

A Study of Australian Undergraduate IS Programs and Curriculum

Final Report, Version 1.0 (First Draft)

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Glossary

Term	Description
Undergraduate (UG)	A 3 or 4 year pass level Bachelor degree course of study, not including an Honours year.
IS Major	A major or stream of an undergraduate degree focussing on one or more Information Systems (IS) professional career outcomes.
IS Program	One or more IS majors developed and managed by a single group of Information Systems academic staff.
Unit	A discrete unit of delivery offered as part of an IS major or program. Commonly referred to as subjects, courses or modules.
Subject Area	A standard or reference description of a set of topics that occur together used to classify units delivered as part of an IS program.
Core Unit	A unit that must be completed by all students undertaking IS majors in a particular IS program.
Non-Core Unit	A unit that is not required to be completed by all students undertaking at least one IS major in a particular IS program; or an elective unit.
Academic Division	A College, Faculty, School, Department or Discipline area responsible for managing a set of academic programs.

Introduction

Information Systems (IS) is a relatively new professional activity. Academic programs first appeared in the early 1970's, and a major professional body, the Association of Information Systems (AIS) was only established in 1994 (Avison and Elliot, 2006). The discipline is broadly described as lying at the juncture of people, organisations and technology. Often definitions include or imply, design, development, usage, management and the impact of Information and Communication Technology (ICT) in an organisational environment.

As Ridley (2006) points out, an academic discipline is defined by its research agenda and the subject areas that are taught in its programs. What is taught is not only important to academics, adequate numbers of graduates with the right skills are needed to realise the productivity, economic and social benefits of rapidly evolving ICT (Avison and Elliot, 2006). Shortages of IT skills continue to be a concern for the community. A report commissioned by the Australian Computer Society (Deloitte, 2016) estimated a current shortfall in IT professionals of up to 450,000 in Australia alone. While demand included those with technical (developer, cloud, security) skills, there were also shortages in business-focussed roles associated with the integration of IT into business, activities central to the IS discipline.

This project will explore the delivery of IS programs in Australia, with a focus on what is taught as core, and what is optional or non-core. It will be useful to examine both undergraduate, graduate and research programs, but this project will focus only on undergraduate curriculum.

The IS Body of Knowledge

In the Australian context, IS curriculum is driven to a large degree by the Australian Computer Society (ACS). The ACS Core Body of Knowledge (ACS, 2015) guides professional certification for IT professionals as well as accreditation of academic programs. All IS majors provided by publicly owned universities are accredited at the professional level. The ACS Core Body of Knowledge (ACSBok) references international frameworks, including SFIA (SFIA, 2016). The ACS accreditation process is not prescriptive about how skills are achieved, and includes a strong focus on "professional" or non-technical skills as well as capstone learning experiences. The ACS does not distinguish between IS professionals and other IT professionals. In the UK, the British Computer Society (BCS, 2015) performs a similar role working with the UK QAA, which provides Subject Benchmarking Statements in the area of Computing (UKQAA, 2016). In the US, the ACM has developed a set of model curricula including IS2010 (Topi et al, 2010), while the European Commission has recently released the European Foundational ICT Body of Knowledge (EC, 2015).

These bodies of knowledge have much in common. All include a requirement for generic, non-technical core professional skills, as well as what is referred to as the DNA of all ICT

professionals (EC, 2015), essential foundational ICT knowledge. There is also flexibility with scope for specialisations and different application domain-specific knowledge, as well as the need to understand the IT-business context. Of these, the ACM/AIS IS2010 standard targets IS undergraduate education specifically, identifying and spelling out in detail seven (7) core IS courses (subjects) in a model curriculum. The latest UK QAA Subject Benchmarking Statements for Computing (UK QAA, 2016) defers to the ACM IS2010 standard indicating that "...[ACM/AIS] documents are recommended to inform programme design and curriculum content".

ACM/AIS IS2010

IS2010 describes a model curriculum with 7 core IS courses (subjects) providing detailed syllabuses for each of the following semester-subjects.

- Foundations of IS (IS2010.1)
- Data and Information Management. (IS2010.2)
- Enterprise Architecture (IS2010.3)
- IS Project Management (IS2010.4)
- IT Infrastructure (IS2010.5)
- Systems Analysis and Design (IS2010.6)
- Strategy, Management and Acquisition (IS2010.7)

The detailed topic list for each subject makes it easy to compare other subjects and to estimate the degree of similarity. IS2010 provides for a capstone course and encourages consideration of electives and specialisation for career tracks. The reduction of the core from ten (10) to seven (7) core courses is a major change from IS2002, encouraging greater flexibility, particularly in enabling career tracks. Reynolds, Ferguson and Leidig (2015) point out that this change has also had the effect of flattening the prerequisite structure.

Topi et al (2010) also provide a starting list of possible IS2010 model electives.

- Application Development
- Business Process Management
- Collaborative Computing (listed, but not specified in detail)
- Data Mining/Business Intelligence (listed, but not specified in detail)
- Enterprise Systems
- Information Search and Retrieval (listed, but not specified in detail)
- Introduction to HCI
- IT Audit and Controls
- IS Innovation and New Technologies
- IT Security and Risk Management
- Knowledge Management (listed, but not specified in detail)
- Social Informatics (listed, but not specified in detail)

IS Program and Curriculum Research

Gable et al (2008) completed a comprehensive analysis of the state of the Australian IS discipline in 2006, identifying 46 areas of IS activity across 37 Australian universities¹. The influence of both business and technology is evident, with IS professional education being managed by Business (25 programs), Science, Engineering and Technology (12 programs) and Information Technology (4 programs) academic divisions. In some cases, multiple IS programs existed in the one institution, with one or sometimes more in Business and one or more administered by SET-based units. Gable et al (2008) addressed distinctive features of the IS curriculum, but their focus was on breadth rather than depth, and their findings with respect to curriculum provided more of a flavour than consistent, detailed quantitative data.

More extensive IS curriculum research has been conducted in the US and UK. Hwang, Ma and Wang (2014) studied 2229 courses (units) in 394 UG IS programs examining adherence to the IS2010 model curriculum courses (Topi et al, 2010). They found that Data and Information Management (IS2010.2), along with Systems Analysis and Design (IS2010.6), were the most common units required as core. Units with a development focus: Programming Language, Application Development and Web Development, were commonly required as core from outside the IS2010 model core.

Bell, Mills and Fadel (2013) also used IS2010 as a reference, examining 127 UG IS programs from Association to Advance Collegiate Schools of Business (AACSB) accredited Business schools. They identified IS2010 core courses offered in the core, as well as those offered as electives, obtaining results in the same order as those of Hwang, Ma and Wang (2014) for most subject categories, only differing substantially in take up of IT Infrastructure (IS2010.4) with Bell finding 32% and Hwang 70%, and IS Project Management (IS2010.5), with Bell finding 66% vs Hwang only 38%. Bell, Mills and Fadel (2013) also examined the level of adoption of full requirement of IS2010 by programs, finding that only 2 programs included all 8 courses (7 courses + capstone) with 77% having 3-5 courses. On average, the take up of IS2010 core units by the programs surveyed was 3.4 from the 7 possible units of the IS2010 model core.

With the respect to core subjects required from outside of the IS2010 model, the findings of Bell, Mills and Fadel (2013) and Hwang, Ma and Wang (2014) were similar. Application Development (Programming/Application Development) was the most common subject category, being present in at least 70% of programs. Web Development was the next most commonly occurring requirement in up to a third of programs. In both US studies, E-Commerce (E-Commerce/Mobile), Business Intelligence (Business Intelligence and Analytics), Cybersecurity (IS Security) were found to be core requirements in less than 1 in 6 programs.

¹ They included two private universities, Bond University and Notre Dame, but not Charles Darwin University.

Bell, Mills and Fadel (2013) and Hwang, Ma and Wang (2014) report studies that collected data in 2011, soon after the introduction of IS2010, possibly too early for the new model to be widely reflected in programs. In both cases, data was collected from readily available web sites and online catalogs. In addition, Bell, Mills and Fadel (2013) followed up their data collection with interviews at a sub-set (a calculated sample size) of heads of programs to validate the collected data, but also to assess perceived adherence against their measured adherence. Interestingly, they found that perceived adherence was significantly higher than their observed adherence.

In the UK, Stefanidis and Fitzgerald (2010) studied 806 modules (units) from 43 Undergraduate (UG) IS degree programs offered by 13 universities in the Greater City of London area. They classified modules into the 16 UK QAA Subject Benchmarking Statement Computing Body of Knowledge descriptors in operation at the time². They found that the most common categorisation of core modules occurred in Data, Information and Knowledge Management (offered in 98% of programs) and Development, Implementation and Maintenance of IS (93% of programs). There were no modules offered in the categories of Compression Technologies, Content Management Systems, Personal Information Systems and Digital Libraries. 18% of core modules could not be placed in any of the 16 categories.

Research Questions

This study adopts IS2010 as its reference point. IS2010 separates the IS discipline from the broader IT area of study. The subject-based approach of IS2010 and the methods of Bell, Mills and Fadel (2013) and Hwang, Ma and Wang (2014) provide a practical way of assessing large numbers of programs. Finally, using this approach will afford Australian IS academics the opportunity to compare their programs to those of the US, and to a lesser extent the UK.

The study addresses the following questions.

- A. What IS majors are delivered by Australian programs?
- B. Where are academic programs placed in terms of academic divisions?
- C. What are the core IS units delivered in Australian IS programs?
- D. What are the non-core IS units offered in Australian IS programs?
- E. What IS2010 core model units are offered as core in Australian IS programs?
- F. What IS2010 core model units are offered as non-core in Australian IS programs?

Method

All 36 publicly owned universities were included in the study and only those UG programs that had an intake in 2017 analysed. Only 6 universities did not offer an Information Systems major. From the remaining 30 universities, 49 IS majors were identified.

² The UK QAA SBS for Computing was updated in 2016.

The collection of data took place in two phases. In the first phase, IS program data was obtained from public information on university web sites. In most cases, there appeared to be enough up to date information to provide a reasonable basis for analysis. Even in those few cases where information was brief, there was generally enough to identify relevant programs and to classify most units. Further searches were often able to reveal more detailed information, if needed.

The identification of IS programs is not always straight-forward. In many cases, titles were clear, but in some cases, particularly in major areas of study such as Software Development, judgement was required. In general, where programs titles indicated Information Systems or Information Systems Development and associated professional roles, they have been included.

A reference list of subjects was used to classify offered units. The reference list consists of the IS2010 model core and IS2010 example electives provided by Topi et al (2010). After a pass of units offered, the IS2010 example elective Data Mining/ Business Intelligence was replaced by two more commonly occurring topic groupings: Data Analytics/ Data Mining and Business Intelligence/ Data Warehousing. A large number of additional subject area descriptions were created during the study for those that did not match existing descriptions. Academic program developers package their subjects according to a range of imperatives and perspectives on their discipline, and offered unit titles, content and depth vary enormously across the sector. In very few cases do unit descriptions exactly match standard subject descriptions, and units were classified more in terms of capturing the "spirit" of the standard in its aims, the level of the offered unit, as well as the inclusion of important topics. In essence, the reference subjects are treated more as categories. The absence of a match with a reference subject does not mean that topics are not covered, but rather that there is no single identifiable unit that can be argued to focus on the content of the reference subject. Overall, 140 distinct subject areas were used to describe the offerings across the 49 majors.

In a second phase all IS providers were consulted to validate information sources, the selection of IS programs, and the classification of offerings. The preliminary analysis and the list of reference subjects were distributed to academic managers and feedback sought, in most cases through a phone conversation. The final decision on whether or not a particular major was an IS major, and how units should be classified was left to the program owners. In the consultation phase, two programs being removed, one was added, and a number of revisions were made to the lists of core and non-core IS units offered.

Program Titles and Structure

Figure 1: IS Major Titles

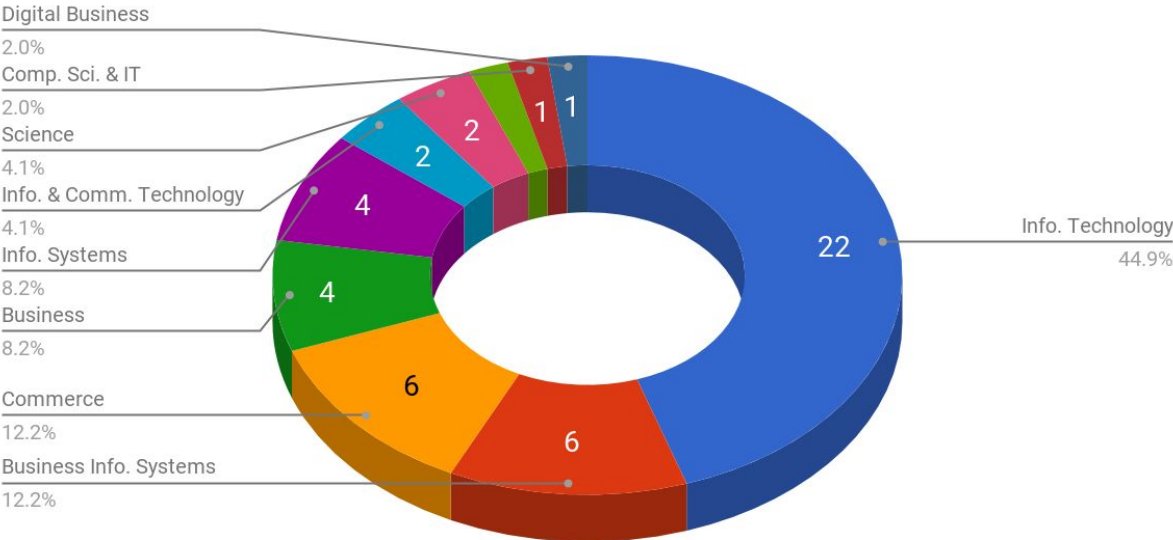


Table 1: Degree Titles/Majors Offered.

Title	Majors/ Streams/ Specialisations	Count
Bachelor of Information Technology	Unspecified (CDU, Flinders, JCU, Swin), Information Systems (Griffith, QUT, SCU), Business Analysis (CQU, CSU), Business Information Systems (Curtin, Monash) Application Development (CQU), Business Systems (FedU), Business Information Technology (Curtin), Business Technology (Newcastle), Information Systems and Business Analysis (MacQ01) Information Systems Development (USQ), Software Design and Development (CSU), Software Development (SCU), Systems Administration (CSU), Systems Development (Newcastle) Technology Management (USQ),	22
Bachelor of Business Information Systems	Not Specified (Griffith, LaTrobe, Woll), Business Analysis (Swin), Data Analytics (Swin), Data Management (Swin).	6
Bachelor of Commerce	Business Information Systems (ANU, Curt, MacQ01, Syd02, UQ), Business Information Technology (Curt)	6
Bachelor of Business	Business Intelligence and Information Systems (JCU), Information Systems (RMIT), Information Systems - Applied (RMIT), IS Management. (VU)	4
Bachelor of Information Systems	Not Specified (Deak, UNSW, UTas, WesternSyd)	4
Bachelor of Information and Communication Technology	Not Specified (USC) Software Development (UTas)	2
Bachelor of Science	Business Information Systems (Murdoch) Information Technology (UTS)	2
Bachelor of Business Informatics	Not Specified (Canberra)	1
Bachelor of Computer Science & Information Technology	Information Systems (Syd01)	1
Bachelor of Digital Business	Not Specified (MacQ02)	1
Total		49

The 49 IS majors used a wide range of titles (See Figure 1 & Table 1). Thirty-five (5) of these degrees had areas of major study in their title. Often these majors were broad, but in some

cases indicated professional roles relevant to the IS discipline. The most common title is Bachelor of Information Technology.

Explicit Professional Roles (Career Tracks)

Figure 2: Specified Roles/ Careers

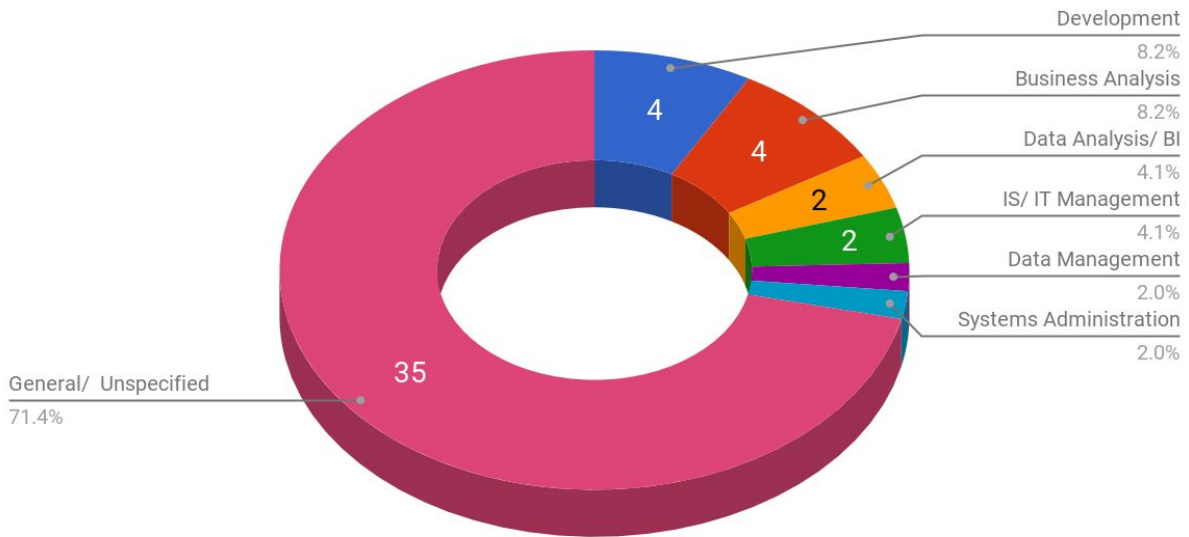


Table 2: Career Tracks/ Professional Roles Identified.

Professional Role	Count
S/W Development/ IS Development	4
Business Analysis	4
Data Analysis/ Business Intelligence	2
IS/ IT Management	2
Data Management	1
Systems Administration	1
General/ Unspecified	35

For 14 of the 49 majors, there was a major or stream that focused on a specific professional outcome. For the remaining 35 majors, a range of career outcomes were indicated. These identified professional roles are shown in Figure 2 & Table 2.

Academic Organisational Divisions

Figure 3: Administering Academic Divisions

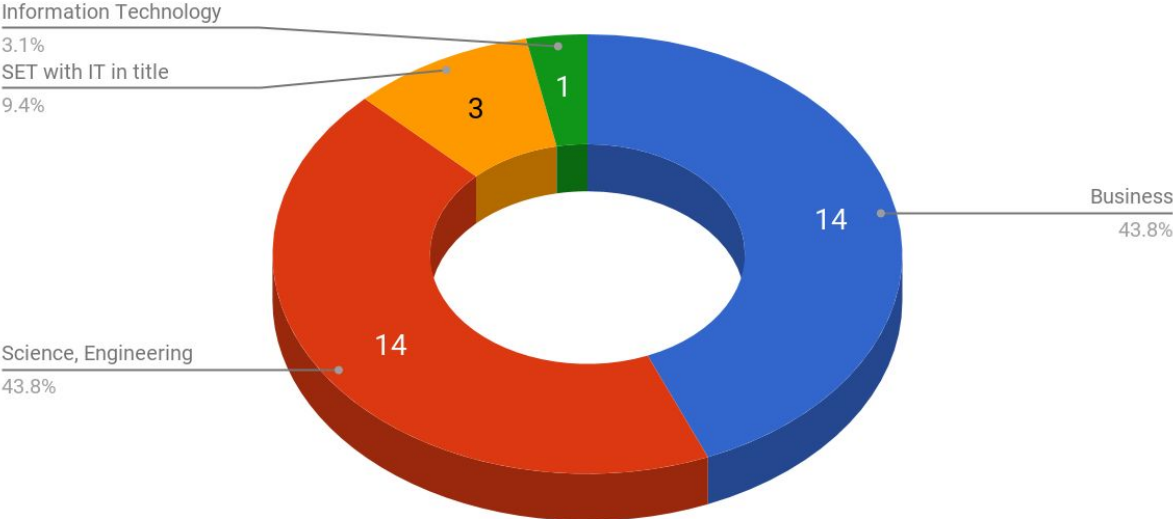


Table 3: Academic Divisions Administering IS Majors.

Main Academic Division	Secondary Academic Units	Count
Business focus	Not Specified (ANU, JCU, MACQ01, SCU, UQ, USC) Department of Information Systems and Business Analytics (Deak) School of Business IT and Logistics (RMIT) School of Information Systems and Accounting (Canberra) Department of Business Technology and Entrepreneurship (Swin) Discipline of Business Information Systems (Syd02) School of Information Systems (Curtin) School of IS and Technology Management (UNSW) School of Computing & Mathematics (CSU)	14
Engineering, Sciences, Technology focus	Not Specified (MacQ02, VicU) School of Engineering & Information Technology (CDU, FedU, Murdoch) School of Information Systems (QUT) School of Agricultural, Computational & Environmental (USQ) Department of Computer Science & Computer Engineering (LaTrobe) School of Computer Science, Engineering & Mathematics (Flinders) School of Computing, Engineering & Mathematics (WesternSyd) School of Electrical Engineering & Computing (Newc) School of Engineering & ICT (UTas) School of Engineering & Technology (CQU) School of Information & Communication Technology (Griffith)	14
IT/ Computing focus in title	Not Specified (UTS) School of Information Technologies (Syd01) School of Computing & Information Technology (Woll)	3
Information Technology	School of Information Technology (Monash)	1
Total		32

From the 30 Universities deemed to have IS programs, 32 different academic organisational divisions administered the selected IS programs. Only in one case did different divisions from the same university provide IS programs relatively independently. Twenty-eight (28) of these 32 academic divisions were split evenly between Business, and Science, Engineering and Technology (SET) (See Figure 3 & Table 3). Three additional SET focused divisions contained the term Information Technology, Information Science or Computing in their title. There was only 1 high level division (a faculty) dedicated to Information Technology. Twenty four (24) of these main academic units were further divided into Schools, Departments or Discipline groups.

IS continues to be offered across Business and SET focussed academic divisions, though there has been some change since the 2006 study of Gable et al (2008). IS programs administered

by Business academic divisions decreased from 25 to 14, while those administered by SET have increased from 8 to 17. The number of dedicated first level IT academic divisions has decreased from 4 to 1. The increased presence of IT in some division titles, primarily SET, may be a result of the merging of dedicated first level IT academic divisions into other SET-based academic divisions.

Core Subject Areas

Of the 49 IS majors identified, 1 university had 4 majors, 3 universities had 3 majors each, 10 had 2 majors each and 16 had a single IS major only. Of the 14 universities that had multiple majors, 8 of these had discernible “Y” structure, where a common core accommodated mostly 2 but also 3 streams. These 49 majors were further collapsed into 33 distinct programs. An IS program is defined as one or more majors designed and managed by the same group of academic staff. For example, a “Y” structure with the same stem and different branches would be classified as a single program, where units offered were counted once only.

Units offered were divided between units that were core to a program, or those that were not core (non-core). Core units are those units that must be completed by all students doing any of the IS majors in a particular program. In essence, core units cover subjects areas needed by all graduates, and are compulsory in all majors within that program. Non-core was defined as subjects that were elective or not core to all majors. In total, 648 IS unit offerings were identified across the 33 programs, 365 core units and 283 non-core units. Each of these units was classified according to the best match (at least 50%) in the reference list of subject areas. Figure 4 & Table 4 shows the subjects required as core in 5 or more programs.

Figure 4: IS Core Subjects Areas

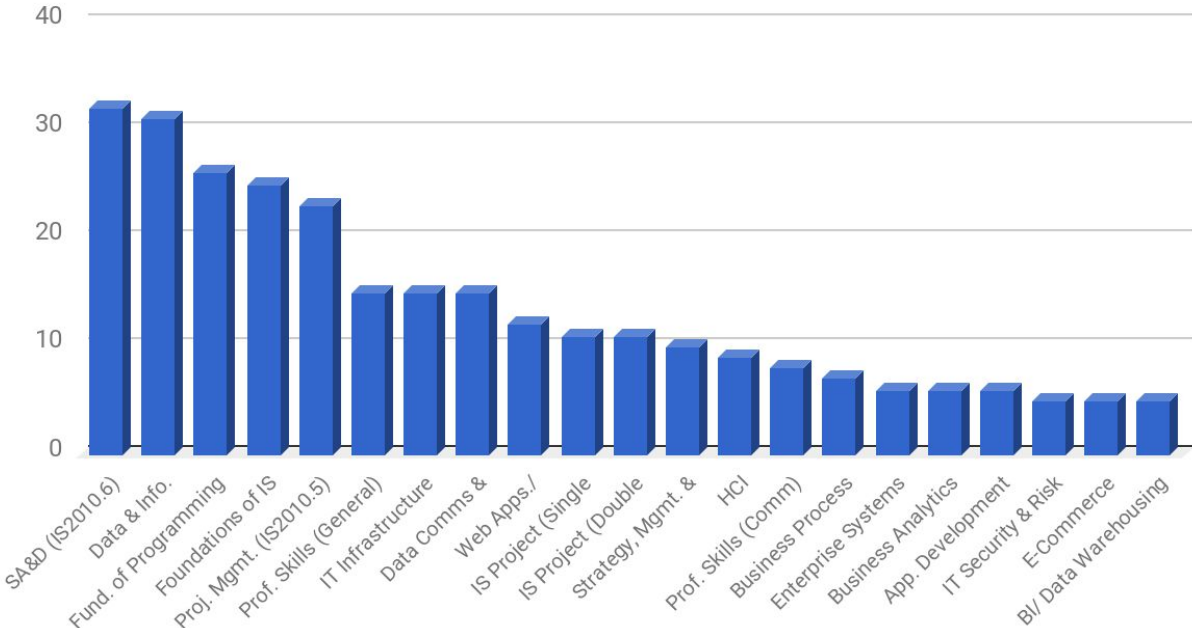


Table 4: Units Required as Core in Australian IS UG programs

Subject Category	Count	%(n=33)
<i>Systems Analysis & Design (IS2010.6)</i>	32	96.97%
<i>Data & Information Management (IS2010.2)</i>	31	93.94%
Fundamentals of Programming	26	78.79%
<i>Foundations of IS (IS2010.1)</i>	25	75.76%
<i>IS Project Management (IS2010.5)</i>	23	69.70%
Professional Skills (General, incl ethics)	15	45.45%
<i>IT Infrastructure (IS2010.4)</i>	15	45.45%
Data Communications and Networking	15	45.45%
Web Applications/Technology	12	36.36%
IS Project (Single Unit)	11	33.33%
IS Project (Double Unit)	11	33.33%
<i>Strategy, Management, and Acquisition (IS2010.7)</i>	10	30.30%
HCI	9	27.27%
Professional Skills (Communication)	8	24.24%
Business Process Management	7	21.21%
Enterprise Systems (ERP)	6	18.18%
Business Analytics Foundations/ Business Statistical Methods	6	18.18%
Application Development	6	18.18%
IT Security & Risk Management	5	15.15%
E-Commerce	5	15.15%
Business Intelligence/Data Warehousing	5	15.15%

IS2010 as Core

Units that correspond to the IS2010 core model subject descriptions, Systems Analysis and Design (IS2010.6) and Data Information & Management (IS2010.2) are required in almost all IS programs, 32 and 31 from 33 respectively. Foundations of IS (IS2010.1) and IS Project Management (IS2010.5) are required in a majority (25 and 23) of programs. IT Infrastructure (IS2010.4) is required in 15 programs, Strategy, Management and Acquisition (IS2010.7) in 10 programs, and IS Architecture (IS2010.3) is a distinct unit in only 2 programs.

Non IS2010 Subjects Required as Core.

Of the non IS2010 subjects commonly required as core, Fundamentals of Programming is required in a majority of programs, 26 of 33. Data Communications and Networking is required

in 15 programs and Web Applications/ Technology in 12 programs. Units identified as HCI, Enterprise Systems (ERP), Business Analytics Foundations/ Business Statistical Methods, Application Development, Business Process Management, IT Security and Risk Management, E-Commerce, and Business Intelligence and Data Warehousing are required in between 5 and 10 of the 33 programs.

Forty-seven (47) subjects are offered by less than 5 programs. Twenty-four (24) subjects are offered by only 1 program. This long tail includes emerging areas of IS, and different ways of offering professional skills learning and capstone experiences. Niche and emerging IS subjects areas include: Data Analytics/ Data Mining (3 of 33), Social Informatics (2), IT Audit and Control (2), IS Innovations (2), Decision Support Systems (2), Service Management & Customer Support (2), and IS and Cloud Computing (1). Unique capstone activity included Industrial Placement Experience (4) and IS capstone activity delivered more in the form of a classroom experience (3). Relatively unique dedicated professional skills units included problem solving skills (3), working in industry (1) and collaboration and teamwork (1).

Professional Skills Subjects as Core

Figure 5: Core Professional Skills Requirements

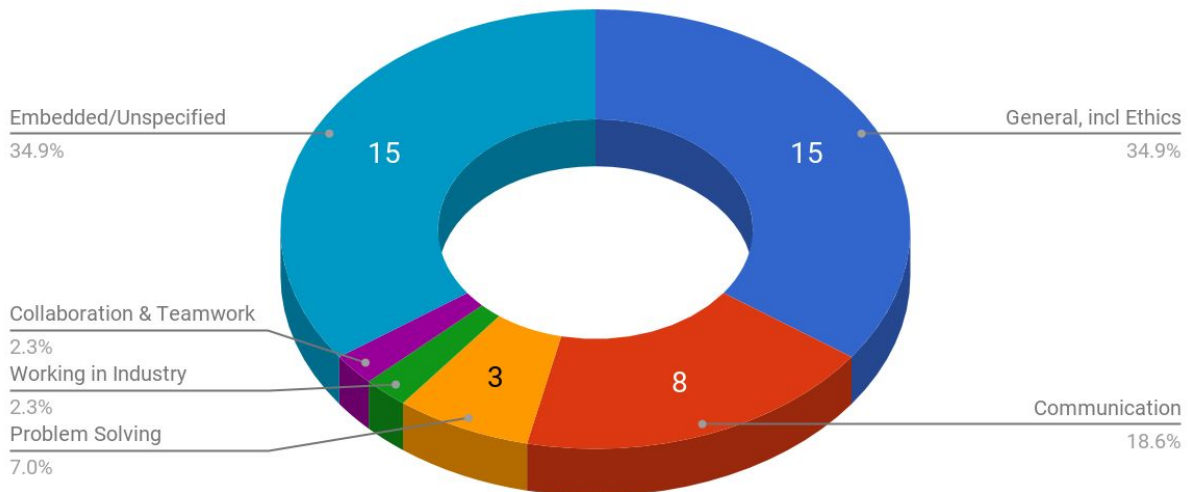


Table 5: Professional Skills Required as Core

Subject Title/Focus	Count	% (n=33)³
Professional Skills (General, incl Ethics)	15	45%
Professional Skills (Communication)	8	24%
Professional Skills (Problem Solving)	3	9%
Professional Skills (Working in Industry)	1	3%
Professional Skills (Collaboration and Teamwork)	1	3%
Embedded/ Other	15	45%

Within Australia, the ACS has a strong requirement of IT programs to include professional skills, such as ethical frameworks and the professional code of conduct, communication and teamwork skills. Some programs integrate these topics into multiple subject areas across the curriculum, but many provide specific targeted units as shown in Figure 5 & Table 5.

³ Note: some programs have more than one professional skills unit.

Capstone Projects

Figure 6: Core Capstone Requirements

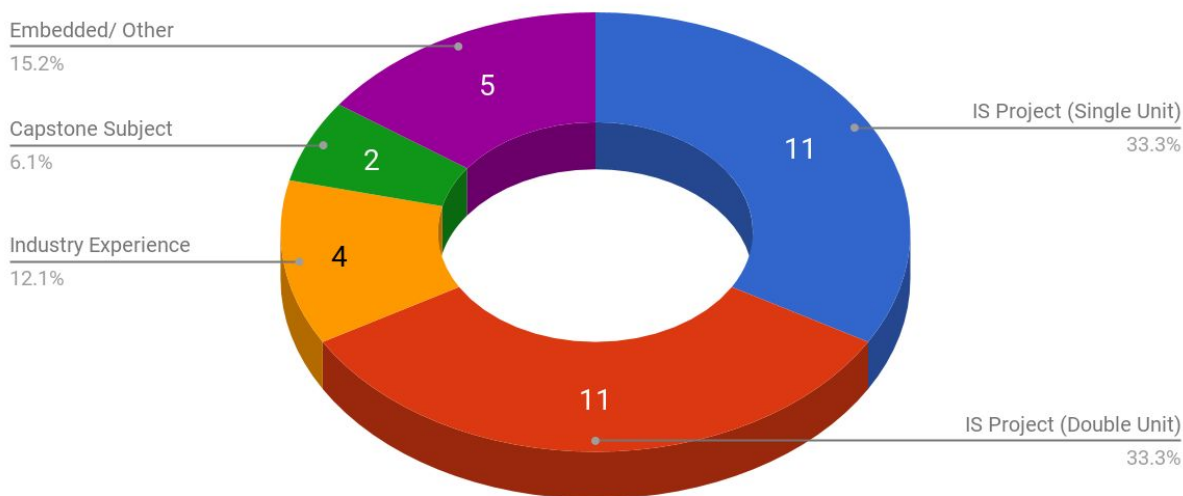


Table 6: Core Capstone Activity

Subject Title/Focus	Count	% (n=33)
IS Project (Single Unit)	11	33%
IS Project (Double Unit)	11	33%
Industry Experience	4	12%
Capstone Subject	2	6%
Embedded/ Other	5	16%

Similar to professional skills, capstone activity is a clear requirement for ACS accreditation. Most commonly, this is addressed through one or two semester projects. A small number of programs require industry experience, and a smaller number mandate a capstone subject, where integration of topics is covered in a more traditional subject format. A small number integrate capstone requirements into other subject areas.

Comparison of Australian, US and UK Core Subject Areas

Figure 7: IS2010 Core Comparison - ACPHIS (Blue):Bell (Red):Hwang(Yellow)

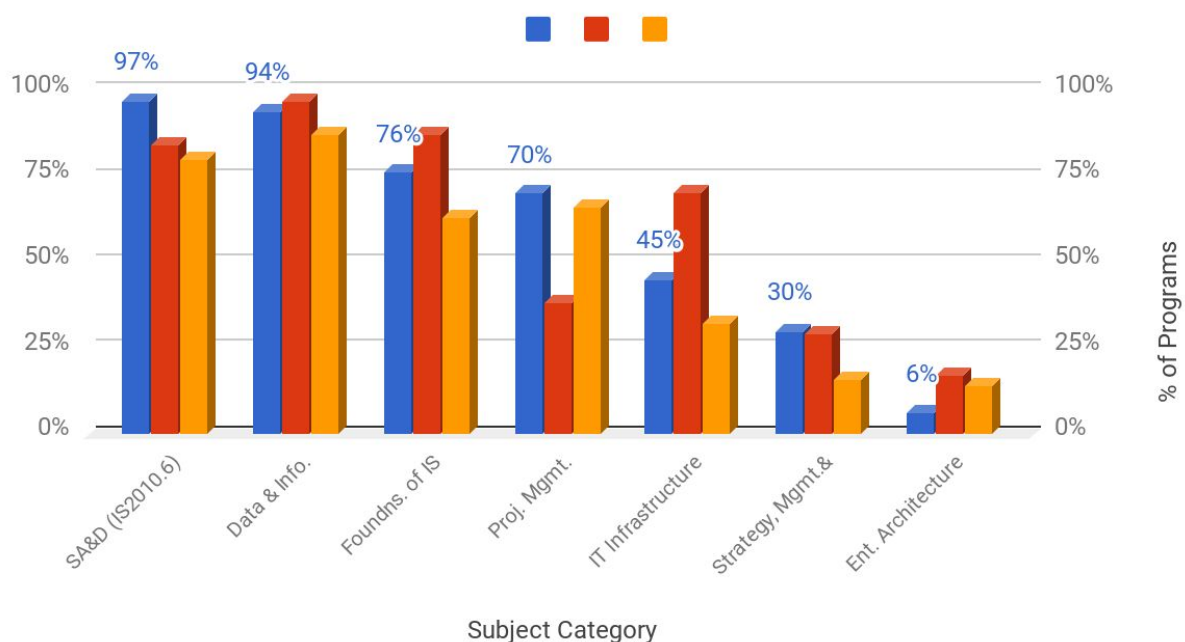


Table 7: IS2010 Subjects Required as Core in Australian IS UG programs

Subject Category	Count	% (n=33)	Bell et al	Hwang et al	Stefanidis & Fitzgerald	UK BoK ⁴
Systems Analysis & Design (IS2010.6)	32	97%	84% ⁵	80%	60%	Information Systems Design
Data & Information Management (IS2010.2)	31	94%	97%	87%	98%	Data, Information & Knowledge Mgmt.
Foundations of IS (IS2010.1)	25	76%	87%	63%	> 50%	No single category
IS Project Management (IS2010.5)	23	70%	38%	66%	93%	Dev. Implementation & Mtce. ⁶
IT Infrastructure (IS2010.4)	15	45%	70%	32%	58%	Inform. & Comm. Technologies
IS Strategy, Management & Acquisition (IS2010.7)	10	30%	29%	16%	53%	Mgmt. of Info. Systems & Services
Enterprise Architecture (IS2010.3)	2	6%	17%	14%	Up to 50%	No single category

⁴ These do not align well with ACM/AIS

⁵ Results in red show where US results are statistically significantly different from the Australian results

⁶ Includes programming & project management

Figure 7 & Table 7 compares the IS2010 core subjects required in this study with those required as core in the US studies of Bell, Mills and Fadel (2013) and Hwang, Ma and Wang (2014). Overall, the results are of the same order. Systems Analysis & Design (IS2010.6) and Data & Information Management (IS2010.2) are the most common core subjects, required in at least 80% of programs. IS Project Management (IS2010.5) and Foundations of IS (IS2010.1) are present in a majority of programs. IT Infrastructure (IS2010.4) is present in about half of the programs. IT Strategy, Management and Acquisition (IS2010.7) subjects are required in about one third of programs. Subjects that focus on Enterprise Architecture (IS2010.3) are clearly present in only 6% of programs. Comparisons with the UK study of Stefanidis and Fitzgerald (2010) are not so straightforward, but indicate alignment where direct comparisons can be made in the subject areas of Data and Information Management, and IT Infrastructure.

Overall Adoption of IS2010 Core

Figure 8A: Take up of IS2010 Core: ACPHIS (Blue) vs Hwang (Red)

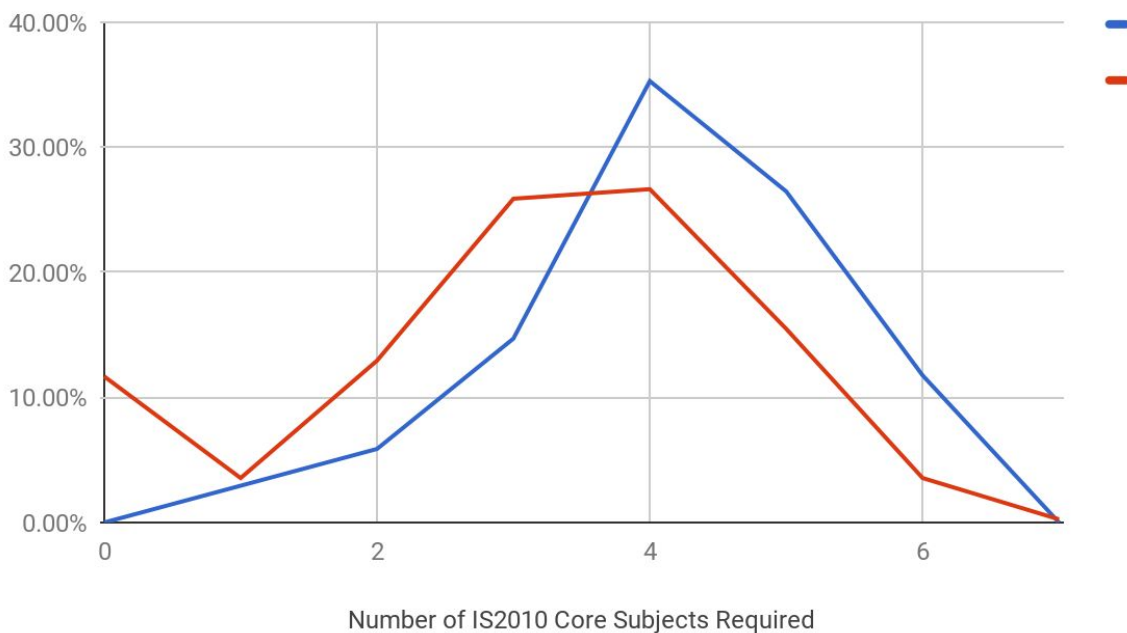


Figure 8B: Overall Adoption of IS2010 by Australian IS Programs

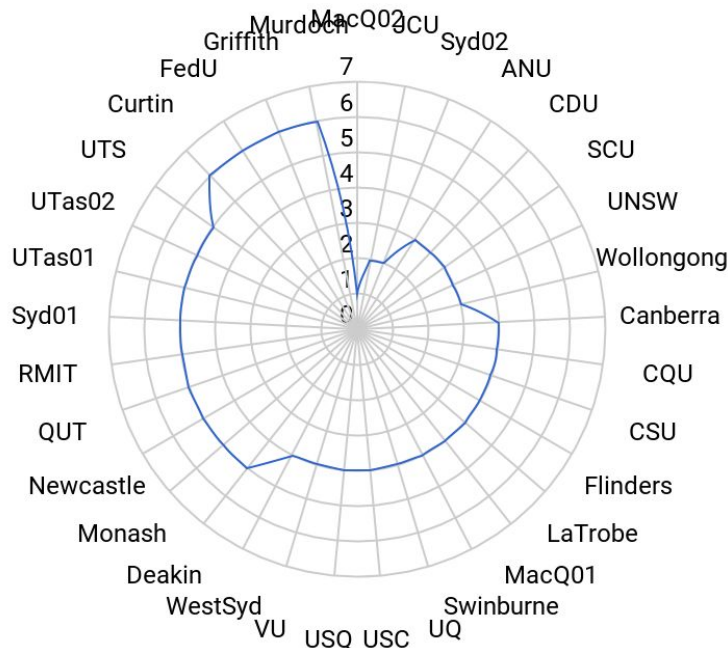


Table 8 Adoption of IS2010 Core

IS2010 Subjects in Core	Programs	Count
0		
1	MacQ02	1
2	JCU, Syd02	2
3	ANU, CDU, SCU, UNSW, Wollongong	5
4	Canb, CQU, CSU, Flin, LTU, MacQ01, Swin, UQ, USC, USQ, VU, WestSyd	12
5	Deakin, Monash, Newcastle, QUT, RMIT, Syd01, UTas01, UTas02, UTS	9
6	Curtin, Fed, Griffith, Murdoch	4
7		

Figure 8A and Table 8 shows that most of the surveyed universities have adopted over half of the IS2010 core as core, with a normal-type distribution of around 4 subjects areas in the core. No university required all the IS2010 core and only 3 programs required less than 3 subjects from the IS2010 core. With an average core requirement of 4.2 of the 7 core IS2010 subjects per program, this study indicates greater than the overall adoption score of 3.4 from 7 found in the US by Hwang, Ma and Wang (2014). Table 8B shows the level of adoption of IS2010 core by each program in the study.

Non-Core Subject Areas

Figure 9: Non-Core IS Subject Areas

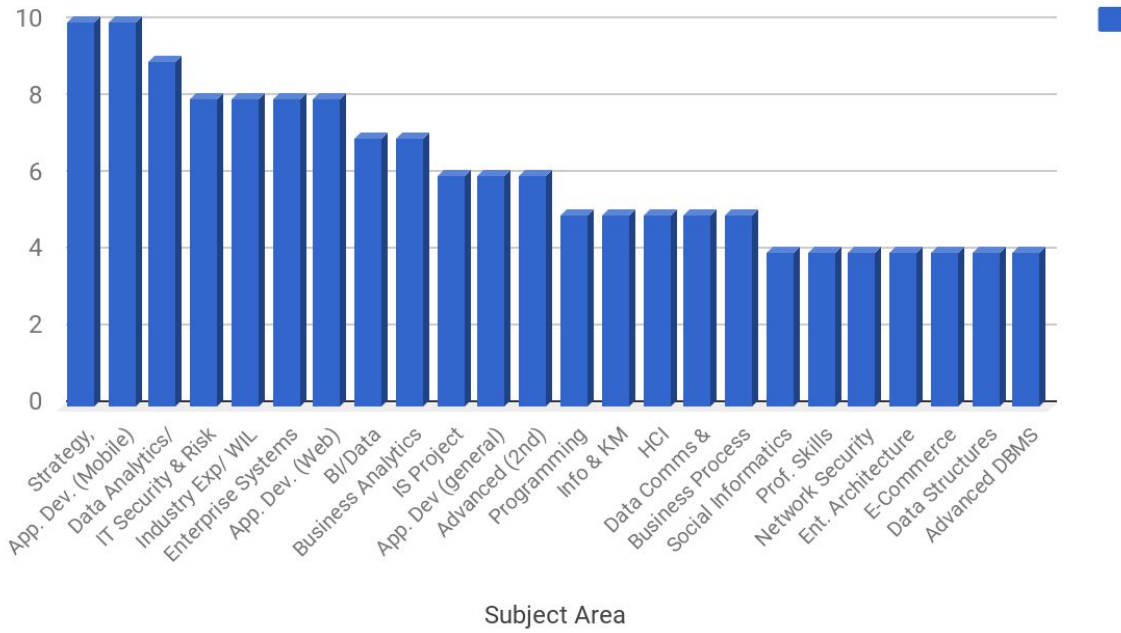


Table 9: Non Core IS Subjects

Subject Category	Count	% (n=33)
Strategy, Management, and Acquisition (IS2010.7)	10	30.30%
Application Development (Mobile)	10	30.30%
Data Analytics/Data Mining	9	27.27%
IT Security & Risk Management	8	24.24%
IS Industry Experience (WIL)	8	24.24%
Enterprise Systems (ERP)	8	24.24%
Application Development (Web)	8	24.24%
Business Intelligence/Data Warehousing	7	21.21%
Business Analytics Foundations/ Business Statistical Methods	7	21.21%
IS Project Management (IS2010.5)	6	18.18%
Application Development	6	18.18%
Advanced (2nd) DBMS subject	6	18.18%
Programming Language (OO)	5	15.15%
Information and/or Knowledge Management	5	15.15%
HCI	5	15.15%
Data Communications and Networking	5	15.15%
Business Process Management	5	15.15%
Social Informatics	4	12.12%
Professional Skills (Working in Industry)	4	12.12%
Network Security	4	12.12%
Enterprise Architecture (IS2010.3)	4	12.12%
E-Commerce	4	12.12%
Data Structures	4	12.12%
Advanced DBMS (Application Development)	4	12.12%

Figure 9 & Table 9 shows the IS/IT-related subjects classified as non-core. From the IS2010 model core, Strategy, Management, and Acquisition, IS2010.7 (10 of 33), IS Project Management IS2010.5 (6), Enterprise Architecture - IS2010.3 (4), Data and Information Management - IS2010.2 (2), and Foundations of IS IS2020.1 (1) are offered as non-core. Outside of the IS2010 core, Application Development (Mobile), Data Analytics/Mining, IT Security and Risk Management, Enterprise Systems (ERP), Application Development (Web), Business Intelligence/ Data Warehousing and Business Analytics Foundations/ Business Statistical Methods appeared in 6 to 10 of the 33 programs.

There is a long tail of 89 subjects offered in less than 4 programs. 53 subject areas are offered in only one program. Notable IS subject areas in this tail include: Web Applications/ Technology, IS and Cloud Computing, Accounting Information Systems, Social Informatics, IT Management, IS Innovation, Global IS, and Health Informatics. A number of subjects areas cover more advanced topics in areas of specialisation, such as: Business Analysis, Application Development (Mobile), Application Development (Web), Data Analytics, and Business Process Management. A small number of programs provide options in the area of professional skills (consulting, organisational behaviour, communication for ESL) and capstone activities (subjects and projects). The most common non-core capstone was actual industry experience, no doubt indicating the selective nature of industry placements.

Summary

These results show signs of a maturing academic discipline with considerable agreement between what is offered under the banner of the IS discipline in Australia, and in the US. Overall adoption of IS2010 in Australia is on par, if not higher than that of the US. Systems analysis and design, data management, foundations of information systems, and project management have common and accepted units of delivery that are core to the vast majority of programs. Along with fundamentals of programming, these are the big 5 of the UG IS curriculum. Topics around IT management and IT infrastructure are less commonly required as identifiable core units, and IS architecture is rarely offered as a distinct unit. We can be less certain about comparisons with the UK, but it is likely that these results are also comparable.

Programming and application development units, which are not part of the IS2010, are still widely required as core in Australia, the US and the UK. Units that build on a first programming unit for application development in general, mobile applications and web applications are also common in the curriculum. Gaming is starting to also appear as an option in IS programs, and possibly as a vehicle for development skills, including analysis, design, HCI, and programming. In the UK and Australia, the professional bodies with their focus on the broader IT professional, may influence this, but IS2010 includes no such recommendation, suggesting that program designers still consider development as a central part of the IS discipline.

Within the Australian context, the influence of the profession through the ACS is clear, with the prevalence of professional skills units, and of specific capstone projects, equally divided

between one and two semester units. Some programs offer actual industry placements, generally in a competitive selection process, but the majority aim to provide as an authentic as possible industry experience without students being embedded in workplaces over an extended period.

There were relatively few advanced, specialised options, and most programs demonstrated the flat structure promoted by IS2010. Notable exceptions were the focus on Business Process Management at QUT, and a wide range of options available at Monash University. The long tail of relatively unique unit packaging indicates a diversity of offerings across the sector.

Limitations

This project, in part for pragmatic reasons, and in part to benchmark with US studies, has analysed curriculum in terms of unit offerings. Subjects have been classified as matching 50%+ with reference subjects. This means some subject areas may be covered in total across the curriculum, but have not been included in any particular item. A focus on topics, without consideration of their packaging into delivery units, may provide a slightly different picture, but would require substantially more work.

Further Work

This project has produced a catalogue of most IS units on offer and their subject areas for 2017 offerings. This may be a useful resource for IS academic program developers, and its availability to the community could be facilitated setting up an appropriate database and web interface, and migration of the program data and the reference list.

In completing the picture of the IS academic discipline in Australia, it would be useful to perform a similar analysis of graduate and research programs.

The lack of previous studies means that it is difficult to establish trends in curriculum. ACPHIS may take on a role of maintaining a database that could be used to routinely view trends. Alternatively, another study could be conducted in five years or at some other interval.

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