# Evaluation of Modes of Electronic Delivery of Construction Management Courses

#### William Sher

The University of Newcastle, Newcastle, Australia willy.sher@newcastle.edu.au

#### Thayaparan Gajendran

The University of Newcastle, Newcastle, Australia thayaparan.gajedran@newcastle.edu.au

Abstract: The profile of construction management students is changing. Our Bachelor of Construction Management (Building) program at Newcastle University (Australia) was recently reviewed by the Australian Institute of Building, the Australian Institute of Quantity Surveying and our University. Changes that were recommended required us to respond to market requirements and student expectations. Over the past three years the degree has been redeveloped to embrace mixed-mode delivery to on-campus as well as to distance learning students. This paper provides some background to the degree program, describes the various e-delivery approaches used for mixed-mode delivery and finally reports on students' evaluation of the efficacy of these methods.

### Background

The opportunities for would-be construction managers are considerable. A recent KPMG survey (2007) notes that the international demand for construction personnel 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." Closer to home, a survey conducted by the Master Builders Australia (2008) reports "increasing difficulty in finding labour in virtually all 15 categories surveyed, with project managers, site managers and foremen/supervisors in chronic shortage."

There are clearly good job opportunities in the construction industry, and these are reflected by buoyant recruitment to tertiary level construction programs. 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. This profile is significantly different from the early 1990's when the Bachelor of Construction Management (BCM) program started at Newcastle University (Australia). Then the degree was conceived to meet the needs of the local building industry, and focused largely on domestic and commercial opportunities in the region. It embraced problem-based learning (PBL) as its main tenet and was developed to be delivered to on-campus as well as to distance learners.

In addition to the changed profile of our current intake of students, 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's (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 James, Bexley, Devlin and Marginson (2007) have confirmed that increasing financial stress was undermining students' abilities to study effectively.

The abovementioned imperatives have influenced the structure and delivery of our BCM program. Students require flexible alternatives that respond not only to their pecuniary realities, but to the different ways of learning that many of them engage in. In 2006 / 07 our School of Architecture and Built Environment obtained support from the Collaborative and Structural Reform (CASR) fund to address pressing curriculum issues. We conducted a gap analysis and looked at ways of improving the delivery of the program including merging the on and off-campus modes of delivery. This paper briefly describes the nature of the changes that have been implemented, the different means by which courses are delivered, and describes a survey of students' perceptions of the advantages and advantages of the delivery methods used.

# **Current Developments in the BCM Program**

Our BCM program is delivered in the School of Architecture and Built Environment. Degree programs at our University are subject to scrutiny from accrediting bodies as well as from the University itself. In 2004, our construction management degree was reviewed as part of our own internal quality assurance procedures, and by the Australian Institute of Building and the Australian Institute of Quantity Surveying. Several recommendations were made and we have responded in various ways. We have re-conceptualised the degree to address the changing needs of our stakeholders and aim to:

- cater for the changing demands/needs of students
- increase efficiency of the program delivery
- revise our teaching philosophy to enhance student learning and to confirm stakeholder requirements
- enhance quality assurance processes
- strengthen staff's skills and understanding of educational design and pedagogies using Information Communication Technology (ICT)

These issues have been addressed through the following strategies:

- We use ICT to facilitate blended learning and improve efficiency. This allows our students to study on-campus or as distance-learners and provides them with the flexibility to reflect on and revise their work at times and locations of their choosing.
- We have enhanced teaching efficiency by combing the delivery of BCM and Architecture courses that were previously taught separately.
- We now approach PBL integration differently. In the past, our BCM program was comprised of a relatively small number of large courses. These were structured around scenarios that required students to integrate their knowledge and skills of several areas. The corollary to the efficiency gains that have accrued as a result of amalgamating BCM and Architecture courses has meant that large integrated courses are no longer viable. Integration per se has been retained but in a contained manner.
- In line with revised University policy, we have introduced two elective courses.
- We have developed a robust map of graduate skills and knowledge that links to all stakeholders' requirements.

# Use of IT to Facilitate Flexible Learning

Our program employs range of tools to create flexible learning environments for students. In the main we use a learning management system (LMS) and an online lecture system. We also make extensive use of MP3 audio recorders and publish our recordings on our LMS.

### Blackboard

Newcastle University introduced Blackboard in 2001. The approaches construction management staff use most frequently include the provision of learning resources, the use of discussion forums, the

management of assessment items and the provision of links to relevant items. Furthermore, Blackboard allows us to provide lectures to online (distance learning) students in a similar manner to that experienced by on-campus students. Lectures are recorded in various formats and these, as well as other supplementary materials are made available through Blackboard. The approaches we use are described below.

#### Lectopia

Newcastle University has invested significantly in ICT infrastructure to service online delivery. A major component is Lectopia. Lectopia is a web-based system that digitally records face to face activities for delivery in streaming media formats (Fardon, 2003). It allows lecturers to record their lectures from specific venues (there are currently 41 Lectopia-enabled venues in our institution). Staff simply present their lectures to on-campus students and what they say and display (from their computer or visualiser) is recorded digitally. Once a lecture has finished it is automatically processed and is ready for students to access via Blackboard within a short space of time. The recordings may be viewed (and downloaded) at various bandwidths and students can choose a speed which accords with that of their Internet service provider. So, for example, students with dial-up access may elect to receive audio files only, whereas those with broadband access may opt to view PowerPoint slides and other visual material as well as audio. Lectopia also publishes these activities as podcasts, and students may subscribe to receive automatic downloads as and when these become available.

### Digital audio recording of lectures

Some staff audio record their lectures (and tutorials) using MP3 recorders. This is done either in addition to or instead of Lectopia. Audio recording came about during the early stages of implementing Lectopia when infrastructure for the system was being installed. At that time academic and technical support staff were learning how to use the system, and MP3 recorders were used as insurance against system failure. Staff are now familiar with Lectopia, and the technical challenges that were initially encountered have been addressed. However, staff have found the MP3 recorders to be a convenient and robust way of communicating asynchronously with students. Furthermore, some staff prefer to be able to edit their recordings (a convenience not readily afforded by Lectopia). Basic audio editing is simple and cheap to effect with freeware. In addition, being able to upload files to Blackboard at will (rather than at the time the Lectopia determines) is seen by some as advantageous. There are many ways to use these technologies effectively and staff continue to exploit them not only to record their lectures, but in a variety of other ways. It is interesting to note that others (Balfour, 2006; Lavelle, 2006) have also found MP3 recordings to be a convenient way of communicating with students.

#### Supporting materials

To assist students who use audio recordings, most staff upload their PowerPoint presentations to Blackboard. Frequently these are formatted with space to allow students to write notes adjacent to slides. These materials are generally made available in pdf format.

### **Student Evaluation**

Recognising that the skills of our staff are evolving as they use new technologies, we were keen to identify how effective the abovementioned approaches were, and to identify ways to improve. We conducted a survey to assess the contribution these technologies make to student learning. We invited 700 students, including 300 Construction Management (CM) students who were enrolled in the School of Architecture and Built Environment Programs to participate. All courses in the BCM program use a combination of the abovementioned technologies. Architecture students are only exposed to these technologies through the five courses that are jointly delivered to both CM and Architecture students.

Of the sixty-eight students who responded, 84% were males and 16% females. Table 1 summarises the background of the participants. Respondents were from different age groups, ranging from school leavers to mature age students. The majority (59%) were aged 21-30.

Sher & Gajendran, Evaluation of Modes of Electronic Delivery of Construction Management Courses

	Frequency	%					
Age group	• • •						
16-20 Years	12	17.6					
21-30 years	40	58.8					
31-40 years	11	16.2					
51-50 years	4	5.9					
Other	1	1.5					
Total	68	100.0					
Level of study							
ARBE 1000 level	18	26.5					
ARBE 2000 level	17	25.0					
ARBE 3000 level	18	26.5					
ARBE 4000 level	15	22.1					
Total	68	100.0					
Mode of study							
On Campus	31	45.6					
Off campus	37	54.4					
Total	68	100.0					
Program of Study							
Bachelor of Architecture	2	2.9					
Bachelor of Construction Management	60	88.2					
Bachelor of Design (Architecture)	6	8.8					
Total	68	100.0					
Student Self assessment of Information and	Communication Technologies	(ICT) skills					
Advanced	16	23.5					
Moderate	43	63.2					
Know a little bit	9	13.2					
Total	68	100.0					
Type of Internet access at home							
Do not have internet	6	8.8					
Dial up access	4	5.9					
Broadband access	58	85.3					
Total	68	100.0					
Frequency of Internet access for work, study and personal reasons							
More than twice a day	44	64.7					
Once a day	20	29.4					
Once every few days	4	5.9					
Total	68	100.0					

**Table 1: Background to participants** 

Respondents were spread though all years of study from first to final year, each year representing about 25% of the sample. The number of on- vs. off-campus was 46% to 56%.

The self-evaluation of ICT skills indicated that most students (88%) felt that their ICT skills were moderate. Around 13% indicated that they only knew a little bit about technology. Around 9% of the students did not have an Internet connection at home and 6% had dial up access. However, the majority of students (85%) had broadband access.

Most students accessed the Internet more than twice a day. However 6% of students only accessed the Internet once every few days.

Table 2 summarises the locations where students reviewed different materials. 'Home' was the most common location, followed by 'work'. However, some students reviewed materials at multiple locations. MP3 files have an advantage over other mediums, as they can be reviewed whilst travelling. PowerPoint was highly used compared to Lectopia and MP3 files.

	Lectopia		MP3 Audio		PowerPoint	
	Frequency	%	Frequency	%	Frequency	%
Do not use	4	5.9	8	11.8	0	0
Home	26	38.2	28	41.2	38	55.9
Work	10	14.7	4	5.9	4	5.9
University	5	7.4	3	4.4	2	2.9
Home and Work	8	11.8	2	2.9	8	11.8
Home and university	4	5.9	3	4.4	6	8.8
Work and university	1	1.5	0	0		0
In all locations	2	2.9	0	0	5	7.4
During Travel	0	0	7	10.3		0
Missing	8	11.8	13	19.1	5	7.4
Total	68	100.0	68	100	68	100

 Table 2: Review locations for Lectopia/MP3/Powerpoint

Table 3 summarises the time spent by students reviewing different materials per week. The majority of students reviewed Lectopia for less than 1 hour (49%) and MP3 / PowerPoint files for 1 to 2 hours (+/- 45%). This may not mean that Lectopia is inefficient. As Lectopia is delivered via media files, students are able to fast-forward and scan though them.

	Lectopia		MP3 Audio		PowerPoint		Blackboard	
	Freq	%	Freq	%	Freq	%	Freq	%
Less than and hour	33	48.5	12	17.6	14	20.6	14	20.6
1 to 2 hours	11	16.2	29	42.6	31	45.6	30	44.1
2 to 3 hours	5	7.4	16	23.5	17	25.0	8	11.8
More than 3 hours	12	17.6	7	10.3	6	8.8	14	20.6
Missing	7	10.3	4	5.9			2	2.9
Total	68	100.0	68	100	68	100	68	100

 Table 3: Average time spent reviewing different learning materials per week

Table 4 summarises the effectiveness of different types of resources as perceived by our students. Their approval of Lectopia was less than for other mediums. PowerPoint slides are seen as the most useful medium. Reasons for Lectopia's ratings include large file sizes; restricted Internet download capacity some students have; and a limited choice of review locations they can use. Moreover, capturing the lively nature of a face-to-face lecture, with questions and answers, presents challenges for Lectopia viewers. These sessions are not scripted productions, and sometimes come across as monotonous. In some cases, lecturers edit their MP3 files to focus them, thereby shortening them and reducing their file size.

 Table 4: Usefulness of different sources of learning materials

	Lectopia		MP3 Audio		PowerPoint		Blackboard	
	Freq	%	Freq	%	Freq	%	Freq	%
Most Useful	7	10.3	16	23.5	44	64.7	26	38.2
Useful	35	51.5	31	45.6	22	32.4	37	54.4
Not useful	16	23.5	12	17.6	2	2.9	5	7.4
Not at all useful	10	14.7	7	10.3	0	0	0	0
Missing	0		2	2.9	0	0	0	0
Total	68	100.0	68	68	68	68	68	100

# **Concluding Comments**

Our analysis of our students' evaluation of the technology they use suggests that PowerPoint is widely accepted as a medium of learning support. MP3 recordings are the next most popular medium. Lectopia is also seen as a useful medium but to a lesser extent. One of the reasons for this may be students' reluctance to download large files and the level of Internet download capacity and speed they have access to. Small file size and portability appear to be key factors in gaining students' acceptance.

Sher & Gajendran, Evaluation of Modes of Electronic Delivery of Construction Management Courses

The reasons for Lectopia's lower than expected acceptance need to be explored further and the preliminary nature of this study needs to be noted. Lectopia provides synchronised delivery of visual and aural media and the manner in which students engage with such materials is not clearly understood as yet.

#### References

- Audacity, open source software for recording and editing sounds. Accessed on 1 May 2008 at http://audacity.sourceforge.net/
- Balfour, J. A. D. (2006). *Audio recordings of lectures as an e-learning resource*. Paper presented at the Built Environment Education Annual Conference (BEECON 2006).
- Fardon, M. (2003), Internet streaming of lectures: a matter of style, proceedings of Educause Australasia, 2003
- James, R., Bexley, E., Devlin, M. and Marginson, S. (2007), Australian Vice Chancellors report A summary of findings from a national survey of students in public universities. Centre for the Study of Higher Education, The University of Melbourne, viewed on 3 May 2007 at http://www.avcc.edu.au/documents/publications/policy/survey/AUSF-Report-2006.pdf
- KPMG International, *Construction procurement for the 21st Century, Global construction survey 2007*, viewed on 1 Oct 2007 http://www.kpmg.cz/czech/images/but/Construction-Survey-2007.pdf
- Lavelle, D. (2006). *Delivery of e-lectures*. Paper presented at the Built Environment Education Annual Conference (BEECON 2006).
- Master Builders Australia, *Builder Survey reveals worsening skills shortage*, National Survey of Building and Construction, MBA Executive Newsbrief, March/ April 2008.
- 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

#### **Copyright statement**

Copyright © 2008 William Sher and Thayaparan Gajendran: The authors assign to AaeE and educational non-profit institutions a non-exclusive licence to use this document for personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to AaeE to publish this document in full on the World Wide Web (prime sites and mirrors) on CD-ROM and in printed form within the AaeE 2008 conference proceedings. Any other usage is prohibited without the express permission of the authors.