

A SURVEY TO DEFINE THE SKILL SETS OF SELECTED INFORMATION TECHNOLOGY PROFESSIONALS

Paul J. Kovacs, Robert Morris University, kovacs@rmu.edu
Gary A. Davis, Robert Morris University, davis@rmu.edu
Donald J. Caputo, Robert Morris University, caputo@rmu.edu
John C. Turchek, Robert Morris University, turchek@rmu.edu

ABSTRACT

The traditional higher education system remains important to the education and training of the information technology (IT) workforce. Diverse responsibilities and jobs within the IT field entail different skill sets and levels of knowledge. As the information technology profession continues to grow, educators are challenged to meet employer needs by maintaining the currency and relevance of IT education. This paper reports survey results of IT professionals' perceptions of what skill sets in IT are considered to be important and not important in relation to the current workforce. Specific areas of IT related Skill Set Areas, such as programming languages, networking, and project management are examined through survey responses. The responses identify the key Skill Set Areas considered to be important to higher education curricular offerings in Information Technology related programs.

Keywords: IT Proficiencies, IT Skill Sets, IT Curriculum Development, Relationships of Academe and the Professions

INTRODUCTION

The traditional higher education system remains essential to the education and training of the information technology (IT) workforce. Diverse responsibilities and jobs within the IT field entail different skill sets and levels of knowledge. Because of the dynamic nature of Information Technology, the IT employee is now expected to engage in a life-long retraining effort. The higher educational system has a major role, offering seminars, short courses, and groups of courses that lead to certificates in specialized aspects of information technology, such as network administration or project management.

Staying current in a changing technological landscape is a challenging and ongoing undertaking for educators in higher education in relation to developing courses and programs. In order to meet the challenge confronting each institution of higher education that prepares Information Technology

professionals, data must be continually collected and analyzed to ascertain the relevancy and the adequacy of its programs and courses [9]. These data traditionally have been gathered many ways. One technique is the analysis of job advertisements [13] regionally and/or nationally. Such analysis can be either static or dynamic/longitudinal [8] in design. Another technique involves surveying the needs of employers [6, 7, 11] either on a regional [3, 4, 10, 12] or national basis. Assuming that most academic institutions have degree programs, which largely serve a metropolitan area around them, the regional basis may be of most interest to institutions with accredited programs. In an era of outcomes-based accreditation [2], institutions must gather continuous feedback from employers in order to assess if their specific degree programs are meeting its objectives. Those employed in Information Technology can provide constructive feedback concerning skills and levels of knowledge necessary for their jobs. These skills can then be incorporated into the Information Systems curricula of colleges and universities.

The objectives of this study are to (1) identify those IT skill set areas that are important; (2) map important skill set areas to employment categories; and (3) identify the most important skills with each skill set area.

SURVEY APPROACH

The survey was developed based on a literature review and input from Association of Information Technology Professionals (AITP) and Corporate Education Career Services. The survey was pre-tested with several CIS faculty members and IT industry professionals resulting in several modifications. The survey was mailed during the period of April through May 2005. Of the 141 surveys mailed, 97 (68%) were returned. The returns of 16 surveys were not included in the study because the respondents reported imprecise data. The unusable responses reduced the number of usable returns from 97 to 81 (57%). The number of unique organizations/corporations surveyed in this sample was 70. In a few cases, those corporations having large and diverse IT departments

(with multiple supervisors and managers in various departments or divisions) provided more than one response per corporate entity.

The survey included two sections. Section I collected data regarding the demographics of the study sample including IT experience, corporate hierarchical level, IT service, degrees attained and current professional status. Section II collected data concerning curriculum and the development of proficiencies associated with Information Technology.

It should be noted that this study is based on the responses of individuals involved with Information Technology in business, industrial, governmental, and service organizations from one geographic region. This region was Southwestern Pennsylvania. In a survey of 40,000 technology companies nationwide, the region involved in this survey ranked favorably with other regions that are similar in size, economic growth, demographics, economics, and maturity of information technology [1].

SAMPLE DEMOGRAPHICS

The two largest components of the sample were from the Education & Health Services Industry (23.5%) and Manufacturing (22.2%), followed by Financial Activities such as Banking and Insurance (18.5%)

and Information Services (12.3%). The remaining industries represented include Utilities, Transportation, Business Services, Retail and Government.

The size of the respondents' employers ranged from five employees to 142,000 employees. More than one-half of the individual respondents (55.6%) reported that they held a Master's Degree; 33.4% held a Bachelor degree and 7.4%, a Doctorate. The years of experience section was more evenly distributed, with the highest percentage occurring between five to ten years (22.2%) followed by two to five years and fifteen to twenty years (19.8%) for each.

Table 1 illustrates the IT Employment Categories of the sample. As indicated in the table, IT Managers, Project Leaders, and Programmer Analysts comprised 60.5% of the sample. Database Administrators, Network Administrators, Systems Analysts, and Technical Support made up 25.9% of the sample and only two respondents indicated an Employment Category of Multi-Media/Graphics Designer. The *Other* category made up 11.1% of the sample and included roles such as Teachers and Consultants. All of the respondents within the *Other* category were included in the study because they did indicate significant time spent in the IT profession.

Table 1. IT Employment Categories

Category	Absolute Frequency	Relative Frequency (%)
IT Manager	24	29.6
Project Leader	14	17.3
Programmer/Analyst	11	13.6
System Analyst	7	8.6
Network Administrator	5	6.2
Technical Support	5	6.2
Database Administrator	4	4.9
Multimedia/Graphics Designer	2	2.5
Other	9	11.1
Total	81	100.0

DATA ANALYSIS

Skill Set Areas

Section II of the questionnaire solicited responses to determine the specific IT Skill Set Areas that the respondents consider to be *important* or *not important*. A breakdown of the six Skill Set Areas included were as follows:

1. Programming Languages – Visual Basic, C++, C#, Java, COBOL
2. Web Development – HTML/XML, Javascript, FrontPage, Dreamweaver, PERL, PHP, ASP.net
3. Network Administration – LAN Administration, Network Technology Manager (N+), Network Security

4. Personal Productivity Software – Word Processing, Spreadsheets, Database, Presentations
5. Project Management – Managing IT Projects, Production Scheduling, Supervising Personnel
6. Systems Development – Process Modeling, Data Modeling, Object Modeling/UML, CASE Tools

These data were analyzed by calculating mean values for each Skill Set Area, based on the following scale: 0 = *not important*; 1 = *important*.

Table 2 provides a breakdown of the responses according to perceived values. The *important* column arranges the Skill Set Areas from most important to least important.

Table 2. Comparison of Respondents' Perceived Importance of Skill Set Areas in IT

Skill Set Area	Not Important		Important	
	n	%	n	%
Personal Productivity Software	0	0.0	81	100.0
Project Management	9	11.1	72	88.9
Network Administration	10	12.3	71	87.6
Systems Development	25	30.9	56	69.1
Programming Languages	28	34.6	53	65.6
Web Development	28	34.6	53	65.5

A review of Table 2 reveals that the most important Skill Set Area is Personal Productivity Software (100%), which included word processing, spreadsheets, presentation graphics, and database software. Project management was the next significant Skill Set Area reported as important by over three-quarters (88.9%) of the responses. Network Administration was the third highest Skill Set Area (87.6%) to be reported as important.

Important Skill Set Areas Related to Employment Categories

A further analysis of the data was conducted to compare important Skill Set Areas by Employment Category. The results of this comparison are presented in Table 3.

Table 3. Comparison of Important Skill Set Areas by Employment Category

	Personal Prod. Software %	Project Mgmt. %	Network Admin. %	Systems Develop. %	Web Develop. %	Programming Languages %
Programmer/Analyst	100.0	100.0	100.0	45.4	54.5	72.7
Project Leader	100.0	87.5	92.8	85.7	71.4	78.5
IT Manager	100.0	100.0	95.8	91.6	87.5	79.1
Database Administrator	100.0	100.0	100.0	100.0	25.0	100.0
Network Administrator	100.0	80.0	60.0	60.0	20.0	60.0
System Analyst	100.0	71.4	71.4	42.8	71.4	42.80
Technical Support	100.0	10.0	100.0	80.0	6.0	60.0
Multimedia/Graphics	100.0	44.4	11.1	11.1	11.1	0.0
Other	100.0	44.4	11.1	11.1	11.1	0.0

A review of Table 3 reveals that Personal Productivity Software was 100% important, regardless of Employment Category. Project management was 100% important for IT Managers, Database Administrators and Programmer/Analysts and was ironically only 87.5% important for Project Leaders. Network administration skills also were deemed 100% important by three employment categories. Web development was the only Skill Set

Area not to be deemed 100% important for any one of the employment categories.

Ranked Importance of Individual Skill Sets

As part of the present study, a final analysis was conducted to determine the relative importance of individual skill sets. Table 4 breaks down the individual Skill Sets within each of the six Skill Set

Areas. The Skill Sets are ranked in the table below by perceived importance, within each Skill Set Area category.

Table 4. Information Technology Skill Sets, Ranked by Importance

Skill Set Area	Skill Set	Ranking	Importance	
			n	%
Programming Languages	Visual Basic	1	54	66.7
	Java	2	52	64.1
	C++	3	43	53.0
	COBOL	4	33	40.7
	C#	5	31	38.3
Networking	Network Design	1	70	86.4
	LAN Administration	2	68	83.9
	Network Security	3	67	82.7
Web Development	HTML / XML	1	68	83.9
	JavaScript	2	67	82.7
	FrontPage	3	51	62.9
	Dreamweaver	4	38	46.9
	ASP.Net	5	34	41.9
	PHP	6	23	28.3
Personal Productivity Software	Word Processing	1	80	98.7
	Spreadsheets	2	79	97.5
	Presentation	2	79	97.5
	Database	3	76	93.8
Project Management	Supervising Personnel	1	76	93.8
	Managing IT Projects	2	74	91.3
	Production Scheduling	3	59	72.8
System Development Tools & Technologies	Data Modeling	1	57	70.3
	Process Modeling	2	55	67.9
	CASE Tools	3	44	54.3
	Object Modeling/UML	4	40	49.3

As depicted in Table 4, Visual Basic ranked most important (n = 54) out of all Programming Languages represented in the study. In the Networking Skill Set Area, Network Design was perceived to be most important (n = 70). In the Web Development Skill Set Area category, respondents ranked HTML/XML as the most important (n = 68) web development language. Word Processing ranked most important (n = 80) out of the four personal productivity software skills included in the study. For the Project Management Skill Set Area, respondents reported Supervising Personnel as most important (n = 76). Finally, in the Systems Development Tools and Technologies Skill Set Area, Data Modeling was ranked most important (n = 57).

CONCLUSIONS

The six categories in the Skill Set Areas relate directly to core information systems courses required in ABET-CAC accredited information systems

degree programs that are tightly coupled to AITP's IS-2002 model curriculum [5].

The first objective of the present study was to identify those Skill Set Areas that are perceived to be important by the respondents. As the research revealed, Personal Productivity Software, Project Management, and Network Administration were reported as the first, second, and third most important Skill Set Areas, respectively (see Table 2). Additionally, the respondents were asked to indicate whether they had obtained a professional certificate. Only 17 of the 81 respondents reported that they currently held a professional certificate. Of the 17 certifications, only ten were within IT.

The second objective of the research built upon the first objective by mapping Skill Set Areas to individual Employment Categories. All Employment Categories included in the study reported Personal Productivity Software as important. Project

Management and Network Administration were considered to be the second most important Skill Set Areas by most of the Employment Categories in the study (see Table 3).

Finally, the third objective of the research sought to identify those specific IT skills that are most important to employers in each of the six Skill Set Areas. According to the findings, employers ranked the following Skill Sets as most important in each of the six Skill Set Area categories: Visual Basic (Programming Languages), Network Design (Networking), HTML/XML (Web Development), Word Processing (Personal Productivity Software), Supervising Personnel (Project Management), and Data Modeling (Systems Development Tools and Technologies). The rankings for all Skill Sets are listed in Table 4.

In an effort to best prepare graduates and to best serve IT-related employers, colleges and universities should emphasize those Skill Set Areas that are regarded as important by employers. Based on the findings of the present research, colleges and universities should emphasize Personal Productivity Software, Project Management, and Network Administration within their IT curricula. More specifically, colleges and universities should place particular emphasis on the aforementioned skills within each Skill Set Area category. Further, colleges and universities should continue to collaborate with industry in order to recognize those skills that are most essential in the workplace. In short, the most responsive and receptive IT degree programs will be the programs that best prepare graduates for the IT workforce of today and tomorrow.

REFERENCES

1. Creedy, S. (1995, August 22). High tech poll high on city: Pittsburgh rates well in software job growth. *Pittsburgh Post Gazette*, p. B7.
2. Criteria for Accrediting Information Systems Programs (Effective for evaluations during the 2006-2007 accreditation cycle), Computing Accreditation Commission, ABET, Inc., Approved October 29, 2005.
3. Crossroads Development Group (2004). University information technology program evaluation. Robert Morris University Executive Summary.
4. Guzzo, M. (2003). Committed to IT. *Pittsburgh Business Times*, 23(2), 21.
5. IS 2002 model curriculum and guidelines for undergraduate programs in information systems. (2002). Retrieved June 8, 2004, from IS 2002 Web Site: <http://www.aisnet.org/curriculum/>
6. Jiang, J., Udeh, I., & Hayajneh, A. (Spring 1994). Employers' expectations of incoming graduates: From recruiters' views. *Journal of Computer Information Systems*, 57-59.
7. Lee, D., Trauth, E., & Farwell, D. (1995). Critical skills and knowledge requirements of IS professionals: A joint academic/industry investigation. *MIS Quarterly*, 19(3), 313-340.
8. Maier, J. L., Clark, W. J., & Remington, W. J. (Fall 1998). A longitudinal study of the management information systems (MIS) job market. *Journal of Computer Information Systems*, 37-42.
9. Modzelewski, E. (2001, June 27). Tech jobs go begging for lack of workers in area. *Pittsburgh Post-Gazette*, p. C1.
10. Paytas, J. (December 2001). Southwestern Pennsylvania industry executive summary: Southwestern Pennsylvania industrial cluster analysis. *Pittsburgh Technology Council*.
11. Richards, T., Yellen, R., Kappelman, L., & Guynes, S. (1998). Information managers' perceptions of IS job skills. *Journal of Computer Information Systems*, 38(3), 53-57.
12. Smith, D. F., et al. (December 2001). The education needs: Southwestern Pennsylvania industry cluster analysis. *Pittsburgh Technology Council*.
13. Todd, P., McKeen, J., & Gallupe, R. B. (1995). The evolution of IS job skills: A content analysis of IS job advertisements from 1970 to 1990. *MIS Quarterly*, 19(1), 1-27.