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In this issue:

Analyzing the Progression of IS/IT Keywords as Assessed by a Regional Trade Association

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EDSIG activities include the publication of ISEDJ and JISAR, the organization and execution of the annual ISECON and CONISAR conferences held each fall, the publication of the Journal of Information Systems Education (JISE), and the designation and honoring of an IS Educator of the Year. • The Foundation for Information Technology Education has been the key sponsor of ISECON over the years. • The Association for Information Technology Professionals (AITP) provides the corporate umbrella under which EDSIG operates.

Analyzing the Progression of IS/IT Keywords as Assessed by a Regional Trade Association

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Abstract

The rapid developments in Information Technology continue to drive the need for Information Technology practitioners to keep their skills up to date. Educational institutions with Information Technology and computer related programs of study must also keep current of the new technologies as they prepare students to enter the job market. This paper analyzes data from the corporate community to determine what specific changes have occurred in IS/IT job skills and job postings over a three year period from October 2003 to October 2006. Specifically, this study seeks to determine if jobs postings between 2003 and 2006 have changed at a level that is statistically significant.

Keywords: IS/IT workforce, IS/IT skills requirements, University Corporate Relationships, IS/IT Curriculum Development

1. INTRODUCTION

The rapid developments in Information Technology continue to drive the need for Information Technology practitioners to keep their skills up to date. Educational institutions with Information Technology and computer related programs of study must also keep current of the new technologies as they prepare students to enter the market. Specifically, this study seeks to determine if jobs postings between 2003 and 2006 have changed at a level that is statistically significant.

Identifying what specific changes have occurred in IS/IT job skills and the job market requires the collection and analysis of data. A number of research approaches have been undertaken, for example, one method involves an analysis of job advertisements nationally and/or regionally using data from localized newspapers and job listings from Fortune 500 Company Web sites or from Internet job databases such as Monster.com and HotJobs.com (Athey & Plotniki, 1998; Koong, et al, 2002; McKeen and Gallupe, 1995). Such analysis can be either static or dynamic/longitudinal in design and can be useful in determining how IS/IT skills have changed over time (Maier, Clark, & Remington, 1998). Another approach involves surveying the needs of employers either on a regional or national basis (Jiang, Udeh, & Hayajneh, 1994; Lee, Trauth, & Farwell, 1995; Richards, Yellen, Kappelman, & Guynes, 1998). Finally, survey research directed at IS/IT faculty in higher education has been undertaken to determine their as-

sessment of "required" versus "achieved" IS/IT skills in academic programs (Tang, Lee, & Koh 2001; Trauth, Farwell, and Lee, 1993).

This study utilizes the analysis of regional job advertisements that solicit resumes by the use of certain skill keywords. The objectives of the study were to determine the following:

- Did available IS/IT positions increase from 2003 to 2006 and, if so, was the increase statistically significant?
- Did the demand for certain IS/IT skill categories increase from 2003 to 2006 and, if so, was the increase statistically significant?
- Did the demand for specific IS/IT skill keywords increase from 2003 to 2006 and, if so, which skill keywords?

The results of this research should be of interest to IS/IT practitioners who seek to advance their skills and further their professional development. The results of this study will also be useful to educational institutions who want to remain competitive in their curriculum design and IS/IT course offerings. Finally, students will find this study helpful in the identification of essential skill sets that are useful in the selection of IS/IT tracks and elective courses.

2. PREVIOUS STUDIES AND FINDINGS

A previous empirical investigation identified and categorized IS/IT skills and abilities (Kovacs, Caputo, Turchek, & Davis, 2006). The first objective of the study identified those Skill Set Areas that are deemed as *important*. The results revealed that Personal Productivity Software, Project Management, and Network Administration were reported as the first, second, and third most important Skill Set Areas, respectively. Additionally, only 17 of the 81 respondents reported that they currently held a professional certificate. Of the 17 certifications, only ten were within IS/IT.

The second objective of the study mapped Skill Set Areas to individual Employment Categories. All Employment Categories included reported Personal Productivity Software as *important*. Project Management and Network Administration tied for the second most important Skill Set Areas by most of the Employment Categories.

The third objective of the study identified those specific IS/IT skills that were most important to employers in each of 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).

Another study obtained input from IS/IT professionals concerning IS/IT competencies directly related to the curriculum requirements specified in the Accreditation Board for Engineering and Technology – Computing Accreditation Commission (ABET-CAC) accreditation standards for information systems degree programs (Davis, Caputo, Kovacs, & Turchek, 2006). The IS/IT professionals surveyed ranked eight categories of competencies by level of importance and by level of criticality. Not only did all of the respondents rate *Professional* (non-technical) competencies as being important, they ranked it the most critical for both entry-level/new hires as well as for current employees.

Additional findings revealed that *IT Fundamentals*, which included personal productivity software skills, information systems fundamentals, and discrete math as the second most important competency area for both entry-level/new hires and current employees as well. With respect to the competency areas deemed *no importance*, the results for the two focus groups were not as symmetrical. For entry-level/new hires, *Management* (23.5%) had the highest ranking of *no importance* for new hires/ entry-level employees; and *Software Development* (16.6%) had the highest ranking of *no importance* for current employees. The second and third competency areas deemed *no importance* for entry-level/new hires were *Software Development* (16.6%) and *Web and Multimedia* (16.0%). *Systems Development* (13.6%) and *Web and Multimedia* (13.6%) were second and third, respectively, for current employees.

3. POPULATION AND SOURCE OF DATA

The population for this study included member organizations of the Pittsburgh Technology Council (PTC). The PTC is one of the largest regional trade associations of its kind in the nation and has been the major connection point for companies from four primary clusters of the technology industry including Information Technology, Advanced Manufacturing/Materials, Biomedical, and Environmental Technology.

The data for this study originated in the Information Technology cluster, which includes participants from more than 750 IT companies in Southwestern Pennsylvania. These companies provide products or services focused on hardware, software, Internet, telecommunications and professional services and represent the full continuum ranging from small, young entrepreneurial organizations to large, well-established corporations. The IT cluster also crosses professional disciplines within the IS/IT sector and includes engineers, programmers, marketers, human resource professionals, financial and sales professionals, managers, administrators and executives.

Although the data in the current study were intended to provide insight into the demand for IS/IT skills in the region serviced by the PTC, the findings of the study may be generalized to other geographic regions that are similar in terms of demographics, economics, and maturity of information technology. CorpTech (a Massachusetts-based survey organization) placed the PTC region as one of the nation's top ten areas for software job growth and high-tech job growth (Creedy, 1995). In the survey of 40,000 technology companies nationwide, this region ranked near the Cleveland and Cincinnati regions in size and economic growth. The PTC region also ranks high in information technology due to considerable advances in healthcare information systems (Guzzo, 2003; Landro, 2002).

4. RESEARCH METHODS

In order to answer the research questions in this study, the authors focused specifically on the number of available positions from archival data provided by the PTC. These data were comprised of keywords that prompted resumes from applicants with associated IS/IT skills. The counts of specific keywords (and resulting categories) found in job postings were regarded as direct indicators of available IS/IT positions that require the associated skills.

Some keywords directly related to a specific IS/IT skill, such as Visual Basic.Net, Oracle, or JavaScript. Conversely, some keywords such as Internet, GUI, or Wireless did not directly relate to a specific IS/IT skill. The keyword postings from October 2003 were compared to keyword postings from October 2006 and included 112 individual keywords. The keywords were carefully examined to ensure that no duplication or omission of data existed. The 112 keywords were then classified into 15 Categories. In order to develop the 15 Categories, existing classifications from ABET (Accreditation Board of Engineering and Technology), ACM (Association for Computing Machinery), and AIS (Association for Information Systems) job categories were used as guidelines. Specific keywords that did not directly relate to an IS/IT skill were placed in a category called *Other.* Table 1 (in the Appendix) shows the resulting Skill Categories, as well as the number of associated job postings in each year of the study.

The available keyword data were entered into SPSS for statistical analysis. SPSS was used to determine any existing change and the percentage increase (or decrease) in the data from 2003 to 2006. Further, the Pearson Chi-Square test was used to determine the statistical significance of any existing change between 2003 and 2006 data. The Pearson Chi-Square was selected as a nonparametric test for determining the significant difference between proportions of the two groups of keyword data involved in this study. A nonparametric test was needed since the job posting data did not follow a normal distribution.

In order to rank individual Job Skill Keywords within each Skill Category, SPSS was used to determine any existing change and the percentage increase (or decrease) in individual Job Skill keywords between 2003 and 2006. The Job Skill Keywords were then ranked in descending order from most substantial change to least substantial change.

5. FINDINGS

Table 2 (in the Appendix) shows the relative proportion of keywords posted in a particular year, grouped by Category. More specifically, the *2003* and *2006* columns of the table represent the percentage of the total number of keywords that fall into a specific category. The *Average* column indicates the average percentage of the total number of keywords for both years in the study. The *Change* column represents the relative change in proportion of keywords from 2003 to 2006.

From 2003 to 2006, five of the 15 categories showed a positive net change in proportion. One category (Vendor Software) remained constant during the two years of the study, and nine categories showed a negative net change in proportion. Additionally, the overall net change in keywords, regardless of specific categories, was statistically significant between 2003 and 2006, x2(1,111)=602.40, p=.000.

To further analyze the data, the statistical significance of each individual category was examined. Table 3 (in the Appendix) lists the individual categories that showed a statistically significant change in number of keywords between 2003 and 2006. The categories Web Development, Operating Systems, Database, Security, Productivity, and Multimedia/Graphics contained sufficient keyword data to compute the Pearson Chi-Square statistic. The remaining nine categories had an insufficient number of cases to compute the Pearson Chi-Square statistic.

Table 4 (in the Appendix) shows the relative proportion of keywords used in a particular year. More specifically, the *2003* and *2006* columns of the table represent the percentage of the total number of keywords. The *Average* column indicates the average percentage of the total number of keywords for both years in the study. The *Change* column represents the relative change in proportion of keywords from 2003 to 2006. This table represents the top 20 keywords (out of the 112 total), according to net positive change in proportion. The keywords are sorted in the table from greatest to least change in net proportion.

6. DISCUSSION OF RESULTS

This research sought to answer the following questions: 1) Did available IS/IT positions increase from 2003 to 2006 and, if so, was the increase statistically significant?, 2) Did the demand for certain IS/IT skill categories increase from 2003 to 2006 and, if so, was the increase statistically significant?, and 3) Did the demand for specific IS/IT skill keywords increase from 2003 to 2006 and, if so, which skill keywords?

To address the first research question, the job posting data from the PTC did indeed show a statistically significant change in available IS/IT positions from 2003 to 2006, $x^2(1,111)=602.40$, $p=.000$. This increase in available IS/IT positions is consistent with contemporary research on the topic. Lee (2006) found "real evidence" that the IS/IT job market is improving since the dot-com bust, as well as IS/IT starting salaries, p. 49. The Bureau of Labor Statistics has also reported that the number of people in the IS/IT workforce has rebounded (Bailey & Mitchell, 2007).

The second research question addressed the categorization of IS/IT keywords. The current research showed a statistically significant change in the number of keyword categories, for six of the 15 categories included in the study. Web Development showed the most significant change out of the six categories, $x^2(1,22)=149.13$, $p=.000$. Of the keywords in the Web Development category, all 23 showed an increase in the number of postings between 2003 and 2006. In the Operating Systems category, seven out of the ten keywords showed an increase in the number of postings for the time periods in question. Only MVS, Windows NT, and Windows 2000 showed a decrease within the Operating Systems category. The Database category (ranking third in significance of change) contained four keywords: DB2, mySQL, Oracle, and MS-SQL. Oracle and MS-SQL dominated the Database category with the highest number of keywords in 2003 and 2006. All keywords in the Database category, however, showed an increase in occurrence between 2003 and 2006.

The third research question looked at individual keywords in comparison to all IS/IT keywords in the study. As expected, keywords showing the greatest change in pro-

portion belonged to the categories that showed statistically significant changes from 2003 to 2006. Referring to Table 4, Javascript, CSS, DHTML, PHP, and Shell Scripting (all within the Web Development category) were among the keywords that showed the greatest change in proportion from 2003 to 2006.

In addition to the proposed elements of this study, certain ancillary findings resulted from the analysis of the research data. Perhaps the most surprising finding was the omission of COBOL as a keyword in the 2003 and 2006 job posting data. This was surprising in light of the rising number of requests made to the University to fill full-time and part-time/internship positions involving COBOL programming. Although COBOL was not referenced in the data, many non-mainframe programming languages (i.e., C#, Java, and Visual Basic) had a high number of occurrences in the 2003 data. These languages also showed a significant increase in occurrence in the 2006 data.

Another interesting finding in the current research was the omission of the Microsoft Office suite within the Productivity category. Ironically, Lotus and Domino were referenced in the research data; although, both were associated with small levels of demand.

A last (albeit, very important) ancillary finding in the data involved the Communication Skills category. Previous research has identified soft skills (e.g., communication and team building) to be as vital, if not more vital, than technical skills in an IS/IT position (Bailey and Mitchell, 2007; Cappel, 2001; Van Slyke, Kittner, & Cheney, 1998). Referring to Table 3, Communication Skills may have resulted in a statistically significant increase; however, the Chi-Square statistic could not be utilized since the Communication Skills category contained only one case. However, Communication Skills is noteworthy since it comprised the largest proportion of all keywords for both years in the study; 667 occurrences or 8.6% of the overall total of 7757 keywords.

7. CONCLUSION

In summary, the present study demonstrated that the number of IS/IT keywords related to job postings has significantly increased between 2003 and 2006. This increase indicates a healthier job market for IS/IT positions in the PTC region. If the region represented by the PTC is a true indicator of the national IS/IT job trend, then the demand for IS/IT positions within the U.S. is on the rise. Second, the category Web Development showed the largest increase in proportion of keywords posted and also exhibited the highest Chi-Square value for statistical significance. Last, although not a specific research topic of this study, Communication Skills surfaced as a keyword and a set of skills that is highly valued by the organizations that employ today's IS/IT professionals.

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APPENDIX

Table 1. IS/IT Keywords by Year, Grouped by Category

Category	*2003*	*2006*	*Total*
Programming Languages	575	1506	2081
Web Development	292	1221	1513
Operating Systems	259	523	782
Database	170	528	698
Networking	111	568	679
Communication Skills	172	497	669
Project Management	90	267	357
Security	66	266	332
Business Intelligence	28	149	177
Certification	28	64	92
Systems Analysis and Design	26	62	88
Other	42	41	83
Multimedia/Graphics	31	43	74
Vendor Software	17	53	70
Productivity	19	43	62
Totals	1926	5831	7757

Table 2. Proportion of IS/IT Keywords by Year, Grouped by Category

Category	*2003*	*2006*	*Average*	*Change*
Web Development	15.%	20.%	19.%	5.8%
Networking	5.8	9.7	8.8	4.0
Security	3.4	4.6	4.3	1.1
Business Intelligence	1.5	2.6	2.3	1.1
Database	8.8	9.1	9.0	0.2
Vendor Software	0.9	0.9	0.9	0.0
Project Management	4.7	4.6	4.6	–0.1
Productivity	1.0	0.7	0.8	–0.2
Systems Analysis and Design	1.3	1.1	1.1	–0.3
Certification	1.5	1.1	1.2	–0.4
Communication Skills	8.9	8.5	8.6	–0.4
Multimedia/Graphics	1.6	0.7	1.0	–0.9
Other	2.2	0.7	1.1	–1.5
Programming Languages	29.9	25.8	26.8	–4.0
Operating Systems	13.4	9.0	10.1	–4.5
Totals	100.0	100.0	100.0	0.0
	(*n* = 1926)	(*n* = 5831)	(*N* = 7757)	n/a

Note: For analysis results, $x^2 = 602.40$, $df = 111$, $p < .001$.

Table 3. Pearson Chi-Square for Categories

Category	x^2	*df*	*Sig.*
Web Development	149.13	22	.000
Operating Systems	118.89	9	.000
Database	11.39	3	.010
Security	9.82	3	.020
Productivity	6.58	1	.010
Multimedia/Graphics	5.73	1	.017

Note: The Skill Categories *Programming Languages, Networking, Communication Skills, Project Management, Business Intelligence, Certification, Systems Analysis and Design, Other,* and *Vendor Software* had an insufficient number of cases to compute the Pearson Chi-Square statistic.

Table 4. Proportion of Top 20 IS/IT Keywords by Year

Keyword	*2003*	*2006*	*Average*	*Change*
Internet	0.0%	2.3%	1.7%	2.3%
IP	0.0	1.5	1.1	1.5
JavaScript	0.0	1.4	1.0	1.4
Linux	1.2	2.3	2.0	1.0
Security	2.8	3.6	3.4	0.9
Shell Scripting	0.0	0.8	0.6	0.8
Data Warehousing	0.2	0.9	0.7	0.8
CSS	0.0	0.7	0.6	0.7
LAN/WAN	0.6	1.4	1.2	0.7
PHP	0.0	0.7	0.5	0.7
Apache	0.0	0.6	0.5	0.6
Firewall	0.0	0.6	0.4	0.6
Python	0.0	0.6	0.4	0.6
DB2	0.0	0.5	0.4	0.5
Cognos	0.0	0.5	0.4	0.5
PeopleSoft	0.0	0.4	0.3	0.4
Wireless	0.0	0.4	0.3	0.4
DHTML	0.0	0.4	0.3	0.4
PMI Certification	0.2	0.5	0.4	0.3
Intranet	0.0	0.3	0.2	0.3
All Others	95.0	79.7	83.5	-15.3
Totals	100.0	100.0	100.0	0.0
	(n = 1926)	(n = 5831)	(N = 7757)	n/a

Note: For analysis results, $x^2 = 602.40.77$, $df = 111$, $p < .001$.