

# Enhancing practical pedagogy for construction students with e-learning technologies

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**ABSTRACT:** E-learning has increasingly come to the fore as a means to enhance students' learning in design education. This is despite academic research warning against putting too much onus on these technologies as the answer in improved learning experiences for students. This paper explores whether e-learning technologies have a significant role in linking students' knowledge, learnt from their practical placement experiences, to the theory learnt in the building and construction education curricula. This paper reviews a recently awarded Australian Learning and Teaching Council (ALTC) research grant, which compares work-based learning within the building and construction discipline, with nursing - a discipline where practical skills and experiences also play an important role. Overall, the research project aims to explore if new e-learning technologies can engage students by better connecting and integrating work-based learning and academic studies.

This paper concentrates on the Construction Management (CM) portion of the project. Derived from the outcomes of our preliminary research, the paper presents a robust framework that could facilitate and encourage reflective learning during work-based activities through using e-learning technologies, predominantly electronic (e)-portfolios. Through the development process of the framework, various challenges in evaluating work-based learning in construction management are discussed. These range from competency definitions, to strategies and criteria for assessing practical experience within e-portfolio platforms.

**Keywords:** e-learning technologies, framework, work based learning, building and construction education.

## INTRODUCTION

This paper presents preliminary outcomes of a recently awarded ALTC grant to the University of XXX to undertake a context study in the disciplines of Construction Management (CM) and Nursing to investigate work integrated learning (WIL) issues and the use of e-portfolios. The project aims to make explicit connections between what is taught at university and students' WIL by creating a robust framework that makes these connections explicit for students, further considering e-portfolios as a solution to promoting these links. This paper considers the initial findings from this study, concentrating on work-based learning in the CM disciplines component of the project. It considers CM WIL issues and then the potential of e-learning technologies as a solution to these issues.

## 1. WORK INTEGRATED LEARNING IN DESIGN EDUCATION

### 1.1 The Project

As stated, the 'Facilitating WIL through skills-enabled e-Portfolios' research project's main aim is to create a framework to assist students to make explicit connections between what is taught at university and students' WIL. A component of the framework is a hierarchical framework of skills statements that map the competency requirements of relevant professional bodies to the learning outcomes of relevant undergraduate programs. In the long term the framework, when implemented, will encourage students reflective learning during work based activities; the framework will then inform the development of discipline specific Continuing Professional Development (CPD) modules that link WIL and formal curricula. Current practices and applications of e-portfolios are reviewed to establish if these platforms can cultivate learning links between the worlds of work and study. For instance, ways of embedding the competency alignment frameworks within existing generic e-portfolio systems will be investigated. The project does not aim to re-invent e-portfolio systems but rather it identifies the opportunities inherent in the technologies which best support the reflective processes when students are engaged in WIL. For example, by examining the skills students develop when they are on placement. The project outcomes will further demonstrate

these links through online resources and describe how the learning framework may be embedded into generic, 'open sourced' e-portfolio platforms, such as *PebblePAD*, *Droople*, *Moodle* or *Mahara*. Other resources to be produced will include; a design brief and specification for a resource on student competency standards/skills for CM and Nursing that will be readily transferable to other disciplines. In addition, final reports will document the potential of e-portfolios to enhance industry practice and related theory. This paper documents the steps taken so far towards achieving these project resources.

### **1.2 WIL and Construction Education**

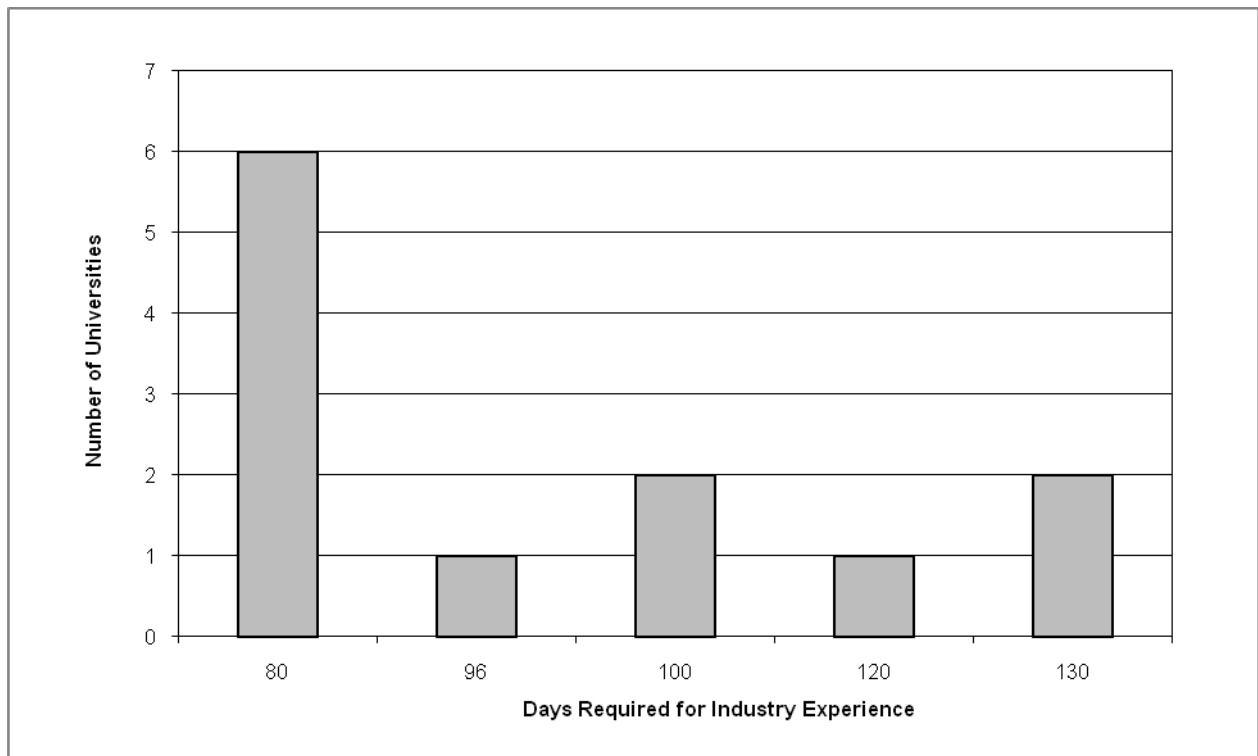
WIL is most often the term used to describe educational activities that integrate theoretical learning with its application in a workplace, profession, career or future employment (Stephen Billett, 2001; Patrick, 2009). WIL is a current trend in Australia and is increasingly being made available for a broad range of undergraduate programs. WIL experiences can be off or on campus, real or simulated, depending on the discipline area, but must involve clearly stated outcomes, assessment and to be consistent with quality teaching and learning (Stephen Billett, 2010). It is promoted by the Higher Education system to encourage opportunities for students to apply conceptual knowledge they learn at university so that it becomes grounded in the real world. For instance, research has shown that when CM 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, & Simmons, 2009). Consequently, the higher education system for the CM disciplines in Australia promotes opportunities within the curricula for students to engage in WIL during their undergraduate studies. Further WIL has been promoted more recently by universities as a response to a skills shortage in both industry sectors (Hager et al 2001).

At the University of XXX for instance, CM students identify and arrange their own industrial placements (Sher & Sherratt, 2010). Students usually complete their placements during University vacations, but some study and work simultaneously (Sher & Sherratt, 2010). Students may consult university staff about industry opportunities, but staff generally play no further part in placement until students submit evidence of completing their industry experience. A range of documentation is called for in this regard, with some degree programs requiring students to submit formal reports and others simply require employers to confirm the duration of placements and the nature of the work students completed (Sher & Sherratt, 2010). Presentations and reports are required at some universities of students' practical experiences (Ashford & Francis, 2007). Some programs offer lab work whilst others offer simulated projects, where students take on roles in industry and 'act out' procedures, such as management of staff whilst on site, other programs use labs to test building materials and have presenters from industry (J Li & Randhawa, 2009; Maier, 2009). A recent report on CM education Australia wide has shown that CM students greatly value WIL. Teamwork and collaborative learning whilst on placement emerged from the data as drivers promoting effective student learning.

### **1.3 Issues with WIL**

It is apparent that the building and construction industry and universities have different ideological objectives when it comes to industry experience. Hager, Crowley & Melville (2001) note that employers view industry-related skills as being predominately acquired through on-site experience rather than formal education. Hager et al (2001) state that the construction industry has become increasingly IT sophisticated and competitive locally and globally (1990-2000) which has resulted in the need for new graduate skills. The recent report on construction education in Australia (Williams et al., 2009) confirmed this WIL issue and identified others in the CM disciplines. For instance, those responsible for managing construction programs at Universities expressed reservations about industrial experience and WIL (Williams et al., 2009). These reservations centre on the availability of placement opportunities for students during volatile economic times, and the resource implications of administering WIL (Williams et al., 2009). The report found that some academics argue 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).

Furthermore, there are no quality control mechanisms in place for WIL in CM as prescribed by the accrediting bodies for this discipline. As such, individual universities need to interpret, administer and monitor WIL requirements in accordance with their own policies and interpret industry placement requirements of the accrediting bodies in different ways (Williams et al., 2009). For example, figure 1 shows how the Universities who offer CM degrees require varied numbers of days for student industry placements.



**Figure 1: Industrial experience required by universities who offer CM - February 2008 (Source: University websites, program guides) (Williams et al., 2009).**

Recent studies relating to WIL, in engineering have highlighted further concerns in particular, the lack of linkages between programs, industry experience and assessment. Richardson, Kaider, Henschke & Jackling (2009) discuss the issues of assessing work integrated learning 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” due to the ad hoc nature of learning in this situation (such as learning ‘informally’) (Richardson et al., 2009:338). Similarly, Hu, Abadeer and Yusman (2009) identify a lack of research on what generic skills are required and learnt on engineering industry placements. The authors reviewed the most important generic skills developed in current industry placements in Engineering (Hu et al., 2009:922). The authors evaluated these skills developed by investigating how the program and workplace support these skills. They then researched what learning experiences in the workplace supported the development of these generic skills (Hu et al., 2009). The skill review developed by Hu et al (2009) has informed the study discussed in this paper.

The literature indicates that industry expectations of learning from WIL need to be constantly monitored, defined and discussed. Such discussions highlight gaps between university and industry expectations in regards to WIL. Most importantly, the WIL issues discussed highlight the need to bridge the gap between theory and practice. As stated, the research discussed in this paper proposes and presents a robust framework that facilitates and encourages reflective learning during work-based activities. In order to promote links between practice and theory, it is necessary to firstly understand how students make these connections when they are on industry placement and then back to what has been learnt in the classroom. Therefore it is necessary to consider reflective learning literature to understand how the robust framework can be developed.

#### **1.4 Developing a ‘reflective’ learning framework**

Literature on reflection states that ‘reflecting on experiences’ can enable the learner to make links between different experiences. Learning through reflection is documented extensively in the literature, one example by Boud, Keogh and Walker (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 experiences through reflection.

This strategy to support learning lends itself to a reflexive approach which can be “a more immediate, continuing, dynamic and subjective self awareness” (Finlay, 2002 :533) 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. Moon (1999) has devised techniques and a ‘reflection’ model to enable this process and

to use as a practical guide in the classroom. These pedagogical findings on the importance of learning through reflection and the method to reflect are pertinent for this current study to establish WIL boundaries and the consequent development of the robust framework.

Literature on developing frameworks for WIL include students' reflecting on their WIL experiences as a necessary component of deeper learning. The recent study by Richardson et al (2009) which set out to develop a WIL assessment framework through interviews and surveys with educators, students and industry, the data gathered formed the assessment framework, this meaning, a criterion for creating relevant WIL assessment tools. The authors defined this assessment framework as CCARDS (Contextual, Capability driven, Action-based learning, Relationship collaboration, Development, Student-centred). Similarly, Temple, Allan & Temple (2003) reviewed students use of e-Portfolios to document their 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" (Temple et al., 2003 :5). These were drawn from the acronym STAR (Situation, Task, Action and Results) as the framework foundation for students to reflect on their skills learnt for assessment tasks which were then embedded into an e-Portfolio platform.

Nevertheless these frameworks are broad in their application to WIL, furthermore they do not allow for the process of reflection defined above as important and as a fluid process, such as reflecting back on an experience to learn from mistakes made (rather than linear as defined in these models). The qualitative data gathered in this study, staff and students' views on WIL, will contribute to a more comprehensive WIL framework to understand how to encourage students to make links between their knowledge learnt and skills gained during WIL. The findings and framework developments from the project will now be considered.

## 2. DISCUSSION

### 2.1 Analysis of CM competencies and WIL issues

An initial analysis of the competency statements of the CM accreditation bodies' skill requirement lists, Australian Institute of Building (AIB), Australian Institute of Quantity Surveyors (AIQS), and the CIOB) was conducted to create a preliminary scaffold to align the CM curricula with work skills. An issue which emerged from this exercise was the extent to which definitions of competency requirements for CM varied between professional bodies. For instance some statements from professional bodies consist of a hierarchy of how a skill will be obtained whilst others have very basic descriptors. These inconsistencies confirm other WIL descriptor issues identified already above in regards to how many days are required on placement.

The initial competency analysis created a scaffold of the framework which aims to provide links to theory and practice for students. A review of program placement coordinators and students' views on issues in documenting their WIL, to supplement this quantitative analysis of competencies, is still in progress. However, initial themes from the review of CM program placement coordinators' (CMPC) views are highlighted in Table 1 below.

**Table 1: WIL Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis – CMPC' views**

PERSPECTIVES	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
<b>'Students and WIL'</b>	Continuous assessment/no exam	General dislike from students for reflecting on experience – exam style assessment	Gain a broader understanding of professional competencies	Sometimes lose students to industry, they do not finish degree
	Real world experiences	sometimes preferred	Integrate theory and practice	Potential to learn bad habits i.e. if students' placement is with a dysfunctional company
	Most students work in industry and study	Lack of assessment Need a mentor to encourage student reflections - most students just want to tick box	Excellent postgraduate experience, may be not as relevant in undergraduate level as students still learning concepts	If student perceived as a 'gopher' in the company perhaps no room for quality learning - reflection/learning, as they are stuck in this role
		No contextualisation Considerable work load for minimum return on investment		

<b>'Staff and WIL'</b>	Staff learn from students - a 'reality check' for staff - listening to students reflect their industry experiences in the classroom – other students learn from hearing these learning experiences	Unrealistic expectations that need to be managed  Lack of time for in-depth monitoring/coaching of the students learning experience  Lack of student motivation	Robust process
<b>'Employer and WIL'</b>	Opportunity to pass on and demonstrate practical knowledge to students - not just chalk and talk - teach 'practical gaps'  Teaching the 'supply chain' the whole process of industry	Unclear expectations - these need to be clarified through marking rubrics  Students need to define these expectations as well as employer  Employers need to be trained on students' education concepts	'Cooperative education' as a solution – placement experiences with employers at different levels of education to educate whole process  '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
<b>'Professional Bodies and WIL'</b>	Real life experiences  Opportunities for students to put their management skills into practice	Lack of engagement of industry to get students into relevant industry experiences	Students identify experience for their future career goals - draws in opportunities  Difficult to assess/design WIL  Resource implications and implementation threats.  Industry's role in accreditation process

Source: Focus group workshop, 2010

Some of the key issues identified from participants and outlined in the table above, included a lack of communication between employers/Professional Bodies and Universities, resulting in curricula which did not fully articulate requirement and expectations of students when engaged in WIL experiences. A solution suggested to this was to create a WIL assessment framework due to the varied levels of experiences students can have within an organisation. Participants also suggested that employers need to be informed of the education concepts that the students learn. Participants' views on the WIL issues that 'students' might encounter included a lack of motivation to reflect, a potential to have negative experiences in industry, such as being exploited by a company for cheap/free labour or being treated as a 'gopher' which could mean a lack of quality learning experiences on site. Further, participants indicated that there needs to be more stringent monitoring and coaching of what students learn when they are on placement, possibly through reflecting after placement or during, such as assessment of WIL through marking rubrics. The 'staff WIL issues' identified included lack of assessment and definition of competencies in regards to WIL experiences and learning. Overall, the participants confirmed the WIL issues highlighted in the literature.

## **2.2 E-learning technologies to support WIL solutions?**

E-learning technologies for managing students learning has increasingly been studied and implemented by universities worldwide, particularly the use of e-portfolios to document students' learning experiences (Ayala, 2006; Heinrich, Bhattacharya, & Rayudu, 2007; Reardon & Hartley, 2007). Generally an e-portfolio is an online program to document learning, assessment and ultimately showcase an actor's skills, progress and reflections and new generations of e-portfolios often provide with links to Web 2.0 tools to support social networks and interactions (Ivanova, 2008; Schwartz, 2006). E-portfolios can also provide ongoing student documentation of achievements that could be used 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 limited use of e-portfolios to document WIL experiences. A study by Li, Molyneaux & Botterill (2009) investigated engineering students' use of the e-portfolio platform *Pebble PAD* to document their vacation employment. Their 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 relevant competencies (Jie Li et al., 2009). They found that "in general, students regard this as a convenient and effective way to complete their work experience evaluation" (Jie Li et al., 2009 :338). Other benefits of using e-portfolios to document employment skills these authors identified were ascertaining gaps in skills learnt and improving employability (Jie Li et al., 2009). More specific potentials of e-learning technologies will now be reviewed as a solution to some of the WIL issues identified by CM course coordinators above.

### **2.2.1 E-portfolios for 'lack of assessment and definition of WIL competencies in regards to WIL experiences and learning':**

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 practical experiences uploaded to show students have achieved the relevant competency (Andre, 2010). Examiners can then validate this achievement with a comment or request for further work until this competency is completed. These competency lists in some platforms can be generic skills, i.e. computer, communication skills or they can be designed especially for the CM WIL component by the assessor and industry in collaboration with the software provider/course provider.

### **2.2.2 E-portfolios for 'Reflecting - linking theory to practice':**

From a functional perspective the 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, 2010:4) and similarly provide a section where examiners and/or peers can comment on these entries, files uploaded or if it is a final portfolio for submission, this information can be made public by the student for professionals to see work achieved through reflections. In time e-portfolios can display students' progression and attainment of goals over their undergraduate years to use in their profession (Andre, 2010). The participant feedback identified above as employer WIL opportunities - 'cooperative education' where the student builds on their knowledge learnt from different WIL experiences over time with different employers/perspectives gained. This WIL solution can be supported through e-portfolio platforms. For example, ongoing employer and teacher can have dialogue with what the student learns on an ongoing basis, such as every year or after a WIL milestone is completed, through reflections uploaded by the student onto the platform. For instance, there can be gateways put in place on the e-portfolio platforms that the student cannot pass until they have submitted their evidence from stage one of their WIL experience.

### **2.2.3 Mobile technologies for 'there needs to be more stringent monitoring of what students learn when they are on placement'**

Mobile technologies could be used to work towards monitoring students learning whilst on placement. This is through using existing technologies, mobile phones, to capture and assess the moment students learn when they are placement. A recent initiative in the United Kingdom, entitled 'Assessment and learning in practice settings' have created and trialling a mobile learning system for students in health and social care with five universities, which "supports the creation, distribution and storing of assessment tools on mobile devices" (MKMLabs, 2009:4) which is sent to students whilst on placement who then can reflect back online on their skills learnt. The devices have assessment items based on core competencies which are sent to students whilst on placement (MKMLabs, 2009). The devices also create opportunities for students to contact and communicate with their tutors through a single portal, this means that students do not feel so isolated when they are out in the real world learning (MKMLabs, 2009).

### **2.2.4 'Multiple web 2.0 tools' for 'students' lack of motivation to engage in WIL/use e-learning platforms'**

The literature states if the student is the driver of their learning they are much more likely to be engaged with e-learning technologies. Here, students are empowered through their self-directed use of e-learning technologies, this is the idea that multiple web 2.0 can be used to document WIL experiences. The idea of a digital shoebox (a metaphor for a collection of documents found in a shoebox) devised by Helen Barrett means a collection of online tools, 'apps' (applications) to document learning experiences rather than a single e-portfolio platform. This means,

the student uses a plethora of free online tools to document their WIL experiences such as blogs using 'blogger', 'twitter', 'word press' - a collaborative writing/learning platform, 'facebook', 'slideshare', the list of these types of tools is extensive. This collection of tools allows for the learning and reflecting on experiences, sharing experiences with friends, to be student centred, thereby students are empowered by the process. Barrett (2004) indeed warns of finding the balance between process (in-depth learning over time) verses product (wanting results/marks from students), as she states;

While administrators often implement electronic portfolios for the assessment purpose, the students usually view this type of portfolio as something "done to them" rather than something they *want* to maintain as a lifelong learning tool. A portfolio that is truly a story of learning is *owned* by the learner, structured by the learner, and told in the learner's own voice (literally and rhetorically) (Barrett, 2004:2).

Barrett (2004) suggests that students become alienated from a platform if it is solely focussed on institution driven assessment. Consequently, when it comes to e-portfolios educators need to resolve the purpose of the e-portfolio before it is implemented (Barrett, 2004). Nevertheless, teachers have reservations about this change in learning to make the student the director of their education as a learning journey. This idea of student engagement or lack of, due to power, can similarly be applied to students being more motivated to engage and reflect on their WIL experiences. Overall, a balance is required here between students' own learning WIL journeys and the need for assessment of these journeys. At the moment in CM there is a lack of WIL assessment therefore any documentation of these experiences, made possible with online tools, will benefit both students and teachers. This brief review of e-learning tools in relation to WIL issues has shed some light on the benefits of these tools to promote deeper WIL experiences for CM students.

The e-learning technologies reviewed in this study raises the question as to how the intricacies of these technologies can further be advantageous to the CM disciplines in regards to WIL. Further findings from the study reported here aim to fill this gap, through additional qualitative analysis of students' placement portfolio reflections to show up how students make these learning links between theory and practice. Overall the framework developed from the research will potentially allow for a stronger benchmark of e-portfolio use in WIL Australia wide in CM to establish the needs of stakeholders - students, teachers, and industry, so that practical placement experiences and the consequent attainment of employability skills are further documented and understood from all these perspectives to rectify ongoing WIL issues identified from the literature and stakeholders in CM and design education.

## CONCLUSION

This paper documents findings from a current ALTC project investigating the facilitation of WIL in the CM and Nursing disciplines. This paper focused on WIL specifically related to the CM disciplines. Literature reveals that CM students' work based experiences is integral to deeper learning and to bridge the gap between theory and practice. It was argued that the CM disciplines will benefit from using e-learning technologies to promote students' WIL experiences, especially for reflecting on WIL experiences in order to make links between theory and practice. As the project develops, the challenges presented by these technologies as primary facilitators of WIL will become clearer as the logistics of implementing e-technologies will be reviewed and how the reflexive framework could be embedded into e-portfolio platforms. Further qualitative data will highlight these issues and contribute to solutions for facilitating reflective WIL and the use of e-portfolios, so students can make the necessary links between practice and theory and graduate as CM professionals.

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