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The Introduction of a 'Learning in the Workplace' Component for an Undergraduate IT Program and its Impact on Professional Accreditation

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ABSTRACT

A new learning in the workplace and community policy (LiWC) at Victoria University has been introduced to ensure that graduates are job and career ready. The policy mandates that all programs incorporate at least a 25% workplace contextual learning component by 2010. For the IT undergraduate program, compliance with this policy poses a number of significant challenges, not least of which is the meeting of professional accreditation criteria. Acquiring a recognized professional body accreditation, like that of the Australian Computer Society (ACS), is pivotal for all IT Australian programs, in that, it is a vital quality assurance measure and it enhances program marketability.

For an ACS accreditation, the course structure and content of the IT program is examined against the Society's defined core body of knowledge (CBOK) which covers both generic and ICT specific skill sets. This paper describes the current Bachelor of Science in Information Technology degree structure with respect to the ACS's CBOK. Within this framework, a possible strategy is proposed for realizing the University's LiWC policy whilst conforming to accreditation requirements. Finally the advantages and disadvantages of the proposed approach are discussed.

INTRODUCTION

At Victoria University (VU) a new initiative has been launched in 2007 to ensure that all teaching programs 'will create job ready and community aware graduates whose courses have at least 25% learning in the workplace, including opportunities for service learning in the community' (Aitken & Mitchell, 2007). To implement this initiative, a new Learning in the Workplace and Community Policy (LiWC) has as its goal that workplace contextual learning be embedded in all course deliveries. Scheduled for progressive implementation by 2010, the policy requires that a minimum of 25% of program content and assessment must be related to work integrated learning. The task to realise this policy has resulted in an extensive review of existing approaches to learning and teaching in all programs across the University.

The compliance with the LiWC policy will pose significant challenges for the Information Technology (IT) course in the School of Computer Science and Mathematics, not least of which is the meeting of professional accreditation criteria. Acquiring a recognized professional body accreditation, like that of the Australian Computer Society (ACS), is pivotal for all IT Australian programs, in that, it is a vital quality assurance measure and it enhances program marketability. This paper outlines the details of the academic skill sets in an IT program necessary to attain a professional level accreditation. It examines the current ACS professionally accredited IT undergraduate program at VU and its mapping to the defined skill sets. A proposed model to incorporate the 25% LiWC component whilst complying with

accreditation requirements in the IT program is detailed. Finally, the advantages and disadvantages of adopting this model will be discussed.

ACS ACCREDITATION FOR ICT PROGRAMS

Acquiring a recognized professional body accreditation is pivotal for all quality, technically-based, academic programs. In particular, such endorsement is vital as a quality assurance measure for courses which have a major component of Information and Communications Technology (ICT) content. It acts as the basis of national and international benchmarking of ICT professional education and it shapes the curricula (Harman & Meek, 2000, p. 3; Collings et al., 2005). The endorsement of a professional accreditation ensures international credibility and it enhances the marketability of academic programs (ACS, 2003; Jones & Price, 2002; Tan & Venables, 2007; Ramakrishnan, 2007).

The ACS is the professional body responsible for the assessment of all Australian higher education ICT courses accreditation ensuring that their programs are robust by assessing the suitability of potential graduates to act as ICT professionals. There are two different grades of accreditation: the Professional level for courses with a major IT focus, and the Associate level for other IT related programs. Both levels are examined against the course content and structure against the Society's defined core body of knowledge (CBOK). It is important to note that the ACS view is 'The CBOK does not in itself constitute a curriculum; it is more a scoping exercise of the disciplines involved in information and communications technology that should be considered in the establishment of a curriculum' (ACS, 2003, p. 9). The CBOK comprises both generic and ICT specific skill sets, as detailed in Table 1 and for accreditation, coverage of both sets of skills is mandatory. Students need to develop their technological knowledge whilst practising their communication, team building and problem solving skills throughout their studies. This emphasis on communication skills is particularly important as employers perceive computing graduates to be inadequately equipped in these skills. According to employers, students need to: learn better how to cope with the practical challenges in current technologies adoption; acquire strong communication skills and business aptitude and, better develop problem-solving skills (A C Nielsen Research Services, 2000; Taft, 2007).

Group 1- Generic CBOK	Group 2 – ICT Specific CBOK
Interpersonal Communications	Data Structures and Algorithms
	Program Design and Implementation
	Software Engineering and Methodologies
Ethics/Social Implications/Professional Practice	Information Security
	Conceptual Modeling
	Systems Analysis and Design
	Database Management
Project Management and Quality Principles	Computer Organization and Architecture
	Systems Software
	Data Communications and Networks
	Discrete Mathematics

Table 1: *ACS Core Body of Knowledge (CBOK)*

The depth to which Group 2- ICT specific skills are taught is somewhat dependent upon the discipline specialization of a degree program. The ACS recognizes that it is impossible for each undergraduate to learn every topic in the discipline to an advanced level. Rather, the above ICT specific knowledge must be covered to an intermediate depth in all programs. Institutions are encouraged to offer further units in any of the ICT specific areas of knowledge to an advanced level, and in doing so they are able to tailor-make programs in different specializations such as computer engineering, software engineering, information systems and information technology. For instance, information technology courses would emphasize advanced knowledge in Conceptual Modeling, Software Engineering and Methodologies, and System Analysis and Design.

CURRENT PRACTICE

The IT degree at VU is a three-year full-time program and its current structure satisfies the ACS Professional level of accreditation, in that, there is a minimum of one equivalent full time year of ICT material, with at least one third of this material being studied at an advanced level. These advanced topics must provide extra breadth and depth of ICT knowledge. Table 2 shows a detailed mapping of the core unit of study offerings of the IT program at VU against the introductory, intermediate and advanced knowledge levels of Group 1 and Group 2 CBOK. Electives are not shown as they are not essential in ensuring coverage of the CBOK areas.

Group	CBOK Areas	Unit of Study	Level of CBOK Knowledge		
			introductory	intermediate	advanced
1	Ethics/Social/ Professional Practice	Introduction to Computing & the Internet			
		Project 1			
		Project 2			
	Interpersonal Communications	Professional Communication			
		Project 2			
	Project Management & Quality Assurance	Project 1			
		Project 2			
		Applied Statistics			
2	Computer Organisation & Architecture	Computer Systems & Architectures			
	Conceptual Modeling	Database Systems 1			
		Database Systems 2			
		Intelligent Systems			
	Database Management	Database Systems 1			
		Database Systems 2			
	Data Communications & Networks	Data Communications & Networks 1			
	Data Structures & Algorithms	Object Oriented Programming 1			
	Discrete Math	Discrete Mathematics			
	Program Design & Implementation	Programming 1			
		Programming 2			
	Information Security	Introduction to Computing & the Internet			
		Data Communications & Networks 1			
	Software Engineering & Methodologies	Software Engineering 1			
		Software Development			
		Software Engineering 2			
	Systems Analysis & Design	Software Development			
		Object Oriented Analysis & Design			
	Systems Software	Operating Systems			

Table 2: *ACS CBOK skills as covered by core Units of Study at Victoria University*

The current IT program comprises of a total of 24 units of study over 6 academic semesters, as illustrated in Figure 1. In the first year, students are introduced to core subjects in information technology by covering the CBOK skills at an introductory level (shaded yellow), the second year covers CBOK skills at an intermediate level (shaded green) followed advanced IT knowledge in the final year of the IT degree (shaded aqua). A significant part of the IT degree is an industry-based

capstone project which gives students the opportunity to work in a team on a real-life software development problem. The Project spans two semesters in the final year of study and it is studied with a co-requisite unit in Professional Communication designed to further develop the necessary advanced written and oral communication skills for successful completion of the Project. Through these 3 units (shaded orange), students experience the practical challenges of building software systems and develop negotiation and listening abilities whilst honing their presentation and marketing skills. Additionally, elective units, at suitable levels, provide students with the flexibility to pursue their particular computing strengths and interests.

Year Level	Units of Study							
	Semester 1				Semester 2			
1	Introduction to Computing & the Internet	Program-ming 1	Database Systems 1	Discrete Maths	Computer Systems & Architecture	Program-ming 2	Non ICT specific unit	Non ICT specific unit
2	Software Engineering 1	Object Oriented Program-ming 1	Database Systems 2	Operating Systems	Data Comm^{n}. & Networks	Software Develop-ment	Elective 1	Elective 2
3	Software Engineering 2	Object Oriented Analysis & Design	Project 1	Professional Comm^{n}.	Project 2	Intelligent Systems	Elective 3	Elective 4

Figure 1: *Current IT program structure*

The scheduled implementation of the LiWC Policy to incorporate a minimum of 25% of work integrated learning in course content and assessment has brought the current IT degree program under scrutiny. Currently, the LiWC practice amounts to only half of the required 25% LiWC component, and it is realized by the Project and Professional Communication units (3 out of 24 units).

DECIDING ON AN APPROPRIATE MODEL

Several different approaches for matching the LiWC requirements are possible. On the one hand, the LiWC material could be integrated into every unit of study or, on other hand, the LiWC component could be segregated into an additional and separate part and then added to the current program. For LiWC to be integrated within the current program, closer examination shows that it will be impractical to insist that every unit of study be rewritten to incorporate workplace learning. For instance, some theoretical units like Discrete Mathematics, by their nature, do not lend themselves to immediate practical application in the workplace; rather they form a basis upon which other material can be framed. A more pragmatic approach would be to gradually introduce a LiWC component into one unit in the first year, two units in the second year, culminating in with current Project and Professional Communication units of the third year.

Alternatively, the inclusion of a specific and separate Work Placement component in a course benefits the students through exposure to technical and business mentoring, current industry practices, and an opportunity to clarify career goals (Calway, 2006; Trigwell & Reid, 1998). Therefore, it is preferable for an IT course to comprise two distinct, yet complementary, parts: the traditional course offering followed by a work integrated learning component. This strategy can be achieved through the introduction of an additional one-year long co-operative education internship or the replacement of

several units with a final semester workplace experience (Tan, 2008). However, the choice of the most appropriate strategy needs to be made with consideration of its impact upon the program's ability to fulfil ACS accreditation requirements.

On first inspection, retaining the current course structure and adding an additional year to the program to accommodate learning in the workplace is a viable option as it would not impact upon the ACS level of accreditation. Such an approach would make the program unattractive to both local and international students due to the time and financial costs associated with an additional one year internship. More attractive to students, is any option where program duration remains at 3 years. To maintain a three-year duration needs further consideration, as incorporating the 25% LiWC component into the existing program requires the addition of 3 LiWC units. This can be achieved by either sacrificing 3 existing core units in the current first and second years of study or alternatively, substituting 3 electives from the overall program. Either way, the implementation should not weaken the intellectual rigor appropriate to an IT course nor have a negative impact upon the level to which the CBOK can be covered. Poor selection of units would risk the downgrading of the current program's ACS accreditation from Professional to the less marketable Associate level.

In view of the argument that only an authentic workplace can provide "on-the-job experiences to students prior to graduation" (Carpenter, 2003, p. 201), substituting 3 electives to create a semester-long workplace component is the preferred option. In this strategy, the work-based component is separated from the academic content whilst still fitting both learning components into a standard three-year course. This approach encourages students' initiative and commitment to their own learning as the work placement/internship is a core component of the course and an academic requirement at the same time; all students must complete it. In this proposal, the five semesters of the previous program content is retained with the final semester replaced by an industry-based internship, as shown in Figure 2. Note that the mandatory units in the fifth semester, the capstone Project (albeit now reduced to one unit) and Professional Communication unit remain in the course and help prepare students for the internship. Careful scrutiny of this approach shows that the new course structure is still compliant with the Professional level accreditation requirements, in part due to the inclusion of an advanced study of Software Engineering late in second year (shaded aqua) and the semester long Work Placement covered in the final year (shaded orange) whilst complying with the 25% LiWC policy. Adoption of this approach will impact upon course assessment and administration and, in particular, management of the Work Placement will require substantial additional resources and support.

Year Level	**Units of Study**							
	Semester 1				**Semester 2**			
1	Introduction to Computing & the Internet	Program-ming 1	Database Systems 1	Discrete Maths	Computer Systems & Architecture	Program-ming 2	Non ICT specific unit	Non ICT specific unit
2	Software Engineering 1	Object Oriented Program-ming 1	Database Systems 2	Operating Systems	Data Comm^{n}. & Networks	Software Develop-ment	Software Engineering 2	Elective 1
3	Intelligent Systems	Object Oriented Analysis & Design	Project 1	Professional Comm^{n}.	**Work Placement**			

Figure 2: *A proposed course structure to achieve 25% LiWC experience*

THE IMPACT

With the introduction of the semester long Work Placement, there will be a considerable need for academic and administrative support to manage the internships. Selection of appropriate placements will need to be made in consideration of the relevance of the work experience to be gained. Therefore criteria for assessing the validity and quality of each placement need development. Additionally, the academic coordinator will need the assistance of a dedicated Work Placement coordinator who will manage the practical aspects of facilitating Work Placement.

Of course, pivotal to the successful implementation of this approach is a steady supply of LiWC opportunities with good industry partnerships for large numbers of students. Importantly, in cases where demand exceeds supply of placements, additional pressure would be exerted on the School to find suitable placements to cater for such shortages.

One benefit of the proposed approach is that there is no immediate need to revamp assessment for existing units; only the Work Placement component will require new assessment practices to be put in place. Therefore the effort can be concentrated in developing appropriate assessment models to evaluate the merit of students' LiWC experiences. The challenge will be to find assessment that places value on a disparate range of student workplace experiences. Criteria for grading will need to be flexible and take into account student progress and skill acquisition throughout the Work Placement.

Finally, consideration needs to be given to an option of allowing international students to undertake the co-operative program in their home countries; and if allowed, this option will require considerable management and additional resources. Similar concerns are raised for offshore partner institutions involved in the delivery of the IT course offshore, in that, there may be implications including issues such as overseas jurisdictions, contractual arrangements and the availability of resources and support (Kay & Russell, 2008).

CONCLUSION

An important lynch pin of our traditional IT degree program has been project-based learning for students which is achieved through industry sponsored projects. The introduction of LiWC policy at the University has mandated that these experiences should comprise a minimum of 25% of course content and assessment. Retrofitting the current course structure to surmount this hurdle has seen 3 electives replaced by a final semester Work Placement, in part, to maintain a three-year program duration.

This approach maintains the strength of the ACS Professional accreditation through the retention of ICT specific core units. The addition of a Work Placement component in the program matches the emphasis that the ACS places upon contextual IT and social competencies needed by graduates in their professional practice. The proposed IT program gives students the opportunity to sharpen their generic and ICT specific skills thereby enriching their learning experiences and enhancing their employment prospects.

REFERENCES

ACS – The Australian Computer Society. (2003). Accreditation of Courses at the Professional Level – Guidelines for Applicants. ISBN 0909925 64 X.

A C Nielsen Research Services. (2000). Employer Satisfaction with Graduate Skills. Research Report 99/7. Department of Education, Training and Youth Affairs (DETYA).

Aitken, D. and Mitchell, J. (2007). 'The answer is already here' A Discussion Paper on Victoria University's Approach to Teaching and Learning in the Context of 'Making VU'. Internal University document.

Calway, B. A. (2006). What has Work-Integrated Learning Learned? – A WIL Philosophy, Industry and Higher Education, IP Publishing UK. Retrieved April 10, 2008, from: http://centreforefs.com/resources/b_calway_2006.pdf

Carpenter, D. A. (2003). Meaningful information systems internships. Journal of Information Systems Education, 14(2), pp. 201-210.

Collings, P., Sharma, D., and Walker, D. (2005). IT education and the knowledge society: an Australian perspective. In Proceedings of Enabling Technologies for the New Knowledge Society: ITI 3rd International Conference , pp. 57-73. Retrieved from http://ieeexplore.ieee.org/iel5/10703/33793/01609615.pdf?tp=&isnumber=&arnumber=1609615

Harman, G. and Meek,V. (2000). Repositioning Quality Assurance and Accreditation in Australian Higher Education. Evaluations and Investigations Programme Higher Education Division, Department of Education, Training and Youth Affairs (DETYA).

Jones, L. G. and Price, A. L. (2002). Changes in Computer Science Accreditation. Communications of the ACM, 45(8), pp. 99-103.

Kay, J., & Russell, L. (2008). Learning in the Workplace and Community – A Discussion Paper to Inform Review of Policy. An internal discussion paper, Victoria University.

Ramakrishnan, S. (2007). Accreditation of Monash University Software Engineering (MUSE) Program, International Journal of Issues in Informing Science and Information Technology, Vol. 4, pp. 73-89.

Taft, D. (2007). Programming grads meet a skills gap in the real world. Retrieved September 21, 2007, from: http://www.eweek.com/article2/0,1895,2178319,00.asp.

Trigwell, K., & Reid, A. (1998). Introduction: Work-based Learning and the Students' Perspective. Higher Education Research & Development, 17(2), pp. 141-158.

Tan, G. and Venables, A. (2007). The impact of Australian legislation upon an IT degree: Considerations and response. In Proceedings of the 2007 Information Resources Management Association International Conference (IRMA). May 19-23, 2007. Vancouver, Canada, pp. 70-73.

Tan, G. (2008). Implementation of the learning in the workplace and community (LiWC) policy in an undergraduate computing course: The pros and cons of three possible approaches. In Proceedings of *WACE Asia Pacific Conference*, 30 September – 3 October, 2008, Sydney, Australia, pp.515-521.