An Analysis of Skills Required of Graduates of an Information Systems Program

Diane C. Davis

Belle Woodward

The study involves an analysis of the requirements of information systems graduates based on the status of the job market as well as the perceptions of 222 graduates over a six year period from an information systems program of a Midwestern university. Approximately one-third of the graduates were working in positions related to technical support. Providing end-user support, installing software, managing information, and installing and maintaining computer devices/components were the top four tasks performed by the largest number of graduates. Research indicates that employers are looking not only for technical skills but also strong soft skills as competition increases at home and abroad. From a list of 18 technical and nontechnical skills, the graduates ranked thinking skills, personal characteristics, desire to learn, attitude and motivation, teamwork, and communication skills as the top requirements for success in the information technology field.

The fast-paced advance of technology continually reshapes the workplace and motivates educators to improve curriculum. One of the main educational goals is preparing graduates for the workplace. Successfully accomplishing this goal is a challenge in all fields, but perhaps more so with information systems (IS) and information technology (IT). This is due in part to the constantly evolving IT landscape with its emerging technologies and advanced business computer systems. Such ongoing innovative development leads to highly variable and transient job requirements. As the field continues to change and evolve at an incredibly fast pace, faculty knowledge of the most current workforce needs is paramount. It is essential not only to identify these newly required positions, but also the specific tasks and responsibilities needed for each of these new jobs. This also requires educators to modify and update their curriculum and instruction regularly so that their students acquire the skills and knowledge requisite to performing these tasks in the current workplace. A steady supply of IT professionals to the business community is necessary for our nation to remain competitive in the global market, and educators must train and support the next generation of IT specialists.

In an attempt to analyze the skills needed and the job market of the next few years, many in the IT field use surveys or interviews to gather feedback from business professionals. For example, in a study conducted by *Computerworld*, 1,137 IT professionals indicated that the two biggest threats to their jobs and careers were outsourcing and the difficulty of keeping skills up to date (Fanning, 2006). The study also revealed that 91% of those surveyed stated that "they would learn a new technical skill to help ensure prolonged employment" (Fanning, 2006, p. 1). According to Challenger, Gray, and Christmas, U.S. college graduates in 2006 had the best job market since 2001, and business and computer

Diane Davis is Professor, School of Information Systems and Applied Technologies, Southern Illinois University Carbondale, Carbondale, Illinois.

Belle Woodward is Assistant Professor, School of Information Systems and Applied Technologies, Southern Illinois University Carbondale, Carbondale, Illinois.

graduates were in the top five careers in highest demand ("U.S. October layoffs," 2006). Studies like these help educators stay current and manage content in the classroom in order to incorporate valuable information on current threats, challenges, and opportunities students will face as graduates of IS programs. Some educators also survey graduates to identify skill sets performed in the workplace. Surveys of graduates, along with analysis of perceptions of which skills are most important, contribute to validating classroom content. This information can be used by faculty to help them revise and improve curricula and better prepare students for the changing workplace.

Purpose and Research Questions

This study elaborates on workplace experiences gathered from graduates of an IS program at a Midwestern university. Specifically, the purpose was to identify the types of jobs and tasks performed by the graduates, to identify their perceptions regarding the importance of various skills in the curriculum, and to compare the status of males and females in such areas as time taken to obtain employment, salaries, primary job focus, and perceptions of importance of various technical and nontechnical skills.

Analysis of this type of data can contribute to improvement in the performance of an IS curriculum. Postgraduation surveys are an effective means to evaluate the value of education gained. Such surveys can also assess institutional excellence, providing valuable feedback on graduates' experiences in the workplace and how higher education impacted the students' experience (Andero, 2000). Graduates who have completed a program are often able to evaluate its effectiveness and make comments regarding content areas to be included in the curriculum once they are in the workforce.

The research questions were:

1. On average, how much time do graduates spend obtaining positions after graduation, and is there a significant difference between males and females in the time taken?
2. What are the salaries of the graduates' first information systems jobs, and is there a difference in salaries between males and females?
3. What are the main areas of job focus (career fields) of the graduates, and is there a difference between males and females?
4. What are the main types of tasks that the graduates perform on a regular basis, and is there a difference between males and females?
5. What are the graduates' perceptions regarding the level of importance of specific technical and nontechnical skills, and is there a difference between males and females?

Review of Literature

Overall Job Market

The overall job market is getting stronger as seen in the reduction in job cuts and layoffs. In November 2006, U.S. employers had 708,406 job cuts, which was 18% less than the cuts in the first 10 months of the year ("U.S. October layoffs," 2006). The planned layoffs in the U.S. also fell by 31% in October compared to September 2006 ("U.S. October layoffs," 2006). This is a good sign for the job market for 2006 and 2007 college graduates. Predictions for the future vary, however. Based on a survey of IT executives conducted by the staff of *Computerworld*, flat budgets and slow hiring were forecast for the year ahead ("2007 vital signs," 2007). According to Robert Half International's annual study (2007) on hiring and compensation trends, business growth is the most significant reason for an increase in the hiring of IT personnel. Strong indications over multiple quarters have shown that chief information officers (CIOs) are optimistic about the prospect of hiring more personnel, and executives at firms with more than 1,000 employees foresee a 23% net increase in levels of staffing (Robert Half Technology, 2007).

IT Job Market and Required Technical Skills

According to Daniel Hecker (2005), an economist formerly in the Office of Occupational Statistics

and Employment Projections at the Bureau of Labor Statistics, as organizations continue to use more sophisticated and complex technologies, the demand for computer-related occupations should increase. Three of the 10 fastest growing occupations projected for 2004 through 2014 are network systems and data communication analysts, computer software engineers (applications), and computer software engineers (systems software) (U.S. Bureau of Labor Statistics, 2005).

In a study conducted by Chao and Shih (2005) that analyzed 484 job advertisements for nonprogramming IT professionals posted on Monster, CareerBuilder, and HotJobs from August through October of 2004, five job categories were identified. These five were end-user support (45.2%), business analyst (37.2%), training (6.8%), web and interface design (6%), and technical writing (4.8%). Subcategories under end-user support were generalist, network and systems administrator, manager, customer service, and network administration. Subcategories under business analyst were systems analyst, manager, quality assurance, consultant, and technical support. The skills and knowledge needed for end-user support varied based on the subcategory, which ranged from network hardware and software knowledge; to installing, configuring, maintaining and troubleshooting LANs, and WANs; project management; and effective communication skills. Chao and Shih stated that the job posting of the business analyst job category had the greatest variability and broadest set of skill requirements for one category. These ranged from knowledge and skills associated with Microsoft Office, to database management systems, enterprise resource planning, and business intelligence tools, along with strong communication skills and proficiency in project planning, monitoring, and directing.

According to the vital signs survey conducted by *Computerworld*, the top five skills that IT executives said they would hire for in 2007 included programming/ application development, project management, IT/business analysis, security, and help desk/technical support. During this time IT managers will be focusing on security and data recovery, and changes brought about from the introduction of Vista ("2007 vital signs," 2007). At the top of the skill set of requirements identified for IT employees, from a survey conducted of CIOs by Robert Half, was expertise in Microsoft Windows administration followed by network administration; database management came in third (Robert Half Technology, 2007). Whether it is a tight job market or not, companies will be looking for qualified graduates. McAdams (2007) reported that there will be many applicants for most IT jobs, and "from those, hiring executives will pluck people with the strongest combination of technical and business skills" (p. 1).

Nontechnical Skills Needed by IT Graduates

Employers are not only looking for good technical skills; they also look for strong soft skills, transferable IT skills, and the ability to adapt in their workforce. In jobs where troubleshooting and helping others are vital aspects, employees must possess strong problem-solving and analytical skills as well as excellent communication skills (U.S. Department of Labor, 2006). McAdams (2007) explained that companies will not just want technical support staff to know how to respond to various calls and questions but will need them to "prioritize and understand why jumping on a problem quickly is a mission-critical must" (p. 1). Soft skills such as communication, problem solving, teamwork and collaboration, planning and leading projects, presentation delivery, and writing skills are critical for success in the IS and IT professions (Bailey & Stefanizk, 2002; Noll & Wilkins, 2002). According to Bancino and Zevalkink (2007), three of the main driving forces behind business leaders' increasing demand for a broader skill set are the necessity for improvements to the bottom line, increasing competition, and globalization. "Technical professionals in various disciplines such as information technology, engineering, architecture, and research and development are increasingly required to broaden their skill sets to master the so-called soft skills" (Bancino & Zevalkink, 2007, p. 20). In fact, soft skills are

gaining in importance. For example, if two candidates with the same level of technical skills apply for the same position, it is likely that the candidate with stronger business knowledge and soft skills may be hired. "The top IT positions are going to candidates with great customer service, stellar project management and effective team-building skills" (Moreira, n.d., p. 1).

Differences in Job Requirements, Skills, and Salaries Based on Gender

According to Computer People, a recruitment agency, 15-16% of their IT placements were female. They saw differences in skills based on gender in job functions where communications and softer skills are more important. Although there were more women in these job functions, the number decreased with seniority (Williams, 2007). Women in the workforce may have different abilities, attitudes, and aptitudes than their male counterparts. The IT jobs of the future require more than just technical ability; these jobs are going to require business aptitude, people-oriented skills, and multi-tasking management potential in addition to technical ability. Many people share the belief that more women carry these skills than men (Teague, 2002).

According to the Summer 2006 Salary Survey report by the National Association of Colleges and Employers (NACE, 2006), starting salary offers for new college graduates continued to increase, extending a trend seen in the previous year. Information sciences and systems graduates saw about an 8.5% increase, bringing their average offer to $48,593 (NACE, 2006). CNN Money reported that computer/IT analysts and software engineers were two of the best jobs in America, with salaries in excess of $80,000 and growth rates of over 36% and 46% respectively (Kalwarski, Mosher, Paskin, & Rosato, 2006). CNN Money rated the best jobs in America taking into consideration not only salary and growth rate, but also flexibility in hours and working environment, creativity, and how easy it is to enter and advance in the field (Kalwarski, Mosher, Paskin, & Rosato, 2006).

Based on data from the Department of Labor Bureau of Statistics (as cited in Liu, 2003), the difference in median wage earnings between males and females in the IT profession is substantial. According to statistics from 2001, it took women in IT professions 15 to 16 months just to make the same salary their male counterparts made in a period of one year (Liu, 2003).

When comparing men and women in the highest median weekly earnings group (managerial, professional and related occupations), men earned $1,176 a week and women earned $859 a week in 2007, a difference of 27% (U.S. Bureau of Labor Statistics, 2007). It also appears that "[t]he pay gap between college-educated men and women continues to widen in the years following graduation" (Selvin, 2007). When comparing the highest earning 10 percent of male workers with advanced degrees—professional or master's degree and above—in 2007 to their female counterparts, males made 32% more; males earned $2,914 per week compared to $1,979 for females (U.S. Bureau of Labor Statistics, 2007).

The gap in wages between males and females can be accounted for to an extent by the segregation of women into lower-paying jobs, industries, establishments, and occupations within establishments. A sizeable part of this gap remains attributable solely to the person's gender, however. "[E]stimates indicate that approximately one-half of the sex wage gap takes the form of wage differences between men and women within narrowly defined occupations within establishments" (Bayard, Hellerstein, Neumark, & Troske, 2003, p. 918).

As the literature indicates, the job market for graduates of computer-related occupations and information systems is positive. As new technologies continue to develop and existing ones advance, however, this poses challenges to educators to continually stay current with the knowledge and skills required of the graduates. In an attempt to do this, educators can survey employers and graduates of their programs to identify the tasks and responsibilities performed,

as well as their perceptions regarding the importance of specific skills.

Methods

Every other year beginning in 2001, a follow-up study of the graduates of an information systems and technologies degree at a Midwestern university was conducted. The survey was designed based on a review of the literature and the curriculum proposed by the Organizational Systems Research Association (Hunt, 2004). A panel of experts pilot tested and reviewed it; revisions were made based on the feedback. For each of the studies (conducted in 2001, 2003, and 2005) the survey and cover letter were sent to the Human Subjects Review Board for approval. The study involved mailing a cover letter, survey, and self-addressed return envelope to all students who graduated in the previous two year period. In 2001, the 1999-2000 graduates were surveyed with a return rate of 57%. In 2003, the 2001-2002 graduates were surveyed with a 62% return rate, and the 2003-2004 graduates were surveyed in 2005 with a 46% return rate. It is important to note that this included all of the graduates of this degree program. Originally, it was a two year office systems program; in 1997, this program was expanded into a four year information systems and technologies degree with the first students graduating in 1999.

The survey was designed to identify the time it took to get the first job, the entry-level salary, the tasks and responsibilities of the graduates on their first information systems or information technology job, as well as their perceptions of the various skills they felt should be included in the curriculum. For each of these studies, a follow-up letter and additional copy of the survey were mailed about three to four weeks after the first mailing to all graduates who had not yet responded.

Upon receipt of the surveys, the information was coded onto Scantron sheets following the same codebook each time the survey was conducted, with the exception of a few minor changes such as date of graduation and some new software/technologies. All the data were tabulated and summarized for each group of graduates of the specific two-year period. The Scantron sheets were submitted to Instructional Support Services at the university and the data returned to the researchers in an Excel file. The data for the first two studies (2001 and 2003) were also analyzed using SAS, Version 6.11. The data for the third study (2005) was analyzed using SPSS, Version 13.

The goal of this study was to combine all the data gathered over this time period for three main purposes: (a) to identify the types of jobs and tasks performed by the graduates, (b) to identify their perceptions regarding the importance of various skills in the curriculum, as well as (c) to compare the status of males and females in such areas as time taken to obtain employment, salaries, primary job focus, and perceptions of importance of various technical and nontechnical skills.

The procedures followed for the study were as follows:

1. Permission was obtained from the Human Subjects Review Board at the university to use the existing data gathered from the previous three studies completed in 2001, 2003, and 2005.
2. The Scantron sheets containing the survey responses of the graduates were gathered from the three studies that had been saved in the researchers' files. Surveys from students who were in the online program were removed from the new combined group. The online students were excluded from the sample because the program was introduced in 2001; therefore, there were only a handful of graduates. Although the content is largely the same, differences warranted a separate analysis of their responses. The data gathered from the three previous studies were combined in one file for analysis. The scores that resulted from the administration of this survey instrument were evaluated by computing Cronbach's alpha. The value (0.90) indicated the scores to be reliable.

3. The data were summarized based on responses received from all graduates and then analyzed to compare responses of males to those of the females to see if any significant differences existed. Data were analyzed using SPSS, Version 13.

A limitation with this study, as with most mail surveys, is that the data were based only on those who responded. Therefore, it is possible that those graduates who had not yet obtained a job were the least likely to respond to the survey.

FINDINGS

In order to analyze findings from any mail survey, it is helpful to have an understanding of the sample and some demographic characteristics of those who completed the survey. Some basic demographics collected on these graduates included gender, age, and ethnic background. The findings discussed concern time taken to obtain employment; salary; location, size, and type of employing company; job focus; and primary tasks and responsibilities of the graduates.

DEMOGRAPHICS

The total number of graduates from the information systems and technologies program at this Midwestern university from 1999 through 2004 was slightly over 400. During this period, approximately 65% of the students were male; however, the percent return rate for each of the three studies (2001, 2003, and 2005) was slightly higher for females. Of the 222 completed surveys used for this study, male graduates complete 132 (59%) and female graduates completed 90 (41%).

Only 6% of the graduates were 22 years or younger when they graduated. The largest number was 23 to 25 years old (53%). Eighty-one percent of the graduates indicated they were white, 12% indicated they were black, 5% reported they were Asian, and 2% selected the Other category.

TIME TAKEN TO OBTAIN EMPLOYMENT

We asked graduates to indicate how long it took them to get their first IT-related jobs. Of the 179 who responded to the question, 23% indicated they were employed prior to graduation, 20% stated they had an offer prior to graduation, and 26% said that they obtained a job within three months. Only 5% indicated it took longer than 9 months to obtain a position, as shown in Table 1.

Eta was used to investigate the strength of the association between gender and the time taken for the graduates to obtain employment; the effect size was 0.033. Eta is a statistic to use when one variable is nominal, in this case gender, and the other is continuous, in this case salary range (Nunnally & Bernstein, 1994). When measuring the strength of a relationship, a value of greater than .45 is considered much larger than typical; 0.37 is considered large; 0.24, medium; and 0.1, small (Cohen, 1988). The small effect size in this study indicates that neither males nor females were more likely to find employment sooner.

SALARY

Graduates were asked to indicate the salary range of their first IT-related job. Of the 179 who responded to this question, the largest number of graduates (20%) marked the range $30,000 to $34,999; the next largest range (19%) was less than $25,000, as shown in Table 2. Almost half

Table 1. Time Taken to Obtain First IT-Related Job

Time Taken	Males		Females		Total	
	n	%	n	%	n	%
Employed prior to graduation	27	23.1	15	22.7	42	23.0
Offer prior to graduation	22	18.8	14	21.2	36	19.7
Less than 3 months	28	23.9	19	28.8	47	25.7
Between 3 and 6 months	17	14.5	9	13.6	26	14.2
Between 6 and 9 months	14	12.0	4	6.1	18	9.8
Between 9 and 12 months	5	4.3	0	0.0	5	2.7
Over one year	1	0.9	4	6.1	5	2.7
Other	3	2.6	1	1.5	4	2.2
Total	117	100.1	66	100.0	183	100.0

(45%) indicated they earned $35,000 or more. Table 2 indicates that female graduates earned less per year than male graduates. A higher percentage of females earned salaries in the lowest range surveyed (less than $25,000) and in the range of $30,000 to $34,999. A lower percentage of females earned salaries in the highest two brackets surveyed.

Table 2. Salary Range of First IT-Related Job

Salary Range	Males		Females		Total	
	n	%	n	%	n	%
Less than $25,000	19	16.5	15	23.4	34	19.0
$25,000 - $29,999	18	15.7	10	15.6	28	15.6
$30,000 - $34,999	20	17.4	16	25.0	36	20.1
$35,000 - $39,999	17	14.8	6	9.4	23	12.8
$40,000 - $44,999	15	13.0	7	10.9	22	12.3
$45,000 - $49,999	16	13.9	9	14.1	25	14.0
$50,000 - $54,000	6	5.2	0	0.0	6	3.4
$55,000 or over	4	3.5	1	1.6	5	2.8
Total	115	100.0	64	100.0	179	100.0

Location, Size, and Type of Employing Company

Seventy-two percent of the graduates indicated that they were employed in the state in which they graduated (Illinois); of these, 23% were in Chicago or the surrounding area. Another 11% were employed in the St. Louis area, and 17% were employed in states outside of Illinois and the surrounding area of St. Louis.

In regard to the size of the employing company, 45% of the graduates stated they had over 2,000 employees at their job location. The second most often marked response was less than 100 employees (18%). The remainder was between 101 and 2,000 employees.

The types of businesses employing the graduates varied greatly, with education (15%), information technologies (14%), communications (10.5%), and consulting (9.9%) at the top. Some of the other industries included hospital/medical, manufacturing, government, and financial services.

In regard to use of the Internet, intranet, and extranets, respondents were asked to mark all options that applied to them. Four out of every five (78%) of the respondents indicated that their company had a web site on the Internet, 70% had an intranet, 42% had an extranet, 31% had a B2C e-commerce site, and 29% had a B2B e-commerce site.

Job Focus and Primary Tasks and Responsibilities

Graduates were asked to identify their primary job focus. About 35% indicated their primary job focus was technical/end-user support, and 12% responded that their primary focus was computer programming. The different areas the graduates indicated as their primary job foci can be seen in Table 3.

The survey shows that the males and females were represented in different percentages in certain fields (see Table 3). The male graduates tended to dominate in fields such as computer programming and networking. The main area in which females had a larger percentage was in database design/development. The different choice in occupation may make up for some of the graduate salary discrepancy between males

Table 3. Primary Job Focus of the Graduates

Job Focus	Males		Females		Total	
	n	%	n	%	n	%
Technical/end user support	38	33.0	24	37.5	62	34.6
Computer programming	17	14.8	5	7.8	22	12.3
Networking	17	14.8	2	3.1	19	10.6
Database design/development	8	7.0	8	12.5	16	8.9
Web design/development	8	7.0	4	6.3	12	6.7
Information management	6	5.2	5	7.8	11	6.2
Systems analysis/design	3	2.6	4	6.3	7	3.9
Information security	3	2.6	1	1.6	4	2.2
Information management and security	1	0.9	2	3.1	3	1.7
E-commerce	1	0.9	0	0.0	1	0.6
Other	13	11.3	9	14.1	22	12.3
Total	115	100.0	64	100.0	179	100.0

and females. This could raise the question as to whether females are segregated to specific occupations in the field.

The graduates were asked what type of job tasks and responsibilities they routinely performed. The tasks and responsibilities most often marked by graduates employed in the field were providing technical/end user support (54%), installing software (45%), managing information (38%), and installing/maintaining computer devices (38%). Respondents were given numerous choices and were asked to mark all that applied. Their responses are detailed in Table 4; no total is provided, since they were asked to mark all that applied.

In all areas, there was a greater percent of males than females performing the tasks. The tasks performed on a regular basis in which the percent of males was twice that of the females were setting up and configuring LANs, creating and maintaining web pages, developing and redesigning systems, writing and customizing computer programs, installing and monitoring security systems, configuring and maintaining WANs, and developing e-commerce applications. The only two tasks that were performed by almost as many females as males (within 5%) were maintaining databases and designing databases.

The graduates were asked to make a vertical mark on a line from not important to very important for general technical and nontechnical skill areas. A scale was then used to assign a value from 1 to 5 for the marks made by the respondents. Both men and women found nontechnical skills to be more important than technical skills. Although technical skills are useful in the workforce, graduates recognized that soft skills could be just as important, if not more important, to overall success in the workplace. As seen in Table 5, both males and females ranked thinking skills as the most important. This was closely followed by personal characteristics, desire to learn, personal attitude, and teamwork. The top technical skills in the ranking, after the six nontechnical skills, were computer software skills, networking, and computer hardware skills.

Summary and Discussion

The majority of the graduates (69%) indicated they were able to find jobs within three months of graduation. Seventy-two percent of the graduates were employed in Illinois, where they graduated from college. About 45% indicated they earned $35,000 or more in their first IT-related job. There were a greater percentage of females than

Table 4. Tasks Routinely Performed by the Graduates

Job Task	Males		Females		Total	
	n	%	n	%	n	%
Providing technical/end user support	79	59.8	41	45.6	120	54.1
Installing software	71	53.8	29	32.2	100	45.1
Managing information	56	42.4	28	31.1	84	37.8
Installing/maintaining computer devices	60	45.5	24	26.7	84	37.8
Maintaining accounts	51	38.6	24	26.7	75	33.8
Maintaining/troubleshooting networks	51	38.6	21	23.3	72	32.4
Maintaining databases	40	30.3	25	27.8	65	29.3
Analyzing systems	43	32.6	20	22.2	63	28.4
Setting up/configuring LANs	47	35.6	13	14.4	60	27.0
Maintaining web pages	37	28.0	12	13.3	49	22.1
Developing/redesigning systems	38	28.8	9	10.0	47	21.2
Customizing computer programs	34	25.8	9	10.0	43	19.4
Creating web pages	32	24.2	9	10.0	41	18.5
Monitoring security systems	28	21.2	9	10.0	37	16.7
Designing databases	23	17.4	13	14.4	36	16.2
Writing computer programs	26	19.7	6	6.7	32	14.4
Installing security systems	24	18.2	3	3.3	27	12.2
Configuring/maintaining WANs	22	16.7	2	2.2	24	10.8
Developing e-commerce applications	16	12.1	0	0.0	16	7.2
Other	17	12.9	12	13.3	29	13.1

Table 5. Mean Rankings of Importance of Technical and Non-technical Skills

Technical/Non-technical Skill	Gender		
	Male	Female	Total
Thinking Skills	4.5523	4.5828	4.5645
Personal Characteristics	4.4939	4.5034	4.4977
Desire to Learn	4.4756	4.5299	4.4972
Personal Attitude and Motivation	4.4664	4.5241	4.4894
Teamwork	4.4138	4.5471	4.4673
Communication Skills	4.3015	4.4195	4.3486
Computer Software Skills	4.0969	4.3724	4.2069
Supervisory Skills	4.1198	4.2609	4.1761
Telecommunications/Networking	4.1000	4.2161	4.1465
Computer Hardware Skills	4.0068	4.2920	4.1201
Business Foundation and Analytical Skills	4.0600	4.1333	4.0894
Programming Skills	3.6892	3.9747	3.8037
Systems Analysis, Design, Imple-	3.6031	3.9471	3.7410
Database Design	3.3947	3.9069	3.5982
Information Systems and Technologies	3.4568	3.5494	3.4936
Project Management	3.2854	3.7081	3.4537
Records and Information Management	2.6537	2.9080	2.7547
Basic Business	2.3045	2.4026	2.3435

males in the lowest salary range, less than $25,000, and a greater percentage of males in the two highest salary ranges.

The four career areas, or job foci, in which the largest numbers of graduates were employed were technical/end-user support (35%), computer programming (12%), networking (11%), and database design (9%). The top two tasks performed on a regular basis by the graduates were providing technical support (54%) and installing software (45%). This matched closely with the predictions by the U.S. Bureau of Labor Statistics (2005) of the three computer-related occupations projected in the top 10 fastest growing occupations for the 2004-2014 time period; these occupations include network systems specialists and data communication analysts, computer software engineers (system software), and computer software engineers (applications).

The top job areas in which graduates were working also matched with some of the top jobs and skill areas that IT executives said they would hire for in 2007: programming/application development, project management, IT/business analysis, security, and help desk/technical support (McAdams, 2007). Not as many of the graduates in this study were working in the security area, but those are jobs often taken by individuals with some work experience in the field. These career areas also matched closely with the top three identified by a study conducted by Robert Half (2007), expertise in Microsoft Windows administration, followed by network administration and database management.

The graduates identified six specific nontechnical skills as most important before any technical skills. The top six skills with the highest means were thinking skills, personal characteristics, desire to learn, personal attitude and motivation, teamwork, and communication. The top technical skill in the ranking, after the six nontechnical skills, was computer software skills. The next two skills ranked were networking and computer hardware skills. Employers often mention these nontechnical skills as important for employment and success (Bailey & Stefanizk, 2002; Bancino & Zevalkink, 2007; Moreira, n.d.; Noll & Wilkins, 2002).

Conclusions

Academicians in similar IT programs can use the results from this study to consider curricular revisions in order to better prepare graduates for the workplace. As a result of the analysis discussed in this paper, the information systems and technologies program at this Midwestern university eliminated two required courses and replaced them with courses that take into account evolving skill requirements in the workplace.

Several studies have underscored the importance of workers honing not just technical skills but also the skills of critical thinking, collaboration, and communication. Research emphasis could also be placed on identifying the degree to which these soft skills should be included in the curriculum as well as the most

effective instructional strategies for enhancing students' development of these skills. Since the workplace is a continually evolving environment, ongoing research should be conducted to identify the top skills and knowledge needed by the future workforce. Academicians should review these data regularly to update their curricula.

Although a strong research-based knowledge of women in technology exists, more can be done in light of the current flat-lining trend of women entering the IT field. Future research could focus on identifying the reasons more females do not choose information technology in general or, more specifically, certain types of careers within the field. This could be accomplished through qualitative research, such as interviews or focus groups, to ascertain the factors that most influence a woman's career choice. Longitudinal studies could also be employed to track the career decision-making processes used by girls from middle school through their postsecondary years. Such research could identify the optimal times to introduce IT careers into the school curriculum as well as the manner in which it is best introduced.

REFERENCES

2007 vital signs. (2007, January 1). *Computerworld*. Retrieved April 23, 2007, from http://computerworld.com/action/article.do?command=viewArticleBasic&articleId=9006866

Andero, A. (2000). Changing role of school superintendent with regard to curriculum policy and decision making [Electronic version]. *Education 121*(2), 276-276.

Bailey, J. L., & Stefanizk, G. (2002). Preparing the information technology workforce for the new millennium, *ACM SIGCPR Computer Personnel, (20)*4. Retrieved April 25, 2007, from http://delivery.acm.org/

Bancino, R., & Zevalkink, C. (2007). Soft skills: The new curriculum for hard-core technical professionals. *Techniques, 82*(5), 20-22. Retrieved May 23, 2007, from http://www.acteonline.org

Bayard, K., Hellerstein, J., Neumark, D., & Troske, K. (2003). New evidence on sex segregation and sex differences in wages from matched employee-employer data. *Journal of Labor Economics, (21)*4, 887-922.

Chao, C., & Shih, S. (2005). Organizational and end-user information systems job market: An analysis of job types and skill requirements. *Information Technology, Learning, and Performance Journal, 23*(2), 1-15.

Cohen, J. (1988). *Statistical power and analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Fanning, E. (2006, July 13). The IT profession: 2010. *Computerworld*. Retrieved November 25, 2006, from http://www.computerworld.com/action/article.do?command=viewArticleTOC&articleId=112367

Hecker, D. E. (2005, November). Employment outlook: 2004–14. Occupational employment projections to 2014. *Monthly Labor Review* (U.S. Dept. Bureau of Labor Statistics Report).

Hunt, C. S. (Ed.). (2004). *The Organizational Systems Research Association Organizational and End-User Information Systems Model Curriculum.* Morehead, KY: Organizational Systems Research Association. Retrieved November 5, 2007, from http://www.osra.org/curriculum2004.pdf

Kalwarski, T., Mosher, D., Paskin, J., & Rosato, D. (2006). Best jobs in America. *CNN Money*. Retrieved February 5, 2007, from http://money.cnn.com/magazines/moneymag/bestjobs/2006/

Liu, L. C. (2003). Some observations on gender and wage differences in the information technology sector. *Issues in Information Systems*, *4*(2), 582-588.

McAdams, J. (2007) The hottest skills for 2007. *Global Knowledge*. Retrieved April 23, 2007, from http://www.globalknowledge.com/training/customgo.asp?find=P33_FEATURE&id=16753&pageid=29

Moreira, P. (n.d.). Soft skills for IT professionals. *Certification Magazine*. Retrieved May 23, 2007, from http://www.certmag.com/issues/jan01/dept_techcareers.cfm

National Association of Colleges and Employers (NACE). (2006, July 12). News for media professionals [Press release]. Retrieved April 23, 2007, from http://www.naceweb.org/press/display.asp?prid=241

Noll, C. L., & Wilkins, M. (2002). Critical skills of IS professionals: A model for curriculum development. *Journal of Information Technology Education, (1)*3, 143-154.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd. ed). New York: McGraw Hill.

Robert Half Technology. (2007). IT staff could benefit from enhanced technical skills, survey shows.

Technically Speaking. Retrieved May 8, 2007, from http://www.roberthalftechnology.com

Selvin, M. (2007, April 28). Study sciences or technology to beat gender gap low wages. *The Hamilton Spectator*. Retrieved September 24, 2007, from http://www.hamiltonspectator.com

Teague, J. (2002, June). Women in computing: What brings them to it, what keeps them in it? *ACM SIGCSE Bulletin*, *34*(2), 147-158.

U.S. Bureau of Labor Statistics. (2005, December 7). Top 10 fastest growing occupations, 2004-2014. Retrieved April 17, 2007, from http://www.bls.gov/news.release/ecopro.t05.htm

U.S. Bureau of Labor Statistics. (2007, July 19). Usual weekly earnings summary. Retrieved September 28, 2007, from http://www.bls.gov/news.release/wkyeng.nr0.htm

U.S. October layoffs fall by 31 percent vs. September. (2006, November 2). *Reuters*. Retrieved November 25, 2006, from http://today.reuters.com/news

Williams, L. (2007, January 18). What women want. *Computing*. Retrieved May 8, 2007, from http://www.computing.co.uk/computing/analysis/2172750/women