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SKILLS OF INFORMATION SYSTEMS GRADUATES: AN EXPLORATORY STUDY

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Abstract

As the information systems (IS) profession continues to evolve, some important challenges to educators include keeping abreast of employer needs and maintaining the currency and relevance of IS education. This paper reports the results of a survey conducted of IS advisory board members at a large public university in the Midwest. Employers were asked to rate the importance of various technical and non-technical skills. Each skill was rated in terms of the degree of academic preparation employers expect entry-level IS employees to have versus the actual degree of preparation that a typical, beginning IS employee brings to the job. This analysis provides some current information about which knowledge and skill areas employers want to see emphasized in an IS program. Some implications of the findings for IS education are examined.

Introduction and Background

The information systems (IS) profession is one the most dynamic fields that has ever existed. Technologies continue to change, and university IS programs grapple with how to make their curricula current and relevant to prepare students for the workplace. Many authorities agree that the IS profession requires a diverse array of skills including technical, problem solving, communications, and teamwork skills (e.g., Kendall and Kendall 1999; Gupta and Wachter 1998; Shah and Martin 1997). A number of researchers have also recognized that as the IS function has evolved from a service orientation to more of a strategic function, the importance of "soft" (i.e., non-technical, or business) skills has grown (Lee, Trauth, and Farwell, 1995; Athey et al. 1995; McGee 1996). How to give sufficient attention to the full range of skills needed for the successful IS graduate within a limited number of credit hours in a university IS program will perhaps always be an enigma for IS educators. However, it is important to gather ongoing input from employers about what skills they think are critical for the IS profession, so that periodic changes can be made to update IS curricula.

Previous studies have examined the skills needed in the IS profession in various ways. Tang, Lee and Koh (2000-2001) considered required versus achieved levels of IS skills as perceived by IS educators. Hingorani and Sankar (1995) compared the perceptions of IT skills of graduating seniors versus industry professionals. Richards et al. (1998) surveyed industry representatives to rate the importance of 19 different job skills, while Jiang et al. (1994) surveyed recruiters about 13 different IS-related job skills. Bailey and Mitchell (2000) surveyed companies to produce a rating of the importance eight "soft" skills needed for the IS profession. Thus, previous studies have tended to focus on obtaining a rating or ranking of skills by students, employers, faculty, or multiple parties. There have been few attempts to survey employers regarding the expected performance of new IS graduates on various skills versus graduates' actual level of performance on these skills, as perceived by employers. This basic approach, of considering the "actual" versus "expected" preparation of new college graduates, was used in a national study of accounting graduates (Siegel and Sorensen 1994). This approach was applied in the current study to the information systems field, utilizing content areas germane to the IS field.

Methodology

This paper reports the results of a survey conducted of industry representatives from an information systems advisory board at a large public university in the Midwest. The survey focused on various IS technical and non-technical skills, that were identified from discussions with industry representatives, previous studies and news reports, e-mail correspondence via IS listservs, and the

authors' personal experience. Employers were asked to rate each skill in terms of the level "expected" in new IS graduates versus the "actual" level of these skills. A five-point response scale was used, where 5 indicated "high", 3 "medium," and 1 "low." Respondents were instructed to answer these questions based on their experience with all IS graduates, not just graduates from our university.

A total of thirty surveys were mailed to members and "potential" members of our IS advisory board. Fifteen responses were obtained, yielding a 50% response rate. The responding organizations included companies in the computers/computer services, financial services, insurance, manufacturing, publishing/printing, chemical, oil and gas, healthcare, and pharmaceutical industries. The responding firms ranged in size in annual revenues from $100 million to over $10 billion. Almost half of the respondents were chief information officers or IS managers. About 80% of the participants had 13 or more years of professional work experience. The results between the expected and actual values for each skill were tested for statistical significance using paired t-tests.

Results

The results of the survey to the ratings for nineteen technical knowledge areas are shown in Table 1. The table is arranged in descending order based on the expected level of skill. While space limitations obviously prevent a comprehensive analysis of these results, a few points merit discussion. First, the highest rated technical knowledge areas were the systems development life cycle (SDLC), structured programming concepts, systems requirements information gathering techniques, process modeling, and data modeling. These areas all received a rating of 3.6 or greater on the five-point scale. The biggest gaps between the expected and actual ratings occurred for the SDLC, information requirements gathering techniques, process and data modeling, and project management. Curiously, for two areas, website development and CASE tools, the actual level of skill was reported to be slightly above the expected skill level, but these differences were not statistically significant. Finally, while CASE tools were rated quite low (1.8), it should be recognized that they can be used as a tool to support the teaching of other concepts such as data and process modeling which were rated quite high.

Table 1. Technical Knowledge Areas

	Expected	Actual	Difference	p
Systems development life cycle	4.07	2.80	1.27	.0007***
Procedural programming concepts	3.87	3.20	0.67	.0158*
Systems requirements gathering techniques (e.g., interviewing)	3.80	2.73	1.07	.0023**
Process modeling (e.g., data flow diagrams)	3.67	2.73	0.94	.0013**
Data modeling (e.g., entity-relationship diagrams)	3.60	2.73	0.87	.0045**
Object-oriented programming concepts	3.33	2.53	0.80	.0403*
Structured query language (SQL)	3.27	2.53	0.74	.0412*
Project management	3.13	2.27	0.86	.0100**
Operating systems concepts	3.07	2.40	0.67	.0246*
Website development	3.00	3.20	(0.20)	.6033
Electronic commerce	2.93	2.27	0.66	.0579
Graphical user interface design	2.93	2.87	0.06	.8581
Data communications	2.86	2.50	0.36	.1621
Systems security	2.80	1.93	0.87	.0111*
Decision support systems	2.80	2.53	0.27	.3719
Networking concepts	2.73	2.27	0.46	.0596
Object-oriented modeling	2.67	2.13	0.54	.1033
Enterprise software (e.g., SAP, Peoplesoft)	2.40	1.73	0.67	.0712
Computer-assisted software engineering (CASE) tools	1.80	2.00	(0.20)	.4514

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

The results for the non-technical skills are shown in Table 2. These encompass various personal qualities and interpersonal skills.

Table 2. Non-Technical Skills

	Expected	Actual	Difference	p
Skills and abilities:				
Ability to learn	4.80	4.20	0.60	.0070**
Teamwork	4.47	3.71	0.76	.0008***
Problem solving	4.27	3.27	1.00	.0004***
Written communications	4.13	3.33	0.80	.0004***
Oral communications	4.00	3.13	0.87	.0000***
Ability to work under pressure	3.93	3.33	0.60	.0070**
Time management	3.87	3.33	0.54	.0061**
Ability to apply IT to business problems	3.80	3.07	0.73	.0104*
Ability to resolve conflict professionally	3.67	2.80	0.87	.0069**
Change management	3.07	2.13	0.94	.0021**
Personal qualities:				
Motivation to work	4.73	3.73	1.00	.0004***
Initiative	4.73	3.80	0.93	.0005***
Professional ethics	4.53	3.93	0.60	.0140*
Attention to detail	4.47	3.40	1.07	.0007***
Persistence	4.07	3.33	0.74	.0062**
Patience	3.80	3.00	0.80	.0029**
Leadership	3.60	2.93	0.67	.0069**
Maturity	3.47	3.13	0.34	.0961

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

As indicated, the highest rated skills were the ability to learn, teamwork, problem solving, and oral and written communications skills. The top rated personal qualities were motivation to work, initiative, professional ethics, and attention to detail. In general, the non-technical skills were rated higher than the technical knowledge areas. For example, all the non-technical skills received a mean rating of 3 or higher, while nine of the 19 technical skills had a mean below 3. In addition, more significant differences between the expected and actual values were observed for the non-technical skills than the technical knowledge areas. There was a significant difference for every non-technical skill except one (maturity), whereas nine of 19 technical knowledge areas had no significant differences between expected and actual values.

Conclusions and Implications

At least a couple of limitations of this study should be noted. First, the data were gathered from employers at one university. Thus, the data do not necessarily represent the views of companies throughout the rest of the United States or the globe. It should also be stressed that while this survey achieved a high response rate for a mail survey (50%), it is based on 15 responses. To gain additional input, the author is currently in stage two of data collection where the survey is being extended to 45 more organizations, and additional rounds of data collection are planned.

Nevertheless, the findings provide some preliminary insight about what knowledge and skills might be emphasized in an IS curriculum. The results also show some consistency with the findings of previous studies. For example, as noted earlier, most non-technical skills were rated higher than technical skills. This effect was also observed in studies by Van Slyke et al. (1998) and Richards et al. (1998). It would appear to be attributable to the fact that IS positions vary more by their technical skills than

their non-technical skills. In other words, because certain common non-technical skills are required for virtually any IS job, it would be expected that these skills would receive consistently high ratings from respondents. In contrast, certain technical skill, such as networking skills, may be very important to some IS jobs but not critical to others, thereby producing more variability in the ratings for the technical knowledge areas.

The findings of this study, consistent with those of other studies, beckon IS educators not to overlook the importance of non-technical skills in the IS curricula. Certainly, technical skills are very important to help IS graduates get a "foot in the door" at many organizations. However, the expanded role of the IS professional in recent years argues for devoting significant attention also to business, teamwork and communications skills. Given this changing role, it is not surprising that more gaps between expected and actual performance occurred for non-technical skills than the technical ones. IS educators need to re-examine whether they are doing all they can to develop students with respect to these skills. Greater use of group projects and encouraging student involvement and leadership in campus and professional organizations are among the important ways these skills can be fostered. Non-technical skills are growing in importance, yet many of these skills are developed in a significant way outside of the classroom – through internships, and involvement with student and professional groups. More than ever, faculty must mentor students to make sure they realize the importance of developing a full range of skills needed to succeed in the workplace.

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