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Graduates Assess Needed Skills and Knowledge for an Information Systems Program in a Small College

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ABSTRACT: Skill/knowledge areas for undergraduate information systems (IS) curricula were assessed by computer and/or information systems professionals who were graduates of a small four-year college program. Survey of graduates was an initial step used to make recommendations for an IS program that would meet the needs of students enrolled in the small four-year college program and their potential employers. Forty graduates representing five regions of the country, and employed in positions ranging from analyst to software engineer participated. Findings indicated that more than 50 percent of graduates believed they possessed 27 (71.1%) of the skill/knowledge areas when hired. Of interest in designing a new program was finding that each of the 11 (28.9%) skill/knowledge areas not possessed required use of higher-order thinking skills, and used terms such as analyze, evaluate, and specify. However, of the skill/knowledge areas not possessed, graduates rated 8 (27.3%) not important or only moderately important in their work. More than half of graduates rated 20 (52.6%) of the 38 skill/knowledge areas very important or absolutely essential in their work.

KEYWORDS: *Information Systems, IS Graduates' Perceptions, IS Skills/Knowledge*

INTRODUCTION

Information systems (IS) educators should design programs that provide opportunities for learners to gain skills/knowledge needed to become employed as computer and/or information systems professionals. Business and industry have come to regard information as one of its most valuable resources, while technological strategies and tools used to process information change rapidly in the business world. Consequently, businesses seek to hire competent, knowledgeable individuals to process, maintain, and manage their information systems. Through education and training that is current, reality-based, and consistent with the needs of business, graduates of IS programs can enter the workforce with a competitive edge.

REVIEW OF THE LITERATURE

Over the past 10-12 years, IS has progressed as a valued component of an organization's structure as well as an academic discipline. In addition to our living in the information age, we are also living in the age of accountability. Rapid change in IS as a business component has resulted in a constantly evolving definition of IS professionals, which ultimately has had significant impact on what students must learn in preparation for this profession. Consequently, business schools in the U.S. are being criticized more and more for producing graduates incapable of meeting the needs of action-oriented employers (1). in response to these criticisms, educators have made efforts to design programs that will prepare graduates who meet the expectations of employers. In this effort educators have studied the perceptions of employers, practitioners, and graduates of their IS programs. For example, a recent study used four groups – IS managers, end-user managers, IS consultants, and IS professors – to identify key skills and knowledge that will be required of future IS professionals and compared this data with current academic IS programs. Findings revealed a continued "gap" between industry needs and academic preparation (2). More emphasis on integration of technologies, applications, data, and business functions and less on traditional and formal system development was suggested. It was further suggested that more articulation between firms and college programs should take place, while recognizing that the mission of college IS programs is career education, not job training.

A study of academics/practitioners to determine how well business schools are meeting the needs of organizations revealed that IS practitioners felt the need for students to practice skills in real-work settings throughout the MIS curriculum, perhaps even supplementing current curricula with business internships. This study concluded that practitioners attach higher importance to skills needed in solving business problems in the real world than do academics (3).

Several studies have examined the skills needed by IS graduates. One such study of graduates and their employers examined their perceptions of the importance of a set of skills identified as necessary for working effectively in IS. It indicated that the most highly rated skills/knowledge involved listening, hardware, software, and programming (4). Another study of how graduates of information technology programs felt about their careers suggested that the kinds of skills rewarded by employers were non-technical skills acquired on the job, such as the ability to solve logical problems (5). A survey designed to determine to what extent an undergraduate management information systems curriculum met the needs of students in their first jobs revealed that students needed more training in software and programming languages, more exposure to real-world applications, and more training in communication (6). The ability to communicate with non-technical people, was ranked in the top five of topics 85

percent of the time by employers who had hired computer information systems graduates. In another study to determine the topics to be included in the course content of a computer information systems curriculum (7), the findings from these studies provided curriculum designers with useful information such as the need for more training in communications, listening, and problem-solving, as well as hardware/ software skills. The need for more exposure to real-world applications was also emphasized.

BACKGROUND

Several professional associations have addressed educators' need for assistance in designing curricula which are responsive to the needs of industry by recommending curricula and skills/knowledge for undergraduate IS education. The Association for Computing Machinery (ACM) made one of the first efforts in a report entitled Curriculum '68. One of its most recent efforts is the Joint ACM/IEEE-CS Curriculum Task Force report published in March, 1991. However, this Task Force report did not consider programs in related areas, such as information systems (8). The Data Processing Management Association (DPMA) has also been instrumental in recommending model curricula for four-year under-graduate programs in information systems. The 1990 publication, DPMA Model Curriculum for a Four-Year Undergraduate Degree, is among the most recent efforts by this association (9).

"Industry has limited knowledge of the existence of model curricula, and even less knowledge of the use of the curricula as a basis for selecting campuses for recruiting new hires."

Although professional associations assist educators in designing curricula by making recommendations, several circumstances may circumvent their usefulness to program designers. For example, in the late 80s it was suggested that the progress and development of quality formal education for IS professionals was not keeping pace with the progress and development of technology (10). Five years later, this situation still exists. This is especially true for small colleges, since curricula recommendations are often based upon resources not usually available to small colleges. A further complication is seen in an earlier study revealing that the majority of IS programs were found in small colleges with between 1,000 and 5,000 undergraduates (11). Finally, another study concluded that industry has limited knowledge of the existence of model curricula, and even less knowledge of the use of the curricula as a basis for selecting campuses for recruiting new hires (12).

These circumstances suggest that study of perceptions of graduates of small colleges may be helpful to program designers in small colleges. If the skill/knowledge areas most often possessed by graduates when hired and most often perceived by graduates as important in their work can be identified, information about those skill/knowledge areas most useful to graduates can be made available to educators. Combining curricular recommendations with this type of information should help program designers to emphasize development of the most useful skill/ knowledge areas, to use resources more efficiently, and to update programs in a more timely manner.

PURPOSE OF THE STUDY

The purpose of this study was to make recommendations for an IS program that would meet the needs of students enrolled in a small four-year college program and their potential employers. This study sought to determine the perceptions of employed graduates of an undergraduate program at a small college toward skills/knowledge identified for working effectively in IS. Program graduates were defined as students who had completed a computer and/or information systems program at the designated college between 1980 and 1991 and had obtained employment in the computer and/or information systems profession. Small colleges have been defined as colleges with between 1,000 and 5,000 undergraduates (11), the size of this institution. To make recommendations for the IS program, the following questions were posed:

(a) Do graduates perceive that they possessed the identified skills/knowledge at the time of hire?
(b) Do graduates perceive that the identified skills/are important in their work?

METHODS

The research methods involved the use of a data-collection instrument previously developed and administered by the researcher. The survey instrument used, *Opinions of Entry-Level Computer Professionals* (4), was used in an earlier study with a similar population to study graduates' perceptions of skills/knowledge for IS. The instrument contained questions regarding possession and importance of 38 skill/knowledge areas previously recommended by ACM (13) and implemented by IS program designers. The 38 skill/knowledge areas were grouped into the following six categories: (a) people, (b) models, (c) systems, (d) computers, (e) organizations, and (f) society. A four-point Likert-type rating scale was used to establish ranges of difference for responses to questions relating to importance of skills/knowledge and YES-NO categories were used for questions related to possession of skills/knowledge.

The 57 graduates of the program between 1980 and 1991 were sent a letter and 52 graduates responded; however, two were not employed in the information systems profession, one was unemployed, and two were enrolled in graduate programs. The remaining 47 graduates were the subjects for this survey. At the beginning of Spring 1992, a cover letter, questionnaires, instructions, and a self-addressed, stamped return envelope were mailed to the 47 graduates identified for the study. At the end of three weeks, 42 responses (89.4%) had been received. Forty responses were usable in the analysis. Descriptive statistics were calculated and reported for the responses. The standard set for the study was agreement by 50 percent or more of graduates to indicate an affirmative answer to the research question, and less than 50 percent to indicate a negative answer to the research question. This standard was applied throughout the study when interpreting the results of the data.

FINDINGS

The findings report the graduates' descriptions of their current employment and their perceptions of skills/knowledge possessed by them at the time of hire. Also reported are graduates' perceptions of the importance of skills/knowledge in their work.

Current Employment.

Over half of the graduates (57.5%) were female. Over 40 percent of the graduates

worked in the Southeastern United States including North and South Carolina. The next largest group of graduates, 32.5 percent, worked in the Northeastern states such as Connecticut and Delaware.

Seventy percent of the graduates had been employed as computer and/or information systems professionals for one year or more. The majority of graduates (80.0%) were at entry-level in their employment. Few of the graduates had pursued education or training beyond the bachelor's degree. Only 7.5 percent had pursued further study in computer and/or information systems areas. Job titles held by graduate ranged from programmer/analyst (35.0%) to software/systems engineer (7.5%). In the *Other* category, graduates identified job titles such as accounting technician and systems control officer. The largest percentage of graduates (30.0%) worked in the Systems Operations department of the organizations employing them. The second largest percentage of graduates worked in Systems Development. Seventy percent of the graduates used mainframes to perform their jobs and 72.5 percent used local area networks on a daily basis. The most often used computer software was a database (72.5%), with spreadsheets, graphics, and telecommunications almost equally as prevalent in their workplaces. An interesting finding, perhaps in support of word processing achieving status as a common core skill, is the fact that 87.5 percent of the graduates used word processing skills on a daily basis to perform their work. The most often used programming language was COBOL (50.0%), followed closely by UNIX operating systems and various levels of C language. A fairly large range of other programming languages were also identified.

Graduates' Perceptions of Skills/Knowledge Possessed.

The first research question asked, "Do graduates perceive that they possessed the identified skills/knowledge at time of hire?" Over half of the graduates believed they possessed 24 (63.2%) of the 38 skill/knowledge areas when they were initially hired (see Table 1). However, an even 50 percent split occurred regarding the perceptions of graduates about three additional skill/knowledge areas. Half the graduates believed they possessed skill/knowledge areas 25, 33, and 37, the other half did not.

Graduates' Perceptions of Skills/Knowledge Importance.

The second research question asked, "Do graduates perceive that the identified skills/knowledge are important in their work? Twenty of the 38 identified skill/knowledge areas (52.6%) were rated as either very important or absolutely essential by more than half of the graduates (see Table 2). In addition, an even 50 percent split occurred regarding the perceptions of graduates about four of the skill/knowledge areas. Half of the graduates rated skill/knowledge areas 24, 28, 32, and 36 either very important or absolutely essential, yet the other half of graduates rated these same skill/knowledge areas not important or moderately important. Conversely, 14 of the 38 skill/knowledge areas were thought to be not important or moderately important by over half of the graduates.

DISCUSSION

The research questions addressed in this study asked: (a) Do graduates perceive that they possessed the identified skills/knowledge at time of hire?, and (b) Do graduates perceive that the identified skills/knowledge are important in their work? The fact that 80 percent of the graduates were entry-level provided an opportunity to examine their opinions about possession of the skills at time of hire, more than would "seasoned" IS professionals who may no longer be able to distinguish between skills/knowledge developed through formal training and skills/knowledge developed on-the-job. Therefore, the opinions of entry-level IS professionals provided a means for the curriculum designers to better assess student outcomes.

Possession of Skills/Knowledge.

An overwhelming 97.5 percent of graduates believed that they possessed the "people" skill/knowledge, ability to hear others as well as listen to them, when hired. This is also the only skill/knowledge area thought to be absolutely essential by over 55 percent of the graduates. The next most highly rated skill/knowledge areas were a "computer" skill (No.12), knowledge of hardware and software components of computer and communications systems, and an "organization" skill (No. 30), knowledge of techniques for gathering information. Each of these skill/knowledge areas were perceived as possessed by 85 percent of the graduates, and over 60 percent of them ranked them very important or absolutely essential. These findings indicate considerable value in these three skill/knowledge areas, and suggest that they may be areas in which this small college is doing well in preparation of graduates.

Of the 38 skill/knowledge areas, 24 (63.2%) were perceived to be possessed (by graduates when they were hired) and only 11 (28.9%) were perceived as not possessed (by over half the graduates when they were hired). Responses "tied" in three skill/knowledge areas (Nos. 25, 33, 37) involving ability to identify, describe and solve problems relating to "organizational" and "societal" issues in information systems. Any number of reasons could have contributed to this "split" perception, such as differences in instructional strategy or emphasis of topics by different faculty at the time of enrollment in the program. Graduates believed they did not possess five of the "computer" skill/knowledge areas (Nos. 17, 19-22), which involved the ability to develop specifications for programming projects and information systems, make an economic analysis, and feasibility evaluations. Less than 38 percent of the graduates believed that they possessed these skills/knowledge; however, between 52.5 and 65 percent believed them not to be important in their work.

Importance of Skills/Knowledge.

Four of the "computer" skills/knowledge areas involved hardware, software, and programming proficiency. Similarly, a recent study of IS managers identified these same four skill/knowledge areas as those important to entry-level IS personnel (4). Two "society" skill/knowledge areas (Nos. 37, 38) were rated not important or moderately important by a majority of graduates. However, a 50 percent "split" occurred relative to the "society" skill/knowledge area (No. 36) that focused on ability to articulate and defend a personal position on some important issue of the impact of information technology and systems on society. This split in perception may be a result of different work environments and their effect on personnel. Further study may determine the effects that work environments have on the perceptions of personnel, if any.

Eleven of 13 "organizations" skills/knowledge seem to be more focused on the use of management skills rather than computer skills. Three of these 13 skill/knowledge areas (Nos. 23, 27, 35) were rated not important or moderately important by more than half of the graduates, while another three (Nos. 24, 28, 32) were "split" evenly at 50 percent between not important and moderately important, and 50 percent between very important and absolutely essential.

Table 1: GRADUATES' PERCEPTIONS: POSSESSION OF SKILLS/KNOWLEDGE

Skills/Knowledge*	Yes Responses
PEOPLE	
1. Hear others as well as listen to them.	97.5
2. Describe individual group behavior.	60.0
3. Describe/predict task-oriented/time constrained behavior in organizational setting.	65,0
	72.5
MODELS	
4. Formulate and solve simple models of the operation research type.	62.5
5. Recognize in context the appropriate models for situations commonly encountered.	42.5
SYSTEMS	
6. View, describe, and define any situation as a system-specifying components, etc.	37.5
7. Apply system viewpoint in depth to some class of organization, firm, etc.	45.0
8. Perform an economic analysis of proposed resource commitments.	76.5
9. Specify needs for information/make conditional evaluations if information unavailable.	52.5
10. Present written summary of project for management action, suitable as decision base.	65.0
11. Present written, detailed description of project for completing/maintaining project.	
COMPUTERS	
12. Knowledge of hardware/software components of computer/communications systems.	85.0
13. Program in a higher level language.	70.0
14. Program a defined problem involving data files and communications structures.	60.0
15. Develop several logical structures for a specified problem.	62.5
16. Develop several different implementations of a specified logical structure.	57.5
17. Develop specifications-major programming project (functions, modules, interfaces).	22.5
18. Knowledge of sources for updating knowledge of technology.	52.5
19. Develop major alternatives in specifying an information processing system.	35.0
20. Make economic analysis for selecting among alternatives.	30.0
21. Make rough-cut feasibility evaluations of new applications of current technology.	37.5
22. Develop specifications for the computer-based part of a major information system.	27.5
ORGANIZATIONS	
23. Knowledge of function of purposeful organizational structure and major alternatives.	65.0
24. Knowledge of functional areas of an organization.	65.0
25. Identify an ongoing organizational situation, key issues and problems of each area.**	50.0
26. Knowledge of typical roles and role behavior in each functional area.	62.1
27. Identify short-term/long-term effects of specified action on organizational goals.	57.5
28. Identify information needs appropriate to issues and roles above.	62.5
29. Knowledge of how information systems are superimposed on organization patterns.	47.5
30. Knowledge of techniques for gathering information.	85.0
31. Gather information systematically within an organization, given specified needs/flows.	67.5
32. Specify alternative sets of information transfers and processing to meet needs.	52.5
33. Make rough-cut feasibility evaluations of alternatives.**	50.0
34. Develop positive/negative impacts of information systems on parts of an organization.	52.5
35. Develop specifications for major information systems, addressing organization needs.	27.5
SOCIETY	
36. Articulate/defend position on impact of information technology/systems on society.	62.5
37. Perceive/describe positive/negative impacts of information system in society.**	50.0
38. Perform rough-cut feasibility analysis of impacts (behavioral/economic variables).	42.5

* Complete skill/knowledge statements can be found in Information Systems Curriculum Recommendations for the 80's: Undergraduate and Graduate (Program (ACM, 1992). ** 50 percent split in perceptions of graduates.

However, in each case the highest percentage of graduates (35-45%), across the four rankings, rated these skill/knowledge areas as very important. With the exception of skill/knowledge area 35 at 27.5 percent, over half of the graduates believed they possessed each of these (Nos. 23, 24, 27, 28, 32) skill/knowledge areas when hired. Although there seems to be some discrepancy in opinion about these skill/knowledge areas, they do appear to have some value to these graduates in their jobs. The fact that the majority of graduates were employed at entry-level and many had been employed for one year or less may account for the discrepancy. Also, focus on management skills may not be a priority for hiring entry-level IS personnel. It may be

Table 2: GRADUATES' PERCEPTIONS: IMPORTANCE OF SKILLS/KNOWLEDGE

Skill/Knowledge*	NI	MI	VI	AE
PEOPLE				
1. Hear others as well as listen to them.	7.5	5.0	32.5	55.0
2. Describe individual and group behavior.	25.0	35.0	25.0	15.0
3. Describe/predict task-oriented/time constrained behavior in organizational setting.	15.0	27.5	37.5	20.0
MODELS				
4. Formulate and solve simple models of the operation research type.	15.0	30.0	40.0	15.0
5. Recognize in context the appropriate models for situations commonly encountered.	10.0	32.5	45.0	12.5
SYSTEMS				
6. View, describe, and define any situation as a system-specifying components, etc.	15.0	25.0	35.0	17,5
7. Apply system viewpoint in depth to some class of organization, firm, etc.	22.5	17.5	47.5	12.5
8. Perform an economic analysis of proposed resource commitments.	27.5	25.0	27.5	20.0
9. Specify needs for information/make conditional evaluations if information unavailable.	17.5	20.0	45.0	17.5
10. Present written summary of project for management action, suitable as decision base.	15.0	25.0	47.5	12.5
11. Present written, detailed description of project for completing/maintaining project.	15.0	25.0	42.5	17.5
COMPUTERS				
12. Knowledge of hardware/software components of computer/communications systems.	12.5	25.0	27.5	35.0
13. Program in a higher level language.	27.5	17.5	27.5	27.5
14. Program a defined problem involving data files and communications systems.	20.0	25.0	35.0	20.0
15. Develop several logical structures for a specified problem.	22.5	17.5	45.0	15.0
16. Develop several different implementations of a specified logical structure.	27.5	25.0	35.0	12.5
17. Develop specifications-major programming project (functions, modules, interface).	32.5	22.5	32.5	12.5
18. Knowledge of sources for updating knowledge of technology.	27.5	27.5	27.5	17.5
19. Develop major alternatives in specifying an information processing system.	30.0	22.5	32.5	15.0
20. Make economic analysis for selecting among alternatives.	27.5	37.5	25.0	10.0
21. Make rough-cut feasibility evaluations of new applications of current technology.	32.5	27.5	32.5	7.5
22. Develop specifications for the computer-based part of a major information system.	32.5	22.5	35.0	10.0
ORGANIZATIONS				
23. Knowledge of function of purposeful organizational structure and major alternatives.	20.0	32.5	32.5	15.0
24. Knowledge of functional areas of an organization.**	25.0	25.0	35.0	15.0
25. Identify an ongoing organizational situation, key issues and problems of each area.	17.5	25.0	50.0	7.5
26. Knowledge of typical roles and role behavior in each functional area.	15.0	32.5	45.0	7.5
27. Identify short-term/long term effects of specified action on organizational goals.	20.0	32.5	32.5	15.0
28. Identify information needs appropriate to issues and roles above.**	15.0	35.0	45.0	5.0
29. Knowledge of how information systems are superimposed on organization patterns.	17.5	20.0	40.0	22.5
30. KnowLedge of techniques for gathering information.	12.5	25.0	37.5	25.0
31. Gather information systematically Within an organization, given specified need/flows.	17.5	20.0	40.0	22.5
32. Specify, alternative sets of information transfers and processing to meet needs."	17.5	32.5	42.5	7.5
33. Make rough-cut feasibility evaluations of alternative.**	20.0	27.5	47.5	5.0
34. Develop positive/negative impacts of information systems on parts of an organization.	20.0	25.0	52.5	2.5
35. Develop specifications for major information systems, addressing organization needs.	20.0	32.5	30.0	17.5
SOCIETY				
36. Articulate/defend position on impact of information technology/systems on society.**	27.5	22.5	42.5	7.5
37. Perceive/describe positive/negative impacts of information systems in society.	25.0	32.5	35.0	7.5
38. Perform rough-cut feasibility analysis of impacts (behavioral/economic variables).	30.0	27.5	35.0	7.5

*Complete skill/knowledge statements can be found in Information Systems Curriculum Recommendations for the 80's: Undergraduate and Graduate Programs (ACM, 1982). **50 percent split in perceptions of graduates NI = Not Important MI=Moderately Important VI=Very Important, AE=Absolutely Essential

related to the type of industries in which the graduates worked. Further analysis, study, and collaboration among employers, employees, and educators may identify factors contributing to these discrepancies.

CONCLUSION AND IMPLICATIONS FOR PRACTICE

The overall purpose of this study was to make recommendations for an IS program that would meet the needs of students enrolled in a small four-year college program and their potential employers. The results of this study indicate that, in general, the majority of the skills/knowledge areas in the current program were perceived to be

important and possessed by the graduates of this small college who were employed in the IS profession. However, awareness of those skill/knowledge areas that were not valued in their work, but were often possessed alerted program designers to consider the possibility that the existing program placed too much emphasis on developing skills that were not needed. Similarly, awareness of those skill/knowledge areas that were highly valued in their work but not often possessed, alerted program designers to consider the possibility that the existing program placed too little emphasis on developing skills that were needed.

Occupational considerations should not be the primary motivation for curricula design in any college. However, when seeking to evaluate student outcome as a component of program effectiveness, questions such as "To what extent are our students accomplishing their educational goals?" "Are our students successful in obtaining jobs in the field for which they are trained?" and "How do employers rate the training received by our students?" need to be asked and answered. Ultimately, the information obtained through this study was instrumental in assessing graduate outcomes; and although not the only component, it provided a basis for the initial phase assumed in redesigning the computer information systems program of the college.

Since the majority of IS programs are found in small colleges, the average age of academic IS programs is less than 12 years, and IS departments are small and have few terminally qualified faculty, the need for accountability suggests that other small colleges should become more involved in the progress of their graduates. Educators generally agree that a single general curriculum model may be useful and appropriate (14)., however, indications are that many small colleges offering IS programs are continuing to use either the DPMA or ACM curriculum models as the basis for their programs. Institutions of all sizes use varied rationale to decide upon which curriculum model to implement and make adjustments as necessary in course content and text selection. Reactions from instructors and students currently enrolled are used to evaluate progress in implementing the curricula (15). This study suggests that information from graduates employed in the field may also be helpful in adapting guidelines and revising program curricula. IS educators with similar populations may find that comparisons of outcomes from routine study of graduates with the most recently recommended curricula and industry needs or expectations, provides another strategy useful in designing curricula and preparing IS professionals for a lifelong career.

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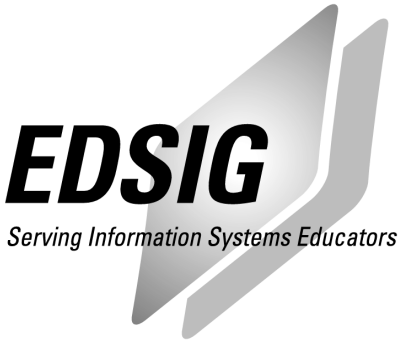

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