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IS Knowledge and Skills sought by Employers: A Content Analysis of Australian IS Early Career Online Job Advertisements

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Abstract

*The purpose of this paper is to develop an understanding of the knowledge, skills and competencies demanded of early career information systems (IS) graduates in Australia. Online job advertisements from 2006 were collected and investigated using content analysis software to determine the frequencies and patterns of occurrence of specific requirements. This analysis reveals a dominant cluster of core IS knowledge and competency skills that revolves around **IS Development** as the most frequently required category of knowledge (78% of ads) and is strongly associated with: **Business Analysis, Systems Analysis; Management; Operations, Maintenance & Support; Communication Skills; Personal Characteristics; Computer Languages; Data & Information Management; Internet, Intranet, Web Applications; and Software Packages**. Identification of the core cluster of IS knowledge and skills – in demand across a wide variety of jobs – is important to better understand employers' needs for and expectations from IS graduates and the implications for education programs. Much less prevalent is the second cluster that includes knowledge and skills at a more technical side of IS (**Architecture and Infrastructure, Operating Systems, Networks, and Security**). Issues raised include the nature of entry level positions and their role in the preparation of their incumbents for future more senior positions. The findings add an Australian perspective to the literature on information systems job ads and should be of value to educators, employers, as well as current and future IS professionals.*

Keywords: IS Careers, IS Knowledge and skills, IS Job Advertisements

1. Introduction

The discipline of Information Systems (IS) has often been characterized by the diversity and complexity of its subject matter (e.g. Avgerou, 2000; Paul, 2002). The intellectual foundations of the IS discipline and its body of knowledge reflect complex processes where the technical, business and social phenomena are continuously interacting and transforming each other. As the IS discipline aims to produce knowledge that is relevant and applicable in practice, it tended to develop in response to the enfolding of these phenomena and changing needs in the IS practice. The broad motivation for this paper arises from the need to continually investigate and understand the IS discipline's body of knowledge from the perspective of IS practice. Specifically in this paper we aim to examine what knowledge and skills employers require from IS graduates by analysing early career IS job advertisements. Such a practice perspective of the IS knowledge and skills is important for both IS teaching and research. On the one hand, better understanding of the required body of knowledge and skills is important for the development and delivery of education programs; and on the other, it helps the IS discipline fulfil its mission and produce knowledge that is relevant and applicable in practice.

Given that the IS discipline is relatively young and that its identity in academia as well as in practice is fast changing, we need first to delimit the domain of our study. There have been many discussions on what comprises the IS discipline and there is no consensus on a definition (e.g. Avgerou 2000; Avison & Eliot 2006; Avison & Fitzgerald, 2002; Paul 2007; Paul 2002). Avison and Fitzgerald, for instance, define IS as "the effective analysis, design, delivery and use of information for organizations and society using information technologies" (2002, p174) which delimits a broad subject domain. In an editorial for MISQ, Lee (2001, p iii) emphasises that the IS discipline "examines more than just the technological system, or just the social system, or even the two side by side; in addition it investigates the phenomena that emerge when the two interact" that we find pertinent for our study. We are targeting IS jobs that involve IS development, management and use in business, organizational and social contexts, implying phenomena emerging in their complex interactions.

IS graduates, generally, come from business school programs that variously may be named management information systems (MIS), computer information systems (CIS) or information technology (IT) (Abraham et al. 2006, p1148; Avgerou 2000 p567). In Australia IS courses are sometimes taught in Faculties with names such as Information Technology. In both cases the courses and therefore the graduates are generally differentiated from computer science, computer engineering and information science programs (Abraham et al. 2006, p1148). Thus, this study excluded job advertisements that sought candidates with degrees in computer or telecommunications engineering, computer science, or where technical qualifications (such as Microsoft Certified Systems Engineer (MCSE)) obtained outside the university system were a requirement. Examples of job advertisements included were those with degree titles such as Bachelor of Information Systems or Information Technology, Bachelor of Business or Commerce with an IS or IT major, Bachelor of Science with an IS or IT major. The Australian Computer Society (ACS) has attempted to clarify the areas of knowledge appropriate for IT professionals (Underwood 1997). It introduced an accreditation process thereby impacting on the development of undergraduate programs at Australian universities and in turn the mix of knowledge and skills new graduates bring to the job marketplace.

A number of factors provided the motivation for the study of Australian IS jobs reported here. Student numbers in IS schools at universities in Australia and elsewhere are reported as dropping (Lea 2006) while in contrast employers are facing difficulties in recruiting appropriate qualified graduates (Alexander 2007). This quandary was discussed in a keynote presentation at the Australasian Conference on Information Systems by Grant (2007) who suggested some of the causes may result from a lack of clarity about career paths and the nomenclature of the IT professions. Misperceptions by potential students about job opportunities and the strength of the job market are fuelled by this lack of clarity and media reports of off-shoring. There are also differences in the perceptions of educators and employers about the knowledge, skills and competencies required of IS graduates

The study investigates what Australian employers actually state they want in job advertisements (job ads). The requirements employers express are a major means by which they indicate, more or less effectively, what they want from potential employees. The paper investigates a sub-set of the Australian IT job market by analysing ads for positions suitable for early career graduates, also referred to as recent graduates (defined here as new graduates and those with up to three years work experience) from university level IS programs. Through this analysis we aim to identify what Australian employers currently require in terms of IS knowledge, skills and competencies as well as any other expressed requirements such as communication skills or personal characteristics. In addition the data analysis aims to throw light on the broad structure of jobs (as represented by the ads) through the identification of groupings of the knowledge, skills and competencies in the requirements specified by employers.

Several issues determined the focus. Primarily there are conflicting views about the Australian IS job market: while many employers believe that there are not enough new graduates to cater for present and future needs, falling numbers in IS programs in recent years suggest that prospective students are concerned that there are not enough jobs or that the jobs which are available are not to their liking. While this research will not directly address whether there are, and will be for the foreseeable future, too many or too few graduates for the work available, it will indicate the skills and knowledge in demand to date. This has value for students in selecting courses and for IS academics in planning and delivering them.

A second reason for restricting the analysis to jobs appropriate for recent graduates is the belief that after several years in the workforce, experience and post graduate studies become increasingly important in decisions about the employability of candidates. The findings of other research indicate that different knowledge and skills are valued in higher level positions (Zwieg et al. 2006, p104). This would be reflected in the content of the ads and lessen the usefulness of the findings of this research for establishing what knowledge, skills and competencies are sought in new graduates. While not claiming to throw light on all aspects of the employment market, job ads are probably the most easily available indicator of the short to mid-term direction of workplace demands for particular knowledge, skills and competencies. They provide a window to what is currently wanted (required as well as preferred) and hence to what employers believe they need for the organization to continue and thrive. The analysis of ads might also encourage employers to reconsider the way they express their needs in the ads.

This paper briefly situates the study in the literature, describes the research method, essentially the collection and content analysis of job ads, and then presents the results. It

concludes with a consideration of the issues arising, particularly the role of entry level positions in the preparation of their incumbents for future more senior positions.

2. Literature

A literature review relevant to this project requires some attention being given to a 'definition' of the IS field in Australia and how this fits with related areas. The Australian Computer Society, while recognizing the difficulties in terminology of differentiating between different parts of the IT family, presents a three field model (see Figure 1) which places IS on a continuum between computer science and the business and management related fields in the discipline of IT (Underwood 1997). The ACS report attempts to identify a "Core Body of Knowledge" (CBOK) for the IT disciplines, which it says should be included in all IT programs across the three disciplines identified in this 1992/1997 representation of the field (Computer Systems Engineering, Computer Science and Information Systems). It recognizes that the scope of the specified CBOK is very broad and could not readily be covered in an undergraduate course and therefore recommends division into two groups. First a mandatory group referred to by ACS as a "generic" requirements group. In the 1997 CBOK document this included interpersonal skills, ethical and social implications, professional practice; and project management and quality assurance. The 2007 CBOK document suggested the "generic" requirements were ethics, project management and interpersonal communication. A second group was proposed in both documents from which courses could be selected depending on disciplinary focus and student interest as well as the accreditation requirements of the ACS.

ATTACHMENT 1

The following figure has been adapted from one originally developed by Roger Clarke for the ACS Submission to the Discipline Review of Computing Studies and Information Sciences Education. The original figure is replicated in the Report of the Review Committee [Rev 1992, p.13].

N.B. The topic areas identified are indicative only and are not meant to be exhaustive.

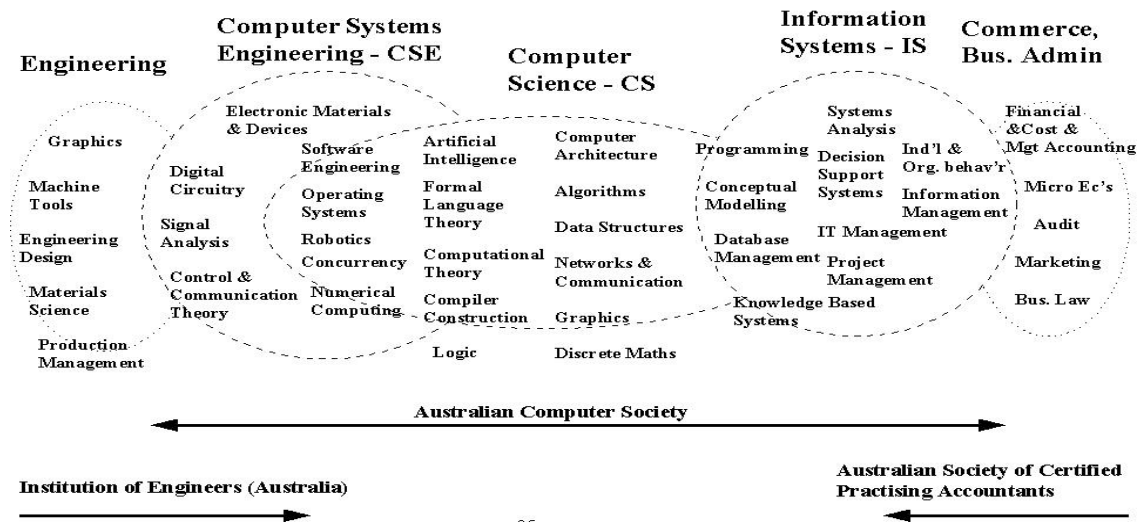


Figure 1: ACS (Underwood 1997) representation of three disciplinary groups within the IT field

An aim in updating the CBOK has been clarification of the roles appropriate for entry level IT professionals and the knowledge, skills and competencies involved (Australian Computer Society Professional Standards Board 2007). This review is a work in progress with the

intention of completion by June 2008. Both the CBOK and the *Discussion Paper* refer to the profession with the *Discussion Paper* acknowledging that the terms Information and Communications Technology (ICT), IT, and Computing “are used more or less interchangeably in Australia to refer to the Profession as a whole” (p4). This lack of clear definition and distinction among the fields is seen as detrimental to disciplinary developments with several major ramifications; one of the most critical being public perception of different professions and the marketing of careers to prospective students in the various fields within IT (p4). The lack of clarity almost surely also applies to employers as they seek to name and describe positions. It also does not help the developers of academic programs in the various fields who seek to give their students as wide a choice of potential employment as possible. To compound the issue of what should or should not be included in programs for IS, Clarke (2006) chronicles the fairly recent development of the IS discipline in Australia noting the “enormous breadth of topics addressed within the IS discipline” (p131). The growth of topics has probably been influenced by the fact that IS as an academic discipline has evolved differently around the world “with identifiably different local forms e.g. from a Soft Systems emphasis to a more technical focus” (Gable 2006, p103). Therefore we may assume that IS practice and IS jobs also may have evolved somewhat differently. This would seem to be justification for studying aspects of the IS job market specifically in Australia rather than relying on the findings of studies in other countries to guide such things as degree program development.

The *Discussion Paper* suggests that a mechanism for viewing the profession can come from understandings conveyed by the word “profession” which it discusses in relation to the development of the revised CBOK. It cites “Professions Australia” criteria of a “special knowledge and skills in a widely recognized body of learning derived from research, education and training” and the “possession of a code of ethics” as providing useful guidance.

Detailed studies of the professions in general indicate that a central element of each is an accepted body of knowledge over which the profession claims unrivalled expertise. Abbott (1988) terms this claimed expertise the profession’s “jurisdiction”, known as “turf” in a colloquial jargon. Coupled with this is a system of certifying individuals that have mastered that body of knowledge. There are other important elements which constitute a profession, which Abbott sees as constituting a “system”, and which vary in significance from profession to profession. Claiming, maintaining and re-claiming jurisdiction is an on-going task for the profession. Macdonald (1995, pp188-189), following Larson (1977), characterises this task as being a significant element in the “project” that professions engage in to maintain their identity. However, the intensity of activity in defining jurisdiction varies from time to time: most intense as the profession is established, and when it is under some challenge from rival professions. The *Discussion Paper* considers that an understanding of what the IT professions entail and the nomenclature used to describe them varies widely. A stated aim in the *Discussion Paper* is the “redefining and building” of the IT professions to develop a wider understanding of what it means to be an IT (or IS) professional and the knowledge, skills, competencies and education required. Our paper aims to contribute to that debate by looking at the knowledge, skills and competencies employers state that they require in job advertisements whilst also acknowledging that any university based education needs to cover areas perhaps not explicitly acknowledged by employers, and which differentiates a university educated professional with the ability to take a critical and wider worldview than a “trade school” graduate with a simple “how to” focus (Metcalf 2006).

Identifying what employers want from new staff can be approached in a number of ways. Commonly used approaches in investigations of this kind have been interviews with, or questionnaires of, employers and/or job seekers, or the unobtrusive method of the content analysis of, for example, newspaper or online job ads (Litecky, Arnett & Prabhakar,?? 2004).

A number of American studies have tracked the IS job market over time to identify the direction of change and current employer requirements (Lee 2005; Litecky et al. 2004). An often cited study by Todd et al. (1995) surveyed newspaper job ads spanning the 20 years from 1970 to 1990 and found little change in the types of requirements specified for programmers and IS management positions. Systems analysis positions had experienced the greatest change and they remark that contrary to expectations there had been an increase in the specification of required technical knowledge and a slight decrease in requirements for business and systems knowledge (p1). A subsequent newspaper job ads study (Gallivan et al. 2004) which spanned 1988 to 2003 identified a similar trend. The authors found ongoing evidence of a recruitment gap between employers' articulation of a desire for business knowledge and 'soft skills', and jobs ads concentrating on 'hard skills'. Interestingly they claim that this is due to it being easier to screen for "hard skills" (Gallivan et al. 2004, p83). In seeking to explain this apparent contradiction Litecky et al. (2004) propose that the hiring process is composed of two stages. They suggest that the first stage scrutinises potential employees against specified technical requirements ('hard skills') stated in job ads, whilst the second stage uses the job interview for the investigation of 'soft skills' such as communication skills for making the hiring decision.

The recent interview-based IT workforce investigation sponsored by the Society for Information Management Advocacy Program (Zwieg et al. 2006) remarks on the difficulties ahead as the use of off-shore workers for technical work may have unintended consequences. It argues that this will produce a shortage of people who have had the opportunity to develop the project and business-related skills required for mid-level work. These skills are often developed in entry level work - work which has in the past been more often of a technical nature (Zwieg et al. 2006). Unlike a number of other studies which address employers' demands as a composite, this research distinguished between the demands for entry-level and mid-level positions. The researchers also point out that entry-level positions more often seek the technically skilled with almost all the skills sought being technical ones. When asked about missing skills in recent recruits, employers identified "communication skills" and indicated that new entrants with good "communications skills" were of high value to them (p104). The researchers argue that the new IT professional should have a balance of technical, business and project skills to prepare them for their careers and that in the present work situation the old model of picking up non-technical skills over time and with experience does not apply (p106).

A recent American unpublished exploratory study (Marion 2006) using 100 ads from two electronic job listings found once again that a large part of the specified requirements in ads were "technical skills". Marion notes that her findings support the proposition that IS professionals need to understand business culture and operations to function well in their workplace stating that the term "integration" was frequently mentioned in different contexts in the ads. The importance of business and behavioural skills was stressed by Lee et al. (1995) and a decade later Bassellier and Benbasat (2004) concluded that IT professionals need a growing range of non-IT skills (p691). Interestingly, another study (Letch and Randolph 2000) indicates that while end-users in functional areas of business are more involved in IS and IT

use and development, they do not see their roles extending to the traditional domains of IS professionals such as programming, IS design and systems installation and integration. It would appear therefore, that IS professionals need to know more about business, and business and functional professionals need to know more about IT, but the need for high level specialisation remains.

North American studies explored the nature and extent of gaps between the perceptions of IS academics and IS practitioners about the field revealing that practitioners appear to value interpersonal skills, understanding of organisations and personal traits more than academics who in turn more highly value software tools (Lee et al. 2002; Trauth et al. 1993). Trauth et al. (1993) identified an "expectation gap" between industry needs and academic preparation claiming that IS jobs had been changing and that academic programs had to keep up with this. This finding was supported in more recent Australian investigations (Snoke et al 2002; Snoke and Underwood 2001). A Delphi technique was used to elicit academic and industry expectations of the generic attributes of IS graduates. The results were compared with the results of a content analysis of texts and academic program unit outlines and identified some disparity between the perceived needs of industry stakeholder and academics perceptions and curriculum requirements. Industry highly rated individual motivational attributes such as learning and working independently. Academics rated more highly generic interpersonal attributes such as teamwork and communication skills and also technical knowledge and competencies.

Many of these investigations have produced lists of skills and competencies identified as being more or less in demand. With the previous studies in mind, and the need established for educators and potential students to understand what skills and competencies employers actually require at any point in time, this study addresses the following questions:

1. What knowledge, skills, competencies and personal characteristics do employers list in current job ads for IS graduates in Australia?
2. Are these different from those identified in previous overseas studies? If so, how are they different?

The contribution of this work lies primarily in that it addresses demands in the Australian workplace and so will supply information to Australian educators, students and employers. As there are similarities with the design of some American papers – the focus on jobs appropriate for recent IS graduates and a desire to throw light on the mix of skills which are currently in demand – this will allow for comparison.

3. Research Method.

3.1 Assumptions and limitations.

A fundamental assumption of this investigation is that the content of job ads is a valid representation of the labour demands of employers. It is acknowledged that some ads are likely to be more accurate in their specification than others. Reasons for this may include a lack of experience in writing ads and/or a lack of clarity about what is required. There may also be non job-task factors which influence what is included and excluded such as company policy or state legislation or the desire to attract a high standard of applicant. In addition, ads vary in length and detail though the motivation to keep ads brief because of the cost

associated with length is not the concern with electronic ads as it is with newspaper ads; as electronic ads are usually charged for on the basis of the duration of their listing.

The study is limited to jobs suitable for recent IS graduates justified on the grounds that IS is a large field and focusing the investigation on a part of it is likely to produce more useful results than a study attempting to analyse all levels of positions. The concern about recent graduate perceptions stated above made this an easy decision.

No study could hope to identify all available jobs at any point in time as jobs are advertised in a wide range of sources and some are filled without public advertisement, by for example word of mouth and the campus and web page recruitment advertising of large companies and employment agencies. However, analysis of ads in widely used and publicly available job listings is likely to turn up a fairly representative list of what is available and the knowledge, skills and competencies in demand.

3.2. Research Design.

The unobtrusive method of job ads content analysis was chosen for this investigation in the belief that a broad sweep could be achieved with quite limited resources. Content analysis is a technique through which content, for example text or images, are examined in a systematic way. Content analysis begins with pre-defined categories developed from previous literature which are iteratively extended and refined through the analysis. (Ezzy 2002). The analysis involves counting how often words, phrases or themes appear individually or in combinations. The results are then organised systematically for quantitative analysis of the text's content. Content analysis is a frequently used descriptive technique (Neuman 2006).

The identification of jobs appropriate for recent graduates involved both choosing sources for the ads and the selection of ads from them. Three major Australian online job lists have been used – *JobServe* (<http://jobserve.com.au>), *seek* (<http://seek.com.au>), and *MyCareer* (<http://mycareer.com.au>)¹. The search terms and strategies for the sources are not identical; however, all used the broad term IT&T (Information Technology & Telecommunications) and all allowed further refinement to express graduate and/or entry level. In addition searching could be done on more specific terms such as Business Analyst. This was done for several terms likely to be in job titles – Consultant, Business Analyst, E-Commerce, ERP, and IS Project Management - and in most cases the position had already been identified in the general search. Other refinements such as geographic restriction were possible but were not used. The choice of the categories under which ads are listed - for example IT&T, Graduate/EntryLevel - are specified by the advertisers so misspecification by them could result in ads being missed however it probably would be very few.

Preliminary scanning of the job listings showed that appropriate jobs have a wide variety of titles. In addition reliance on university program names had limited usefulness as there is no uniform language and not all ads specified the qualification required though it appeared from

¹ These sources were also used by the Commonwealth Department of Education and Workplace Relations (DEWR) in preparation of its monthly ICT vacancy reports as they provide a broad national coverage (Australian Government Department of Employment and Workplace Relations 2006).

the content that the requirement of “graduate” did not mean absolutely any degree. These two factors limited the use of quick scanning in ad identification.

As our focus was the IS field, we excluded those ads where a computer science or engineering degree was stipulated, and focussed on those ads which specified degree titles such as Bachelors of Information Technology and Information Systems, Bachelors of Business or Commerce with an IS or IT major, Bachelor of Science with an IS or IT major. Where no degree was specified, we were guided by the criteria in the area indicative of “IS” within the ACS representation of the broader IT field reproduced as Figure 1 of this paper. Criteria for the selection of ads were then tested in discussion with colleagues from the IS and IT fields before the data collection began.

Other criteria used in defining appropriate jobs included salary package (minimum \$35,000 to a maximum of approximately \$80,000 per annum), and experience requirements that would not exclude early career graduates (defined here as new graduates and those with up to three years work experience). We attempted to eliminate the duplicate ads but cannot guarantee this as the numbers of jobs scanned was quite large even after the restriction of graduate/entry level was used². No assumptions can be made with regard to the probable percentage of entry level ads in comparison to the total number of ads. IT&T included ads that covered the broad spectrum of positions and this study focuses on IS positions, specifically entry level positions. In addition the online job lists not only duplicated ads between themselves, but often ads were repeated within the same online job list, even on a daily basis. Thus, we selected the ads on a purposive basis excluding duplicates, according to the criteria listed above. For reasons similar to those preventing us from making assumptions about the proportion of entry level jobs we cannot make estimates about the proportion of ads excluded as a result of being deemed more suitable for other types of IT graduates, such as computer scientists and engineers. To reiterate, this is not a study of the size of the job market, rather the focus is on the knowledge, skills and competencies specified in ads targeted at entry level IS graduates

The ads were gathered over ten weeks from 12 July to 13 September 2006. A preliminary analysis after 50 ads had been gathered showed that the approach was identifying a range of job titles and requirements. This process of job identification was found to be quite time consuming. As the period of data gathering proceeded it became clear that the same types and mix of ads were recurring. We ceased collection at ten weeks with a final sample size of 400 ads. Essentially the strategy was to access one of the sources, apply the search terms and work through the entries retrieved in the several hours available for a session. The order of the ads was chronological by placement date with the most recent at the top of the list. In addition to checking the job title and brief description, the fuller description of many ads, which was available on a second screen, had to be read. Two researchers worked together reaching agreement about whether the ads met the definition of an early career or entry level IS graduate position defined above. Once an ad was deemed appropriate it was downloaded. In addition the following data was recorded if available: the geographic location of the job, the salary range, the specification of experience or qualifications.

² DEWR which scans four weeks of ads gathered over 20,000 under IT&T for the four weeks to mid April 2006 and note that this included some duplication. (Australian Government. Department of Employment and Workplace Relations 2006).

The job titles and ad content was downloaded into Simstat/Wordstat (Provalis Research 2005) a word counting software package which enables the production of an hierarchical dictionary developed from the terms describing the desired knowledge, skills and competencies specified in the ads. The creation of the user-defined inclusion dictionary to group related words into meaningful categories is a critical step in enabling the most informative use of the software. Words and phrases in the ads are examined and placed within a developing picture of the knowledge, skills and personal characteristics sought in the ads. Whilst the actual words used in the ads are the basis for the dictionary, the sources used in developing major and minor categories included the knowledge of the researchers and their colleagues, various published accounts of IS work such as the *Australian and New Zealand Standard Classification of Occupations* (Australian Bureau of Statistics and Statistics New Zealand 2006) and the coding schemes of a number of IS work studies (Marion 2006; Prabhakar et al. 2005; Gallivan et al. 2004; Todd et al. 1995).

Table 1 contains the categories used including examples of dictionary terms under the 17 category labels developed.

Category Label	Examples of Dictionary Terms
Architecture & Infrastructure	Architecture, infrastructure, technology environment, ITIL
Business Analysis, Systems Analysis	BA, analyse and design, business analyst, business processes, business solutions, business and technology solutions, functional specification, monitor, system specification, system analysis, technical specification
Communication Skills	Articulate, interpersonal skills, negotiation presentation, oral, written, verbal
Computer Languages	ASP, C+ , C++, Cobol, code, Java, Perl, SML, SQL, UML, VB, Visual Basic
Data & Information Management	Data administration, data analysis, data cleansing, data content management, data integrity, EDI, information management, relational database, warehouse
Enterprise Resource Planning Hardware	Enterprise application, enterprise architecture, enterprise enabling, enterprise resource planning, enterprise solutions, ERP, PeopleSoft, SAP
Internet, Intranet, Web applications	Hardware, laptop, MAC, mainframe, PC,
IS Development	Apache, ColdFusion, Cookie, CSS, Domino, E-business, E-commerce, Extranet, HTML, Web design, XML, XHTML, XSL
IS Project Management	Analyst programmer, applications design, applications development, development, documentation, J2EE, JEE, lifecycle, .NET, object oriented, quality assurance, re-engineering, testing, visual studio.
Management	Implementation, project management, scoping
Networks	BPO, business intelligence, business strategy, distribution chain, marketing strategy, supply chain.
Operating Systems	Active directory, CISCO, Citrix, DHCP, DNS, IP, LAN, UUCP, Socket programming, VPN, WAN
	Linux, Unix, Windows, Win, XP, NT

Operations, Maintenance & Support	First level support, applications management and support, automation, bugs, change requests, desk top support, customer training, diagnose, disaster recovery, helpdesk, operational maintenance and support, training end users, upgrades
Personal Characteristics	Adaptable, ambitious, attention to detail, business acumen, can do attitude, client relationship, confident, creative, desire to learn, eager to learn, energetic, enthusiastic, flexible, initiative, innovative, intelligent, leadership, organized, passionate, proactive, problem solver, quick learner, team player, relationship builder, self motivated, time management, work ethic, work independently
Security	ACI, audit, firewall, forensic, security, spam, threat
Software Packages	Adobe, Crystal Reports, Excel, Lotus Notes, Microsoft Office, Photoshop, PowerPoint, Visio

Table 1: Content analysis categories

In determining all 17 categories, in addition to consulting the literature, academics and students with relevant knowledge and experience were consulted about what should be included. There was consensus that the skills and competencies listed under **IS Development** would be a part of any IS graduate's knowledge base, with specialization depending on electives selected and personal interests. The view was that even if graduates did not have hands-on experience in these areas, they would have an understanding of how these skills and competencies would fit in the occupational/business context.

As **IS Development** includes such a wide sweep of activities a further breakdown was undertaken to establish the relative demand for various sub-categories within it. Table 2 includes examples of the dictionary terms included within the sub-categories.

Sub-category Label	Examples of Dictionary Terms
IS Development Broad Terms	Applications design, applications development, documentation, lifecycle, software analysis
Object Oriented	Object Oriented, OO, OOP
Programming	Programmer, programming.
Re-engineering	Reengineering, re-engineering
Testing	Testing, tester, QA, quality assurance, UAT,
Tools, Environments, Technologies	ADO, API, DCOM, J2EE, JEE, .NET, servlet, Visual Studio

Table 2: Sub-categories of IS Development

Once the dictionary was constructed the dictionary categories were ranked to identify the frequency with which the terms within specific categories were listed in the ads. The next stage of the data analysis involved quantifying the structural characteristics of our set of job ads and looking for relationships; that is, categories which were found together in ads and categories which never or rarely occurred together. By definition, co-occurrence happens every time words in two categories appear in the same ads. WordStat offers a number of ways to measure co-occurrence. For this research we chose the Jaccard's coefficient similarity measure which is based on the occurrences of categories in the ads but does not take into

account their frequency. This has the effect of compensating for large differences in counts for commonly occurring terms. The construction of the similarity matrix provides input for the multivariate technique of cluster analysis which is used to identify terms with similar co-occurrence patterns. This technique is part of the SimStat/WordStat software package. Using several methods to explore the data enables a more complete picture of the underlying structure.

The cluster analysis is based on the pattern similarity of the 17 categories in the dictionary. This hierarchical agglomerative clustering begins by joining two terms with the most similar patterns according to the distance criteria (average linkage). Following a similar linkage approach subsequent terms are joined to existing clusters until the one large cluster encompassing all 17 categories is formed. While there is no best number of clusters, the software identifies a 'default' cluster configuration based on the frequency of co-occurrence of terms. Selection of the final cluster solution depends on researcher judgment; however, the resulting clusters should display within-cluster homogeneity and high between cluster heterogeneity.

4. Results

Almost half of the 400 job ads were collected from *seek* (199, 49.8%). A third came from *JobServe* (133, 33.3%) and the remaining 68 ads (17.0%)³ from *MyCareer*. *JobServe* and *seek* are dedicated job listing companies whilst *MyCareer* is a part of the Fairfax publishing company which produces newspapers in Sydney and Melbourne and grew out of their classified job ads pages. All three sources claim national coverage. Over half the ads (246, 61.5%) were for positions in the Sydney metropolitan area, 65 (16.3%) were located in the Melbourne metropolitan area with no other geographic area exceeding 10% of the ads.

The software package was run against the content of the ads for the frequency counts and cluster analysis. Table 3 ranks the dictionary categories according to the frequency of their occurrences in the ads.

Content Analysis Categories	Rank	No. Ads	% Ads
IS Development	1	312	78.0
Personal Characteristics	2	295	73.8
Communication Skills	3	273	68.3
Computer Languages	4	204	51.0
Data & Information Management	5	158	39.5
Management	6	150	37.5
Business & Systems Analysis	7	146	36.5
Internet, Intranet, Web Applications	8	146	36.5
Operations, Maintenance & Support	9	139	34.8
Software Packages	10	87	21.8
Operating Systems	11	78	19.5
Architecture & Infrastructure	12	62	15.5

³ Throughout this paper, percentages may not sum to 100 due to rounding.

Networks	13	52	13.0
IS Project Management	14	51	12.8
Hardware	15	43	10.8
Enterprise Resource Planning	16	41	10.3
Security	17	33	8.3

Table 3: Categories ranked by frequency of occurrence

Terms categorised as **IS Development** were the most frequently occurring; (in 312, 78.0% of the ads). As this was such a large and inclusive category it was further broken down into six areas. The ranked results of the breakdown are included in Table 4. The more detailed analysis revealed that in addition to asking for specific software knowledge and skills, for example skills in **Testing** and/or **Programming**, a large number of the ads included terms which conveyed a broader scope here termed **IS Development Broad Terms**. Approximately three quarters of the 400 ads (298, 74.5%) and 95.5% of the ads providing a word match with terms under the category **IS Development** included terms in this broad sub-category. None of the terms in the more focused sub-categories occurred in more than half the ads.

Sub-categories of IS Development	No. Ads	% IS Development Ads	% Total Ads
IS Development Broad Terms	298	95.5	74.5
Tools, Environments, Technologies	113	36.2	28.3
Programming	89	28.5	22.3
Testing	48	15.4	12.0
Object Oriented	25	8.0	6.3
Re-engineering	5	1.6	1.3

Table 4: Ranking of sub-categories of the category IS Development

The broader analysis sub-categories are not exclusive as job ads can ask for a mix of knowledge and skills which come from any number of the categories. An ad could have asked for knowledge and skills from more than one subcategory of **IS Development** (e.g. **Testing** and **Programming**) and from components of several other categories as well. Table 2 shows that well over half the ads included terms in **Personal Characteristics** and **Communication Skills**.

Returning to Table 2 in detail, knowledge of computer languages (**Computer Languages**), arguably one of the more technology oriented categories, was the fourth most frequently occurring category (204, 51.0%). The technologically oriented knowledge and skills (represented in these ads as the requirements under **IS Development** and **Computer Languages**) appear to form an important part of the requirements of many employers seeking recent IS graduates. This technology focus in job ads is in keeping with the findings of the literature (Todd et al. 1995; Gallivan et al. 2004) and particularly in the content of early career job ads (Abraham et al. 2006; Zwieng et al. 2006).

No other skills or competency category occurred in more than 50% of the ads. The two categories ranked last (**Enterprise Resource Planning** and **Security**) are probably so ranked because many of the positions requiring knowledge and skills in these areas are at a higher level than the positions targeted for investigation in this project. Specifically, positions which have responsibilities for security and enterprise resource planning also have requirements for the type of business knowledge which is generally accepted to come with several years in employment in IS work.

Personal Characteristics and **Communications Skills** (ranked 2 and 3 respectively) were mentioned in nearly 75% of ads. This finding is in line with the literature which reports that employers put high value on various personal characteristics and communication skills. While a limited number of terms convey the idea of requiring **Communication Skills** (e.g. verbal, speak, write, articulate) this is not so with **Personal Characteristics**. The ads yielded over fifty terms to be included in this category (see Table 1 for a selection of the terms). Some of these terms were used very frequently such as “learn” which occurred in 78 cases (19.5%) in contexts such as “ability to learn”, “aptitude to learn” and “eager to learn”.

The next stage of the data analysis involved looking for relationships; for example which skill categories were found together in ads and which ones never or seldom occurred together. WordStat offers cluster analysis as a method to address this. As discussed in the Method section the cluster analysis is based on the pattern similarity of the 17 categories in the dictionary. Using this approach the default emerged, which was a four cluster picture. These clusters are represented in the dendrogram, which is a graphical display of the clustering process (Figure 2).

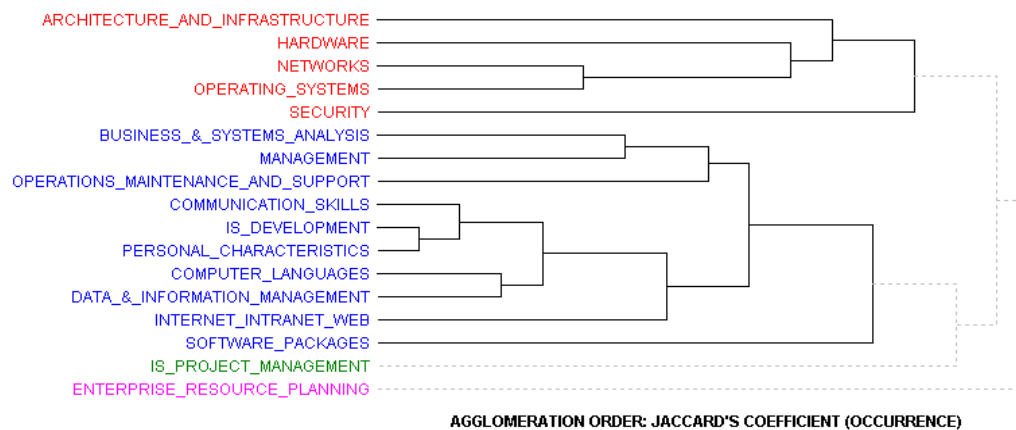


Figure 2: Cluster analysis of the 17 categories

As can be seen in Figure 2, the dominant cluster consists of ten categories—**Business & Systems Analysis; Management; Operations, Maintenance & Support; Communication Skills; Personal Characteristics; IS Development; Computer Languages; Data & Information Management; Internet, Intranet, Web Applications; and Software Packages**. This cluster portrays what might be characterized as core IS skills and competencies required by employers in job ads for early career IS graduates. **IS Development** as the most frequently (78% of ads) required knowledge category seems to be central to this core IS cluster. Interestingly, the **IS Development** category is most strongly associated with **Personal Characteristics** and **Communication Skills**, thus indicating the importance of non-

technical characteristics and soft skills for IS jobs. The next strong **IS Development** association appears to be with **Computer Languages** and **Data & Information Management** categories. Given that 51% of ads require **Computer Languages** knowledge and skills, this category figures quite prominently in the core cluster. This finding is to some extent surprising as **Computer Languages** would be seen as core in more technical IT jobs but not necessarily in IS jobs. What employers actually mean when they request **Computer Languages** knowledge and skills in IS job ads is not known. They may require general knowledge and understanding of computer languages rather than high proficiency, but this remains to be confirmed.

The second cluster consisting of **Architecture & Infrastructure; Hardware; Networks; Operating Systems;** and **Security** are all related to the more technical information technology aspects of IS and would thus appear to be a rational and expected grouping. This cluster however overlaps with the Software Engineering and Computer Science body of knowledge, which requires further empirical exploration. This finding may suggest either that employers are seeking IS graduates for a more technical side of the IS job spectrum (but still requiring business and IS knowledge) or that employers do not differentiate IS from IT jobs or lump them together in their ads.

In addition two categories (**Enterprise Resource Planning** and **IS Project Management**) demonstrated little linking either with each other or with the other categories and are identified by the software as outliers. We have already speculated that the low ranking of **Enterprise Resource Planning** in Table 2 may be because it is more likely the preserve of more senior and experienced staff than the recent graduates on which this study focuses. This is also likely to be the case with **IS Project Management**. Another explanation might be that these two knowledge categories are more recent domains of early career IS jobs that may expand in the future. It would be certainly interesting to monitor whether they will become in higher demand in the future.

4.1. Qualifications and Experience

In the Research Method section it was explained that the ad selection process aimed to restrict the selection to IS positions appropriate for recent graduates. This was done through the selection of search terms (e.g. Graduate/Entry Level), use of specific criteria (e.g. salary level) as well as investigation of the content of the ads. In regard to both salary and academic qualifications many ads made no specification. In respect of academic qualifications the omission of this would not necessarily have meant that the employer did not have an expectation that applicants would be graduates. As employers could specify retrieval terms for their ads it is probably fair to assume that if they indicated that they wished their ads to be retrieved from a search using the term 'recent graduate' they believed that that they had covered this point. Two thirds of the ads (269, 67.3%) required academic qualification (Table 5). Not surprising, in light of the ad selection process only 25 (6.3%) specified that they did not seek any qualifications.

Qualifications required	No. total Ads	% Total Ads
Required	269	67.3
Not specified	71	17.8
Either University/TAFE/Microsoft	18	4.5

Not Required	25	6.3
Either Qualifications or Experience	17	4.3
TOTAL	400	100.0

Table 5: Qualifications required

Analysis of the ad content for the requirement of appropriate work experience (i.e. in IS work) showed that almost half of the ads (194, 48.5%) sought a person with some experience. A further 36 (9.0%) indicated a preference for some experience. While this stated preference is not concerning, the fact that almost half of the position ads retrieved on a search under terms conveying recent graduate required experience is of concern. Even taking into account that some recent graduates would have had part-time work as students (which enabled them to answer the experience requirement) the number of ads requiring experience was high. There is no way of knowing what the employers who failed to specify whether experience was required (138, 34.5%) wanted. Only 18 (4.5%) of the 400 ads indicated that experience was not required.

Experience required	No. total Ads	% Total Ads
Required	194	48.5
Not specified	138	34.5
Preferred	36	9.0
Not Required	18	4.5
Either Qualifications or Experience	14	3.5
TOTAL	400	100.0

Table 6: Experience required

4.2. Position titles

For the job searcher the job title is the preliminary identifier as to whether a position may be suitable, hence some investigation of titles seemed a necessary step in this project. As already remarked it quickly emerged as the ads were being scanned and selected that there was a wide variety of position titles and that in some cases these were not very informative (e.g. 'IT Graduate'). By contrast some positions had very specific titles (e.g. 'J2EE Developer'). Almost half of the ads had the words 'Junior' (89, 22.3%) or 'Graduate' (92, 23.0%) as part of their title (e.g. 'Junior Business Analyst', 'Graduate Business Analyst'). The most frequently occurring term in a job title was 'Developer' which occurred in 97 (24.3%) of the position titles. In addition it was clear from the description of a number of other positions that developer was implied in the ad title (e.g. 'Fun with VB' and 'VB.Net' and 'VB6/VB'). The next most frequently used terms were 'Consultant' or 'Consultancy' occurring in 56 (14.0%) of the ads. The positions under this heading varied, some dealing with technical areas and others having more of a business management focus. No other term appeared in more than 10% of job titles. Programmer, which in some titles was linked with Analyst and in others with specific software (e.g. 'Graduate Programmer VB.Net') occurred in 32 (8.0%) of job titles and was the third most frequently occurring term. A small number of jobs had titles indicating that they were 'help desk' positions however there were also positions which included the term 'support' in their titles which appeared likely from the description to be help desk roles possibly bringing the total of this type of work to around 8%. Further analysis of job titles and content of their associated ads may reveal that at least some positions

were poorly titled in respect to the work involved, which has been identified as a problem (Grant 2007). We speculate that some position titles might be thought to be a turn off for particular applicants, such as 'help desk' though whether this influences potential employers not to use them is not known.

4.3.. Employing organizations

In addition to specifying their requirements many employing organizations choose to say something about themselves. In addition to comments about aspects such as size and purpose many comments dealt with the organizational environment the new recruit would be entering. Characteristics of the organizational environment were mentioned in 316 (79.0%) of the ads. Terms which the researchers identified as conveying this type of message included 'fast-paced', 'friendly', 'team' and 'vibrant'. It could be argued that in conveying these messages about the workplace the employer was indicating the types of characteristics a potential employee might need to fit into it. The use of team structures was often expressed in the ads as were words which conveyed a dynamic culture. Of course such words do not necessarily represent what a workplace is like and few employers would advertise unattractive workplace characteristics, however they probably represent what management would see as desirable.

5. Discussion

The purpose of this project was to gain a picture of what Australian employers want in knowledge, skills and competencies in new entrants to the IS workforce. The job ads revealed the dominant cluster of knowledge categories that might be considered as core knowledge and skill competencies for IS jobs: **Business & Systems Analysis; Management; Operations, Maintenance & Support; Communication Skills; Personal Characteristics; IS Development; Computer Languages; Data & Information Management; Internet, Intranet, Web Applications; and Software Packages**. The competency with the highest frequency of mentions and which also appears centrally in the cluster analysis maps we categorized as **IS Development**. As this was such an inclusive category (including words representing knowledge and skills in areas such as **Tools, Environments Technologies; Testing and Programming**) a sub-categorisation was used to illuminate demands. Perhaps not unexpectedly terms categorised under **IS Development Broad Terms** were found in almost all the ads: in 298 (95.5%) of the 312 ads in which there was a word match with terms under the category **IS Development** and 74.5% of the total 400 ads. As **IS Development Broad Terms** included terms such as applications design, documentation and software analysis this is not surprising. Employers would almost certainly expect recent graduates to have gained a sound foundation in these areas during their studies and be able to contribute to work in these areas even if a position was advertised as being primarily focused on for example, working with specific software.

Computer Languages occurred in more than half of the ads and is strongly associated with **Data & Information Management** and **IS Development**. The high demand for **Computer Languages** in the IS entry position ads may be explained by the technical nature of these entry level positions. The high ranking of **IS Development** and **Computer Languages** is similar to findings in other studies (Todd et al. 2005; Gallivan et al., 2004) that found emphasis on "hard" skills in IS job ads. This may confirm Litecky's contentions that ads screen potential applicants' for technical skills, whereas interviews are more likely to screen for "softer" communications skills and personal attributes. Similarly it may add weight to

Zwieg et al's. (2006) proposition that early career technical jobs are seen to provide a foundation for later career positions that require more business knowledge and management skills.

While no other technical or professional categories occurred in more than 40% of the ads, many are newer skills categories (such as **Enterprise Resource Planning, IS Project Management** and **Security**). These may not currently be receiving a great deal of attention in courses, but appear to be requested by employers, and so perhaps warrants further consideration by educators. In addition, as we noted earlier, positions incorporating these skills may often be at a higher level, so graduates may need to know them for the next step in their career.

Personal Characteristics and **Communications Skills** (ranked 2nd and 3rd in frequency respectively, and also appearing in the centre of the core cluster) were mentioned in over 70% of the ads. Importantly they are closely linked with IS Development in the core cluster of knowledge (Figure 2). These findings confirm the claims in the previous literature about the high value employers place on these skills (Zwieg et al. 2006). This also strengthens the argument in the ACS proposal that this set of skills remain a component of the revised CBOK (Australian Computer Society Professional Standards Board, 2007).

The area of "Ethics, Social Implications and Practice/Professionalism", comprises an important subset of "generic" skills as defined in the CBOK appears only in two ads, which is surprising. However, it is likely that this particular requirement like other "soft" skills is pursued at the interview stage. (Litecky et al. 2004). With regard to the CBOK category "Practice/Professionalism"; characteristics which we have categorised under **Personal Characteristics** include those which employers label with terms such as "desire to learn", "proactive", "innovative", "relationship builder", "team player" etc. were mentioned frequently. This reinforces the need for IS education programs to consider creative ways of developing these skills.

The variety of jobs available was reflected in the large number of titles for positions – Developers, Programmers, Business Analysts, Test Analysts Web Designers, ERP Consultants to name a few. Positions including the term 'Developer' were the most frequently advertised representing almost 25% of the ads. Positions for 'Programmers' were also quite frequent though the rather vaguer terms 'Consultant' and 'Consultancy' occurred more often. Almost half of the ads had the words 'Junior' (89, 22.3%) or 'Graduate' (92, 23.0%) as part of their title which would be a helpful flag for the new graduate seeking to find suitable ads.

Two thirds of the ads (269, 67.3%) specified a requirement for academic qualifications (perhaps not surprising in light of the ad selection process) and only 25 (6.3%) specified that they did not seek any qualifications. Almost half of the ads (194, 48.5%) sought a person with some experience. A further 36 (9.0%) indicated a preference for some experience. As the search for the ads was structured to identify jobs suitable for recent graduates the high level of requirement and preference for experience is concerning. While some recent graduates would have had part-time work as students the experience requirement is still worrying. While there is no way of knowing what the employers who failed to specify whether experience was required wanted (138, 34.5%) only 18 (4.5%) of the 400 ads indicated that experience was not required. This findings regarding the high number of

graduate or junior positions requiring experience provide backup to the calls made in an earlier paper for an experiential business context to be added to IS programs (Abraham et al. 2006).

Nearly 80% of employers (316) chose to say something about themselves. The terms used conveyed messages about the work environment being team based, friendly, vibrant and it seems likely that in flagging these characteristics the employer may have been suggesting that only people who wanted to work in these types of environments should apply.

6. Conclusions

This investigation aimed to identify what employers wanted in new IS graduates and classify required knowledge and competency skills according to their presence in the job ads. Several key findings from this study make an important contribution to understanding knowledge demanded by employers of IS graduates in the Australian context. The first is the identification of the major cluster of knowledge and competency skills required for early career and entry level IS jobs. This cluster revolves around **IS Development**, the most frequently required category (78% of ads), associated with **Communication Skills; Personal Characteristics; Computer Languages; Data & Information Management; Business & Systems Analysis; Management; Operations, Maintenance & Support; Internet, Intranet, Web Applications; and Software Packages**. Identification of the core cluster of IS knowledge and skills – in demand across a wide variety of jobs – is important to better understand employers' needs for and expectations from IS graduates and the implications for education programs. This cluster however is rather broad and more detailed studies are called for to examine individual categories in greater depth. It would also be useful to monitor changes in the core cluster over time.

Particularly interesting is the strong presence of **Computer Languages** category in the core cluster of knowledge (in 51% of ads). While the presence **Computer Languages** in the core cluster does not identify what depth of knowledge in this area is required of graduates it none the less states that they are required. Establishing the balance between technical and business knowledge and skills has been "bothering" educators since the first IS Programs were introduced. Studies in the past criticised education programs where technical knowledge dominated and emphasized the need to introduce more business knowledge and skills (Farwell et al. 1995; Trauth et al 1993). Finding the right balance remains the challenge for educators and employers.

Another important finding is the second cluster consisting of knowledge and skills from a more technical side of IS: **Architecture and Infrastructure, Operating systems, Networks, and Security**. This cluster of knowledge, while present in smaller number of ads, raises questions about the nature of entry level and early career IS jobs. The knowledge categories in this cluster indicate that graduates with Software Engineering and Computer Science degrees might be better suited than IS graduates. On the other hand, it is conceivable that employers might be seeking IS graduates but with more emphasis on technical knowledge and skills. To better understand both knowledge clusters more in-depth, longitudinal studies of IS job ads, recruitment processes and IS recruits would be needed.

Recent studies identify IS job requirements as increasingly focussing on project management and business skills and less on technical requirements. While the desire for these particular

skills are articulated in interviews with employers (Abraham et al. 2006; Zwieng et al. 2006), they are not well represented in our ads for early career IS professionals. These same recent studies identify a dilemma for academia which is to determine how early career job seekers who are sought for their technical skills can be prepared to move into mid- and senior-level positions. We may speculate that the value of critical thinking and the broader perspective encouraged by a university education increases in value as a career progresses. It might also be that the skill encompassed by the phrase "ability to learn" identified in ads in this study and by Snope et al. (2002) and Snope and Underwood (2000) need to be emphasised more in education, for example an explicit acknowledgement of education as a career long process, and therefore the need for skills to enable life long learning being emphasised in the curriculum. .

IS is a rapidly changing field and while studies done some time ago are useful and informative, it is necessary to continually gather information about education and employment. While this study looks at one aspect, job ads, there are other dimensions for analysis which could contribute to providing a rounder picture. To throw more light on IS professional careers as a whole we need more research on the skills and competencies called for in job ads for more senior positions. Further work, for example, an exploration of the content of courses offered in Australian universities could be undertaken. Nomenclature of these courses and government classifications of IS work could be analysed with a view to clarification and standardisation. Investigation could also be undertaken of popular perceptions of the IS field and IS work. Field studies, including interviews with early career IS professionals and their employers on their perceptions of the usefulness or otherwise of courses would add to the picture.

Our study provides a snapshot picture of IS jobs and what knowledge and skills employers require from the IS graduates in Australia. The study confirms that knowledge and skills required do not form a cohesive structure. On the contrary, even the core body of knowledge identified is not monolithic and includes diverse components with breadth and depth required in both the technological nature as well as the business and social nature of IS development, adoption and use. And so it seems that the challenges and dilemmas of IS education are not likely to be any easier in the foreseeable future.

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