

From Distance to Online to Blended: A Programme's Journey

Anthony Williams, Willy Sher (willy.sher@newcastle.edu.au) and Graham Brewer

School of Architecture and Built Environment, The University of Newcastle, Australia

Abstract: *The profile of students studying construction management is changing. In Australia, a buoyant construction industry is currently fuelling high student expectations. Job opportunities for graduates as well as for students as part-time employees are attractive. Students embarking on their studies come from a wide variety of backgrounds. Their profile is significantly different from the early 1990's when the Bachelor of Construction Management (Building) program started at Newcastle University (Australia). This degree was conceived to meet the needs of the local building industry. It embraced problem based learning as its main tenet. Furthermore it was developed to be delivered to on-campus as well as to distance learners. Reviews by the accrediting bodies (the Australian Institute of Building and the Australian Institute of Quantity Surveying) as well as the University have highlighted the need to respond to changed market requirements and student expectations. Over the past two and a half years the degree has been redeveloped to embrace blended delivery of courses to on campus as well as to distance learning students. This paper describes how the degree has evolved to respond to change conditions. It describes the manner in which e-learning has been harnessed to deliver innovative problem based learning curricula in mixed-mode to construction management students. The paper concludes with two initiatives adopted in the delivery of the programme.*

Keywords: *blended learning, distance learning, e-learning, problem based learning.*

Background

The opportunities for would-be construction managers are considerable. A recent KPMG survey (2007) notes that the demand for construction is expected to increase significantly over the next five years. The report observes that the "single overwhelming conclusion that can be drawn from our study is that the shortage of qualified contractors is without doubt the biggest challenge to new construction projects in the future. Furthermore, with market demand expected to increase significantly over the next five years, this issue looks set to intensify as the pool of qualified contractors able to bid for projects is reduced and the wider shortage of skilled labor contractors impacts the ability of teams to deliver on projects."

Closer to home, a recent survey conducted by the Master Builders Australia (2007) acknowledges marked differences between states and sectors but goes on to note that in "the non-residential sector conditions are strong and are expected to continue to improve. In contrast, current conditions in the residential sector are reported as poor. However, in a significant finding after negative results in previous surveys, builders now expect residential activity to improve over the next six months."

Students embarking on their studies at the University of Newcastle come from a wide variety of backgrounds. Many are of mature age and already have a construction background. Few are female. Many are highly computer literate and expect to engage with their studies using computer systems. An increasing number of them bring with them financial necessities of having to work to support their tuition. This latter point is emphasized by Mills and Ashford (2004) in their investigation into part-time employment of construction management students. They highlight a trend of increasing levels of student engagement in the workplace. More recently an Australian Vice Chancellors' Committee report (2007) confirmed that increasing financial stress was compromising students' abilities to study. Students require flexible alternatives that respond to their pecuniary realities and ways of learning.

Barnes, Marateo and Ferris (2007) cite Bonamici, Hutto, Smith, and Ward (2005) who claim that the current (Internet or 'net') generation is unique in that it is the first to grow up with digital and cyber technologies. Not only are net-geners acculturated to the use of technology, they are saturated with it. By the time he or she has reached 21 years of age, the average net-gener will have:

- (spent) 10,000 hours playing video games,
- (written / responded to) 200,000 e-mails,
- (spent) 20,000 hours watching TV,
- (spent) 10,000 hours on cell phones, and
- (spent) under 5,000 hours reading.

The last point warrants further consideration. Anecdotal evidence suggests that many construction management lecturers may have unrealistic expectations of their students' reading skills. If Barnes et al's (2007) data are indicative of students, lecturers need to recognise that many students prefer to use digital materials rather than paper.

Current developments

Our Bachelor of Construction Management program is delivered by staff in the School of Architecture and Built Environment. The School comprises three disciplines, construction management, architecture and industrial design. In 2004, our construction management degree (Bachelor of Construction Management [BCM]) was reviewed as part of our own internal quality assurance procedures, and by the Australian Institute of Building and the Australian Institute of Quantity Surveyors.

There have been two factors of significance; the BCM program has been taught in mixed-mode, allowing students to study on-campus or as online-learners, providing them with the flexibility to decide at what pace to progress their studies. Secondly the delivery of BCM and Architecture courses have been integrated. Delivery of these redeveloped courses to on-campus BCM students commenced at the start of 2006. The new program structure is illustrated in Figure 1.

The changes to the BCM degree are significant, and extensive resources and effort have been directed to developing and delivering what is effectively a new curriculum. Chief amongst these are:

- **Blackboard**
Our University uses the Blackboard learning management system. Staff have been using the system for several years, and have developed expertise in most aspects of online pedagogy. For example, all courses on our BCM

program provide students with access to electronic course outlines, course materials, relevant websites and so on. Our University's Teaching and Learning unit have developed targeted electronic materials to support our construction students in working in groups and in writing technical and other reports. Members of staff are skilled in engaging on and off-campus students in groupwork and in electronic discussions (Sher and Williams, 2007).

- **Lectopia**
The University of Newcastle has invested significant funds in an information technology infrastructure to service the online delivery of teaching and learning materials. A major component is Lectopia, a system which gives students access to recorded lectures via the Internet. Lectopia allows lecturers to record their lectures from specific venues (there are currently 31 Lectopia-enabled lecture theatres in our institution). Staff present their lectures to on-campus students and what they say and display (from their computer or visualiser) is recorded in a digital format. Once a lecture has finished it is automatically processed and is ready for students to access via the Blackboard (usually a couple of hours).

SEMESTER 1 — 1ST YEAR [1000 LEVEL]	SEMESTER 2 — 1ST YEAR [1000 LEVEL]
Construction Integrated Project 1	Construction Law and Legislation
Communication in the Built Environment 1	Building Condition Reports and Surveying
Construction Technology 1	Communication in the Built Environment 2
Construction Ecology 1	History & Theory in the Built Environment 1

SEMESTER 1 — 2ND YEAR [2000 LEVEL]	SEMESTER 2 — 2ND YEAR [2000 LEVEL]
Open elective	Construction Technology 2
Construction Integrated Project 2	Health and Safety in the Built Environment
Measurement of Building Works	Estimating and Tendering
Economics in the Built Environment	Construction Procurement

SEMESTER 1 — 3RD YEAR [3000 LEVEL]	SEMESTER 2 — 3RD YEAR [3000 LEVEL]
Construction Ecology 2	Research In The Built Environment 1
Construction Technology 3	OPEN ELECTIVE

Construction Business Management	Construction Integrated Project 3
Construction Project Planning	Construction Integrated Project 4
SEMESTER 1 — 4TH YEAR [4000 LEVEL]	SEMESTER 2 — 4TH YEAR [4000 LEVEL]
Construction Technology 4	Construction Integrated Project 5
Construction Ecology 3	
Research In The Built Environment 2	Construction Integrated Project 6
KEY	
	Courses taught to Quantity Surveying and Architecture students
	Courses taught to Quantity Surveying students
	Integrated Projects taught to Quantity Surveying students

Figure 1: Structure of redeveloped BCM program

- **Audio recordings**
In addition to Lectopia, staff audio record their lectures (and some tutorials). These recordings are then made available to students via Blackboard in mp3 format. This approach is designed to service students without broadband access, as well as those who wish to use their iPod's to listen to lectures (whilst traveling to and from work, or at other times that are convenient to them).
- **Online quantity surveying measurement tutorials.**
A significant challenge for those teaching measurement is (and always has been) to ensure students have sufficient knowledge and understanding of construction technology to enable them to measure buildings. Measurement is a process which requires a technical knowledge and understanding of building or civil engineering technology. However, at the time students are required to learn how to measure, many of them do not yet have the requisite technical knowledge and understanding. Measurement requires students to follow a prescriptive set of rules provided by published standard methods of measurement (SMM). These publications do not explain the taking-off process and are designed to provide experienced surveyors with rules for measuring in a standardized manner. From a lecturer's perspective the challenge lies in teaching SMM based measurement processes to students who have just enough knowledge of construction technology to comprehend the measurement rules. We have collaborated with the Department of Civil and Building Engineering at Loughborough University (UK) to develop several online construction management measurement tutorials that assist on and off-campus students to understand these processes (Hodgson, Sher and Mak, 2007).

- 3D models.
As previously mentioned, many novice construction management students are not familiar with how to read and interpret construction drawings. A discussion of whether or not these students need to be able to prepare technical drawings before they can fully understand them is outside the scope of this paper. However, many software packages are currently available to help students overcome the limitations of 2D drawings. We have trialed 3D models developed using Google SketchUp (2007) and have been encouraged by the ease with which these have been created, and by the verbal feedback students have provided. We are currently developing 3D construction drawings in addition to traditional 2D drawings to facilitate students' understanding of the manner in which buildings are constructed.

Problem-based learning

The BCM program is based on a Problem Based (PBL) curriculum. Traditionally, in universities, PBL is expressed in terms of the content that is taught and the sequencing of this content (Brubacher, 1977, Boud and Feletti, 1991). It is argued that a PBL curriculum consists of the:

- application of concepts and theories to practice/real world situations,
- concepts and theories that inform practice of the discipline
- processes of the discipline
- processes of learning

The problem-based learning (PBL) approach adopted in the BCM degree builds on an established body of knowledge, at the heart of which is our intention to improve the effectiveness and relevance of student learning (Brubacher, 1977, Boud and Feletti, 1991). Students should be 'empowered learners' who have the capacity for autonomous learning and an inner drive for continuous and lifelong learning (Candy, Crebert and O'Leary, 1994). Their motivation is initiated by an assessment process that places students' development at its heart (Newble and Entwistle, 1986). Integrated PBL courses are included in all years of study, and provide opportunities for students to assimilate and exercise newly acquired knowledge, understanding, and skills.

PBL programs are able to facilitate fully integrated curricula. The goals of PBL programs include students (Brubacher, 1977, Boud and Feletti, 1991, Cowdroy, Kingsland and Williams, 2007):

- developing high professional competencies
- reasoning critically and creatively
- making reasoned decisions in unfamiliar situations
- adapting to and participating in change
- appreciating another person's point of view
- making self evaluations, identifying own strengths and weaknesses and undertaking appropriate remediation
- working productively as a team member

Our PBL curriculum is aligned with the development of students' graduate attributes (Cowdroy, Kingsland and Williams, 2007). The proficiencies of graduates then become the basis for the development of each course's objectives. The University of Newcastle identifies three broad domains of graduate attributes as key outcomes of our undergraduate degrees: professionalism, community responsiveness and scholarship. They define the abilities of each graduate that transcend disciplinary

outcomes. The program specific attributes within the domains are developed in the various disciplinary and interdisciplinary contexts. The domains are defined as follows:

Professionalism: An attitude or stance towards work and activity: Graduates of the university, through well-founded knowledge and skills within their fields of study will be enabled to act professionally with honesty and integrity. They will be enabled to act effectively and ethically in decision-making and problem-solving and work both autonomously and collaboratively. They will have the ability to respond effectively to change and to seek continuous improvement in practice.

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 capacity 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, having a commitment to the expansion of knowledge and a respect for intellectual integrity and the ethics of scholarship. As scholars 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.

Reflective practice

Central to the PBL approach is the idea that students develop as reflective practitioners, requiring development of abilities to "think-in-action", to develop an awareness of "knowing how they think", which progressively translate into managing their own thinking, increasing their problem-solving skills, and ultimately developing as a life-long learner (Fonteyn, 1998). This practice is mirrored by the activities BCM staff get students to engage in. Staff develop new and innovative ways to foster and gauge the students' developments as reflective practitioners (e.g. Brewer, Jefferies, Gajendran and Williams (2007); Brewer, Gajendran, MacKee and Williams (2004) and Brewer, Gajendran, MacKee and Williams (2003)). These activities include reflective journals, the combination of reflection and self-assessment in reflective self-assessment tools, and most recently the inclusion of student reflection within assessable items as reflective footnotes.

Student evaluation

Our Discipline of Building continually improves the courses it delivers. This is initiated by frequent evaluation of courses, teaching, and the programme itself, using techniques that provide multiple perspectives. These include student evaluations of each course, using a standard University survey instrument, the results of which are recorded, reported and publicly published on our University website. Graduates of the programme are also surveyed prior to exit, and again some time after they have graduated to elicit feedback on their overall experiences. Focus groups are also conducted with the students in each year of the programme to augment the Student Evaluation of Course surveys, providing detail on the issues raised. The combination of all of these approaches results in a programme that continuously evolves and improves to meet the needs of our students.

Two Strategies Adopted in the Programme

To move to an online / blended mode required consideration of appropriate teaching and learning strategies for the delivery of courses. Two examples are virtual teaming and contract learning.

Teaching virtual teamwork

The goal of university teaching is to provide students with current knowledge and skills. The ability of universities to identify current research outcomes and to apply these to the learning experiences of the students is fundamental. The relationship of teaching to research can be defined in four ways (Griffiths, 2004):

- Research-led where the curriculum is structured around the research of the teacher
- Research-oriented where the curriculum includes how the knowledge is produced by research
- Research-based where the curriculum itself is structured around inquiry-based learning
- Research-informed where research is used to inquire into the teaching methods themselves

In the context of this paper, we have drawn on some of the outcomes of a Cooperative Research Centre for Construction Innovation (CRC CI) funded project that we were involved with (CRC CI report # 2002-024-3-04-2004). We have transferred some of the lessons learned about virtual teams operating in the workplace to educational settings. We have embedded activities which develop students' generic skills in a course delivered to third year BCM students. This course is delivered as an integrated project with students working in teams representing construction companies. Each group aims to win a tender for the completion of a building in competition with other groups. Submitting the lowest bid does not necessarily result in the highest marks being awarded. Other factors are also considered, such as the level of detail which students have worked to, commercial awareness, originality and teamwork. This mirrors recommended industrial practice, which advocates that projects are not awarded on price alone. Rivalry between teams is generally intense.

As already mentioned, our BCM program is offered in mixed-mode. This allows our students to study on-campus or as distance-learners, and provides them with the flexibility to decide at what pace to progress their studies. However, arranging for distance-learning students to engage in teamwork activities is challenging for both students and staff.

We have devised exercises that allow on-campus and distance-learners to work together discretely or as integrated cohorts. A key strategy has been to facilitate interactions between students, and we have used Blackboard extensively for this purpose, facilities include:

- Email, where students can send emails and attachments to each other as well the outside world
- Discussion boards, which allow members of a group to communicate asynchronously by posting and responding to messages from other members of their group

- File exchange facilities, which allow students to make electronic documents available to other members of their group
- Electronic whiteboards, which allow students to communicate synchronously using free-hand sketches and text

The asynchronous opportunities (email, discussion boards and file exchange facilities) are particularly important for this exercise as they allow students to meet their work commitments and engage in their studies at times that suit them.

We have devised explicit assessment practices so that students are clear what is expected of them. We have also explicitly required students to demonstrate their virtual teamwork skills, and we have incorporated activities which assess this aspect. Teamwork is an activity where non-performance by a team-member can compromise the efforts of others. We have provided disciplinary procedures modeled on industrial relations practices, whereby students can identify non-performers and require them to work satisfactorily or be penalized.

Students working in virtual teams need to be proactive and take initiative. Although many of them use electronic media on a day-to-day basis, few have worked collaboratively in the way that they are required to. Time management is a key issue. Students need to provide evidence of their teamworking activities and reflect on the skills they have developed.

Team working skills do not develop simply with the formation of students groups and letting them perform group assignment, it requires a well designed, implemented, managed and evaluated experience (Williams and Gajendran, 2004). This allows students to draw on the knowledge, skills and understanding they have accumulated in prior courses, and their work experience and assesses' teamworking in two ways:

1. Students assessed themselves and their peers.
2. Group logs which were assessed by staff.

Marks for the self / peer assessments and the logs were converted into a multiplier which was used to manipulate the mark obtained for the estimate. Generic skills associated with team participation were assessed using the self / peer assessment instrument shown in Figure 2.

The methodology developed to support students in evaluating themselves and their peers was informed by the methodologies proposed by Habshaw (in Gibbs, 1995) and involved:

- providing detailed instructions of the process
- providing opportunities for students to question and discuss the process
- trialing the assessment instrument before use

The self / peer assessment process involved students ranking evidence of each skill on a Likert scale (see Figure 2). Each student submitted an assessment for his / herself as well as for all other group members. Staff then collated these assessments for all the students in each group, aggregated and averaged their scores and arrived at a score for each student.

Each group of students was required to submit a log of their activities on a weekly basis using the template shown in Figure 3. Students needed to submit evidence of their 'work in progress' that aligned with the issues / discussions and actions recorded in the logs. The team log provided evidence and validation of students'

performance of tasks as well as documentary proof of the methodology applied by the group.

The marks calculated using the Log Assessment Rubric and the Self / Peer Assessment mark were combined into a multiplier which was unique to each student. This was then applied to the mark achieved for the final group report.

Please fill in the following assessment sheet using the key below:					
1 never					
2 rarely					
3 sometimes					
4 most of the time					
5 always fulfils task completely					
For the person under consideration circle the number that is most appropriate:					
	Never				Always
<i>Participation in group meetings/discussion.</i>	1	2	3	4	5
<i>Degree of preparation for group meetings/discussions</i>	1	2	3	4	5
<i>Fulfils responsibilities allocated at group meetings</i>	1	2	3	4	5
<i>Communicates well with the group</i>	1	2	3	4	5
<i>Makes a positive contribution to group dynamics</i>	1	2	3	4	5
1. Participation in group meetings/discussion: Ideally a student should participate in and contribute to group discussions. The contributions should reflect a familiarity with the issues at hand and be thoughtful and constructive.					
2. Degree of preparation for group meetings/discussions: Ideally a student should have prepared for the group discussion by reading around the area for discussion in addition to their allotted task. They should be keeping abreast of where the group is in terms of discussion and direction.					
3. Fulfils responsibilities allocated at group meetings: Ideally a student should responsibly fulfill any tasks assigned at group meetings and report on this activity at the next group meeting or date assigned by the group.					
4. Communicates well with the group: Ideally a student should communicate their thoughts and ideas in a clear concise scientific manner. Communication can also take the form of diagrams small presentations handouts use of the white board or other aids.					
5. Makes a positive contribution to the group dynamics: Ideally a student should contribute to the harmony of the group. They should encourage an atmosphere of intelligent discussion where all points of view are heard. They should not dominate the discussions or be argumentative; nor should they overly sidetrack the group by injecting issues not directly relevant to the task in hand.					

Figure 2: Self / peer assessment of teamworking skills

PROJECT MEETING LOG	
Meeting Date:	Time:
Team Members Present:	
Report on Actions or Items carried over from previous log	Member Reporting

Issue No. 1 Discussed Description of the issue Decisions reached	Participating Member
Issue No. 2 Discussed Description of the issue Decisions reached	
Issue No. 'n' Discussed Description of the issue Decisions reached	
New Actions	Member to Action
Members in Attendance Sign-off	

Figure 3: Groupwork meeting log template

The case for Learning Contracts

It has become axiomatic to say that assessment drives learning (Hedberg and Corrent-Agostinho, 2000), and this is reflected in the design of undergraduate programmes in the School of Architecture and Built Environment at the University of Newcastle in Australia, where Problem Based Learning is widely used across the disciplines of architecture, construction management and industrial design. Whilst each programme uses unique assessment strategies they all embrace constructivist theory, encouraging each student to create their own knowledge as they solve complex problems (Savery and Duffy, 1994), thus empowering the students to take charge of their own learning.

However, students from other Faculties are more often used to a traditional programme structure where the individual courses are based upon content delivery, placing the course lecturer in the position of “knowledge director”, thereby assuming responsibility for the students’ learning (Knowles, 1986). In a course where the majority of the students are used to this model of delivery and yet the deliverers are firmly constructivist the challenge becomes one of finding an assessment mechanism that drives student learning and knowledge creation, whilst concurrently telegraphing its professional relevance.

By using careful course design, particularly in relation to assessment mechanisms, it is possible to accommodate a wide range of different students needs, fulfill the course aims and objectives, and provide a strong motivation for students to engage with the subject matter and take ownership of their learning.

Learning contracts have long been recognised as a mechanism by which students can be empowered to take command of their own learning, negotiating a range of matters including topics to be covered, criteria for assessment, and the nature of their assessment product (Knowles, 1986). Yet the strong didactic teaching tradition within professional education has dampened their adoption despite the obvious multidisciplinary of the technological domain. Consequently the use of Learning Contracts in the context of professional education has tended to be limited to postgraduate courses and self-directed Continuous Professional Development (Williams and Williams, 1999).

This School had considerable experience of using learning contracts in design courses. There the introduction was in response to student feedback, and their use met with an enthusiastic response (Williams and Williams, 1999). The learning contracts were based upon the principles set out by Knowles (1986) and involved students negotiating:

- Their learning goals
- The nature of the evidence to be generated by them
- The means and standards by which their work would be assessed

Some BCM courses have been redesigned to incorporate learning contracts. This move has been informed by student evaluation of other courses that utilised learning contracts (Williams and Williams, 1999), and of the predecessor course, which had trialed a transdisciplinary approach to the environmental evaluation of artifacts.

Concluding comments

Like other disciplines, construction management education needs to adapt to widespread changes. For example, measurement and other office and site practices have been revolutionised by computer technology, and industry practices have evolved in response to changed contractual conditions. These changes have necessitated revisions to traditional construction management curricula. The problem based learning construction management degree program that has been successfully implemented at the University of Newcastle has been revised over the past three years. It is now delivered in mixed-mode, providing on and off-campus students with innovative and flexible education. This structure is continually evolving, and it is inevitable that the curriculum currently being delivered at our institution will be different to that of the future.

References

Barnes K, Marateo R, and Pixy Ferris S (2007), Teaching and Learning with the Net Generation, in *Innovate, Journal of Online Education*, April/May 2007, Volume 3, Issue 4 accessed on 28 April 2008 at <http://www.innovateonline.info/index.php?view=article&id=382>

Boud, D. and Feletti, G. (1991) "Introduction" in Boud, D. and Feletti, G. (eds) "The Challenge of Problem –Based Learning". London. Kogan Page. 13 – 20.

Brewer, G. Jefferies, M. Gajendran, T. and Williams, A. (2007) Development and Assessment of Metacognition in First Year Undergraduates. In AUBEA-Proceedings of the Australasian Universities Building Education Association 32nd annual conference, Swinburne University

Brewer, G., Gajendran, T., MacKee, J. Williams T (2004) "Integrating Reflective Self-Assessment Across The Curriculum." in Chen, S.E., Brewer, G., Gajendran, T. and Runeson, G. (eds) "AUBEA 2004: Higher Education Shaping The Built Environment.", Centre for Infrastructure and Property, University of Newcastle,. ISBN: 1-9207014-2-7

Brewer, G., Gajendran, T., MacKee, J. Williams A, (2003) Motivation to Engage: Piloting techniques to encourage Student engagement with unusual learning activities. In AUBEA-Proceedings of the Australasian Universities Building Education Association 28th annual conference, Deakin University pp 47-52

Brubacher, J. S. (1977) "On the Philosophy of Higher Education". Jossey Bass. San Francisco.

Candy, P. C., Crebert, G. and O'Leary, J. (1994) "Developing Life-Long Learners through Undergraduate education". National Board of Employment, Education and Training. Commissioned Report no. 28. AGPS. Canberra.

Cooperative Research Centre for Construction Innovation. Generic skills in design teams: final report (Report # 2002-024-3-04-2004) accessed 28 April 2008 at http://www.construction-innovation.info/images/pdfs/Research_library/ResearchLibraryB/FinalReports/Generic_Skills_in_Design_Teams.pdf

Cowdroy, R., Kingsland, A. and Williams, A. (2007) Achieving Cost-effective Problem-based Learning: Dispelling myths about Problem-based Learning, in de Graaff, E. and Kolmos, A. (eds) (2007), Management of Change: Implementation of Problem Based Learning in Engineering, Sense Publishers, Rotterdam
Fonteyn, M. E. (1998). Thinking strategies for nursing practice. Philadelphia: Lippincott.

Gibbs, G., (1995) Assessing Student Centred Courses, The Oxford Centre for Staff Development, Oxford Brookes University, Oxford.

Google Sketchup, accessed on 28 April 2008 at <http://sketchup.google.com/>
Griffiths R (2004). Knowledge Production and the Research-Teaching Nexus: the Case of the Built Environment Disciplines, Studies in Higher Education, Vol. 29, No. 6, pp709 - 726
Hedberg, J. and Corrent-Agostinho, S. (2000) Creating a Postgraduate Virtual Community: Assessment Drives Learning. Educational Media International. Routledge. Volume 37, Number 2, June.

Hodgson G, Sher W and Mak M (2007) e-learning Quantity Surveying measurement, Australasian Universities Building Education Association (AUBEA) Conference, Australian Graduate School of Entrepreneurship, Swinburne University of Technology, Melbourne, Australia, July 4-5, 2007, pp 197 – 209

R. James, E. Bexley, M. Devlin & S. Marginson (2007) Australian University Student Finances 2006: A summary of the findings from a national survey of students in public universities, report prepared for the Australian Vice-Chancellors' Committee, Melbourne, Centre for the Study of Higher Education, University of Melbourne.
Knowles, M. S. (1986). Using learning contracts. San Francisco: Jossey-Bass.
KPMG International, Construction procurement for the 21st Century, Global construction survey 2007, viewed on 28 April 2008 at <http://www.kpmg.com/NR/rdonlyres/987CE35B-8581-4B04-A8D0-6796300BAC5E/0/KPMGGlobalConstructionSurvey2007.pdf>

Master Builders Australia, National Survey of Building and Construction, March Quarter 2007, viewed on 28 April 2008 at http://www.masterbuilders.com.au/pdfs/NationalSurvey_March2007.pdf

Mc Kenny, L (2007). Work in the way of study, in The Sun Herald (1st April 2007)

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

Newble, D. I. And Entwistle, N. J. (1986) "Learning styles and approaches: Implications for Medical Education". *Medical Education*, 20, 162-175.

Savery, J. R. and Duffy, T. M. (1994) Problem Based Learning: an instructional model and it's constructivist framework. In Wilson, B. (ed) *Constructivist learning environments: case studies in instructional design*. Educational technology publications. Englewood Cliffs, NJ.

Sher W and Williams A (2007) Virtual teamwork in distance learning provision of construction courses. 2007 AIBS International Transitions Conference, Adelaide, Mar 5 to 7, pp 257-271

Williams A and Gajendran T (2004). Multiple Perspective Assessment Strategies for Group Work, International Design Conference - Design 2004, Dubrovnik.

Williams, A. P. and Williams, P. J. (1999) The Effects of the Use of Learning Contracts on Student Performance in Technology Teacher Training. *Research in Science & Technological Education*, Vol. 17, No. 2, 1999 193