

IT Skill Requirements: Perspectives from Industry

Liisa von Hellens

Sharon Wong

Jo Orr

School of Computing and Information Technology

Griffith University

Brisbane, Australia

Email: L.vonHellens@cit.gu.edu.au

Abstract

The study described by this research-in-progress paper aims to identify the skill requirements of graduate and practising IT&T professionals in Australia, from the perspective of IT employers, and assess the relative importance of these skills in the workplace. Data was collected via an analysis of IT&T jobs advertised in three Australian newspapers and are being supplemented by questionnaires and unstructured interviews. The preliminary findings indicate that for graduates, non-technical skills, such as teamwork and communication skills, are unanimously considered of greater importance in industry than purely technical skills. This is in contrast to IT professionals, for whom specialist technical skills were more important in terms of positions advertised, despite non-technical skills being rated more highly on the questionnaires.

Keywords

EH0208 IS skill requirements, EH0210 IS professional values, EH0205 IS career path, EH0206 IS recruiting

INTRODUCTION

The IT&T (Information Technology and Telecommunications) Skills Task Force is an industry initiative supported by a broad cross-section of the Australian community including IT&T companies, major users of IT&T, academia and Federal, State and Territory governments (AIIA 1999). A comprehensive survey was recently conducted to address the perceived IT&T skills shortage in Australia.

The IT&T Skills Task Force predicted that in the five years to 2004, Australian employers will be seeking in excess of 180,000 skilled IT&T professionals, representing a growth rate of 50% (NOIE 1999). The Task Force also identified a skill shortage in IT&T in Australia. Employers are already reported to be experiencing difficulty obtaining IT&T personnel with the required technical skills and it is expected this problem will continue over the next five years (NOIE 1999). Concern for the IT&T industry is significant and an official web site (Ignite) has been developed as a joint initiative of the IT&T Skills Task Force and the Federal, State and Territory governments to address this concern.

During the Second IT&T Skills Summit, the need to provide the industry with required skills was the main subject of discussion (AIIA 1999). Given the shortfall of skilled professionals, educational institutions are under great pressure to produce graduates with skills reflective of the industry's needs. Thus it is of great importance that IT&T educators understand what employers seek in IT&T graduates and professionals.

According to the IT&T Skills Task Force survey, areas of IT work currently in highest demand include client/server applications, internet and multimedia, database management, system support and networking (NOIE 1999). Another Australian study concluded that the most popular skills to have in the Australian IT&T market are "personal computer skills, relational database skills knowledge, programming ability preferably in C or COBOL, and some knowledge of networking" (Athey & Wickham 1995-1996)

A discussion paper by the Department of Communications, Information Technology and the Arts et al. (1998) reported that specialisations reported to be in shortage in two or more states in Australia include Java/Java Script, C++/Delphi, COBOL, SAP, CICS, IBM Mainframe, Oracle and OO Design. Specialisations reported to be in shortage in at least one state in Australia include DB2, PeopleSoft, AS400, LAN/WAN, CISCO certified professionals, Unix, Real Time Systems, Ingres, Advanced Web, Powerbuilder, & GIS (Dept of Communications, Information Technology and the Arts et al. 1998).

A study conducted in Queensland, Australia, looked at the relative importance of a set of attributes of IS graduates (Snoke & Underwood 1998). Industry respondents indicated the top five attributes important to IS graduates as being able to: (1) retrieve, evaluate and use relevant information; (2) work as part of a team in a productive and cooperative manner; (3) participate in continued learning and intellectual development; (4) develop critical, reflective and creative thinking, and define problems in a systematic way; and (5) self-motivate. A further finding from the IT&T Task Force was that business and other non-technical skills were desirable or necessary, yet they were difficult to find in potential employees (NOIE 1999).

Studies conducted in other nations have also shown that 'soft' skills, such as interpersonal communication, analytical skills, general thinking, teamwork, business knowledge and a good foundation in systems analysis and design and database concepts, are at least as important as specific technical skills (Lee et al. 1995, Todd et al. 1995, McGuire & Randall 1998, Van Slyke et al. 1998, Freeman & Aspray 1999, Shawyun 1999, Wynekoop & Walz 1999, von Hellens et al. 2000). A further study in the United States has identified technical support, which comprises troubleshooting, facilitation/customer service, hardware/software installation and systems operations, as one of the "hottest" and most in-demand jobs (ITAA 2000). All of these positions involve user and customer interaction, therefore 'soft' skills would play an important role in effective job performance. While the single most important skill was a good knowledge base in the relevant area, more than one-third of important skills were non-technical in nature (ITAA 2000).

This paper discusses the preliminary findings of research in progress, which aims to identify the required technical and non-technical skills for IT&T graduates and professionals in Australia, from the perspective of IT employers, and to assess the relative importance of these skills in the workplace.

RELEVANCE OF THIS STUDY

The findings from this study are expected to help educators increase the industry relevance of IT degree courses and to motivate students to work on subject material that is likely to assist them in gaining employment in the IT industry. Case studies and accompanying instructional notes will be developed to advance students' learning and understanding of information systems quality management skills. The case studies will be based on industry research and include the most recent data on industry skill requirements. Advice will be provided to the instructor on how these skills could be applied and how they contribute to the global

competitiveness of the Australian IT&T industry.

METHODOLOGY

Job advertisements

Every single job advertisement in the IT section from each of three Australian newspapers (*The Australian* – Tuesday, *The Weekend Australian* and *The Courier-Mail* – Saturday) was surveyed over a period of three months. The analysis involved recording the all the types of skills the advertisement contained (grouped into specialist technical, general technical or non-technical). It was also noted whether the position advertised was aimed at graduates or practising professionals.

The number of positions recorded was the number of positions advertised for, not the actual number of advertisements, as one advertisement may advertise for multiple positions. Where multiple positions were advertised, the actual figure was included in our totals only if the number of positions advertised was known (see Figure 1b). However, if the actual figure was unknown, it was counted as one advertisement and the relevant skill groups would only receive one count each (see Figure 1c). If an advertisement was considered to be a repeat from a previous edition of the newspaper, it was ignored.

<p>(a) Programmer: Needs OOA&D and Java. Needs to be an effective communicator. → <i>This is an ad for 1 position, containing specialist technical skills (Java), general technical skills (OOA&D) and non-technical skills (communication skills), so the three skill groups get one count each and the number of positions would equal one.</i></p>
<p>(b) Programmers (x10): Need OOA&D and Java. Need to be effective communicators. → <i>This is an ad for 10 positions, so each of the skill groups would get 10 counts and the number of positions would equal ten.</i></p>
<p>(c) Programmers: Many positions for people with OOA&D and Java skills. Also need to be effective communicators. → <i>The number of positions being advertised is not specified (unknown), therefore the advertisement is counted, not the positions, so each skill group would get one count and the number of advertisements would equal one.</i></p>

Figure 1: Examples of job advertisement analysis

While the studies conducted on IT&T skill requirements by Todd et al. (1995) and Athey and Wickham (1995-1996) relied on newspaper job advertisements as the sole method of data collection, review of the recruitment literature suggests that this may be inappropriate. The skills listed in job advertisements often exceeded the skills required for a position advertised to reduce the pressure placed on time and resources during recruitment (Echols & Gupta 1998). Therefore, a questionnaire and unstructured interviews are being used to supplement the review of job advertisements.

Questionnaires

The purpose of the questionnaire is to determine the skills required for IT&T graduates and professionals and to assess the relative importance of these skills, from the perspective of IT employers. The questionnaire developed by Van Slyke et al. (1998) is being used with modifications. These modifications are based on the most recent literature on IT skills (Lee et al. 1995, Todd et al. 1995, Becker et al. 1997, McGuire & Randall 1998, Sawyer et al. 1998, Snoke & Underwood 1998, Shawyun 1999, Wynekoop & Walz 1999) and additional skills

have been sourced from the job advertisement analysis. The resulting questionnaire used in this study includes a wider range of job skills that appear to be reflective of today's market.

The questionnaire has so far been distributed to 60 people. Although participants have not chosen at random, they are seen to represent a wide cross-section of IT&T employers, including government, commercial software developers, consulting and recruitment agencies. The skill groups given in the questionnaire include: specific technical skills (programming, operating systems, networking); general IS skills; business-related skills; non-technical ('soft') skills; and personal attributes. Respondents are asked to rate each individual skill on a scale of 1 (not important) to 5 (critical) for both IT&T graduates and professionals.

Interviews

The purpose for the interviews is to explore, in greater detail, views on information systems management practices, skill requirements and the competitive environment of IT organisations in Australia. Interviews will provide further substantiation for the skills identified in the questionnaire. More importantly however, the interviews will allow us to explore the combination of skills taken into account when employment decisions are being made. So far, interviews have been conducted with an IT recruiter and software developer, therefore the results presented here are preliminary in nature. Further interviews with at least six people from other IT areas are being scheduled.

RESULTS

Job advertisements

In total, 39950 known positions and 5360 unknown advertisements were counted (Figure 2). There were 11 editions of The Australian analysed between 20 April and 29 June 1999; 7 editions of The Weekend Australian analysed between 1-2 May and 3-4 July 1999; and 6 editions of The Courier Mail analysed between 22 May and 3 July 1999.

Newspaper	All Positions (incl. Grads)		Graduate Positions	
	<i>Known (no. of posns)</i>	<i>Unknown (no. of ads)</i>	<i>Known (no. of posns)</i>	<i>Unknown (no. of ads)</i>
The Australian (Tuesday)	37548	5119	102	21
Weekend Australian (Saturday)	22	3	0	0
The Courier Mail (Saturday)	2380	238	12	1
Total	39950	5360	114	22

Figure 2: Total number of positions and advertisements analysed

The results indicate that, of the known positions advertised for graduates, 78% specified mainly non-technical skills. Just over half of known advertised positions required specific technical skills (58%) and only about one-third mentioned general technical skills (33%). Of course, many positions contained a mixture of each of these skill groups. The majority of known jobs were permanent positions (97%) placed by recruitment agencies (85%).

Known positions for practising professionals, on the other hand, specified technical skills (81%) as a requirement for the position, with non-technical and general skills required for only one-third (33%) of positions. There was a considerably higher percentage of contract positions

(40%) available, compared to just 3% for graduates. The majority of known professional positions were also advertised by recruitment agencies (92%).

Questionnaires

To date, 25 responses to the survey have been received. These respondents came from a wide range of IT&T employers and covered all the various industry sectors. Each skill group will be considered separately. Non-technical skills was the highest rating skill group for both graduates and professionals (Figure 3) and there was a trend for the mean rating to be slightly higher for professionals than for graduates for each skill group. The figures in parentheses throughout the following section refer to the mean ratings for graduates (Grad) and professionals (Prof). Skills with mean scores between 4.00 and 5.00 were considered highly rated and very important, whereas skills with mean scores between 1.00 and 2.00 were considered to have a low rating and relatively little importance.

Skill group	Graduates		Professionals	
	<i>Mean</i>	<i>sd</i>	<i>Mean</i>	<i>sd</i>
a) Non-technical skills	4.16	0.45	4.23	0.43
b) Personal attributes	3.73	0.42	4.00	0.45
c) Networking	3.46	0.42	3.94	0.40
d) General IS skills	3.42	0.57	3.77	0.40
e) Business-related skills	3.17	0.29	3.89	0.26
f) Programming languages	2.76	0.95	3.01	0.91
g) Operating systems	2.54	1.23	2.81	1.14

Figure 3: Mean ratings for graduates and professionals for each skill group

Programming skills: Programming skills as a group had a medium rating (Figure 3f), however specific programming languages, such as Java (Grad: 3.88, Prof: 3.96) and C++ (Grad: 3.71, Prof: 3.96), were considered important skills to have.

Operating systems: This skills area was not considered of critical importance for either graduates or professionals (Figure 3g), but knowledge of Unix (Grad: 4.06, Prof: 4.20), Windows NT (Grad: 4.06, Prof: 4.32) and Windows 95/98 (Grad: 3.88, Prof: 4.00) was highly regarded.

Networking: This group rated the highest out of all the specific technical skill groups (Figure 3c), particularly for client/server (Grad: 4.12, Prof: 4.40) and Windows NT (Grad: 3.82, Prof: 4.32) skills. This was not a surprising result, considering the prevalence of network systems from small businesses to multi-national corporations and industry.

General IS skills: The group means for graduates and professionals indicated these skills were considered quite important (Figure 3d). Some individual skills were highly rated for both graduates and professionals. These were structured programming (Grad: 4.18, Prof: 4.08), systems analysis and design (Grad: 3.94, Prof: 4.48) and database concepts (Grad: 4.00, Prof: 4.12). The skill with the lowest rating was metrics and measurement (Grad: 2.71, Prof: 3.08).

Business-related skills: This group of skills as a whole was considered of medium to high importance for graduates and professionals (Figure 3e). Several individual skills were considered important for professionals, such as understanding business areas (4.40), project management (4.28) and user interviewing (4.04).

Non-technical skills: These skills were given the highest ratings compared to other groups (Figure 3a). Several individual skills were considered critical for both graduates and professionals, including an ability to work in groups (Grad: 4.94, Prof: 4.80), problem solving ability (Grad: 4.71, Prof: 4.80), critical thinking (Grad: 4.53, Prof: 4.60), oral communication skills (Grad: 4.76, Prof: 4.52) and written communication skills (Grad: 4.47, Prof: 4.60). However, the majority of skills listed in this group were considered important and rated scores above 4.00.

Personal attributes: This was the second-highest rated skill group (Figure 3b), with the most important personal characteristics being ethicality (Grad: 4.29, Prof: 4.52), integrity (Grad: 4.29, Prof: 4.64), reliability (Grad: 4.24, Prof: 4.64) and self-motivation (Grad: 4.18, Prof: 4.52). Other important attributes were a realistic outlook (Grad: 4.06, Prof: 4.40), an ability to adapt (Grad: 4.06, Prof: 4.36), team orientation (Grad: 3.94, Prof: 4.24) and a sense of responsibility (Grad: 3.94, Prof: 4.36).

Interviews

The findings from this skills study so far, particularly those relating to non-technical skills and personal attributes, will be used to guide the direction of interviews. However, the two interviews conducted so far have resulted in agreement with many important points regarding skills, adaptability, motivation and experience in the workplace. The following text includes quotations from the interview transcriptions.

In order to survive in the “loose and fluid” internal structure of an e-commerce company, people need to be “quite flexible individuals who are open to ideas...can cope with the changing environment...and be really good communicators”. Further, in the IT industry, there is a shortage of people with “good documentation skills” to accurately record the new developments that are occurring. Many programmers possess the English level of a “Year 10 high school student” and thus do not have the skills to document effectively.

There appears to be greater demand for database administrators, due to the rapid growth of databases and the struggle to handle such a vast amount of data and data manipulation with current systems. It is becoming “a really big specialist area, whereas before it was a much smaller area”.

There is also demand for “designers and code cutters”. Clients are looking for “creative people”, who can “do the system design”, are “very strong coders” and can “manipulate code”.

Roles in IT are changing and becoming more “multi-faceted”. Whereas once you used to be “just a computer programmer”, now a “programmer doesn’t only have to program”. The position may now involve project management, which means client liaison, talking to users, documenting what is being done and checking documentation from other people.

People need to be able to transfer their existing skills from one area to another and “demonstrate they have the ability to learn to apply themselves”. It is becoming increasingly expensive for employers to train employees, so they are tending to turn to people who are willing to teach and learn themselves. There is “no room for apathy”, so “candidates have to keep themselves educated”.

Clients generally require graduates to have some work experience, whether the graduate “goes out and dabbles and develops web pages for their friends or does a little bit of holiday work”. It is “more work place experience rather than actual particular programming experience [and]

needs to be more general rather than specific". People also need to have a good work ethic, turn up to work on time, be able to speak to people and show respect for fellow workers.

The IT industry is "very subject to supply and demand" and is "not so restrictive anymore". Graduates, especially, need to realise that "it's getting more competitive...so, they need to be prepared".

CONCLUSIONS

The preliminary results from the analysis of job advertisements and questionnaires suggests that non-technical or 'soft' skills, such as interpersonal communication, the ability to work with others, adaptability and self-motivation, were considered more important than technical skills for graduates in terms of employment prospects. Although positions for graduates requested some technical ability, non-technical skills were considered essential and explicitly mentioned. This perhaps reflects the fact that IT employers do not expect recent graduates to possess much technical and industry experience and hence, more importance is given to non-technical skills.

This was in contrast to professional IT practitioners, who were more likely to be evaluated by employers on their specialist technical abilities. Non-technical skills were required for some positions advertised, however the majority of positions were highly technical in nature. This is despite the fact that, for IT professionals, non-technical skills were given a higher rating on the questionnaires than technical skills. The interviews with the two IT employers also highlighted the importance of non-technical skills in the current IT work environment with references made towards flexibility, adaptability, motivation and good communication as the skills most sought after.

The results from this study reflect those from similar studies done in the United States. Respondents in the United States rated 'soft' skills and basic technical skills more important than specialised technical skills for evaluation of recent graduates and also as IS professionals advance in their careers (Van Slyke et al. 1998). Students themselves also felt that employers placed more importance on 'soft' skills and that general technical skills were considered more relevant than skills relating to specific technologies (von Hellens et al., 2000). These findings will be discussed further in another paper exploring cross-cultural comparisons of IT skill requirements.

REFERENCES

- AIIA (1999) Australian Information Industry Association Media Release: Communique from the Second IT&T Skills Summit, 2nd September 1999, URL <http://www.aiia.com.au/2Media/2MR990902.html>.
- Athey, S. and Wickham, M. (1995-1996) Required Skills for Information Systems Jobs in Australia, *Journal of Computer Information Systems*, Winter 1995-1996, 60-63.
- Becker, J.D., Insley, R.G. and Endres, M.L. (1997) The Effects of Customized Communication Skills Training on Undergraduate Information Systems Majors, *Proceedings of the 1997 ACM SIGCPR Conference*, San Francisco, USA, 3-5 April 1997, 49-61.
- Department of Communications, Information Technology and the Arts, Department of Education, Training and Youth Affairs, Department of Employment, Workplace Relations and Small Business and Department of Immigration and Multicultural Affairs

- (1998) Skill Shortages in Australia's IT&T Industries, URL <http://www.noie.gov.au/docs/skills/skills.html>.
- Echols, M. and Gupta, U.G. (1998) Recruiting and Retention of Information Systems Professionals in Nebraska: Issues and Challenges, *Proceedings of the 1998 ACM SIGCPR Conference*, Boston, USA, 26-28 March 1998, 28-32.
- Freeman, P. and Aspray, W. (1999) *The Supply of Information Technology Workers in the United States*, Computing Research Association (CRA), Washington.
- ITAA (2000) Bridging the Gap: Information Technology Skills for a New Millennium. A Study Conducted by the Information Technology Association of America, April 2000.
- Lee, D.M.S., Trauth, E.M. and Farwell, D. (1995) Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation, *MIS Quarterly*, 19(3), 313-340.
- McGuire, E.G. and Randall, K.A. (1998) Process Improvement Competencies for IS Professionals: A Survey of Perceived Needs, *Proceedings of the 1998 ACM SIGCPR Conference*, Boston, USA, 26-28 March 1998, 1-8.
- NOIE (National Office for the Information Economy) (1999) Future Demand for IT&T Skills in Australia, 1999-2004, URL <http://www.noie.gov.au/publications/publications.htm>.
- Sawyer, S., Eschenfelder, K.R., Diekema, A. and McClure, C.R. (1998) IT Skills in the Context of BigCo., *Proceedings of the 1998 ACM SIGCPR Conference*, Boston, USA, 26-28 March 1998, 9-18.
- Shawyun, T. (1999) Expectations and Influencing Factors of IS Graduates and Education in Thailand: A Perspective of the Students, Academics and Business Community, *Informing Science*, 2(1), 19-32.
- Snoke, R. and Underwood, A. (1998) Generic Attributes of IS Graduates - A Queensland Study, *Proceedings of the 9th Australasian Conference on Information Systems*, University of New South Wales, Sydney, 29 September - 2 October 1998, 615-623.
- Todd, P.A., McKeen, J.D. and Gallepe, R.B. (1995) The Evolution of IS Job Skills: A Content Analysis of IS Job Advertisements From 1970 to 1990, *MIS Quarterly*, 19(1), 1-28.
- Van Slyke, C., Kittner, M. and Cheney, P. (1998) Skill Requirements for Entry-Level IS Graduates: A Report from Industry, *Journal of Information Systems Education*, 9(3), 7-11.
- von Hellens, L., Van Slyke, C. and Kittner, M. (2000) A Comparison of Australian and American Students' Perceptions of IT Job Skills, forthcoming in *Proceedings of the 2000 Information Resources Management Association International Conference*, Anchorage, USA, 21-24 May 2000.
- Wynekoop, J. and Walz, D.B. (1999) Characteristics of High Performing IT Personnel: A Comparison of IT Versus End-User Perceptions, *Proceedings of the 1999 ACM SIGCPR Conference*, New Orleans, USA, 8-10 April 1999, 209-218.

ACKNOWLEDGEMENTS

The authors would like to thank the people who kindly responded to the questionnaire and the IT professionals who agreed to be interviewed. Thanks also go to Craig Van Slyke for allowing the use of his survey instrument as a basis for our questionnaire. This study was conducted with the assistance of a National Teaching Development Grant.

COPYRIGHT

Liisa von Hellens, Sharon Wong, and Jo Orr (c) 2000. The authors assign to ACIS and educational and non-profit institutions a non-exclusive licence to use this document for

personal use and in courses of instruction provided that the article is used in full and this copyright statement is reproduced. The authors also grant a non-exclusive licence to ACIS to publish this document in full in the Conference Papers and Proceedings. Those documents may be published on the World Wide Web, CD-ROM, in printed form, and on mirror sites on the World Wide Web. Any other usage is prohibited without the express permission of the authors.