

THE EVOLVING GRADUATE INFORMATION SYSTEMS EDUCATION: A SURVEY OF THE U.S. INSTITUTIONS

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ABSTRACT

This paper reports the results of a survey of IS graduate programs across the United States. Information summarized includes statistics relating to the nature of institutions offering graduate IS programs, the characteristics of IS faculty members, and the content of these programs. Analyses of the responses suggest that the IS graduate programs are by no means universal: only 38% of the responding institutions had graduate IS programs. However, IS as an academic discipline has matured significantly, with 92% of the faculty holding terminal degrees and 70% having tenure. The most remarkable finding of this survey is that the graduate IS programs have been undergoing dramatic changes over the last five years in terms of contents, with the Internet and client/server related topics supplanting traditional systems analysis/design and programming courses. It is also found that graduate IS programs are putting more emphases on case studies of emerging technologies and corporate IS management strategies. The information provided in this paper should be valuable to IS educators in their curriculum design and to practitioners in their understanding of the graduate IS programs and their graduates.

Keywords: IS curriculum, IS faculty, IS education, IS skill requirements, graduate education.

INTRODUCTION

The dynamic nature of the information technology (IT) has created one of the most challenging tasks for information systems (IS) educators: how to provide state-of-the-art education to students while maintaining a core body of knowledge of the fundamental principles of the IS discipline. The explosive development of the Internet, client/server, and computer networking related technologies, coupled with the widely spread downsizing and decentralization in IT management, has generated waves of dramatic changes in corporate IT infrastructure and management philosophies during the last five years.

On the academic side of the IT spectrum, however, changes seem to be more subtle and slower. Recent studies of IS education have expressed concerns that IS curricula may be failing to keep up with the reality of corporate information technologies (6, 15). Many attempts have been made to address the issue of IS curriculum from different perspectives. Some have tried to identify the need for future IS professionals

(1, 2, 7, 9, 11). Others have studied and proposed model curricula and guidelines for IS programs (4, 6, 9, 13, 14).

While these studies provide a broad, albeit fragmented, picture of the IS programs, most of them are based on the data collected more than five years ago. Given the explosive rate of change of information technologies during the last five years, there is clearly a need to provide more up-to-date information about the IS programs. In addition, most of the studies focused on undergraduate IS programs, with few (14) addressing the issues of graduate IS programs. The current paper presents the results of a survey of graduate IS programs in the United States. It was conducted as part of a general survey specifically designed to improve our knowledge of the state of IS education in the United States. The results of the survey are intended to serve as a useful frame of reference for IS academics who are considering redesign of their own graduate programs, and for IS practitioners who are involved in the curriculum design process at their local academic institution, or who are grappling with the question of whether or not to hire graduates of IS programs. The present paper specifically focuses on the graduate IS programs offered in various colleges and universities in the United States.

RESEARCH DESIGN

The **MIS Curriculum and Faculty Survey**¹ was conducted as a joint project of the authors and a sponsoring company that specializes in undergraduate education products. Its immediate motivation was the need for information about existing IS programs for a biannual reassessment of the undergraduate Computer Information Systems major being conducted at the authors' university. The survey questions were designed to help answer a number of questions, including 1) the type of IS program offered; 2) the profiles of the faculty who teach the IS programs; and 3) the contents of these programs and the changes of the contents over the last five years. In developing the survey instrument, many of the questions were based on the proposed technical specialties knowledge measures by Lee, Trauth and Farwell (6) as well as the proposed guidelines for IS majors by Cougar, et al. (4). In addition, a number of questions were added that were of specific interest to the IS curriculum review committee of the authors' university.

Before the survey was mailed out, a pilot test was

¹ The survey instrument is available upon request.

conducted with the faculty members of the authors' department. The unanimous conclusion was that the instrument was too long. As a result, approximately 25% of the questions in the original survey were eliminated. Since the authors felt that additional elimination would have required removing questions that appeared to be of considerable interest, the decision was made to accept the reduced response rates to be expected with such a complex instrument in order to acquire a richer picture from those who did respond. At the end, the instrument consists of eight sections regarding various aspects of the IS programs with a total of 90 questions. The survey instrument was mailed to IS faculty listed in the Management Information Systems Research Center (MISRC) directory in the United States in late October 1996, and responses were accepted through 15 January 1997.

RESULTS AND ANALYSES

Profile of the Respondents

A total of 2056 survey instruments were mailed out to IS faculty members in 442 different educational institutions listed in the MISRC directory. By the cutoff date, 240 usable responses were returned, representing a 12% individual response rate. Viewed in terms of institutions, the rate was much higher: surveys were returned from faculty at 193 different institutions, a 44% response rate. Most of the respondents were affiliated with traditional four-year colleges and universities with advanced degree programs: about 84% of the responding institutions offering graduate level programs, with 46% offering doctoral level degrees and 38% offering Master's level degrees. Only the responses from these institutions and faculty are presented in the present paper. Nearly all these institutions had a business school that functioned as an autonomous (82%) or semi-autonomous (12%) unit. A number of different institutional affiliations were also present in the survey population, with public institutions (72%) and private institutions (25%) predominating.

Tables 1 and 2 present information about the responding faculty affiliated with graduate degree granting institutions. Considering the fact that most of the faculty in the graduate degree granting institutions teach both undergraduate and graduate courses if both are offered, all responses from the faculty in institutions that offer graduate level IS courses were included, resulting in 168 faculty responses. Of those, about 70% were tenured, 20% were in tenure earning positions, and 8% were in non-tenure positions.² The four-year Master's degree granting institutions have higher percentage of Professors (52%), while the doctoral granting institutions have higher percentage of Associate Professor (37%). The percentages for instructors and adjuncts are not comparable due to small sample sizes. About 95% of the faculty hold a doctoral degree, of these degrees about 41% were from the MIS area and 52% from business related fields (MIS, Management, and Accounting combined). Although there is no comparable historical data about these characteristics of graduate IS faculty, the 70% tenure and 95% terminal degree rates strongly suggest the maturation of graduate IS faculty in the four-year educational institutions of United States.

²Percentages are computed within institution types, except the category for All institutions. Overall percentage may be slightly less than 100 due to missing data in a few responses.

Departments and Programs

The majority of respondents (72%) reported that their school had a department where IS faculty predominated. A wide variety of courses and programs were offered by the institutions surveyed. However, graduate IS programs have not yet been well developed in many of these institutions: well under half (38%) of the institutions with graduate programs offered a graduate IS major, and just under half (49%) offered IS track for MBA students. Only about 22% of the responding institutions offered IS doctoral programs. The data also suggest that the doctoral granting institutions were far more likely to offer executive IS programs than the Master's level institutions (24% vs. 5%). The breakdown by institution types is presented in Table 3.

Ninety-two institutions responded to the question of how many IS credits were required for IS Track of business Master's degree. Of those, 87 (95%) were four year institutions with graduate degrees. Their credit requirement is shown in Table 4. As can be seen, about half (45%) of the responding institutions required 10-15 IS credits, and about one-third (34%) required fewer than ten IS credits. Thus, the majority (79%) of the surveyed institutions required less than five IS courses for their IS track in MBA program, assuming three credits per course in a typical semester system.

Graduate Program Content

A particularly important objective of this IS faculty survey was to assess the IS program contents. Toward this end, three sections of the survey were directed to assessing the computer programming language skills being taught, hardware platforms and operating systems being used, and the degree of 40 IS content areas being incorporated into various IS courses now and five years ago.

Technical Skills. As can be seen from Table 4, a wide range of third and fourth generation languages are taught in graduate IS programs. Overall, the three most popular are SQL (taught in 49% of all institutions), C++ (38%), and COBOL (36%). When C and C++ are combined, they are in second place with 44%. While this order remains true for doctoral degree granting institutions, in Master's degree granting institutions, COBOL and SQL are tied for the first place, and C replaces C++ in the second place. This seems to suggest that doctoral granting institutions were more vigilant in keeping up with the technological trends than Master's level institutions. The small percentage differences between the top three languages should not be overemphasized due to the small sample sizes in each category. But the overall picture is clear: IS graduate programs were moving away from the traditional programming languages, such as Pascal, Assembler, and FORTRAN, toward languages that are more closely related to client/server and network computing environment, such as C/C++ and SQL. The prominence of COBOL may be contributed to two major factors: its historical role as the dominant language in most of the business applications that are still running in many mainframe based corporate information systems and the recent surge of demand for COBOL programmers to deal with the Year 2000 problem. We can reasonably expect its rapid decline after the millennium issue is over.

TABLE 1
Characteristics of the Responding Faculty *

Institution	Tenure						Degree			
	Tenured		Tenure-Earning		Non-Tenure		Terminal		Non-Terminal	
	#	% of All	#	% of All	#	% of All	#	% of All	#	% of All
4YwD	73	69.52	22	20.95	9	8.57	100	95.24	5	4.76
4YwM	45	71.43	12	19.05	5	7.94	59	93.65	4	6.35
Overall	118	70.24	34	20.24	14	8.33	159	94.64	9	5.36

TABLE 2
Rank Distribution of Responding Faculty*

Institution	Academic Rank									
	Professor		Associate Prof.		Assistant Prof.		Instructor		Adjunct	
	#	% of All	#	% of All	#	% of All	#	% of All	#	% of All
4YwD	33	31.43	39	37.14	24	22.86	5	4.76	0	0.00
4YwM	33	52.38	16	25.40	10	15.87	1	1.59	1	1.59
Overall	66	39.29	55	32.74	34	20.24	6	3.57	1	0.60

*4YwD and 4YmM represent four-year College/University with highest degree offered being Doctoral and Master's, respectively.

TABLE 3
Characteristics of the Graduate IS Programs

Institution Type	Graduate IS Program Offered									
	IS Major		IS Track in MBA		IS Doctoral Program		Executive IS Program		IS Survey for Graduate	
	#	% of All	#	% of All	#	% of All	#	% of All	#	% of All
4YwD	41	46.07	57	60.67	36	40.45	21	23.60	54	60.67
4YwM	21	28.38	26	35.14	N/A	N/A	4	5.41	37	50.00
Overall	62	38.04	80	49.08	36	22.09	25	15.34	91	55.83

TABLE 4
The IS Credit Requirement for MBA with IS Track

Institution Type	IS Credit Requirement for IS Track in MBA							
	< 10		10-15		16-21		> 21	
	#	%	#	%	#	%	#	%
4YwD	17	30.36	25	44.64	9	16.07	9	16.07
4YwM	13	41.94	14	45.16	3	9.68	3	9.68
Overall	30	34.48	39	44.82	12	13.79	12	13.79

As is the case for programming languages, a large number of different operating systems and platforms were used in undergraduate IS programs. Here, as shown in Table 5, however, there is a clear leader: Windows or OS/2 based systems are used in 89% of all institutions. UNIX comes in as a distant second place (42%), closely followed by mainframe operating systems with 31% and DOS with 29%. While the

leadership of Windows or OS/2 systems is no surprise, the strong showing of UNIX--traditionally the preferred operating system for computer science and engineering field--suggests that a significant fraction of graduate IS programs teach technical skills related to advanced computer hardware and software systems.

TABLE 5
Programming Language Taught in Graduate IS Programs*

Language	Institutions					
	4YwD (n=28)		4YwM (n=17)		All (n=45)	
	#	% of All	#	% of All	#	# of All
SQL	15	53.57	7	41.18	22	48.89
C++	13	46.43	4	23.53	17	37.78
COBOL	9	32.14	7	41.18	16	35.56
C	7	25.00	5	29.41	12	26.67
Other	6	21.43	3	17.65	10	20.00
Basic	5	17.86	4	23.53	9	20.00
dBASE/xBASE	5	17.86	2	11.76	7	15.56
Pascal	4	14.29	1	5.88	5	11.11
Assembler	2	7.14	0	0.00	2	4.44
FORTRAN	0	0.00	1	5.88	1	2.22
PL/1	1	3.57	0	0.00	1	2.22
RPG	0	0.00	0	0.00	0	0.00

TABLE 6
Operating Systems and Platform Used in Graduate IS Programs*

OS/Platforms	Institutions					
	4YwD (n=28)		4YwM (n=17)		All (n=45)	
	#	% of All	#	% of All	#	# of All
Windows/OS/2	25	89.29	15	88.24	42	88.89
UNIX	13	46.43	6	35.29	20	42.22
Mainframe	11	39.29	3	17.65	14	31.11
DOS	11	39.29	2	11.76	13	28.89
Macintosh	7	25.00	2	11.76	10	20.00
Other	4	14.29	2	11.76	6	13.33
AS400	2	7.14	0	0.00	2	4.44

*"% of all" are calculated using the number of institutions indicating they use such operating system in graduate IS programs and the number of institutions responding to this question, which is smaller than the total number of institutions represented in this survey.

Changes of Program Content. To evaluate the content of graduate IS programs offered by various institutions, we adopted questions from the skills questionnaire devised by Lee, Trauth and Farwell (6). Questions from the technical specialties knowledge category were emphasized. In addition, a series of case-study related questions were added to the survey instrument to assess the prevalence of the case method in graduate IS programs. Finally, questions related to areas of specific interest to the authors, including the Internet, client-server applications development, and ethical issues in IS, were added.

In total, 40 questions were used to assess the general content of IS programs. Respondents were asked to rate their graduate IS programs on each content area using a scale of 0 to 6 for both now and five years ago. To minimize bias and improve reliability of the response, the scales were carefully anchored by providing detailed description for each value (Table 6). Based upon the responses to these questions, the current ten most and least important content areas for graduate IS programs are identified using the mean value of the

responses for each of the 40 content areas. The results are presented in Tables 7 and 8. The top ten areas experiencing the greatest upward movement and downward movement are also identified according to the change of ranks below now and five years ago for each of the 40 content areas. The results are presented in Tables 9 and 10.

It is clear that the graduate IS programs have been undergoing a transformation in focus from traditional text-based, centralized, and mainframe-dominated architectures to distributed and network-centric environments. While relational databases remain the mainstay of IS graduate programs, systems analysis and design, 3GLs (particularly COBOL programming), and managing IS implementations have all dropped off the top ten list. The Internet, client/server, and the emerging technologies have shown the greatest increase in importance, while COBOL programming, programming in at least on 3GL, and systems analysis/design related contents show the greatest downward movement in IS graduate programs. These changes appear to be consistent with major trends in real world of information technologies.

TABLE 6
The Anchored Scales for IS Program Content

Scale Value	Description
0	Not taught in any course
1	Minor topic in one or more elective courses
2	Major topic in elective courses or minor topic in required courses
3	Central topic in elective course or major topic in a required course
4	More than one: Central topic of elective, major topic of required course
5	Central topic of a required course and/or several elective courses
6	Central topic of more than one required course

TABLE 7
The Top 10 Contents of Graduate IS Program: Now and Then

Rank	Now	Five Years Ago
1	Internet technologies and usage	Systems analysis/Structured analysis
2	Telecommunications	Relational Database
3	Relational Database	Managing IS implementation
4	Networks	Data management (e.g. data modeling)
5	Case studies of IS situations, emphasizing emerging technologies	Telecommunications
6	Case studies of IS situations, emphasizing corporate strategies	Case studies of IS situation (any)
7	Data management (e.g. data modeling)	Strategic application of IT
8	Strategic application of IT	Case studies of IS situations, emphasizing emerging technologies
9	Emerging information technologies	COBOL programming
10	Case studies of IS situation (any)	Programming in at least one 3GL

TABLE 8
The Bottom 10 Contents of Graduate IS Program: Now and Then

Rank	Now	Five Years Ago
31	Managing the information resources	Client/Server applications development
32	Case studies of IS situation, emphasizing marketing issues	Minicomputer operating systems
33	MS Windows application development	MS Windows application development
34	Ethical issues in IS	Managing the information resources
35	Minicomputer operating systems	Case studies of IS situation, emphasizing marketing issues
36	Computer hardware	Case studies of IS situation, emphasizing ethical issues
37	COBOL Programming	Microcomputer operating systems
38	Minicomputer operating systems	Ethical issues in IS
39	Mainframe operating systems	Assembly language
40	Assembly language	Minicomputer operating systems

TABLE 9
The Top 10 Contents with the Greatest Upward Change

Rank	Program Area	Current Rank	Previous Rank	Change
1	Internet technologies and usage	1	21	+20
2	Client/Server application development	12	31	+19
3	Emerging information technologies	9	19	+10
4	Networks	4	13	+9
5	Systems integration	18	26	+8
6	Distributed processing	20	28	+8
7	Case studies of IS situation, emphasizing OB/HRM issues	23	29	+6
8	Case studies of IS situation, emphasizing ethical issues	30	36	+6
9	Case studies of IS situation, emphasizing corporate strategies	6	11	+5
10	Case studies of IS situation, emphasizing general management issues	11	15	+4

TABLE 10
The Top 10 Contents with Greatest Downward Change

Rank	Program Area	Current Rank	Previous Rank	Change
1	COBOL Programming	37	9	-28
2	Programming in at least one 3GL	28	10	-18
3	Systems analysis and design	15	1	-14
4	Managing IS implementation	13	3	-10
5	Expert Systems/Artificial Intelligence	29	22	-7
6	Mainframe operating systems	39	32	-7
7	Computer hardware	36	30	-6
8	Decision Support Systems	24	18	-6
9	Structured programming/CASE methods and tools	22	17	-5
10	Case Studies of IS situations (any)	10	6	-4

Another interesting change is the rise of the importance of case studies in IS graduate programs. Four out of the ten content areas with greatest upward movement are case study related. These changes, however, do not prove an increasing reliance on the case method in IS graduate programs. While the case studies of emerging technologies and corporate strategies related issues are among the top ten content areas with the greatest upward movement, general IS case studies are among the top ten content areas with the greatest downward movement over the last five years. Thus, a change in focus in the types of cases being used may be a more important phenomenon that is occurring in the case method used in IS graduate programs.

DISCUSSION AND CONCLUSION

Information technologies are changing dramatically. In order to maintain both relevance and marketability for its graduates, an IS program must therefore continually reevaluate its goals and content. A useful contributor to this process of continuous improvement is awareness of what other IS programs are doing. In order to promote such awareness, the current paper has compiled a significant amount of information related to the nature of graduate IS programs throughout the United States. Even though the sample size may not be large enough to generalize some of the observations with confidence,

the results have clearly shown a number of interesting characteristics of these programs, including:

- While IS, as an academic discipline, appears to be maturing, the penetration of graduate IS programs is far from universal. Less than one half of the institutions with graduate programs surveyed offer an IS graduate degree. Although a large set of institutions offer an IS track in their MBA programs, their programs tend to be more limited in scope, requiring, on average, less than five IS courses.
- Programming languages, such as COBOL and C/C++ are still present in many of the graduate IS programs surveyed, but their importance had diminished significantly over the last five years. In fact, not one programming language falls in the top ten content areas in graduate IS programs, a major change from just five years ago.
- Just as the real world corporate information technologies have moved from mainframe base centralized computing architecture to the network centric client/server computing environment, so has the emphasis of graduate IS education. The Internet, client/server, and emerging information technologies content areas have all risen dramatically within the IS graduate programs surveyed.
- The case oriented teaching methodology seems to

have been widely accepted in the graduate IS programs. Four out of the top ten content areas showing the greatest increase in importance over the last five years involved case studies of IS related issues. Given the evidence that most IS graduate programs continue to emphasize technical skills as well, the challenge of how to balance technical and managerial content is clearly being faced by most graduate IS programs.

Since the IS graduate survey was conducted as part of an overall IS program survey, only a limited amount of information was collected and analyzed in this paper. These findings, nonetheless, serve useful contributions toward a better understanding of graduate IS education. In addition, it may serve as an inducement for more comprehensive studies. Such studies are critical because, as it is evident from the findings of this survey, IS graduate programs are influenced not only by the changing technologies, but also the need to balance managerial and technical content. Thus, an ongoing discussion of appropriate content, supported by findings regarding what other institutions are doing and what the real world IS profession are demanding, is critical if an IS graduate program is to remain relevant and competitive.

REFERENCES

1. Athey, S. and J. Plotnicki. "A Comparison of Information Systems Job Requirements in Major Metropolitan Areas," *Interface: The Computer Education Quarterly*, 13:4, Winter 1991-1992, pp. 47-53.
2. Athey, S., J. Plotnicki, and Y. Ballester. "Changing Information Systems Job Requirements from 1989 to 1993," *Journal of Computer Information Systems*, 35:3.
3. Chen, J., N.A. Danesh, and J.A. Willhardt. "Computer Curricula in AACSB-Accredited Business Schools," *Interface: The Computer Education Quarterly*, 13:4, Winter 1991-1992, pp. 60-72.
4. Cougar, J.D., G.B. Davis, D.G. Dologite, D.L. Feinstein, J.T. Gorgone, A.M. Jenkins, G.M. Kasper, J.C. Little, H.E. Longenecker, and J.S. Valacich. "IS'95: Guideline for Undergraduate IS Curricula," *MIS Quarterly*, 19:3, 1995, pp. 341-359.
5. Fabri, T. and R. Mann. "A Critical Analysis of the ACM and DPMA Curriculum Models," *Journal of Computer Information Systems*, Fall 1993, pp. 77-80.
6. Lee, D.M.S., E.M. Trauth, and D. Farwell. "Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation," *MIS Quarterly*, 19:3, 1995, pp. 313-340.
7. Leidner, D.E. and S.L. Jarvenpaa. "The Use of Information Technology to Enhance Management School Education: A Theoretical View," *MIS Quarterly*, 19:3, 1995, pp. 265-291.
8. Leitheiser, R. "MIS Skills for the 1990s: A Survey of MIS Managers' Perceptions," *Journal of Management Information Systems*, Summer 1992, pp. 69-91.
9. Longenecker, H.E. and D.L. Feinstein. "A Comprehensive Survey of USA and Canadian Undergraduate Programs in Information Systems," *Journal of Information Systems Education*, 3:1, pp. 8-13.
10. Longnecker, H., D. Feinstein, J. Cougar, G. Davis, and J. Gorgone. "Information Systems '95: A Summary of the Collaborative IS Curriculum Specification of the Joint DPMA, ACM, AIS Task Force," *Journal of Information Systems Education*, Winter 1994-95, pp. 174-186.
11. Mackowiak, K. "Skills Required and Jobs Available for CIS Majors," *Interface: The Computer Education Quarterly*, 3:4, Winter 1991-1992, pp. 9-14.
12. Silver, M.S., M.L. Markus, and C.M. Beath. "The Information Technology Interaction Model: A Foundation for the M.B.A. Core Course," *MIS Quarterly*, 19:3, 1995, pp. 361-390.
13. Stolen, J. "The Undergraduate MIS Curriculum: A Sampling of AACSB Schools," *Journal of Computer Information Systems*, Winter 1992-93, pp. 174-186.
14. Towell, E. and J. Lauer. "The Master's Degree in MIS: A Baseline Study," *Journal of Computer Information Systems*, Summer 1994, pp. 2-6.
15. Trauth, E., D. Farwell, and D. Lee. "The IS Expectation Gap: Industry Expectation Versus Academic Preparation," *MIS Quarterly*, 17:3, 1993, pp. 293-303.