

TECH SKILLS IN TEN U.S. CITIES: COMPARING JOB NEEDS IN A CHANGING WORLD

Marcy Kittner
University of Tampa
mkittner@ut.edu

Raymond Papp
University of Tampa
rpapp@ut.edu

Abstract

This study is a survey that identifies those IS skills which are in the greatest demand in various cities around the United States. Classified ads appearing in the cities' major newspapers during Fall 2003 were examined. This paper analyzes these findings and compares them to the technology skills which employers from other regions (e.g. Mid-Atlantic states, New England states, and the Tampa Bay area) have deemed important. It also suggests curriculum implications for information systems educators with respect to new programs and course creation as well as directions for future research.

Keywords: Information technology skills, jobs, job needs assessment, IS curriculum.

Introduction

The past decade has witnessed numerous changes in hiring opportunities in the IS field. Many factors have contributed to this phenomenon and will continue to affect IS hiring opportunities. These include an increase in the U.S. population, a more diverse labor force, a requirement for a higher level of education and training, and changes in the IS industry itself (Occupational Outlook Handbook, 2002-03; Moody, J.W., et al, 2003). Changes in the global and domestic economies have also affected hiring in the U.S. Changes in the IS industry will be exacerbated because many companies have projects that have been on hold because of a lack of confidence in the economy (Zetterbert, R.L., 2003).

Students and faculty alike are aware of the volatile demand for skilled knowledge workers with a strong background in technology concepts. A challenge faced by university faculty curriculum committees is to assess their current program and course offerings to determine which skills are still applicable and which, if any, need to be added to the curriculum. In the past, there has been an "expectation gap" between industry needs and academic preparation (Trauth, E.M.; Farwell, E.W.; and Lee, D., 1993), therefore, information available for better planning curriculum needs is useful.

To better understand this changing demand for technology-literate workers, a survey of major newspapers in Atlanta, Chicago, Dallas, Denver, Los Angeles, New York City, Phoenix, Seattle, Tampa, and Washington D.C. was undertaken to determine which skills were in greatest demand by employers in these large cities. This paper will compare current results with those of the previous studies (Jacobson and Armstrong, 1996; Case, Price and Rogers, 1997; Papp, 1998; Papp, 2002) to determine the magnitude of the changes and how educators should prepare for current and future changes.

Previous studies have looked at the classified ads for trends and skills. A recent study on the Southeast U.S. (Papp, 2002) and studies of other regions such as the Middle Atlantic states (Jacobson and Armstrong, 1996) and New England (Papp, 1998) has suggested that the classified ads can be used to gauge demand for technology jobs. This paper will use a methodology similar to that undertaken by Jacobson and Armstrong (1996), Case, Price and Rogers (1997), and Papp (1998). It will focus on demand for skills similar to the earlier studies, but focus on several major cities throughout the United States.

Methodology

This study has attempted to determine which IT skills are in demand by employers by analyzing classified ads for information systems jobs using major newspapers from large cities across the United States. Ads from both the actual printed classifieds as well as the Internet web sites of these newspapers were included.

The papers selected for this study included the Sunday edition of the Atlanta Journal-Constitution, Chicago Tribune, Dallas Morning News, Denver Post, Los Angeles Times, New York Times, Arizona Republic, Seattle Times, Tampa Tribune and Washington Post. These ten cities were chosen as a basis for comparison as each represents a different geographic region of the United States.

Following the coding of previous studies (Jacobson and Armstrong, 1996; Case, Price, and Rogers, 1997; Papp, 1998; Papp, 2001), more than one hundred criteria were used to group several categories such as general job skills, information systems skills, programming languages, hardware platforms and operating systems, database skills, networking topologies and structures, application packages, specialized development software and educational backgrounds. The same coding methodology was employed as that used by Jacobson and Armstrong (1996):

The study was limited to ads for business-oriented IS positions placed by organizations for their own work force and to ads placed by consulting firms who hire individuals to work for them. If the advertisement was for a specific number of positions, with a particular set of skills, the need for those skills was tallied for that number. However, when the number of positions to be filled was not indicated, the skill was tallied only once (p. 45).

Thus, by using a similar classification scheme, it becomes possible to compare the demand for positions and skills among cities and time periods and also allows for replication of the study in the future. To address reliability concerns and enable comparison with earlier studies on different regions, all information systems ads were scanned and only those ads that met the criteria noted above were included. Ads for IS sales positions, teachers, and non-technical personnel were not included in the survey.

Results

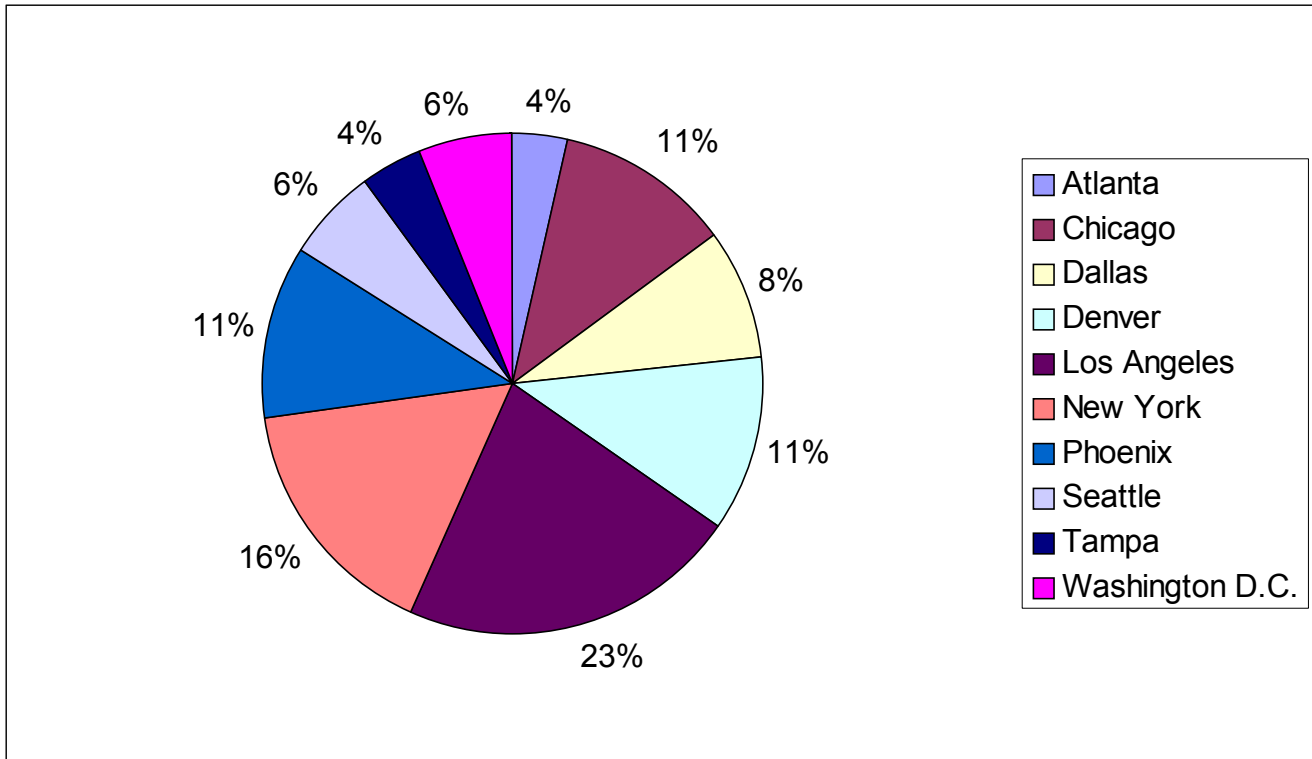


Figure 1. Technology Jobs By City: September – December 2003

Information systems advertisements appearing in the ten papers on each Sunday in September, October, November, and December of 2003 resulted in a total of 1098 jobs. The ads were analyzed using the methodology described above and the results were tabulated and analyzed using an Excel spreadsheet.

With respect to general job skills, those in the greatest demand across all cities surveyed were interpersonal and communication skills. Denver, New York and Seattle employers also requested a high level of coordination and project management knowledge. This supports earlier studies in that “soft skills” continue to be deemed important by employers (Cappel, 2001-2002). Table 1 illustrates the percentage of ads requesting each of the specific skills mentioned.

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
Coordination & Project Mgmt.	5%	10%	7%	16%	12%	21%	5%	18%	9%	15%
Interpersonal Communication	20%	19%	19%	16%	14%	6%	10%	29%	18%	20%
Analytical & problem solving	5%	5%	8%	9%	9%	18%	5%	12%	11%	2%
Non-specific IS Skills	32%	0%	0%	3%	0%	0%	0%	2%	11%	3%

Table 1. General Job Skills

With respect to specific information systems skills, those in greatest demand were design and development skills. There was also lesser demand for hardware and software implementation as well as networking and telecommunications skills than in previous studies. Atlanta was the only region that did not follow this trend and had much higher demand for these skills than other regions. Database administration skills continue to be fairly strong and consistent across all regions. Table 2 delineates the most common IS skills.

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
Design &	17%	13%	10%	44%	16%	34%	12%	20%	18%	11%

Development										
Hardware & Software Implementation	22%	6%	7%	21%	13%	9%	7%	17%	2%	2%
Networking & Telecommunications	20%	5%	5%	6%	3%	2%	5%	5%	4%	8%
Database Administration	12%	11%	12%	13%	13%	11%	3%	11%	9%	20%

Table 2. Information Systems Skills

The educational background requested by most employers was that of a bachelor's degree. This is in line with previous studies of other regions (Case, Price, and Rogers, 1997; Jacobson and Armstrong, 1996; Papp, 1998 & 2002). The demand varies among regions, however, with the Southern cities requiring a bachelor's degree about half as often as the Northern cities. There was also a greater demand for employees with advanced degrees than in previous years' studies. The number of years of experience continues to rise as more and more employers are requesting three or more years of experience. Seattle, Washington and Atlanta require more than four years for approximately one-quarter of all their jobs listed. This demand of more experience appears to be a long-term trend since it was observed in earlier studies (Papp, 1998 and 2002) and appears that it is continuing. Table 3 breaks down the education and training requirements.

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
Bachelor's Degree	37%	27%	45%	36%	44%	48%	20%	38%	20%	74%
Advanced Degree	10%	8%	7%	1%	6%	1%	4%	6%	2%	6%
1-2 Years Experience	5%	10%	10%	9%	10%	30%	17%	18%	16%	23%
3-4 Years Experience	15%	12%	1%	6%	12%	17%	7%	14%	11%	14%
5+ Years Experience	22%	7%	16%	19%	19%	11%	14%	26%	9%	21%

Table 3. Educational/Training and Years of Experience

Previous studies looked at the demand for hardware platforms. In this analysis, there was some mention of mainframe systems and mini- and mid-range systems. This is in line with previous studies of other regions and reflects a nationwide trend in migration toward personal computers and away from mainframe and minicomputers. Specific mention of the AS400 platform has increased over previous studies of other regions (Case, Price, and Rogers, 1997; Jacobson and Armstrong, 1996; Papp, 1998 & 2002) and is needed in New York in particular. Table 4 lists hardware platform requirements.

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
Personal Computer (PC)	2%	1%	3%	2%	3%	16%	1%	3%	4%	3%
AS/400	7%	4%	8%	1%	1%	12%	1%	1%	4%	1%
Mainframe systems	4%	5%	1%	1%	7%	13%	7%	8%	11%	2%

Table 4. Hardware Platforms

Not surprisingly, Windows was the operating system in greatest demand. Windows XP, the current version, along with older versions (2000, NT, 95/98) was requested in many ads. Demand for UNIX has grown and represents a significant increase in popularity over previous studies of other regions. The demand for Novell seems to be a bit stronger in Atlanta, Denver and Tampa than in the past (Case, Price, and Rogers, 1997; Jacobson and Armstrong, 1996; Papp, 1998 & 2002). Linux has been added to the list as a new item as it is beginning to be requested in larger numbers in some cities. Table 5 highlights the Operating Systems demands for each area.

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
Windows XP	7%	12%	4%	1%	2%	6%	2%	11%	1%	6%
Windows 2000	1%	3%	3%	2%	1%	4%	4%	12%	1%	11%
Windows NT	7%	6%	3%	1%	2%	1%	7%	9%	1%	5%
Windows 95/98	10%	9%	19%	2%	9%	7%	15%	22%	4%	22%
Linux	0%	0%	1%	10%	4%	4%	0%	5%	0%	0%
Novell Netware	10%	1%	12%	4%	2%	1%	5%	2%	13%	5%
UNIX	24%	5%	1%	1%	7%	13%	7%	8%	11%	2%
AIX	0%	3%	5%	0%	1%	2%	0%	2%	2%	0%
DOS	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Table 5. Operating Systems

Internet-related languages such as JAVA, JavaScript, C++, Visual Basic and ASP are in high demand in many cities. The growth of the Internet over the past few years is reflected in the demand for these new languages and this is a substantive change from previous findings (Case, Price, and Rogers, 1997; Jacobson and Armstrong, 1996; Papp, 1998). There was little demand for older languages such as COBOL and C. The movement from older procedural languages to new object-oriented languages and especially Internet-based languages seems to be a national trend. Previous studies of the New England region (Papp, 1998), the Southeastern U.S. (Case, Price, and Rogers, 1997; Papp, 2002) and in the Middle Atlantic states (Jacobson and Armstrong, 1996) support this. Table 6 illustrates the breakdown by language.

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
ASP	7%	9%	13%	2%	3%	8%	9%	18%	9%	2%
C	7%	0%	2%	9%	7%	8%	8%	11%	4%	0%
C++	20%	6%	8%	9%	11%	0%	13%	14%	2%	0%
C#	7%	5%	7%	0%	4%	0%	1%	3%	2%	0%
COBOL	7%	0%	0%	0%	2%	0%	2%	0%	2%	0%
Java/JavaScript	17%	0%	7%	9%	21%	4%	12%	12%	11%	7%
VB / VB.Net	20%	2%	3%	1%	4%	11%	10%	14%	2%	5%
HTML/DHTML	7%	5%	2%	2%	0%	23%	7%	12%	7%	3%
XML	0%	0%	2%	1%	3%	5%	0%	2%	0%	2%

Table 6. Programming Languages

Specialized application package needs varied by sub-region. This is also not surprising given the different types of business found in each area. The applications consistently in greatest demand across all regions were SAP, Microsoft Office and Microsoft Exchange. The demand for SAP is noteworthy as it has increased dramatically over the last few years and appears to be a continuing trend (Papp, 2002). This may be a result of the growth of e-commerce and the need to integrate various systems. Table 7 breaks down the applications by region.

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
Front Page	5%	0%	0%	1%	0%	0%	0%	0%	2%	2%
Lotus Notes	5%	13%	2%	0%	0%	1%	0%	2%	0%	2%
MS Office	7%	5%	11%	8%	9%	9%	2%	9%	15%	11%
MS Exchange	17%	3%	10%	1%	2%	1%	2%	2%	3%	3%
PEOPLESOFT	2%	6%	3%	1%	1%	6%	6%	5%	2%	2%
PowerBuilder	2%	0%	1%	0%	0%	0%	1%	0%	0%	0%
SAP	7%	10%	8%	7%	11%	22%	3%	15%	20%	14%
SAS/SPSS	5%	1%	1%	4%	7%	2%	2%	5%	2%	11%
VISIO	5%	4%	5%	0%	0%	6%	2%	2%	2%	3%

Table 7. Software Applications & Specialized Tools

Database skills continue to be a requested skill in all regions. Among the specific systems mentioned, Oracle and Access were in greatest demand. This continues to support a national trend as ads from the Southeastern U.S. (Case, Price, and Rogers, 1997; Papp, 2002), the Mid-Atlantic states (Jacobson and Armstrong, 1996) and New England (Papp, 1998) also demand these skills. SQL continues to be a newly emerging area (Papp,2002). Table 8 illustrates database needs.

Table 8. Database Systems

	Atlanta	Chicago	Denver	Dallas	Los Angeles	New York	Phoenix	Seattle	Tampa	Washington D.C.
Access	10%	4%	4%	2%	2%	4%	3%	2%	11%	2%
dBase	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
DB2	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%
FoxPro	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
IMS	1%	0%	0%	1%	1%	0%	1%	0%	0%	0%
Oracle	22%	1%	1%	1%	1%	1%	0%	2%	2%	2%
Sybase	20%	5%	10%	7%	5%	8%	4%	9%	4%	5%
SQL	5%	1%	3%	1%	13%	2%	2%	1%	1%	5%

Discussion & Implications

Some interesting trends and patterns emerge when job needs are compared across major cities in the United States. Employers continue to seek coordination & project management ability, strong interpersonal & communication skills, and problem solving & analytical competence. This supports findings from previous studies of other regions (Jacobson and Armstrong, 1996; Case, Price and Rogers, 1997; Papp, 1998).

Basic skills are a necessary co-requisite for a position in information systems. Windows (XP, 2000, NT, 95/98) and Unix are the operating systems in greatest demand, although we see Linux for the first time as a needed skill. This, coupled with a movement toward personal computers, mirrors a national trend as firms begin to move programs and data from mainframe systems to a more distributed environment. Programming language needs are also changing. Previous studies have suggested a move toward newer object-oriented languages. The current languages most in demand are those associated with the Internet—ASP, C++, Visual Basic, Java and JavaScript. The emergence of e-commerce has undoubtedly affected this demand. Along the same lines, database skills are also highly sought and Oracle and Access remain the most demanded skills. Demand for SQL and database administrator skills continue to rise, suggesting a need for employees with a strong general background in database. Finally, the number of years of experience required continues to rise, indicative of the changing economic climate that has made it advantageous and, in some cases necessary, to have more experience for these “entry-level” jobs.

The findings in this study present a dilemma for MIS educators. Do we teach the latest hot skills or do we teach concepts that students can adapt to changing requirements and technologies? The authors concur with Case, Price, and Rogers (1997), who suggest that universities must emphasize lifelong learning and students should be provided with a strong conceptual foundation with which they can acquire and adapt to new skill sets to meet changing business needs. Tech skills notwithstanding, there is even greater demand for business skills, especially oral, written, and presentation skills. This is echoed by employers, who have requested these "soft" skills as co-requisites to the obvious "technical" skills.

Employers across the country face many of the same needs. Students with a strong information systems background are few and jobs are available, despite the recent economic downturn. The climate may quickly change as the economy rebounds, according to a recent Tampa Bay Business Journal article (Leavy, 2003).

Companies are currently able to find skilled workers much more easily than they could two years ago. In addition, many companies are not filling IT positions; rather they are having their current IT workers absorb additional responsibilities (Watt, C.E., 2003). This phenomenon, coupled with the rapidly changing IS field, requires job seekers to be able to market their existing skills effectively. This process has also seen significant changes (Canada NewsWire, 2003). Applicants need to understand the employer’s needs and emphasize those rather than their own personal goals (Hill, 2003). They may also need to consider job satisfaction over higher pay or location (Brockmeier, 2003).

As educators, we must do our part to assist students in the learning process and prepare them for the dynamic, global business environment. As employer demands become known, we are better able to prepare today's students for the jobs of tomorrow.

Future Research

Over the past few years, various large cities and regions of the U.S. have been analyzed with respect to information systems job skills and employer needs. This study examined both printed classified ads as well as those appearing on the papers' websites. Future research should consider on-line job sites (e.g. computerwork.com, monster.com, computerjobs.com, etc.) as well as professional organizations to better determine the job skills and employer needs throughout the United States. Studies within the international job markets are also important within our global economy, particularly due to the tightening of the job market within the United States.

Few longitudinal studies have been done relating to the IS skill arena. Todd et. al. (1995) examined the evolution of IS job skills between 1970 and 1990 concluding that there may be a 'need to rethink both educational and recruitment strategies.' Additional longitudinal studies should be conducted in the coming years to determine whether the analyses reported herein are long-term trends or short-term needs. By tracking information skills over time, it will be possible to forecast which skills will likely be needed in the near future, which are in current demand, and also which skills are quickly falling out of favor among employers. Such research will assist universities in development of local courses as well as national MIS curricula to meet the dynamic needs of employers and employees in the next millennium.

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