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TECHNICAL SKILLS NEEDED IN SOFTWARE DEVELOPMENT - A SNAPSHOT FROM 2002

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ABSTRACT

In the rapidly changing Information Technology (IT) industry, the software development skills sought after from IT professionals by employers are changing according to new emerging technologies. This on-going research project aims to maintain the awareness of the Bachelor of Applied Information Systems (BAppIS) degree curriculum at the Universal College of Learning (UCOL) to new trends by exploring the specific technical skills required in the New Zealand IT industry. The research method applied is the case study method, where data is collected by visiting different IT companies and interviewing software developer professionals. An orally administered questionnaire - which lists 19 technical skills categories with sometimes multiple skill items currently in demand - is used to collect both qualitative and quantitative data. The participants were asked if the particular skill was required from them when they were hired and currently when fulfilling their daily duties and to rank the importance of the skills used. The second part of the questionnaire contains three open - ended questions to gather qualitative data. This paper reports on the findings of the most recent data collection. The most striking trend is the dramatic growth in complexity of skills necessary to fulfil the demands of the job. The same number of responses could be found for: testing, 3rd generation programming skill and office/email/groupware skills in both 'when hired' and 'currently' categories; but all the rest of the technical skills are of greater importance now than at the time of hiring. In the case of the research participants, it seems that the majority were hired for the "hard core" technical skills, but presently many are expected to practice project management, systems analysis and telecommunication skills. Currently, senior software developers' ranked structured systems analysis skills, information gathering techniques/client consultation skills together with object-oriented programming languages as the most important compared to testing and procedural programming skills as the most important when the participants received their employment. Another finding is that the web development skills, data warehousing knowledge and object-oriented analysis skills are not yet generally expected from this company's employees, although these skills have made a "debut". From the collected qualitative data the opinion emerged that "business re-structuring" generally causes more anxiety than the projects technical deadline.

Keywords

IT Education and research, IT skill requirements, technical skills, software development

1. INTRODUCTION

Much has been emphased about the vocational nature of New Zealand polytechnic teaching and its

aim to produce employable graduates (Young, Senadheera & Clear, 2001; Snell, Snell-Siddle & Whitehouse, 2002; Bekesi & Gardner, 2002). To enter or re-enter the workforce and have a beneficial professional life are usually the aspiration of the new students on any of our computing courses. Lecturers measure their courses success by the numbers of employed graduates. The vast majority of IT graduates become employed in analyst/programmer, network or database administrator positions. Over the last seven years there was only one UCOL BAppIS degree graduate who started in a purely IT management position (personal knowledge). So, for most graduates to be able to enter into the local IT industry, good technical skills are needed - a justification for this on-going research on technical skills in software development currently used in the New Zealand IT industry.

This paper aims to answer the question 'what technical skills are software developers currently using in their daily job?' by means of interviewing employees of a large software company.

2. BACKGROUND AND RESEARCH METHOD

This research was started in 1997, with the aim of maintaining the responsiveness within the BAppIS degree at UCOL to changing industry needs by identifying the technical skill sets used in software development in New Zealand. The research uses the case study design method and the observer-as-participant research technique (Bekesi & Hanson, 1998). To ensure consistency in data collection, focused interviews were conducted with each research participant by using an orally administered questionnaire to collect both qualitative and quantitative data from the research participants. This questionnaire plays a pivotal role as it should be an up-to-date list of the most required technical skills, two updates have been made to this data collection instrument over the years to fit the changing situations (Bekesi & Gardner, 2002). Presently the questionnaire lists 19 technical skill categories (some with multiple skill items), an asterisk shows the technical skills incorporated in 2002 (Table 1). In the interviews, the participants were asked if the particular skill was required from them both when they were hired and currently when fulfilling their daily duties (yes or no), and if yes, to rank the importance of the skills on 1 - 10 scale (the lowest possible score is 1). The second part of the questionnaire contains three open - ended questions to gain participant's views on skills currently required in the IT industry; important technical skill not mentioned in the questionnaire; and what general skills required to succeed in the IS industry?

3. RESEARCH PARTICIPANTS IN 2002

After three years break from visiting software developer companies, the latest data collection took place over two days, in October 2002. The company researched was a large New Zealand software developer company and six software developers were interviewed. Despite the general setback experienced in the IT industry worldwide, this organisation has managed to maintain their profit margins and correspondingly very attractive salary packages for their employees. This success comes from a well-paced organisational re-structuring and having cutting edge technology for highly motivated and well - educated staff. Before the visit, the information sheet, questionnaire, and the following definition was sent to the participating company:

A software developer is defined as a person who performs some or all of feasibility studies, software project planning, requirements elicitation and analysis, high level design, detailed program design, coding, testing, debugging, documentation, implementation, and maintenance of commercially oriented information systems (Bekesi, 1997:7).

4. FINDINGS

Results from the questionnaire are summarised in Tables 1 and 2; and the collected qualitative data on the participants' comments on the three open-ended questions of the questionnaire are given in Appendix 1.

Table 1 shows the number of positive answers received from the six research participants on whether the particular skill contributed to their employment when hired and when used currently during their daily job.

Table 2 ranks the importance of the listed technical skills when hired and currently, based on the average score. For example, 'Testing' ranked the most important technical skill when getting the job, (6.50 average score), but in their current role, this skill is 5th along with the third generation programming skill.

5. ANALYSIS

The most striking trend is that the complexity of the skills necessary to fulfil the demands of the job has dramatically grown. The same number of 'Yes'

Table 1: Participants positive responses to the particular skills when hired and currently; an asterisk (*) shows skills incorporated in 2002.

CATEGORY		Item	Job Skill Required (Number of 'Yes' responses received from the six research participants.)	
			When hired	Currently
1	Project management skills	Long – term planning*	1	5
		Systems lifecycle management	1	5
2	Telecommunications and networking concepts	Telecommunications & networking concepts	1	6
		LAN administration*	1	3
3	Systems analysis and design techniques	Structured systems analysis	4	6
		Information gathering techniques/client consultation skills*	2	6
4	Object Oriented Analysis & Design	Unified Modeling Language*, Rational Unified Process*	-	2
5	Database design & DBMS programming	Relational (e.g. MS Access)	3	4
		Object – Oriented* (e.g. JADE)	-	1
6	Operating systems	System software and support* – in PC	2	4
7	Client/server applications	e.g. Oracle	-	4
8	Office/email/groupware		5	5
9	3rd generation (3GL) procedural programming	A specific programming language	4	4
10	3rd generation (3GL) object-oriented programming	A specific programming language	4	5
11	Testing		5	5
12	Internet/e-commerce development	Web design	1	3
13		Web development	-	3
14		Integrating with other applications	1	4
15	Data warehousing		-	1
16	GUI design	Human behaviour and computer interaction	3	4
17	Technical specialist knowledge	eg Microsoft Certified Solution Developer	-	1
18	Technical writing		1	1
19	Ergonomics		2	5

Table 2: Ranking the importance of technical skills when hired and currently

Category	Item	Importance of category/item when hired and currently score 1 = low 10 = high			
		When hired	Rank	Currently	Rank
Testing		6.50	**1**	6.00	**5=**
3rd generation (3GL) procedural programming	A specific programming language	5.50	**2**	6.00	**5=**
Office/email/groupware		5.00	**3**	5.83	**7=**
GUI design	Human behaviour and computer interaction	4.33	**4**	5.83	**7=**
Systems analysis and design techniques	Structured systems analysis	3.83	**5=**	7.50	**1**
3rd generation (3GL) object-oriented programming	A specific programming language	3.83	**5=**	7.16	**2=**
Database design & DBMS programming	Relational (e.g. MS Access)	2.66	**7**	5.50	**10=**
Systems analysis and design techniques	Information gathering techniques/client consultation skills	2.50	**8**	7.16	**2=**
Project management skills	Systems lifecycle management	2.16	**9=**	6.33	**4**
Ergonomics		2.16	**9=**	5.83	**7=**
Operating Systems	System software and support – in PC	2.00	**11=**	4.50	**12=**
Internet/e-commerce development	Integrating with other applications	2.00	**11=**	4.50	**12=**
Technical writing		1.83	**13**	2.16	**22**
Project management skills	Long – term planning	1.16	**14=**	4.50	**12=**
Telecommunications and networking concepts	Telecommunications & networking concepts	1.16	**14=**	5.50	**10=**
Telecommunications and networking concepts	LAN administration	1.16	**14=**	3.16	**19**
Object Oriented Analysis & Design	Unified Modeling Language, Rational Unified Process	1.00	**17=**	3.66	**16=**
Database design & DBMS programming	Object – Oriented DBMS (e.g. JADE)	1.00	**17=**	1.66	**23**
Client/server applications	e.g. Oracle	1.00	**17=**	4.50	**12=**
Internet/e-commerce development	Web design	1.00	**17=**	3.66	**16=**
Internet/e-commerce development	Web development	1.00	**17=**	3.66	**16=**
Data warehousing		1.00	**17=**	2.50	**20=**
Technical specialist knowledge	eg Microsoft Certified Solution Developer	1.00	**17=**	2.50	**20=**

answers could be found for testing, 3rd generation programming skill and office/email/groupware skills in both 'when hired' and 'currently' categories; but all the rest of the technical skills are of greater importance now than at the time of hiring. In the case of the research participants, it seems that the majority were hired for the "hard core" technical skills, but presently many are expected to practice project management, systems analysis and telecommunication skills. The newer skills (web development, data warehousing knowledge and object-oriented analysis) are not yet generally expected from this company's employees, but these skills have made a debut.

When hired, the core technical skills expected from the employees were testing and procedural programming. Currently, senior software developers' ranked structured systems analysis skills, information gathering techniques/client consultation skills together with object-oriented programming languages as the most important. Also, there is a notable increase in the importance of project management skills, this is the first time that 'long-term planning' has been included in the questionnaire and is already ranked 12th (Table 2). Results of the ranking of technical skills matched with the comments given by participants (Appendix 1). One of the general motifs in the answers to the open - ended questions that good programming skills are essential to become employed, but later, in more senior position systems analysis and project management skills are gaining more importance. Another general opinion that emerged is that the research participants do not feel generally under stress because of their project (technical) deadline, but rather from business re-structuring and organisational change. Also, it was not surprising to find that research participants keep on learning new skills on their jobs and emphasis the need for good interpersonal skills.

Version/change control management was the only technical skill identified that was not incorporated in the questionnaire. However, it can be debated whether that skill belongs to the project management category or is an independent skill.

6. CONCLUSIONS

The aim of this on-going research is a "reality check" in more than one way - to record changes in trends in the IT industry; compare currently used technical skills to currently taught skills and to pick up the 'vibes' on the New Zealand job market. Having the opportunity to talk to industry practitioners of IT and access to these people in their own working environment proved especially useful during the process. All currently used technical skills listed in the questionnaire are part of the BAppIS curricula, true to the traditional vocational nature of the New Zealand polytechnic teaching. This research shows that the training given to a polytechnic student gives a good skill base for their initial job when a new graduate and the skills to cope with future challenges.

REFERENCES

Bekesi, E. (1997). Technology-related skills used in software development - a New Zealand case study. Palmerston North: Manawatu Polytechnic.

Bekesi, E., & Gardner, N. (2002, September). Changing industry needs: Keeping information systems research updated. In N. Bridgeman (Ed.), APNZ Research Conference (pp. 17-23). Palmerston North: UCOL.

Bekesi, E., & Hanson, M. (1998). Technical skills in software development: The responsiveness of an IS degree programme to changing industry needs. The New Zealand Journal of Applied Computing and Information Technology, 2(2), 7-16.

Snell, S., Snell-Siddle, C. & Whitehouse, D. (2002, July). Soft or hard boiled: Relevance of soft skills for IS professionals. In S. Mann (Ed.), Proceedings of the 15th Annual Conference of the National Advisory Committee on Computing Qualifications (pp. 403-408). Hamilton: NACCQ.

Young, A.L., Senadheera, L., & Clear, A.G. (2001). Trends in knowledge, skills and abilities: An industry perspective. Journal of Applied Computing and Information Technology, 5(1), 77-83.

APPENDIX 1 - COLLECTED QUALITATIVE DATA

All the research participants had a university education and had been employed in the IT industry for a period of 5-25 years. Many of them also had worked overseas.

Interview 1

"A" is the Service Delivery Manager. The research participant describes this job as being responsible for the implementation of a software development

programme and to manage 15 people through all stages of the projects.

Participant's comments on specific skills listed in the research questionnaire

"I need 80% people skills and 20% broad business and specific technical skills. I have to have only a general understanding on networking, systems analysis, databases/programming, but not the detailed technical knowledge, and I can rely on my excellent technical people for keep me updated in the changing technology."

What general skills are required to succeed in the IS industry?

"General skills used and needed at my position just as same as everywhere else: ability to coordinate people in a timely manner and I, personally, do not find the IT industry especially stressful. One of the hardest tasks is for an IT manager is to keep the technical staff interested and involved. It is very important to give them every chance to develop on their area of interest otherwise the employee would move on soon.

We usually hire people through agencies. There are two parts to a job interview - one with technical peers and one general with me and with other project managers. I do not look for technical geniuses but someone with real interest in technology and able to understand project requirements and who is able to initiate technical solutions and do not treat this job at my company from 9 - 5; but would go any extra miles needed. Also I highly value self-discipline in my people - not to leave the programme to be written for the last minute and test the work before passing it on. It is also very important for programmers to know when to ask for help and be able to get along with people from all cultures.

IT industry is a new one, has got to learn a lot from other (engineering) industries on standards and tighter project contract. Over the years programming has been mystified to certain extent, that resulted in IT industry overpaid its employees. As the technology becomes more and more accessible to the society in general this trend should become more realistic. At this moment, I feel, people are still being overpaid compared to other professionals."

Interview 2

"B" is Senior Software Engineer. The research participant describes the job responsibilities as to liaison with customers in a technical level and to produce software which meets the requirements.

Participant's comments on specific skills listed in the research questionnaire

"C and C++ programming languages are used."

What general skills are required to succeed in the IS industry?

"The most important attributes to the success are the genuine interest in IT and persistence to see through a project. Having the right technical skills are important when getting the first job, and people skills later if promoted. Now I am in a technical management position the only career path for me is getting into people management - to progress onto a project management position."

Interview 3

"C" is Senior Software Developer - a technical leader who also looks after other developers."

Participant's comments on specific skills listed in the research questionnaire

"C, Delphi and C++ are used as the specific programming languages. "

What general skills are required to succeed in the IS industry?

"The most important "skill" is to have the right attitude. Of course one must be a good programmer and must be flexible enough to get along with others. There are loads of extra hours to work, which are not a problem for me. I only find the business re-structuring periods especially stressful."

Interview 4

"D" is Senior Software Developer who describes this job as supporting and developing new features for an existing system.

Participant's comments on specific skills listed in the research questionnaire

"Most of us know that the analysis and design phase is the most important phase in software

development - but in practice that phase that gets skipped. There never seems to have enough time for a proper analysis/design job. The legacy system I work with never had formalised design documentation - I used to ask around people when running into difficulty."

What general skills are required to succeed in the IS industry?

"Interpersonal skills are very important when working in a team: listening to one another and respecting others ideas if those are the better ones. Being able to stay positive, learning continuously and enjoy the challenge of daily problem solving help to stay motivated. Finding the simplest possible way to programme the requirements - not make the solution unnecessarily complex just to show off - is very important to make maintenance work easier. I also find I feel competitive with myself and more and more compassionate with my colleagues."

Interview 5

"E" is a Technical Leader. The research participant describes this job providing detailed design skills and mentoring other developers.

Participant's comments on specific skills listed in the research questionnaire

"I was hired as a tester; and currently Delphi is the specific programming language that I use."

What general skills are required to succeed in the IS industry?

"I think what is the most important is being passionate about the technical work and to be able to take initiatives that would take the project ahead. People skills are not that important to start with, but with promotions - having management skills becomes more and more vital part of this job. Of course there is stress around deadlines, but that is part of life at any project work."

Interview 6

"F" is a Technical Leader. The research participant describes this job as to provide technical leadership and mentoring in software development project.

Participant's comments on specific skills listed in the research questionnaire

"None."

Important technical skills not mentioned in the questionnaire

"Maybe version/change control management in software engineering."

What general skills are required to succeed in the IS industry?

"The ability to continuously learn and general problem solving skills are more important than specific technical knowledge. Of course very strong programming skills are necessary for getting a job. I find this industry very competitive. Lately the stress comes from the changed general situation of the IT industry, there are not as many jobs available as there used to be. The lack of predictability causes lot of anxiety among the programmers. I do like the IT industry, even after 25 years work, and I can envisage myself working in it in 5 years time, too."