Developing an engaging IT degree

Completed Research Paper

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Abstract

Curriculum renewal is a constant activity in Information Technology (IT), Information Systems (IS), Information and Communication Technology (ICT) and Computer Science (CS). Guiding documents from curriculum authorities such as AIS, IEEE and ACM assist in this process, as do those from professional societies, but these are often out of date when the institution seeks to refresh its approaches to learning, and position its graduates for emerging roles and technologies. This paper describes and discusses a curriculum renewal project undertaken in response to changing government requirements, student interests and the adoption of a learner-centric, active learning paradigm utilizing new physical collaborative learning facilities. This paper presents the stimulus for change, describes the use of reference resources and discusses the resulting degree structure, its majors and learning approaches.

Keywords

Curriculum development, IT degree structure

Introduction

A continuing challenge to IS and CS academics is the requirement to periodically update ICT curriculum offerings in response to changing technologies, emerging theories, the requirements of curriculum authorities, professional bodies and government. This paper discusses the outcome of such a degree renewal project necessitated from changes in government legislation and the adoption of key requirements in the Skills Framework for the Information Age (SFIA, 2012), meeting accreditation requirements of the Australian Computer Society (ACS 2013). Design was informed by the ACM/AIS 2010 Model IS Curriculum and the ACM/IEEE 2013 Model Computer Science Curriculum.

The project context was a large, public university in Australia seeking to update its ICT curriculum in the light of these informing documents meeting the Australian Government requirement to produce curriculum that was Australian Quality Framework level 7 compliant by 2015.

This paper first describes the university context and then discusses the competing requirements presented by the mandated government requirements and informing professional curricula sources. The project structure and processes are then described which engaged both staff and industry to frame the structure and subject selection required to achieve job-ready graduates. Next the structure of the degree is presented, followed by observation of market acceptance of the new degree. The paper closes by discussing the course continuum under development and summarizing the project, making recommendations for a post-graduate professional education year that can meet the demands of the professional societies while continuing to engage young minds in learning the foundational knowledge and skills appropriate to the broad and coherent degree outcomes required by government.

The university context

The Australian university context is rapidly changing, with increasing demands for high impact research outcomes, increased engagement with the local community and the need to educate, rather than train, in an industrial environment demanding work-ready graduates. Student satisfaction with their studies and their environment is annually assessed in a course experience questionnaire produced by Graduate Careers Australia (2014). This comprehensive survey covers many different aspects of university study, not all of which are in the control of a school or a faculty. The scales measure teaching, generic skills acquisition, overall satisfaction, clarity of degree goals and structures, workload, appropriateness of assessment, intellectual motivation, student support, attainment of higher order thinking, quality of learning resources and the social experience of the student while at university. Senior academic staff, including the university executive, review these results annually. Pro-active ways of establishing better student outcomes and increased satisfaction were goals for the renewed degree.

Compounding this focus on student experience was newly mandated requirement of university education to conform to the Australian Quality Framework (AQF 2013). This framework formerly controlled the post-secondary awards of the Technical and Further Education institutions and any private provider of higher education. In 2012, legislation was passed, requiring all university degrees to conform to this framework, and a specific authority was established to ensure that the degrees awarded by both public and private higher education institutions met the framework requirements. This authority is called the Tertiary Quality Standards Agency (TEQSA 2014), which established a Higher Education Standards Framework and Regulatory Risk Framework as a means of ensuring the attainment of the mandated outcomes. In addition, TEQSA has a reform and continuous improvement agenda to ensure that the process of reporting and review is improved in its efficiency as experienced by the universities and its effectiveness in terms of monitoring and managing outcomes.

Many universities in Australia have undergone substantial restructuring, seeking to reduce administration costs through structural reform. Many IS schools in the country have either closed or been merged into Business faculties, often with substantial reduction in staff and reduction in course offerings. The university reported in this paper has undergone three major restructuring projects over the last seven years. The university had one of the largest IT Faculties in the country with two schools: Computer Science and Data Networks, and Information Systems. The first restructuring removed all schools and reduced staff by 1/3. The second restructuring effectively merged the faculty with the Science faculty with a smaller reduction in staff. The third restructuring merged the Science & Technology Faculty with the Engineering Faculty, forming a consolidated Science and Engineering Faculty of six schools, one of which is the Information Systems School, with a separate Electrical Engineering and Computer Science school.

This structural reform affects the delivery of its IT degrees (Bachelor and Master) as degree delivery involves two independent schools. The institution attracts the largest segment of the regional market to its ICT degrees and has a reputation for producing work-ready graduates. The faculty sought to renew its ICT degrees to take into account the new requirements for a bachelor degree to be at AQF level 7. This review commenced late 2012 and was completed by September 2013. The Master of Information Technology AQF9 revision commenced late 2013 was completed in March 2014. The PhD and the Doctor of Information Technology degrees were reviewed in 2012 and made AQF 10 compliant in 2013. This paper reports the process and outcomes for the renewal of a Bachelor of Information Technology. The AQF 7 requirements for this degree are shown in Table 1.

AQF 7 component	Description
Knowledge	Graduates of a Bachelor Degree will have a broad and coherent body of knowledge, with depth in the underlying principles and concepts in one or more disciplines as a basis for independent lifelong learning.
Skills	Graduates at this level will have advanced cognitive, technical and communication skills to select and apply methods and technologies to: • analyze critically, evaluate and transform information to complete a range of activities. • analyze, generate and transmit solutions to complex problems. • transmit knowledge, skills and ideas to others.
Application	Graduates at this level will apply knowledge and skills to demonstrate autonomy, well-developed judgment, adaptability and responsibility as a practitioner or learner

Table 1 AQF 7 Generic Requirements for a Bachelor of IT (AQF 2nd Edition, 2013 p. 48).

Bachelor degrees have a volume of learning between 3 to 4 years. Different institutions have offered both variants of a Bachelor of Information Technology, with the student market generally seeking a three-year award. The project design goal was an AQF7 compliant three-year IT degree.

Identifying and managing competing requirements

In the Australian Quality Framework (AQF), a bachelor qualification is AQF level 7, a master qualification is AQF level 9 and a doctoral qualification is AQF level 10. All degrees offered in all Australian universities are required to be AQF compliant by January 2015. As a result of this requirement, a review of the ICT bachelor degree was commenced in December 2013 with University approval required by September 2014. This required substantial work to understand the mandated changes and map the new curriculum against the AQF degree requirements. Additional effort was required to engage with industry to identify the effectiveness of degree design and to ensure that the resultant degree could be accredited against the professional bodies requirements. These professional bodies included the Australian Computer Society, the Skills Framework for the Information Age (2013), and the Seoul Accord (2010). In addition, the design team sought to achieve compliance with the expectations of the informing model curricula. The ACM/IEEE Computer Science 2013 Ironman Draft informed Computer Science. The ACM/AIS Information Systems 2010 Model IS curriculum informed Information Systems.

Because the AQF award specifications are deliberately generic and applicable to all disciplines, the Australian Government Office of Learning and Teaching (OLT) appointed domain experts to establish discipline specific threshold learning outcomes. A panel was established for the Engineering and ICT disciplines and these scholars communicated their findings in December 2010. See OLT 2010 for details. These discipline scholars identified five outcome areas. The first three areas are technical and are shown in Table 2.

Outcome Areas	Rationale	Description
Needs, Contexts and Systems	Graduates must be able to recognize, understand and interpret socio-technical, economic and sustainability needs within the context of Engineering and ICT challenges. Systems thinking enables graduates to represent the individual components, interactions, risks and functionality of a complex system within its environment.	Identify, interpret and analyze stakeholder needs, establish priorities and the goals, constraints and uncertainties of the system (social, cultural, legislative, environmental, business etc.), using systems thinking, while recognizing ethical implications of professional practice.
Problem Solving and Design	Engineering and ICT practice focuses on problem-solving and design, whereby artifacts are conceived, created, modified, maintained and retired (lifecycle assessment). Graduates must have capabilities to apply theory and norms of practice to efficient, effective and sustainable problem solution.	Apply problem solving, design and decision-making methodologies to develop components, systems and/ or processes to meet specified requirements, including innovative approaches to synthesize alternative solutions, concepts and procedures, while demonstrating information skills and research methods.
Application	Graduates must be able to model the structure and behavior of real or virtual systems, components and processes. Decision-making is informed by these processes of abstraction, modeling, simulation and visualization, underpinned by mathematics as well as basic and discipline sciences.	Apply abstraction, mathematics and discipline fundamentals to analysis, design and operation, using appropriate computer software, laboratory equipment and other devices, ensuring model applicability, accuracy and limitations

Table 2 Technical OLT ICT Threshold Learning Outcomes Bachelor of IT (OLT 2010 p. 8).

The last two areas are concerned with interpersonal and organizational skills and shown in table 3.

OLT AQF7 Outcome Areas	Rationale	Description
Communication & Coordination	Engineering and ICT practice involves the coordination of a range of disciplinary and interdisciplinary activities and the exercise of effective communication to arrive at problem and design solutions usually in team contexts.	Communicate and coordinate proficiently by listening, speaking, reading and writing English for professional practice, working as an effective member or leader of diverse teams, using basic tools and practices of formal project management
Self Management	Graduates must have capabilities for self-organization, self-review, personal development and lifelong learning.	Manage own time and processes effectively by prioritizing competing demands to achieve personal and team goals, with regular review of personal performance as a primary means of managing continuing professional development.

Table 3 Interpersonal & Organisational OLT ICT Threshold Learning Outcomes Bachelor of IT-(OLT 2010 p. 8).

Curriculum renewal project structure and processes

The university in which this curriculum renewal project was undertaken has a very structured framework to employ for degree and subject design. This framework ensures that the degree is financially viable, addresses a known market need and employs best practice teaching and learning principles in its detailed design and execution. This approach is summarized below.

Course design framework steps
1. Establish the course vision graduate profile
2. Establish the course knowledge, skill and application elements that underpin the graduate profile
3. Represent the course knowledge, skill and application elements as course learning outcomes
4. Clarify and share how the course will be experienced, assessed and enacted
5. Clarify and share how the units will contribute to the course

Table 4 Course design Framework (QUT 2012)

Each of these steps was executed. A curriculum leadership group consisting of the relevant heads of schools (Information Systems and Electrical Engineering & Computer Science), and the Information Technology Program Director (sub-dean) developed the degree vision and overall structure. This output was used by the degree design team, which consisted of one senior staff representative from each school (IS, CS) and the First Year Experience coordinator, augmented by senior staff representing the research centres of activity. A series of staff workshops were conducted to elicit the course outcomes and then the school curriculum leaders either conducted workshops to advance the detailed subject and sequencing design or individually met with senior academics within each research area to progress subject design.

Market research was conducted in February 2013 to determine the areas and approaches of most interest to 2014 potential students. In addition, this study tested early degree structures and approaches, allowing for identification of focal study areas and learning practices.

The key design vision was based on the finding that IT students come to ‘do IT’. Adopting an inverted curriculum approach (Pedroni, 2006), students are engaged to design and build systems appropriate to first year knowledge, extended in second year and consummated in a third year industry informed (or based) capstone project. The end result is to ensure that the graduate has attained a broad and coherent study of their discipline. A key point of debate was the nature of the discipline: IT or (IS, CS). Industry jobs are no longer plentiful in the support areas requiring the generic IT degree, so it was decided to achieve deeper knowledge at the IS and CS discipline level. This became the focus to ensure that the graduate achieved the AQF7 outcome: "*depth in the underlying principles and concepts in one or more disciplines as a basis for independent lifelong learning.*" (AQF 2nd Edition, 2013 p. 48)

An active learning approach was adopted as part of this vision, with students working collaboratively in purpose built collaborative learning spaces. Staff were trained in how to move to this mode of student engagement and elements of this form of education and learning were piloted in selected units prior to and during the degree development.

The design team was supported by professional learning designers who were able to assist in the conduct of workshops, quality assurance of outputs, review of assessment strategies and their alignment with university policy and best practice and in the review and revision of the resultant course documentation. Professional Curriculum Support Officers worked closely with the IT Program Director to develop the documentation required for university approval processes. This documentation included a business case, an academic plan and the final integrated course proposal document. There were several cycles of review and revision processes involving other faculties, library, financial services and student services. The first cycle occurred in March 2013 through the curriculum endorsement process. This first university wide review identified elements requiring further expansion or explanation.

Between March and June, 2013, weekly course management meetings were held attended by the course leadership group, the major leaders, curriculum support officers and learning development consultants. At these meetings the detailed subject designs were reviewed and revised, allowing the Heads of Schools to shape the degree to meet their expectations as articulated in the Degree Vision and Structure documents. Industry partners were individually briefed by the leaders in the design team and obtained industry feedback was implemented.

The degree proposal went to the Faculty Advisory Board in June 2013. Revisions to the proposal were required, and the revised proposal was put to the University Academic Board in July 2013 and approved, subject to further work required regarding the design of minors. The full degree was approved in September 2013. This degree structure included two primary majors (IS, CS), one secondary major (Design & Innovation) and 6 minors (Business Process Management, Design and Innovation, Social Technologies, Human Computer Interaction, Networks & Security, Robotics) each of which were aligned with the research concentrations in the faculty.

The degree outcomes are represented by course learning outcomes, which are shown in Table 5. These elements were then expanded, based on learning and teaching principles of the faculty. These principles had been developed and articulated over a period of curriculum reform and research into learning and teaching. These principles are: Flexibility, Delayed Choice, Engagement, Viability, Pathways to research and opportunity for work integrated learning.

The foundation year program was designed with the first year experience principles applied and the evolving best practice principles of active learning in the collaborative learning spaces. These six first year experience principles are: Transition (students require support as they transition from previous learning experiences to university); Diversity (student come from a variety of social, cultural and academic backgrounds); Student-focused (curriculum design and delivery needs to be student focused, explicit and focused, yielding first year success); Engaging (learning, teaching and assessment approaches need to be engaging, and enable active and collaborative learning, opportunities for peer learning and developing student-teacher interaction); Relevant Assessment (recognizing that the assessment needs to target first year target competencies); Evaluative (recognizing that regular evaluation of the effectiveness of teaching, learning resources, assessment methods is essential for evidence-based curriculum design; Monitoring Engagement(regular monitoring of student engagement with the learning and assessment activities is essential for student success, with early intervention in at-risk students) (QUT 2011).

These principles informed the design and development of the first year units, which then influenced the design and development of subsequent units in the program. In first year, engagement is increased by designing mobile applications and games, building simple networks and devices using technologies such as Raspberry Pi and developing a range of programming and scripting skills on appropriate sized problem domains. In addition, students were encouraged to understand the organizational, societal and cultural impact of IT through a series of case studies, evaluating the effect of transformational technologies. Careful attention was paid to the nature of the assessment, its frequency and scope, leading to a rationalized portfolio of assessment across first year. In addition, monitoring student engagement processes were refined, allowing specific student service staff to identify and intervene by direct student contact when required.

Graduate Attributes	
Needs, Contexts and Systems	
1-1	Demonstrate depth of knowledge in a discipline area
1-2	Be aware of the relevance and impact of IT (individual, social, business, & environmental)
1-3	Identify, interpret, analyze and consolidate stakeholder needs
1-4	Apply systems thinking to establish priorities goals, constraints, uncertainties and inter-dependencies within a system
1-5	Collect , accurately record and manage data and information
1-6	Apply professional standards and ethics
Problem Solving and Design	
2-1	Apply problem solving, design and decision-making methodologies
2-2	Apply critical, creative, and design thinking, to generate innovative solutions
2-3	Apply information retrieval skills and research methods appropriate to the discipline
2-4	Practice evidence based analysis and design
Abstraction and Modeling	
3-1	Develop abstract representations of processes, data, systems, organization and information
3-2	Make appropriate conclusions based on data and models, recognizing limitations.
3-3	Select, deploy, integrate and critique appropriate modeling techniques
3-4	Use models to manage the complexity of real world systems
Coordination and Communication	
4-1	Communicate effectively and professionally with peers, stakeholders, and the broader community
4-2	Effectively and persuasively communicate in multiple forms and media
4-3	Engage effectively as a member of multicultural and multidisciplinary teams
4-4	Demonstrate effective project management
Self Management	
5-1	Demonstrate autonomy, collegiality and self-direction
5-2	Work efficiently, effectively, responsibly and safely
5-3	Reflect on personal performance & plan professional development
5-4	Demonstrate the ability to effectively work with others
5-5	Deliver project components on time and to the expected standard

Table 5 Degree (Course) Learning Outcomes

Degree structure

The final degree architecture appears in Table 6. It consists of a core of four common subjects in semester 1, two electives selected from a core options list, a primary major of 10 subjects commencing in semester 2 and a complementary studies stream of eight subjects. This complementary study stream can be consumed as a secondary major (taken from within the faculty or anywhere within the university) or two minors of four subjects each (again taken from within the faculty or anywhere within the university). Similar architectures are used for the Business and Science degrees.

This degree has four introductory units in first semester. Students then select a major to pursue from second semester first year, selecting either IS or CS. The target entry-level job for IS graduates was a Business Analyst while that for CS Graduates was a programmer.

Type of unit	Number of Units (Subjects)	Description
Core: Understanding & Doing IT	4	Four common subjects in first semester
Core Options:	2	Two subjects in second semester
Primary Major	10	Ten subjects, commencing with two in second semester
Secondary Major or 2 minors	8	Either 8 subjects in a theme or two minors in different themes consisting of 4 subjects each

Table 6 Degree Architecture

The normal consumption patterns for a full-time student is shown in Table 7.

Year 1		Year 2		Year 3	
Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6
Impact of IT	Major Subject 1	Major Subject 3	Major Subject 5	Major Subject 7	Major Subject 8
Computer Technologies	Major Subject 2	Major Subject 4	Major Subject 6	Capstone Project	
Designing IT	Core Option 1	2nd Major or Minor 1	2nd Major or Minor 1	2nd Major or Minor 1	2nd Major or Minor 1
Building IT Systems	Core Option 2	2nd Major or Minor 2	2nd Major or Minor 2	2nd Major or Minor 2	2nd Major or Minor 2

Table 7 Degree (Course) Study pattern

For Information Systems, the second year units are Business Process Modeling, Business Analysis, Database Application Development and Corporate Systems. The third year IS units are the Capstone Project, Enterprise Architecture, and one from Project Management, Business Intelligence, or IS Consulting.

For Computer Science, the second year units are Discrete Structures, Software Development, Networks and Application Design & Development. The third year CS units are Capstone Project, Algorithms and Complexity and one from High Performance and Parallel Computing, Programming Paradigms or Systems Programming.

IS major continuum and its relationship to the IS Model Curriculum 2010

The IS Model Curriculum suggests the following units in an IS major, listed in the table below. The subjects included in this IS Major are shown in bold, with elective units are shown in grey, bold, italic font. Elements not highlighted are not addressed to a significant extent in this major.

Core	Electives
• **Foundations of Information Systems**	• **Application Development**
• **Enterprise Architecture**	• **Business Process Management**
• **IS Strategy and Acquisition**	• Collaborative Computing
• Data and Information Management	• ***Data mining/Business Intelligence***
• **Systems Analysis and Design**	• ***Enterprise Systems***
• **IT Infrastructure**	• ***Human Computer Interaction***
• ***IT Project Management***	• Information search and retrieval
	• IT Audit and Controls
	• ***IT Security and Risk Management***
	• Knowledge Management
	• Social Informatics

Table 8 Covered Subjects from IS Model Curriculum 2010

The unit on Impact of IT covers much of the content of Foundations of Information Systems using a case study approach. The unit Enterprise Architecture is a capstone final year unit. Parts of IS Strategy and Acquisition are covered in the unit Business of IT. Systems Analysis and Design is covered in the Business Analysis unit. All CS and IS students complete a second year team based project in Application Development, and elements of Application Development are covered in the foundational unit Building IT.

Electives are offered in Data Mining, Business Intelligence, Enterprise Systems, IT Security, IT Project Management. A unique elective offering is IS Consulting.

As the target employment for graduates is that of a Business or Systems Analyst, the focal knowledge and skill development supports this role. Thus the units on Modeling IS, Business Analysis, Business Process Modeling and Corporate Systems are included, emphasizing the modeling and abstraction skills required in such a role. In addition, a deeper understanding of the role of IT and IS in organizations is developed in the units Impact of IT, Business of IT and Corporate Systems.

Professional skills in IT Infrastructure and IS Strategy & Acquisition are considered post-graduate areas for development, although the basic language and approaches are developed in Impact of IT and Business of IT.

CS major continuum and its relationship to the ACM/IEEE Ironman Draft Model Curriculum 2013

The Ironman CS 2013 curriculum is organized into knowledge areas and the recommended volume of learning is provided for each knowledge area. The volume of learning requirement in the model curriculum, coupled with the description of the level of knowledge and skills, as contrasted with the active and collaborative learning strategies of from the adopted vision and learning design principles caused particular concern to the CS curriculum design team as these seemed to be in opposition.

In addition, in order to align the minors with the research concentration areas of the School, led to core Ironman elements being moved from the CS major into the CS minors. The areas which are covered to some extent in the CS major to this new Bachelor of Information Technology are shown in Table 9, again showing elements in the major in bold, with elements in the elective minors shown in grey, bold and italic.

AL Algorithms and Complexity	**AR** Architecture and Organization	*CN* *Computational Science*	**DS** Discrete Structures	*GV* *Graphics and Visual Computing*
HCI *Human-Computer Interaction*	*IAS* *Information Assurance and Security*	IM Information Management	*IS* *Intelligent Systems*	**NC** Networking and Communications
OS Operating Systems	*PBD* *Platform-based Development*	*PD* *Parallel and Distributed Computing*	**PL** Programming Languages	**SDF** Software Development Fundamentals
SE *Software Engineering*	**SF** Systems Fundamentals	**SP** Social Issues and Professional Issues		

Table 9 Knowledge Areas CS Ironman Model Curriculum 2013 within the CS Major

This table shows the coverage of elements of the CS Ironman Model Curriculum. Though most areas are covered, they are different in the number of suggested contact hours, and not presented in the suggested style. Learning in this CS major is through the creation of appropriate IT artifacts from semester 1. The specification and type of the actual artifact is a function of the subject; an artifact is developed in all units, except the mathematics unit.

Active learning, prototyping and engagement with users are emphasized in most of the subjects, leading to two project units: a one semester Application Design and Development team based project involving IS and CS majors, followed by a two semester industry informed or industry based development project, that can either be team or individual, with teams formed within or between students in the CS/IS majors.

It should be noted that the Agile project management methodology is introduced to students in semester 1 in the unit on Designing IT and is extended in the unit on Software Development and applied in the combined second year project unit on Application Design and Development. The waterfall project management approach in Project Management Book of Knowledge (PMBOK) or Prince 2 is covered in the elective unit on project management, which is offered by the IS School to the CS majors.

Initial uptake and experience

The degree has attracted about 225 students into the single degree (Bachelor of Information Technology) and an additional 120 students into a double degree with the Bachelor of Information Technology. In addition, foundation year units have attracted about 20 students from other degrees in the university. Student satisfaction and engagement has been high, as shown by the following early semester survey results in table 10.

Unit	Number of students	Provision of learning opportunities	I took advantage to learn	I am satisfied with the unit
Impact of IT	606	4.0	3.8	3.9
Computer Technologies	407	3.7	3.6	3.5
Designing IT	445	4.0	4.0	3.8
Building IT Systems	451	4.1	4.1	4.3

Table 10 Student experience with 1st semester units (Likert 5 point scale)

Discussion

The informing curriculum sources provide latitude for schools to select elements and shape their curriculum to meet their individual goals, local industry needs and government requirements. Most sources are quite prescriptive and focused on content mastery (knowledge component) without providing clear guidance on the skill requirement nor the application of the knowledge and skills to particular problems. This situation provides both a constraint and an opportunity for the faculty to design appropriate curriculum experiences that cover the required material in novel and interactive ways. Many documents such as SFIA or the Australian Computer Society are seeking to ensure professional training and work ready graduates, but some of this material is not suitable for the 17-21 year old student seeking to learn to 'do IT'. Indeed the requirement for an AQF7 qualification is to provide a 'broad and coherent ' coverage of the discipline, rather than meet advanced knowledge and skills or professional chartered outcomes. Other professions recognize this situation and often require a professional year of study after graduation, which is at the AQF8 or AQF9 standard levels. The relationship between professional registration and AQF standard is still being discussed.

Conclusion

Curriculum renewal is never an easy task, particularly with conflicting requirements from curriculum authorities, professional societies and government expectations. This paper has discussed one project in which these conflicting requirements were addressed and presented a degree design which sought to meet as much of the expectations as was possible in a three year degree, and ensure that the required acquisition of knowledge, skills and application met the mandated government requirements. In particular, it was difficult to design an innovative, futures oriented degree program in Information Systems and Computer Science because the requirements for professional accreditation are fixed in the past, rather than seeking to attract and educate students in the 21st century, who are engaging differently with university study than students of the previous generation.

The need for curriculum renewal has been described and discussed, commencing from the government mandated changes articulated in the Australian Quality Framework, the professional society requirements and the informing curriculum sources from the ACM/AIS and ACM IEEE for the IS and CS outcomes respectively. These requirements have been attenuated and refined, in order to meet the principles of the first year experience and conform to the curriculum development framework of the university.

The final degree design embraces innovation, and seeks to engage students to 'do IT' from semester 1, first year. Delivery emphasizes student engagement through activity based learning situated in collaborative learning spaces that encourage teamwork, movement, idea generation and sharing. This challenge in subject design and delivery is substantial, as is the training of academics in the use of such spaces. Though more costly to resource than the traditional two hour lecture and one hour practical/tutorial, active learning is an essential component to the engagement of the 21st century scholar in IT.

The authors recommend that professional accreditation programs take this generation of student into account and require a professional, post-graduate year of study in which the elements of project management and IT management are effectively dealt with, and appropriate for the current level of employment.

Without the active participation of all academics on the project team and the willingness of industry partners to review and constructively critique the intermediate degree designs, a robust and financially viable degree could not have been designed and approved within the short time of this project. We recommend that all IS schools establish and maintain such a circle of critical friends grounded in industry, but maintain acute awareness of the need to educate students, rather than merely train them. In addition, urgent renewal of the IS Model Curriculum is required, as the 2010 document is clearly dated and not future oriented. The question remains to identify what is enduring in IS curriculum and how to effectively teach this material to a student cohort with limited attention spans, and a need for novelty and entertainment. Such a curriculum resource is essential for IS schools as it provides an authoritative source on which to base their own degree renewal programs. We recommend that the model curriculum be updated more frequently and take shorter deliberation times in order to maintain currency.

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