UNDERSTANDING E-LEARNING TECHNOLOGIES FOR SUPPORTING WORK INTEGRATED LEARNING IN CONSTRUCTION EDUCATION

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ABSTRACT:

Work Integrated Learning (WIL) refers to educational activities that combine theoretical learning with practice (Stephen Billett, 2001; Patrick, 2009). Using the Construction discipline as the context, this paper reports on the preliminary findings from a project supported by Australian Learning and Teaching Council, which aims to develop a robust framework for WIL by understanding e-learning technologies to promote links between the parties involved. The paper firstly highlights the discipline's key competencies as required by the industry's accrediting bodies. These are used to align curricula with work skills. The perceptions about WIL are then elicited and presented from a qualitative workshop session comprised of academics, students, and the accrediting bodies' representatives. The paper concludes by discussing

the implications of using e-learning technologies to support WIL. These findings contribute to the ongoing development of the WIL framework.

1. INTRODUCTION

Work Integrated Learning (WIL) is the term used to describe educational activities that integrate theoretical learning with its application in workplace, profession, career or future employment (Stephen Billett, 2001; Patrick, 2009). Research about WIL is timely and probes the complex relationships between education and industry. Using the Construction discipline as the context, this paper reports on the preliminary findings from a project supported by Australian Learning and Teaching Council, which aims to develop a robust WIL framework by exploring e-learning technologies, in particular, e-portfolios, to promote links between universities, students and practices to facilitate WIL. E-learning has increasingly become a significant way of enhancing student experiences in design education. Our project explores whether e-learning technologies have a significant role to play in linking the knowledge and experience students learn from their practical placement with the theory gained from their curricula.

The main content of paper is divided into three parts, each contributing to the ongoing development of the WIL framework. Part one highlights the Construction discipline's key competencies as required by the industry's accrediting bodies in order to align the curricula with work skills. Part two reports on the qualitative data collected for the project, this being a workshop to understand teaching and industry professionals' perceptions of WIL issues and opportunities. Part three concludes the paper by discussing the implications of e-learning technologies, in particular, the potential of e-portfolios in supporting WIL regarding the main emerging issues and themes from the first two parts.

2. BACKGROUND

This background section firstly defines WIL and secondly discusses WIL issues and their impact on Construction education. This is followed by a brief literature review on the use of e-portfolios for supporting WIL.

2. 1. WIL AND CONSTRUCTION EDUCATION

WIL is a current trend in higher education and is increasingly being made available in a broad range of undergraduate programs to create improved connections between the educational and industrial contexts. WIL experiences can be off or on campus, real or simulated, depending on the discipline area, but must involve clearly stated outcomes, assessment and be consistent with quality teaching and learning (S. Billett, 2010). It is promoted by the higher education system to encourage opportunities for students to apply their university learned conceptual knowledge to the real world. For instance, research has shown that when Construction students start employment they frequently find it difficult to relate theory to practice, however once they have been exposed to the workplace, they tend to modify their views and make these connections more explicitly (Williams, Sher and Simmons, 2009). Consequently, Australian higher education for the Construction discipline, promotes opportunities within the curricula for students to engage in WIL during their undergraduate studies. More recently WIL has also been promoted by universities in response to a skills shortage in the industry sector (Hager, Melville and Crowley, 2001).

The education of Construction professionals at universities is unique as the curricula straddle diverse areas such as building design, technology, management, law and finance, which

requires close connection between the theory and practice. A recent report on Construction education Australia wide has shown that students greatly value WIL. WIL is managed in varied ways across the Construction Management (CM) programs in Australia. For instance, at the University of University, Australia, students in the CM program identify and arrange their own industrial placements and usually complete their placements during university vacations, alternatively some study and work simultaneously (Sher and Sherratt, 2010). Students may consult university staff about placement opportunities, but staff members generally play no part in placements until students submit evidence of achievement of the required placement experiences (Sher and Sherratt, 2010). A range of documentation is called for in regards to WIL experiences, with some degree programs requiring students to submit formal reports and presentations and others simply requiring employers to confirm the duration of placements and the nature of the work students completed (Ashford and Francis, 2007; Sher and Sherratt, 2010). Some CM programs offer alternative lab work options whilst others offer simulated projects, where students take on roles in industry and 'act out' procedures (J Li and Randhawa, 2009; Maier, 2009).

WIL issues are also raised in the literature from different stakeholders' perspectives. For instance, from an industry perspective, Construction education providers and industry have different ideological objectives when it comes to industry experience (Williams et al., 2009). It is noted that employers view industry-related skills as being predominately acquired through on-site experience rather than formal education (Hager, Crowley and Melville, 2001). On the other hand, from a teaching perspective, the recent report on Construction education in Australia identified that those responsible for managing CM programs at universities expressed reservations about industrial experience and WIL (Williams et al., 2009). These reservations centred on the availability of placement

opportunities for students during volatile economic times, and the resource implications of administering WIL. The report further found that some academics see that, given the choice, it is debatable whether students would engage in industrial placements if these were not required by their degree program (Williams et al., 2009). From an accreditation perspective, this same report highlighted issues on there being no quality control mechanisms in place for WIL as prescribed by the accrediting bodies. As such, individual universities need to interpret, administer and monitor WIL in accordance with their own policies and interpret industry placement requirements of the accrediting bodies in different ways, hence creating fragmentation of WIL experiences across the education sector (Williams et al., 2009).

Recent studies of WIL in Engineering have highlighted similar concerns, in particular the lack of pedagogical connections between programs, industry experience and assessment. Richardson, Kaider, Henschke and Jackling (2009:338) discuss the issue of assessing WIL in Engineering programs, they state that 'the underpinning cause for inadequate WIL assessment is a lack of understanding of the nature of learning in the work place' they conclude that this is due to the ad hoc nature of learning in this situation (such as learning 'informally'). Similarly, Hu, Abadeer, and Yusman (2009) identify a lack of research on what generic skills are required and learnt on Engineering industry placements.

The above literature indicates that industry expectations of learning from WIL need to be constantly monitored, defined and discussed. Most importantly, such discussions highlight gaps between university and industry expectations in regards to WIL and the need to bridge these gaps. As stated, to achieve this, the research reported here aims to develop a robust framework and to analyse the use of e-learning technologies which

facilitate and encourage students' reflective learning during their industry placement for supporting and improving WIL.

2. 2. WIL AND E-PORTFOLIOS

E-learning technologies for managing students learning has increasingly been studied and implemented by universities worldwide, particularly the implementation of e-portfolios to document students' learning experiences (Ayala, 2006; Heinrich, Bhattacharya and Rayudu, 2007; Reardon and Hartley, 2007). Generally defined, an e-portfolio is an online program to document learning, assessment and ultimately showcase an actor's skills, progress and reflections (Ivanova, 2008). New generations of e-portfolios often provide links to Web 2.0 tools to support social networks and interactions (Ivanova, 2008; Schwartz, 2006). Furthermore, e-portfolios can facilitate ongoing student documentation of achievements that could be used as an ongoing resource after they graduate. According to the Business Industry and Higher Education Collaboration Council (BIHECC, 2007 p.41) 'one of the greatest strengths of (an e-portfolio) is that it provides a structured and cost-effective means to encourage students to manage their own career planning and skill development'. Presently there is no use of e-portfolios in the Construction discipline, and in particular for WIL. However Learning Management Systems (LMS) such as *Blackboard* are commonly used by universities for managing and supporting administration of student learning (Williams et al., 2009).

Literature on e-portfolio use in relation to documenting WIL is limited. A study by Temple, Allan and Temple (2003) reviewed students use of e-portfolios to document their placement learning in an undergraduate physical education course, they encouraged students to think about their competencies by reflecting on their previous experiences and to think about

these experiences in different categories of their 'behaviours, knowledge, skills, and abilities that are job related'. These reflections were then uploaded into the e-portfolio platform. Similarly, in Engineering, a closer related discipline to CM, has trialled using an e-portfolio platform to document students' industrial placements. A study by Li, Molyneaux and Botterill (2009) investigated Engineering students' use of the e-portfolio platform *Pebble PAD* to document their vacation employment. The project involved creating detailed work experience evaluation profiles and embedding these on the e-portfolio platform so students could attach evidence of their work and relate this to the relevant Engineering competencies (Jie Li et al., 2009). Generally, these authors found that students regarded the e-portfolios as a convenient and effective way to complete their work experience evaluation (Jie Li et al., 2009). Other benefits of using e-portfolios to document employment skills identified by Li et al. (2009) were ascertaining the gaps in skills learnt and therefore improving students' employability.

3. DISCUSSION: ALIGNING INDUSTRIAL COMPETENCIES

To develop and implement the robust framework for Construction education which aims to promote the relevant links between the university's curricula, students experiences and practices to improve WIL, the research team analysed competency statements of the CM accreditation bodies' skill requirements as defined by the Australian Institute of Building (AIB), Australian Institute of Quantity Surveyors (AIQS), and Chartered Institute of Building (CIOB). This review created an initial skills framework, which aligned curricula requirements with work skill requirements. To achieve this skill analysis, the competencies and graduate professional qualities were mapped and evaluated against each other. The alignments of

accreditation requirements identified by this mapping were communication skills, management/leadership skills, ethical knowledge, knowledge of health, safety and risk management, legal knowledge, self evaluation, industry knowledge update, research skills, and generic information and communication technology (ICT) skills. Table 1 provides a brief explanation of each of these competency alignments.

Communication skills	Communication skills - writing and orally: Documentation and presentation skills, budget preparation and report writing, …; Interpersonal skills - teamwork; Communication skills - leadership; appraisal/evaluation; Claims and dispute resolution; …
Management/leadership skills	Building management skills; Project management skills; Domain and interdisciplinary knowledge and management skills; Strategic planning skills; Human management skills; …
Ethical knowledge	Knowledge of codes of ethics; Knowledge of environmental protection principles to building work; Claims and dispute resolution; …
Health, safety and risk management	Health and safety review skills; Risk management skills; …
Legal knowledge	Legal knowledge and compliance; Claims and dispute resolution; …
Self evaluation	Self evaluation skills: reflecting on lessons and experiences, recording achievements; …
Industrial knowledge update	Up-to-date knowledge of the industry – design, technologies, legislation, management, …; Self and continuing learning; …
Research skills	Analysis, problem-solving skills; …
ICT skills	Ability to apply ICT to building and construction uses; …

Table 1: Alignment of competency requirements from the professional bodies.

The competency analysis of skills created a scaffold for the framework development, which ultimately aims to improve WIL experiences for Construction students.

4. WIL PERCEPTIONS

The next stage of the project investigated perceptions of WIL through qualitative data, a workshop session. The workshop, involving approximately sixty individuals representing major parties involved in WIL; academics, students and representatives of industry's accrediting bodies. These participants' views on the issues provided qualitative understandings which will in the long term, supplement the initial competency analysis and alignment.

The sixty participants were divided into four sub-groups of viewing WIL issues on Construction education from 'Academics', 'Students', 'Practitioners' and 'Accrediting bodies' perspectives and conducted a Strength, Weakness, Opportunity and Threat (SWOT) analysis on these issues. An introduction on WIL and a list of triggering issues and questions were presented as the starting point of the workshop. Each sub-group then discussed the issues and SWOT for thirty minutes and the outcomes were then reported back to the group. The final presentations of each sub-groups were recorded, transcribed and are currently undergoing analysis. The initial themes identified by this session are highlighted in Table 2. The data presents WIL through the lenses of academics, students, practitioners, and the industry's accrediting bodies and related SWOT.

LENSE	STRENGTH	WEAKNESS	OPPORTUNITY	THREAT
Academics	Staff learn from students - a 'reality check' for staff; Reflect on industry experiences in the classroom -	Unrealistic expectations that need to be managed; Lack of time for in-depth monitoring/ couching of the students' learning	Robust process; ...	...

	other students learn from hearing these experiences; …	experience; Lack of student motivation; …		
Students	Continuous assessment - no exam; Real world experiences; Most students already work in industry while studying; …	Lack of assessment; General dislike of reflecting on experience - exam style assessment sometimes preferred, or need encouragement for student reflections; No contextualisation; Considerable work load for minimum return on investment; …	Gain a broader understanding of professional competencies; Integrate theory and practice; Excellent postgraduate experience - may be not as relevant in undergraduate level as students still focusing learning concepts; …	Sometimes lose students to industry; Potential to learn 'bad' habits, i.e. if the student's placement is with a dysfunctional company; If student perceived as a 'gopher' in the company perhaps no room for quality learning and reflection; …
Practitioners	Opportunity to pass on and demonstrate practical knowledge to students; Teach the 'practical gaps'; Teach the whole process of industry; …	Unclear expectations - these need to be clarified through assessment, i.e. marking rubrics; Students need to define these expectations as well as employers; Employers need to be familiar with students' education concepts; …	'Cooperative education' as a solution – placement experiences with employers at different levels; 'Try before you buy' see how students work before they are employed; …	Safety and pay issues – insurance and bureaucracy, i.e. opportunities needed to register with PB before working in industry; Employers may have a bias to what they want the student to learn; …
Accrediting bodies	Real life experiences; Opportunities for students to put their professional and management skills into practice; …	Lack of engagement in the industry to get students into relevant industry experiences; …	Students identify experiences for their future career goals - draws in opportunities; …	Difficult to design/assess WIL; Resource implications and implementation threats; Industry's role in accreditation process; …

Table 2: WIL Perceptions: SWOT analysis with the stakeholder lenses.

The above qualitative data has initially highlighted the areas that need to be improved, such of lack of industry engagement of student experiences, WIL assessment issues, the gap between theory and industry expectations. Further the opportunities WIL provides, such as students learn this 'industry gap' when they are on placement. Student learning styles and

e-learning technologies will now be considered to further bridge this gap.

5. E-LEARNING TECHNOLOGIES FOR SUPPORTING WIL AND 'REFLECTION'

As defined, the aim of WIL is to promote links between the theory and practice. To understand this process, we must firstly review how students already make these connections between their industry placement experiences in relation to their university learning. The literature states that 'reflecting' on experiences allows for the learner to make the necessary links between different experiences (D. Boud, 1999; D Boud, Keogh and Walker, 1985). Indeed, learning through reflection is documented extensively in the literature, one example by Boud, et al. (1985) define reflection as 'returning to experience', 'attending to feelings' and 'evaluating experience', therefore defining a way the learner can return to their theoretical knowledge learnt, as they evaluate their learning experiences through reflection.

This strategy to support learning lends itself to a reflexive approach that can be 'a more immediate, continuing, dynamic and subjective self awareness' (Finlay, 2002) from the student, which allows for a more holistic approach to learning. Moon (1999) similarly discusses the importance of reflection for learning in practice and suggests that students, teachers and practitioners all require guidance on how to reflect which facilitates deeper whilst engaged in practice. These pedagogical findings on the importance of learning through reflection and the method to reflect are pertinent for this current study to establish development of the robust framework, a final outcome from the research project. This paper now concludes by discussing the implications of e-learning technologies in

supporting student ‘reflection’ and consequent deeper WIL - practice experiences.

E-portfolios can present opportunities to assess WIL in Construction education. For instance, skills-enabled e-portfolio platforms such as *Mahara*, *Droople* have sections within the platform on ‘competencies’ - evidence based records (some platforms being more detailed than others). There are slightly different ways the competency section can be viewed and assessed, such as ‘assessor views’, the range of competencies, or options where staff create a ‘shopping trolley’ of competencies (Andre, 2010). Within the “competencies” section of the e-portfolio there are tags/links to artefacts, such as a document/video/audio of reflecting upon practical experiences uploaded to show students have achieved the relevant competency in their placement (Andre, 2010). WIL examiners could then validate the evidence with a comment or request for further work until this competency is completed. The competency lists in some platforms can be generic skills, i.e. ICT skills, communication skills or they can be customised especially for WIL and the Construction discipline.

E-portfolios can support students’ reflections while learning in other ways, for example, from a functional perspective common e-portfolio architecture allows for reflections and summative assessment. For instance there are a range of tools for reflection, some examples include ‘action plans, journals, blogs and reflective activities that provide prompts when uploading achievements to specific activities’ (Andre, 2010) and similarly provide a section where examiners and/or peers can comment on these entries. This information can also be made public by the student for sharing and further review, which allows for another layer of reflecting on learning. In time the e-portfolio can display students’ progression and attainment of goals over their education to be used in their profession (Andre, 2010).

These functions can allow the student to document their ongoing knowledge built up over time of different WIL experiences. Employers and academics can also have ongoing dialogues on students' WIL experiences through the same platforms, through feedback links.

Mobile e-learning technologies could also be used to work towards monitoring students learning whilst they are on placement. This is through using existing technologies, such as mobile phones, to capture and assess the evidence and information students learned when they are on placement. A recent initiative with five universities in the UK has created and trialled a mobile learning system for students in health and social care with, which 'supports the creation, distribution and storing of assessment tools on mobile devices' (MKMlabs, 2009). The devices have assessment items based on core competencies, which are sent to students whilst they are on placement (MKMlabs, 2009). The devices also create opportunities for students to contact and communicate with their tutors through a single portal, which means that students do not feel so isolated when they are out in the 'real world' learning.

Furthermore, the literature on e-learning technologies states that if the student is the driver of their online learning they are much more likely to be engaged with e-learning technologies (Barrett, 2004). Here, students are empowered through their self-directed use of e-learning technologies. Barrett (2004) refers to an important concept of a digital shoebox. 'Shoebox' is used as a metaphor here meaning a collection of items often found in a shoebox. Therefore digital shoebox emphasises the needs of the use of a collection of online tools or applications to document and reflect learning experiences rather than relying on one single electronic platform. For example, student can use a wide range of electronic means, essentially Web 2.0 tools such as blogs using 'Blogger', 'Twitter', 'WordPress' - a

collaborative writing/learning platform, 'Facebook', 'SlideShare', and so on, to document and reflect their WIL experiences. Web 2.0 tools can play an important role in reflective learning, as it allows for sharing experiences with peers. The popularity of these tools also can encourage students to be engaged in the process. It is also student centred, as students decide what application they want to use to document their experience and who will view their evidence.

On the other hand, Barrett (2004) also suggests that students can become alienated from a platform if it is solely focused on institution driven assessment. Therefore it is important for e-portfolios educators to resolve the purpose of the e-portfolio before it is implemented. Overall, a balance is required here between students' own WIL journeys and the need for assessment of these journeys. As stated, at the moment in Construction education there is a lack of WIL assessment therefore any documentation of these experiences, made possible with web tools, will benefit both students and academics. These implications of e-portfolio in relation to WIL issues has shed light on the potential of these tools to promote deeper WIL experiences for students.

6. CONCLUSION

The above review of WIL and e-portfolios in Construction education raises the question as to how the intricacies of these e-learning technologies can further be advantageous to the Construction discipline in regards to WIL experiences and assessment. Further findings from the research aim to fill this gap, through additional qualitative analysis on students' reflections on WIL to understand the ways students demonstrate WIL (besides reflecting on experiences) and what supports them to make these links between theory and practice. Overall these data will contribute to the ongoing

development of the WIL framework, allowing for a stronger benchmark of WIL and e-portfolio use in the Construction education nationally and indeed internationally. The project will ultimately establish the needs of all Construction education stakeholders so that practical placement experiences and the consequent attainment of student employability skills are documented and understood. These project outcomes will work towards rectifying ongoing WIL issues identified from the literature and the preliminary findings on WIL issues reported in this paper.

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REFERENCES:

Andre, K. (2010). E-Portfolios for the aspiring professional. *Collegian, In Press* (doi:10.1016/j.colegn.2009.10.005).

Ashford, P., & Francis, V. (2007, July 3-5). *Creating and implementing new built environmental courses: The challenges and opportunities of the Melbourne Model.* Paper presented at the AUBEA Conference, Swinburne University, Melbourne.

Ayala, J. l. (2006). Electronic Portfolios for Whom? *Educause Quarterly*(1), 12-13.

Barrett, H. C. (2004). Electronic Portfolios as Digital Stories of Deep Learning: Emerging Digital Tools to Support Reflection in Learner-Centered Portfolios [Electronic Version]. *The Reflect Initiative: Researching electronic portfolios and learner engagement*. Retrieved June 21st, 2010.

BIHECC. (2007). *Graduate Employability Skills: Prepared for the Business, Industry and Higher Education Collaboration Council*. Canberra: Commonwealth of Australia.

Billett, S. (2001). *Learning In The Workplace: Strategies for Effective Practice* Sydney: Allen & Unwin.

Billett, S. (2010). National Teaching Fellowship Project (email from Stephen Billett to William Sher).

Boud, D. (1999). Avoiding the traps: Seeking good practice in the use of self assessment and reflection in professional courses. *Social Work Education, 18*(2), 121-132.

Boud, D., Keogh, & Walker. (1985). Reflection - Turning experience into learning. In. London: Kogan.

Finlay, L. (2002). "Outing" the researcher: The Provenance, Process, and Practice of Reflexivity. *Qualitative Health Research, 12*(4), 531-545.

Hager, P., Crowley, S., & Melville, B. (2001). *Challenges for skill formation in evolving industry: The case of the Australian building and construction industry.* Paper presented at the AARE Conference, University of Technology, Sydney http://www.aare.edu.au/01pap/hag01142.htm.

Heinrich, E., Bhattacharya, M., & Rayudu, R. (2007). Preparation for lifelong learning using ePortfolios. *European Journal of Engineering Education, 32*(6), 653-663.

Hu, X., Abadeer, O., & Yusman, C. (2009). *Evaluation of Engineering Work Experience Programs (I): Principles*. Paper presented at the 20th Australasian Association for Engineering Education Conference

Ivanova, M. (2008). *Learning ePortfolio deployment in social network NING*. Paper presented at the Electronics 2008.

Li, J., Molyneaux, T., & Botterill, M. (2009). *Integrated a PebblePAD ePortfolio into the Vacation Employment Curriculum*. Paper presented at the 20th Australasian Association for Engineering Education Conference AAEE.

Li, J., & Randhawa, S. (2009). *Work Integrated Learning for Engineering Students at Flinders University*. Paper presented at the 20th Australasian Association for Engineering Education Conference

Maier, H. R. (2009). *Bringing industry experience into the "classroom" via multimedia flash presentations*. Paper presented at the 20th AAEE.

MKMlabs. (2009). *My Knowledge Maps: Taking learning forwards*. York: My Knowledge Map (MKM) labs, Ltd

Moon, J. (1999). *Reflection in learning & professional development : theory & practice*. London: Kogan Page.

Patrick, C. (2009). *The WIL (work integrated learning) report : a national scoping study* Queensland http://www.altc.edu.au/system/files/grants_project_wil_finalreport_jan09.pdf.

Reardon, R. C., & Hartley, S. L. (2007). Program evaluation of e-portfolios. *New Directions for Student Services*(119), 83-97.

Richardson, J., Kaider, F., Henschke, K., & Jackling, B. (2009, 6-9 July). *A framework for assessing work integrated learning.* Paper presented at the 32nd HERDSA Annual Conference, Darwin, Australia.

Schwartz, C. (2006). Managing electronic portfolios. In P. Hernon, E. Dugan & C. Scwartz (Eds.), *Revisiting Outcomes*

Assessment in Higher Education. Westport, Connecticut, London: Libraries Unlimited.

Sher, W., & Sherratt, S. (2010). Evaluating the work integrated experiences of engineering and built environment students. The University of Newcastle.

Temple, V. A., Allan, G., & Temple, B. W. N. (2003). *Employers' and students' perceptions of electronic employment portfolios*. Paper presented at the AARE.

Williams, A., Sher, W., & Simmons, C. (2009). *Understanding Construction Education in Australia: A Review of Teaching and Learning Challenges and Opportunities Construction Management, Quantity Surveying & Building Surveying*. Sydney Australian Learning and Teaching Council - Discipline Based Initiative Grant http://www.altc.edu.au/resource-identification-teaching-construction-uon-2009.