The IS Expectation Gap: Industry Expectations Versus Academic Preparation

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Abstract

Recent changes in information systems technologies, applications, and personnel require us to reconsider the skills for tomorrow's IS professionals. This study uses data from four groups—IS managers, end-user managers, IS consultants, and IS professors—to identify the key skills and knowledge that will be required of future IS professionals. These requirements were then compared with current IS academic programs. The results reveal that despite a shared vision of the future IS professional, there is an "expectation gap" between industry needs and academic preparation. Industry and universities must work together to close this gap. Universities need to place more emphasis on the integration of technologies, applications, data, and business functions and less on traditional and formal system development. Firms need to send consistent messages to universities about their expectations while recognizing that the mission of university business programs is career education, not job training.

Keywords: Information systems education, information systems profession, information systems curriculum, training, skills, end-user computing

ISRL Categories: EH0201, EH0205, EH0208, IA01

Introduction

Are colleges and universities responding fast enough to the business and technology changes that have redefined the role of information systems in today's organizations? Are we providing the right type of education for future information systems (IS) professionals? The study described in this article was conducted to answer these questions.

A key concern of curricular designers is striking the right balance between technical and business knowledge (Rogow, 1993). Many believe that the rapid pace of technological innovation demands professionals have state-of-the-art technical knowledge (La Plante, 1986; Sullivan-Trainor, 1988), but others believe advances in computer technology lessen the need for technical expertise (Young, 1988). Nevertheless, the skill mix for many IS professionals today favors technical expertise over people-handling ability. The IS manager who possesses sufficient human relations and management training and can communicate effectively remains a scarce and vital resource (Ball, 1988; Carlson and Wetherbe, 1989; Connolly, 1988; Nelson, 1991).

The IS education process has been criticized as incapable of producing qualified, employable IS professionals (Archer, 1983; Cardinali, 1988), and universities have been faulted for teaching obsolete technologies and irrelevant or obsolete computer programming languages (Mandt, 1982). These accusations suggest an "expectation gap" between the needs of industry and the academic preparation of those intended to satisfy them. Meanwhile, professors complain of inadequate and contradictory advice from industry about appropriate qualifications. Accreditation standards also limit curriculum flexibility.[1] Finally, there is a delay between the design and implementation of curriculum changes.

Little previous attention has been focused on the expectation gap. Previous discussions have considered industry needs but not the role of academic programs in satisfying them (see, for example, Cheney, et al., 1990). Where the expectation gap is discussed (for example, Rifkin, 1987), the evidence is anecdotal and general in nature. Despite the publication by professional associations, such as the DPMA and the ACM, of curriculum guides (Data Processing Management Association, 1981; 1985; 1990; Nunamaker, 1981; Nunamaker, et al., 1982), there appears to be insufficient input from industry about the quality and relevance of IS education (Buckingham, 1987). In such a rapidly evolving field, there is a need to continuously and systematically examine the fit between the skills and knowledge possessed by IS graduates and the requirements of industry.

Data Collection

In research involving several phases, both qualitative and quantitative data were collected from 1987 to 1992. Phase one involved a "brain storming" session of CIOs, vendors, consultants, and professors. This session focused on the growing concern among IS practitioners about the relevance of IS curricula in the face of distributed computing and the explosive growth of new technologies.

In phase two, telephone interviews were conducted with IS practitioners to discuss: (1) entry-level job descriptions; (2) satisfaction with new hires; (3) recommendations for IS curricula; and (4) qualifications of IS professionals in the future. Respondents frequently discussed the decline of computer programming, an activity that has historically been at the core of the IS profession. In the respondents' view, as IS personnel move to the functional areas of the firm, fourth generation tools, packaged software, end-user computing, and business process analysis have grown in importance. Respondents recommended that university programs place greater emphasis on "real world" experience, communication skills, analytical ability, and problem solving.

In phase three, focus group sessions were conducted with IS managers, consultants, professors, and recent graduates of IS academic programs. IS managers and consultants were asked to describe the "ideal" IS professional, while recent graduates of IS programs were asked to discuss how their IS program is contributing to the achievement of career goals. IS professors were asked to comment on key issues that they face in providing a relevant IS education to their students. The dominant theme that emerged from the practitioners was the need for a "high quality person" with general intellectual depth, solid interpersonal and communications skills, and some functional business knowledge. Professors were primarily concerned about having the necessary resources to enable schools to simulate the problem-solving environment of the workplace. Graduates noted that in school they were given small, isolated problems that did not prepare them to bring together disparate parts in the solution of large, "real world" problems.

Expectation Gap

The qualitative data captured in the first three phases of this research confirmed the gap between practitioner needs and graduates' abilities. The researchers attributed this expectation gap to problems with the relevance of IS curricula. Further, it was expected that this "curriculum gap" resulted from the absence of a shared vision of the appropriate knowledge and skill mix for the IS professional. Therefore, phase four relied on a structured method to provide quantitative data about appropriate knowledge and skills and the academic emphasis on them. A questionnaire was mailed in 1989 to IS managers in both IS and functional departments, IS consultants, and IS professors throughout New England.[2] The questionnaire contained a series of task and knowledge/skill inventories drawn from previous research, curriculum guides published by professional societies (Data Processing Management Association, 1981; 1985; 1990; Nunamaker, 1981; Nunamaker, et al., 1982), the qualitative results from the previous phases, and the experience of the research team.[3] The questionnaire was arranged into three categories: (1) tasks IS professionals perform; (2) technical skill requirements; and (3) interpersonal and business skill requirements.[4]

One hundred thirty-one (24.5 percent) questionnaires were returned. Respondents included senior managers (68) and consultants (30), who are both knowledgeable about current IS practices and are in a position to comment on corporate needs.[5] (See Table 1 for respondent profiles.) Thirty-three IS faculty also responded, representing a variety of colleges and a wide range of educational settings.

The curriculum gap

The mean score rankings[6] shown in Table 2 clearly revealed a curriculum gap. The most notable differences between the priorities of educators and practitioners fell into two areas: integration and management.

While the three integration tasks[7] in the survey were ranked very high by practitioners, they were of low priority among the faculty. Apparently IS professionals who must deal with the changing corporate and competitive environment see integration as a means of adding value and improving information access. But faculty appear unable, unwilling, or uninterested in helping in this critical area. Faculty in the focus groups often felt that they did not have the tools to teach students about the hands-on aspects of integrating technology and business applications.

A different profile resulted for tasks related to the systems development process. Although these are heavily emphasized in academic programs, their importance to practitioners is diminishing. Practitioners generally suggested placing less emphasis on traditional systems development. In an increasingly time-sensitive business arena, efficiency and elegance of process may be less important than effectively focusing new technologies on business problems.

Table 1a. Respondent Profiles by Stakeholder Group: IS Managers and End-User Managers

	IS Managers (n = 52)	End-User Managers (n = 16)
Industry		
Manufacturing	58%	56%
Service	42%	44%
Company Size		
Small ([7] $250 M)	18%	33%
Medium ($250 M - $1b)	45%	48%
Large (• $1b)	37%	27%
Job Function		
Corporate / Division IS	84%	0%
Functional	10%	53%
Cross-functional	0%	47%
Other	6%	0%
Organizational Position		
Corporate / Divisional Executive	85%	44%
Middle Level Manager	15%	44%
Professional Staff	0%	12%
Average Professional Experience (Years)	19.4	15.2

Table 1b. Respondent Profiles by Stakeholder Group: IS Consultants (n = 30)

Nature of Consulting	
Business	77%
Training/Placement	23%
Types of Consulting Activities*	
Strategic Planning / Needs Assessment	78%
Systems Procurement/Implement/Design	36%
Market Analysis, Forecasting	20%
Contract Programming	20%
Average Professional Experience (Years)	20.3

* Categories are not mutually exclusive.

Table 1c. Respondent Profiles by Stakeholder Group: IS Professors (n = 33)

Number of Universities Represented	17
Location of IS Department	
Within Business School	86%
Within Other Schools	14%
Autonomy of IS Department	
Independent Department	44%
Part of Another Department	56%
Average Teaching Experience (Years)	10.5

There is also a gap in the emphasis placed on technical integration. Among the 10 skills ranked as most important by practitioners were four that relate to working in a distributed computing environment. Only one of these—telecommunications—is ranked among the top 10 technical skills emphasized in IS curricula.

Once again, certain skills emphasized in schools are less valued by practitioners. Two highly emphasized technical topics in IS curricula relate to programming languages. But practitioners think that knowledge of COBOL or some other third generation language is decreasing in importance. Instead they increasingly value knowledge of a fourth generation language. Another technical skill showing a discrepancy in priority is systems/structured analysis. Once again, a time-critical IS environment may be driving practitioners to replace life cycle tasks with techniques such as prototyping, intended to speed up the application of information technology.

Among the human, business, and technical abilities, the most pronounced mismatch in priorities relates to interaction with customers. Maintaining a productive relationship with the user/client is viewed by practitioners as the most important of this set of skills. It apparently receives little attention in the classroom.

Shared vision

The survey confirmed a curriculum gap between what is being taught in IS degree programs and what practitioners require. Contrary to our expec-

Table 2. The Curriculum Gap

	Practitioner Future Rank*	Academic Emphasis Rank
IS Tasks		
Integrate Networks	3	23
Integrate Existing Business Applications	4	14
Integrate New with Existing Applications	6	20
Manage/Plan Systems Development/ Project Implementation	15	1
Manage/Plan Feasibility/Approval for New Systems and Technolgy	20	5
Technical Skills		
Network	1	13
Telecommunications	2	8
Fourth Generation Languages	4	10
Systems Integration	5	14
Distributed Processing	6	15
COBOL/Other Third Generation Language	16	4
A Specific Programming Language	14	3
Systems Anaylsis/Structured Analysis	11	1
Abilities		
Maintain Productive User/Client Relationships	1	10

* 1 = most highly ranked.

tations, however, this gap did not appear to result from the absence of a shared vision. Instead, there was considerable agreement between academic and business respondents on the importance of certain IS tasks and skills (see Table 3).[8]

The same seven tasks were ranked among the top in priority for both groups. Tasks that received low importance scores from practitioners also received somewhat lower importance scores from academics. The fit between both groups' vision of important technical skills was also similar.

A finding from the focus groups was that a rich combination of human, technical, and business abilities is a key success driver. Survey responses showed practitioners and educators agreeing on the importance of these skills (see Appendix B). One important exception—"maintain productive user/client relationships"—was rated by practitioners as first in future importance, while academicians rated it as eighth. Recent total quality management programs aimed at improving dialogue and relationships among internal and external customer/vendor pairs may have influenced practitioner responses.

These results suggest that there is only a modest difference of vision between the two groups. But there is an implementation problem of translating that shared vision into the academic reality.

Table 3. The Shared Vision

	Practitioner Future Rank*	Academic Importance Rank
IS Tasks		
Analyze IS Solutions to Business Problems	1	1
Analyze Business Problems	2	2
Integrate Networks	3	10
Integrate Existing Business Applications	4	8
Develop Databases	5	5
Integrate New with Existing Business Applications	6	5
Implement New/Changed Computer-Supported Business Processes	7	3
Analyze Software Packages-Evaluation and Selection	18	21
Support Existing Portfolio of Applications	19	20
Integrate Data Types	21	24
Support User-Developed Systems	22	16
Support Hardware	24	25
Develop In-House Applications	25	18
Technical Skills		
Network	1	5
Telecommunications	2	2
Relational Databases	3	4
Fourth Generation Languages	4	6
Systems Integration	5	7
Distributed Processing	6	10
Data Management	7	8
Structured Programming/CASE Methods/Tools	9	12
Decision Support Systems	10	11

*1 = most highly ranked.

Recommendations

In the final phase of this research the results were presented to the sponsoring organization. These feedback sessions provided an opportunity to confirm our interpretations of the data. This completed the cycle of practitioner involvement in this project. Through the various phases of practitioner involvement the key issues were identified, explored, analyzed, and, finally, interpreted. The results tell us that the expectation gap is real. However it is not caused by an incompatible vision of the future IS professional. The cause, instead, seems to lie with the slow process of curriculum change and implementation. Starting from a shared vision of the future IS professional, practitioners and universities must together address these implementation issues. To provide a backdrop for the specific recommendations to follow, we offer a description of this future IS professional, labeled "the integrator."

The integrator

The respondents described a new type of IS professional. This individual will possess traditional IS skills but will be focused on integration rather than systems development. Integrating activities associated with joint ventures, mergers, downsizing, globalization, and the ever-present demand for cost control continue to be the most significant challenges faced by IS professionals. These trends will continue to increase complexity throughout the 1990s. However, as new or enhanced information technology becomes available it must be quickly and seamlessly integrated into existing environments. Practitioners place significant importance on the people and technical skills, as well as the business knowledge that such integration will require. The future IS professional will be required to cross political, organizational, and national boundaries in order to solve problems. The ability to carry out enterprise-wide tasks, such as business process re-engineering (Davenport and Short, 1990; Hammer, 1990; Hammer and Champy, 1993), will become the defining characteristic of this future IS professional, replacing traditional systems development.

IS professionals will devote as much effort in analyzing business problems as in developing technical solutions. They will integrate technologies and applications to provide better access to corporate data. But they must also maintain a strategic orientation toward information technology investments. In order to accomplish these tasks they will need certain key technical skills, which fall into four categories: (1) telecommunications and integration; (2) data access and management; (3) decision support and CASE; and (4) firm-specific technologies (see Appendix B).

In addition to these technical skills, the future IS professional will need a strong *contextual orientation*. This will include a deep understanding of the business units within which they will work, interpersonal skills necessary to work with the end users, and an ability to effectively apply technology in seeking solutions to business problems.

Implications for IS curricula

Educators, for the most part, concur with this vision but have reacted slowly in implementing required curriculum changes. Bridging the gap between what IS practitioners expect of graduates and what graduates have learned will require a fresh look at the IS curriculum. Activities associated with the formal systems development life cycle will diminish in importance, while activities associated with the integrator role should begin to take center stage. While analysis skills will remain important, they will involve more than the traditional "systems analysis" skills required to critically assess business problems. Analysts must also be equipped to re-engineer business processes in order to best fit information technology to business objectives. They must have the skills to promote change and improvement and to understand and select from a set of technical alternatives the one most appropriate to the particular business context. The IS curriculum must also promote a strategic orientation toward specific applications and the IS function.

The growth of end-user computing has caused the tasks and skills associated with data access to take on greater importance. Although most IS programs are adequately preparing students for this area, greater emphasis needs to be placed on fourth generation languages and the support of information access and security.

The greatest need for curriculum change lies with the skills and knowledge associated with integration. These were a low priority in the schools surveyed but were the highest priority among practitioners. Acquiring this skill set may be difficult to achieve, however, in a traditional classroom setting. Learning about integration requires a sufficiently complex environment so that students can observe how disparate parts are brought together. Schools with internship or cooperative education programs have a mechanism already in place. Practitioners can assist by providing sites for student work placement or field research.

Further study

Two issues arose in the course of doing this research that suggest important areas for further study. One issue relates to the academic reward system. University professors are rewarded for classroom teaching and research but not generally for curriculum development. Further, professors conducting curriculum-related research often experience difficulty and delays in publishing their results. The influence of the academic reward system on closing the curriculum gap should be further explored.

The second issue relates to recruitment. This study suggests that companies are sending inconsistent messages to students and professors about the appropriate skill set. Despite the fact that tasks associated with developing and maintaining applications are perceived by practitioners to be declining in importance, current hiring criteria and campus recruiters still place heavy emphasis on skills in such areas. Educators preparing graduates for immediate placement into IS positions may be using valuable curriculum resources to teach techniques that will soon be (if they are not already) outmoded and for whom there is already a large base of skilled workers. Research that explores the dimensions of this "recruitment gap" would be a valuable addition to IS curriculum discussions.

Implications for the IS profession

Neither practitioners nor scholars, working alone, can shape our field. The issue is not defining who should lead and who should follow but rather creating a productive partnership. To do so we must open up the lines of communication and change perceptions. For example, during the initial data gathering activities, some IS managers had the impression that the purpose of the study was to enable practitioners to tell educators what to teach. Professors, meanwhile, at times became defensive about their "turf."

A bridge is needed between the long-term educational approach of the classroom and the short-term skills expectation of the workplace. This bridge can take several forms. One approach would be for students to take more courses that focus on specific technologies, software packages, and programming languages. Accreditation standards, however, place a constraint on the number of IS courses for which a student can receive graduation credit. A second option is for schools and companies to work together to develop cooperative education or internship positions to enable students to become familiar with company-specific technologies and applications. A third approach is in-house training for new employees. However, only 28 percent of the respondent MIS managers indicated that their companies currently offer such programs. No matter which options are chosen, the rapid pace of technological innovation coupled with environmental turbulence means that employee training will be an ongoing requirement.

Conclusion

In the past the typical career path of an IS professional was linear: from programmer to systems analyst to project manager to IS manager. Most IS professionals, seeking advancement, would move through the same steps toward the same goal. But the changes in corporate computing brought about by powerful yet affordable technology, end-user developed applications, off-the-shelf software, increased use of telecommunications, and the increased use of systems integration houses and outsourcing have created many new career paths. We find that the IS profession is being pulled in opposite directions. One is toward a more business and human orientation. The other is toward the technical skill required to maintain a firm's technology infrastructure. The result is a knowledge explosion. The range of IS knowledge and skill that must be available to a firm has expanded and diversified. No longer can one individual or a single curriculum be all things to all people. Just as the systems life cycle is giving way to integration as the organizing principle of the field, the programmer/analyst as the focal point of the IS career has been replaced by a range of career paths, as shown in Figure 1. These career paths have distinct educational implications, entry points, and objectives (Trauth, 1988; 1989).

The *technical specialist* possesses deep technical expertise in an area such as telecommunications, database, or operating systems. Those following this career path would work as individual contributors in a scaled-down IS department whose mission is to maintain the information technology infrastructure of the firm.

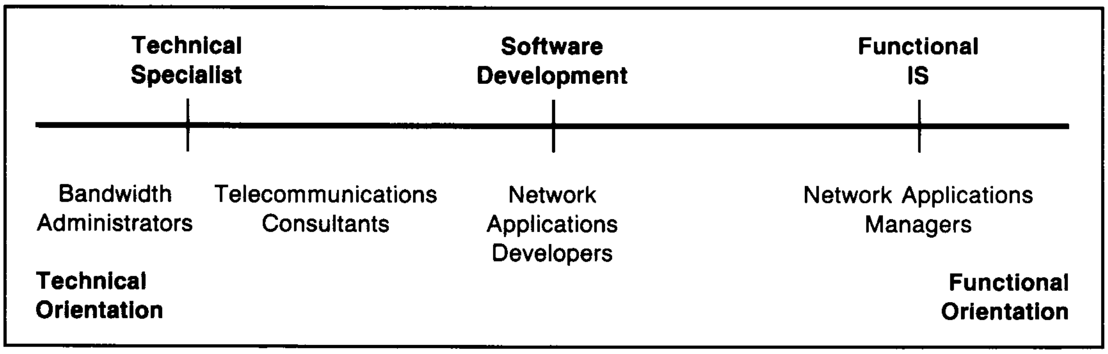

Figure 1. Continuum of IS Career Paths (Using Telecommunications Positions as an Example

The *software developers* work for software vendors, consulting and outsourcing firms, or (generally large) companies that still do their own software development and/or tailoring. The programmer/analyst, which had been the typical "product" of IS degree programs, has been replaced by the *functional IS* career path. End users developing their own applications have reduced the need for specialists who design and program systems for others. Instead, these IS professionals must have a solid understanding of the business areas, as well as a broad range of possible technological solutions. This type of IS professional may not work in the IS department but rather in accounting, finance, marketing, or some other area of the company. It is therefore important that IS educational preparation be in the context of a business education.

Closing the expectation gap requires the involvement of all stakeholder groups: professors, IS managers, end-user managers, and consultants. Industry and groups such as the Society for Information Management need to communicate with universities and help develop programs to expose students to real-life integration situations. Academic programs, for their part, need to continually reassess their markets and their customer requirements. Without compromising long-term educational benefits for short-term training, a school can select from the continuum of IS career paths those that best suit its circumstances and corporate customers.

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Endnotes

[1] Current accreditation guidelines of the American Assembly of Collegiate Schools of Business (AACSB) (American Assembly of Collegiate Schools of Business, 1991) require that general education—that is, nonbusiness—courses comprise at least 50 percent of the undergraduate student's four year program. From the remaining 50 percent a student must take a set of required business courses. As a result, there is a limit on the number of courses a student can take in his or her major area such as information systems.

[2] Recipients were members of the Boston SIM Chapter, the Society for the Management of Professional Computing, and IS professors at New England colleges and universities. The same skill inventory was sent to every respondent, but the phrasing of questions was tailored to each stakeholder's position in the field. (See Appendix A.)

[3] Practitioners were not asked what to include in the IS curriculum because educators are the experts in curriculum design. This became clear during the "brainstorming" session when practitioners' views of the skills and knowledge needed by IS professionals, while valuable, were sometimes contradictory. One attendee sought "people who can hit the ground running" and who would "be able to program right away in COBOL." But another attendee sought graduates with a well-rounded, liberal education. Instead, practitioners' viewpoints were solicited on the tasks that IS professionals must perform and the skills and knowledge they must possess in order to carry them out.

[4] The questionnaires were pilot tested on a subset of the stakeholder groups prior to dissemination of the revised instrument.

[5] Given the uneven response rate of the three practitioner groups and the consistency of responses across them, IS managers, end-user IS managers, and IS consultants were grouped together for analysis.

[6] Appendix B shows the complete set of mean scores and rankings for tasks, skills, and abilities by practitioners and professors. For identification of a curriculum gap, differences between "practitioner future" and "academic emphasis" were used. The reason that rankings along these two different scales were compared is that each indicates priorities through the relative rankings of tasks, skills, and abilities.

[7] By integration we mean the ability to link business processes through integrating technology, data, and applications. Five items in the survey specifically related to integration (see Appendix B): integrate networks, integrate existing business applications, integrate new with existing applications, integrate data types, and systems integration.

[8] The shared vision was examined by comparing practitioner mean scores and rankings on the future importance of the tasks and skill sets with academics' view of the importance of each item in the skill set mix of an IS professional. We assumed a future orientation in the professors' descriptions as well because of the delay in implementing curriculum changes. The length of the delay will vary. At some universities a curriculum change is applied to the next freshman class, resulting in a four-year delay. Other universities may implement a curriculum change immediately. It is generally difficult, however, to introduce a significant curriculum change when students are in their third or fourth year.

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Appendix A
Structure of Questionnaires
(Using the Sample Item: Telecommunications Skill)

Form A: MIS Managers

Please indicate below how important the following IS knowledge of skills are in supporting the computing needs of your company, now and in three years:

	Now					Three Years from Now				
	Not Important				Extremely Important	Not Important				Extremely Important
Telecommunications	1	2	3	4	5	1	2	3	4	5

Form B: Non-DP Executives

Please indicate below how important the following IS knowledge of skills are in supporting the computing needs of your department now and in three years:

	Now					Three Years from Now				
	Not Important				Extremely Important	Not Important				Extremely Important
Telecommunications	1	2	3	4	5	1	2	3	4	5

Form C: IS Consultants

Please indicate below how important the following IS knowledge of skills are in supporting the computing needs of the companies with which you work, both now and three years from now:

	Now					Three Years from Now				
	Not Important				Extremely Important	Not Important				Extremely Important
Telecommunications	1	2	3	4	5	1	2	3	4	5

Form D: CIS/MIS Professors

Please indicate below how important it is for IS professionals to possess the following IS knowledge of skills and the extent to which they are emphasized in your program:

	Importance to Jobs					Emphasis in Curriculum				
	Not Important				Extremely Important	Not Emphasized				Heavily Emphasized
Telecommunications	1	2	3	4	5	1	2	3	4	5

Appendix B
Survey Items

Table B1. IS Tasks

	Practitioner						Academic					
	Future			Current			Emphasis			Importance		
Activity	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD
Analyze IS Solutions to Business Problems	1	4.53	0.62	3	3.71	0.94	3	3.73	1.00	1	4.48	0.51
Analyze Business Problems	2	4.43	0.71	5	3.56	1.09	2	3.85	1.08	2	4.46	0.51
Integrate Networks	3	4.37	0.89	19	3.17	1.13	23	2.48	0.90	10	4.04	0.89
Integrate Existing Business Applications	4	4.34	0.82	7	3.48	1.24	14	2.96	1.12	8	4.04	0.66
Develop Databases	5	4.29	0.77	11	3.40	1.06	4	3.62	1.13	5	4.08	0.74
Integrate New With Existing Applications	6	4.28	0.82	6	3.53	1.07	20	2.75	0.99	5	4.08	0.74
Implement New or Changed Computer-Supported Business Processes	7	4.25	0.67	9	3.44	0.88	10	3.12	0.95	3	4.11	0.82
Manage/Plan Corporate IS Strategies	8	4.25	0.74	16	3.27	1.16	8	3.26	1.10	14	3.88	1.03
Support Information Access and Security	9	4.25	0.87	15	3.28	1.00	13	3.04	1.19	17	3.65	0.89
Manage/Plan Identification of Strategic IS Application	10	4.18	0.75	18	3.19	1.01	7	3.29	1.04	13	3.92	1.09
Implement Data Management Procedures	11	4.13	0.77	22	2.99	0.97	6	3.37	1.01	11	4.00	0.69
Train/Educate End Users	12	4.10	0.88	21	3.07	1.01	9	3.17	1.31	4	4.11	1.01
Train/Educate IS Professionals	13	4.03	0.90	14	3.29	1.00	15	2.92	1.28	19	3.56	1.15
Manage/Plan IS Technology Architecture	14	4.02	0.92	17	3.24	1.03	21	2.67	0.92	17	3.65	0.98
Manage/Plan Systems Development/Project Implementation	15	4.00	0.81	4	3.63	0.88	1	3.87	0.85	5	4.08	0.74
Support End-User Computing	16	3.96	1.03	20	3.13	1.05	17	2.87	0.97	23	3.50	0.81
Develop Application Software (Purchase and Tailor)	17	3.93	0.91	8	3.45	0.98	19	2.79	1.18	15	3.81	0.79
Analyze Software Packages—Evaluation and Selection	18	3.89	0.84	12	3.35	0.89	18	2.80	1.08	21	3.52	0.89
Support Exisiting Portfolio of Applications	19	3.88	0.96	1	3.77	1.09	22	2.61	1.03	20	3.54	0.71
Manage/Plan Feasibility/ Approval for New Systems and Technology	20	3.79	0.91	13	3.33	0.92	5	3.48	1.08	9	4.04	0.84
Integrate Data Types	21	3.66	1.05	25	2.41	1.03	24	2.17	0.82	24	3.42	0.99
Support User-Developed Systems	22	3.55	1.05	24	2.60	1.00	16	2.91	1.12	16	3.73	0.92
Implement Systems Evaluation Process	23	3.48	1.01	23	2.93	1.00	12	3.08	1.18	12	4.00	0.89
Support Hardware	24	3.47	1.11	10	3.41	1.04	25	2.00	0.67	25	2.77	0.99
Develop In-House Applications	25	3.33	1.10	2	3.75	0.89	11	3.12	1.26	18	3.56	0.89

Table B2. Technical Skills

Skill	Practitioner						Academic					
	Future			Current			Emphasis			Importance		
	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD
Network	1	4.43	0.80	3	3.44	1.03	13	2.78	0.85	5	4.19	0.75
Telecommunications	2	4.38	0.85	2	3.53	0.99	8	3.22	1.00	2	4.35	0.63
Relational Databases	3	4.37	0.68	11	2.94	0.97	2	3.86	0.83	4	4.19	0.69
Fourth Generation Languages	4	4.15	0.89	5	3.19	1.00	10	3.09	1.19	6	4.00	0.80
Systems Integration	5	4.12	0.99	6	3.17	1.03	14	2.65	0.88	7	3.96	0.77
Distributed Processing	6	3.90	1.07	12	2.81	1.05	15	2.54	1.01	10	3.85	0.78
Data Management	7	3.88	1.00	14	2.77	0.99	7	3.27	0.93	8	3.92	0.81
Other Technical Knowledge*	8	3.78	1.40	17	2.42	1.07	16	2.40	0.89	1	4.40	0.55
Structured Programming/ CASE Methods or Tools	9	3.69	1.10	15	2.49	0.96	9	3.14	1.04	12	3.69	0.97
Decision Support Systems	10	3.64	1.01	16	2.47	0.87	5	3.48	0.79	11	3.73	0.67
Systems Analysis/ Structured Analysis	11	3.55	0.98	9	2.97	0.95	1	4.04	0.78	3	4.35	0.69
Systems Life Cycle Management	12	3.43	1.06	10	2.97	0.96	6	3.39	0.89	9	3.88	0.99
Operating Systems: Micros	13	3.41	1.18	8	3.06	1.05	12	2.95	0.84	16	3.31	0.88
A Specific Programming Language**	14	3.34	1.37	13	2.79	1.23	3	3.60	1.43	15	3.33	1.43
Expert Systems/AI	15	3.25	1.19	19	1.98	0.92	11	2.96	0.98	13	3.46	0.76
COBOL or Other Third Generation Language	16	3.24	1.17	1	3.69	1.16	4	3.50	1.26	14	3.42	1.14
Operating Systems: Mini	17	3.22	1.24	7	3.11	1.04	17	2.09	0.75	17	2.88	0.65
Operating Systems: Mainframe	18	3.08	1.27	4	3.27	1.32	18	2.00	1.11	18	2.85	0.73
Assembly Language	19	1.82	1.03	18	2.06	1.03	19	1.36	0.79	19	1.73	0.92

* Examples include executive IS, image processing, UNIX, end-user computing.
** Responses were evenly distributed across C, BASIC, and Pascal.

Table B3. Abilities

Activity	Practitioner						Academic					
	Future			Current			Emphasis			Importance		
	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD	Rank	Mean	SD
Human												
Be Close to Customers and Maintain Productive User/Client Relationships	1	4.51	0.63	3	3.88	0.98	10	2.83	1.15	8	4.19	0.80
Accomplish Assignments	2	4.50	0.60	1	4.35	0.66	1	3.83	1.03	3	4.58	0.58
Plan/Execute Work in a Collaborative Environment	3	4.37	0.68	4	3.85	0.88	3	3.73	0.99	2	4.60	0.58
Be Self-Directed and Proactive	4	4.34	0.72	6	3.81	0.96	7	3.22	1.08	6	4.31	0.74
Work Cooperatively in a One-to-One and Project Team Environment	5	4.33	0.70	2	4.04	0.81	2	3.77	0.81	1	4.68	0.50
Deal with Ambiguity	6	4.30	0.75	7	3.75	1.06	8	3.17	1.11	4	4.50	0.58
Plan, Organize and Lead Projects	7	4.22	0.78	5	3.84	0.90	6	3.43	1.04	7	4.25	0.68
Plan, Organize, and Write Clear, Concise, Effective Memos, Reports, and Documents	8	4.03	0.79	8	3.51	0.88	5	3.65	0.98	5	4.38	0.75
Develop and Deliver Effective, Informative, and Persuasive Presentations	9	4.02	0.81	10	3.43	0.92	4	3.70	0.76	9	4.15	0.61
Teach Others	10	3.94	0.77	9	3.47	0.88	9	2.87	1.18	10	3.96	0.87
Business												
Understand the Business Environment	1	4.61	0.57	1	3.83	1.03	1	4.13	0.97	1	4.69	0.55
Learn About Business Functions	2	4.50	0.63	2	3.75	1.01	2	4.04	0.82	2	4.50	0.71
Knowledge of a Specific Business Function*	3	4.48	0.63	4	3.40	1.00	3	4.00	0.71	3	4.29	0.76
Be Sensitive to Organizataional Culture and Politics	4	4.20	0.79	2	3.75	1.01	4	2.59	1.10	4	4.20	0.76
Technical												
Interpret Business Problems and Develop Appropriate Technology Solutions	1	4.39	0.73	1	3.83	1.00	1	3.87	0.92	1	4.35	0.63
Focus on Technology as a Means, not an End	2	4.28	0.83	3	3.63	1.00	2	3.35	1.03	4	4.08	0.93
Ability to Learn about New Technology	3	4.12	0.68	2	3.68	0.75	4	3.17	0.98	2	4.27	0.83
Ability to Understand Technology Trends	4	4.05	0.80	4	3.62	0.95	3	3.22	0.74	3	4.08	0.74

*Responses were evenly distributed across the range of functional areas.