, an intercept but no trend, and an intercept and a trend. The results show that none of the eight cities' house prices are stationary at levels. According to the results of the ADF tests in the three forms, ratios between local house price indices and the national level are not stationary in most of the capital cities. The ratio in Canberra is found stationary when the tests without trend were applied. This suggested that house price indices should move with the national house price level but the house price indices in the other cities should not converge in the long run perspective.

Table 1 – The unit root tests for house prices in Australian capital cities

Types of tests	cities	ADF test at level		
		t-statistic	Sig. level	Lag
No intercept and trend	Adelaide	-0.7819	Na	1
	Brisbane	-0.7822	Na	1
	Canberra	-4.0817**	Na	1
	Darwin	-0.6793	Na	2
	Hobart	-0.8545	Na	2
	Melbourne	-1.5695	Na	0
	Perth	-1.6112	Na	1
	Sydney	-0.5129	Na	2
Intercept without trend	Adelaide	-0.8398	Na	0
	Brisbane	-1.2937	Na	1
	Canberra	-3.3773**	Na	0
	Darwin	-1.7230	Na	2
	Hobart	-1.0890	Na	0
	Melbourne	-1.1164	Na	0
	Perth	-1.5202	Na	1
	Sydney	-0.2279	Na	2
Intercept with trend	Adelaide	-0.2856	Na	0
	Brisbane	-1.0304	Na	1
	Canberra	-1.8044	Na	1
	Darwin	-1.3787	Na	2
	Hobart	-0.3732	Na	0
	Melbourne	-1.5059	Na	0
	Perth	-1.8168	Na	1
	Sydney	-0.2001	Na	0

Note: Critical value of null hypothesis at the 5% significance level is -3.4852.

Since little evidence can be found to support the convergence in an individual city, the developed panel regression approach based on *Eq. (2)* was applied to identify the proportional convergence in the Australian capital cities. Table 2 reports the estimations of the model based on *Eq. (2)*, which indicates that the house price index in a capital city will move together with the national house price index in the long run. The house prices, in Sydney, Adelaide, Brisbane and Hobart, are found proportionally move together with the behaviour of the national level. On the other hand, the house prices of Canberra and Darwin are likely to move away from the national price level, as suggested by the positive coefficients in these two cities. There is little evidence to support a price ratio convergence in Melbourne and Perth.

Therefore, the idea can be generated that house price ratio convergence may be present in some capital cities of Australia, when the contemporary correlations across the regions are involved in the investigation model. However, the ratios of Canberra and Darwin may diverge. The properties in Melbourne and Perth are uncertain.

Table 2 – Investigation of house price differential ratio convergences

Cities	Coefficients	t statistics
Adelaide	-0.0589	-3.0046**
Brisbane	-0.0340	-1.8213*
Canberra	0.0063	0.2831
Darwin	0.0460	2.0966**
Hobart	-0.0349	-2.1287**
Melbourne	-0.0338	-1.0890
Perth	-0.0243	-0.9656
Sydney	-0.0611	-2.0576**

Note: * and ** denote the significances at 10% and 5% respectively.

Moreover, the half-lives associated with deviations from long run steady states are illustrated in Table 3, indicating the convergence speeds in each city. The half-life is calculated by $(\ln 0.5)/\ln(1+\gamma_i)$, where γ_i is the estimated coefficients in the panel regression model. The half-lives are found to range from 2.75 years in Sydney to over 7 years in Perth. This indicates that the adjustment speeds of house prices towards the national level are faster in Sydney and Adelaide. Relatively slower speeds are experienced by the house prices in Perth. It takes around 5 years for Brisbane, Hobart and Melbourne against the national level converge to the steady state in the long run.

Table 3 – Convergence speeds

Cities	Half-lives (year)
Adelaide	2.85
Brisbane	5.01
Canberra	N/A
Darwin	N/A
Hobart	4.88
Melbourne	5.04
Perth	7.04
Sydney	2.75

The long run convergence characteristics of regional house prices can only be investigated in Canberra by an individually estimated ADF test. When heterogeneity and contemporary correlations between regions are considered, the house price differential ratios of Sydney, Adelaide, Brisbane and Hobart are proved to move proportionately with the national price level, while the ratios of Darwin and Canberra diverge.

CONCLUSIONS

This research carried out an ADF unit root test to investigate the stationary characteristics of house prices in a specific city. A panel regression model, with SUR estimators, was

developed to explore the proportional convergence status of a series of regional house prices based on a common benchmark. The panel regression method can capture heterogeneity of house prices across cities, by allowing house prices to have their own unit roots. The SUR estimators are able to take the contemporaneous correlations among the disturbances, in the equation of each city, into account.

In practice, both the ADF and panel ADF tests were applied on the house price indices in the Australian capital cities. Little evidence could be obtained from the ADF test to support the convergence among the house prices in the Australian capital cities. However, the convergences of the price ratios, taking the Australian national house price level as a benchmark, were found in some cities. It showed that the house prices of Sydney, Adelaide and Hobart were moving proportionally with the national price. The house price of Canberra and Darwin diverged. Relatively faster convergence speeds were experienced by house prices in Sydney and Adelaide.

REFERENCES

ABS. (2005) *Renovating the established house price index*. Cat no. 6417.0. Australian Bureau of Statistics, Canberra.

ABS. (2009) *House price indexes: eight capital cities*. Cat no. 6416.0. Australian Bureau of Statistics, Canberra.

Chien, M.S. (2010) Structural breaks and the convergence of regional house prices. *Journal of Real Estate Finance and Economics*, 40 (1), 77-88.

Cook, S. (2005) Detecting long-run relationships in regional house prices in the UK. *International Review of Applied Economics*, 19 (1), 107-118.

Dicky, D.A. and Fuller, W.A. (1979) Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74 (336), 427-431.

Drake, L. (1995) Testing for convergence between UK regional house prices. *Regional Studies*, 29 (4), 357-366.

Holmes, M.J. and Grimes, A. (2008) Is there long-run convergence among regional house prices in the UK? *Urban Studies*, 45 (8), 1531 -1544.

Luo, Z.Q., Liu, C. and Picken, D. (2007) Housing price diffusion pattern of Australia's state capital cities. *International Journal of Strategic Property Management*, 11 (4), 227-242.

Ma, L. (2010) "Spatial and temporal variation of house prices". Dissertation for PhD degree. School of Architecture and Building, Deakin University, Geelong.

Maysami, R.C. and Koh, T.S. (2000) A vector error correction model of the Singapore stock market. International Review of Economics & Finance, 9 (1), 79-96.

Meen, G. (1999) Regional house prices and ripple effects: a new interpretation. Housing Studies, 14 (6), 335-346.

Australasian University Building Educators Association

www.bond.edu.au/aubea-2011