

EDUCATION PROGRAM FOR SYSTEMS DEVELOPMENT

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Abstract

It is the most important responsibility of the academic educators MIS/CIS programs to constantly revise their curriculum in order to remain the vital information supply agencies of employable graduates for organizations. According to the MIS/CIS practitioners in the organizations of this study, the MIS/CIS programs should (1) teach project management, walkthrough, object-oriented techniques, structured analysis and design techniques, walkthrough, system integration, rapid application development tools, data warehouse, data mining, and telecommunications; (2) emphasize the team work, communication and problem solving skill; and (3) establish close relationship with MIS/CIS practitioners in the organizations.

1. Introduction

Management Information System/Computer Information System (MIS/CIS) programs in the Schools of Business have been established with the objective to produce college graduates with competent skills and knowledge in the software development over thirty years. The MIS/CIS graduates should be able to use the most current and available information technology for the creation of the computer information system that meets not only the end user's requirements but also the predefined time schedule and budget. Therefore, the academic educators in the MIS/CIS programs constantly have to revise and update their course contents with the intention to well prepare their students to encounter the challenge when they enter this rapid innovative and changing systems development field.

Three organizations, Association for computing Machinery (ACM), Association for Information Systems (AIS), and Association of Information Technology Professionals (AITP), have got together and periodically published "Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems" [11] for the purpose of helping the academic educators to properly structure their MIS/CIS programs. Many schools including College of Business Administration at California State University, Sacramento, have followed the published guidelines to design, improve, and implement the academic curriculum for their MIS/CIS programs.

In general, the most important concern regarding the evolution of a MIS/CIS program to stay current and excellent is always measured by the employment opportunity of its students after their graduation. The MIS/CIS programs have to offer proper courses with appropriate concepts and methodologies that are currently used and needed in the field of computer systems development, in order to increase the chance of its student's employment opportunity. Consequently, the MIS/CIS academic educators have to create an open communication with the MIS/CIS practitioners to clearly understand the techniques and tools been utilized and required in the organizations.

A four-page questionnaire was developed and sent to the names of the organizations and executive/managers drawn from the Directory of Top Computer Executives [5] in order to seek some views and answers related to the MIS/CIS academic programs from the MIS practitioners in the industry. The primary focus of this paper is to identify (1) the summary profile of the organizations that have returned the questionnaires for the research, (2) the methodologies that are used for developing application software, (3) the minimum educational background that is required by the organization to hire a new application development personnel, (4) the system development concepts and techniques should be included in the curriculum of a MIS/CIS program, (5) the most important skills that are emphasized by the organizations for hiring a MIS/CIS graduate, and (6) the potential contributions could be provided to information technology community by a MIS/CIS academic program.

2. Survey Results

Over 1,100 questionnaires were mailed to the different types of organizations such as banking, consulting/system integration, government, insurance, manufacturing, transportation, utility/energy, and wholesale/distribution, throughout the United States. The questionnaires have been completed by the information technology management personnel in the organizations. Only 48 questionnaires were returned, of which 46 information reported in these questionnaires provided the basis for this study.

Table 1 presents a summary of the characteristics of the diverse organizations that have responded the survey questionnaire. The average maintenance work performed by information technology employees among the responding

organizations is equal to 31% comparing to 60% that was reported in the earlier researches and studies [1][10][11]. This result implies that MIS/CIS practitioners in the responding organizations could reduce the maintenance efforts by utilizing the structured analysis and design, structured programming, data flow diagram, and data model, etc. that have been the concepts and methodologies taught in the MIS/CIS academic programs in the last two decades [2][4][6][8][9].

The impact or the important benefit being realized from the improved maintainability of the computer information system is to enable the information technology employee to spend more time working on building new computer information systems that are requested by end users. Table 1 also supports this implication as the average software application development work performed by information technology employees has increased to 39% from 10% reported in the earlier researches and studies [1][10][11].

Table 1: Characteristics of Responded Organizations

Attributes	Low Value	Median Value	Average Value	High Value
Annual Revenue (millions)	3	900	1,531	11,300
Number of Employee	21	2,000	4,169	32,000
% of IT Employee	0.008%	7%	27%	100%
% of SAD Work by IT Employee	0.4%	40%	39%	90%
% of Maintenance Work by IT Employee	0%	25%	31%	90%

The academic educators should be pleased to see these two findings since they have included the appropriate curriculum for the MIS/CIS programs by center around the structured concepts. These programs enable the MIS/CIS graduates not only to overcome some computer information system's maintenance problems, but also to decrease the new computer information system backlog for the information technology department.

Table 2 summarizes the emerging trend of computer information systems development practices currently used by the responding organizations. The in-house software application development method has received the high average percentage that is close to 50%. This result suggests that the courses of academic MIS/CIS programs should still emphasize (1) the entire systems development life cycle (SDLC) from feasibility study phase to maintenance phase, and (2) different techniques such as structured approach, rapid application development (RAD), prototyping, end user computing to accurately and timely develop software application from ground zero.

There are 38% of surveyed organizations that have purchased read-to-use software packages to meet the needs of their computer information systems. This outcome implies that the curriculum of MIS/CIS programs should include a course to teach their students (1) the basic and important criteria of selecting the most suitable off-the-shelf software package(s) to perform the designated task or function, and (2) the skills of integrating different types of off-the shelf software packages and in-house developed computer information systems for the entire organization's information and processing requirements.

Table 2: Application Software Development Practices

Methods	Low Value	Median Value	Average Value	High Value
In-House	5%	45%	48.1%	97%
Outsourcing	2%	10%	19.5%	100%
Acquiring Package	1%	27.5%	38.4%	95%
Other	10%	10%	7.0%	15%

Nineteen percent of responding organizations has indicated that they contract an external entity to custom-developing their computer information system. This down sizing trend for reducing over all information technology overhead suggests that MIS/CIS programs have to cover the concepts of (1) the basic principle of outsourcing computer information systems, (2) the selecting criteria of a outsource entity, (3) the management issues related to outsource, and (4) the future impact of outsourcing to the organization's internal information system demand and information technology supply.

The hiring criteria of the new information systems development, maintenance, and support personnel in terms of academic education background and experience requirements in the responding organizations is presented in Table 3. The responding organizations have stated that the relevant experience of a future employee is the most important factor to be considered as a new hire in all three areas of computer programming, technical support and systems development.

Table 3: Qualifications of New Application Development Personnel

Requirement	Programmer n = 45	Technical Support n = 46	Systems Analyst n = 44
Relevant Experience	30 (66.7%)	38 (82.6%)	30 (68.2%)
Bachelor's Degree, MIS/CIS Major	9 (20.0%)	3 (6.5%)	10 (22.7%)
Master's Degree, MIS/CIS	0	1 (2.2%)	1 (2.3%)
Other Degree	6 (13.3%)	4 (8.7%)	3 (6.8%)

These organizations do not wish to invest the limited information technology resources to train new college graduate for any information technology related works. Consequently, the MIS/CIS academic educators should address this issue by establishing a close relationship with local organizations (1) to form the required internship and/or cooperative programs where organizations can hire MIS/CIS students as the inexpensive information technology assistants, and (2) to obtain some significant information system problems or needs existing in these organizations that can be used as the required term projects for students.

The implementation of these internship or cooperative programs can benefit every involved party. For the local organizations, they can benefit from (1) dedicating the routine information system work to the inexperienced student assistants, (2) relieving the full time information technology personnel to conduct more advanced application development, (3) spotting the capable and skillful students for their future information technology employees, and (4) getting some opinions and inputs for solving their existing information technology problems and/or information system needs.

For the MIS/CIS students, they can (1) gain valuable related experiences by going through the internship and cooperative programs or participating in the classroom problem solving process before graduation, and (2) have a better chance to be employed by organizations after graduate. For the MIS/CIS educators, they can (1) strengthen their curriculum by acquire information system problems and needs from the local organization to equip students with the problem solving experiences, and (2) enhance their knowledge and expand their research by working with information technology problems and information system needs in the organizations.

Vast majority of the responding organizations would not hire candidates with an advanced master degree to perform application development and technical support tasks. This particular fact strongly implies that the purpose of a MIS/CIS program is to produce a group of capable information technology managers who have the qualification and ability of utilizing the information system and information technology to gain the maximum competitive edge for an organization in the current information age.

The curriculum of a MIS/CIS master program should then emphasize those courses dealing with management issues related to information system need and information technology supply in an organization. The graduates of MIS/CIS master program will have the knowledge and background in areas such as the architecture and infrastructure of information technology, strategic analysis of information technology, strategic planning of information system and information resource management in addition to some basic information technology concepts and methodologies.

A comprehensive list of concepts and techniques ranging from the traditional structured methods to newer techniques such as client/server, data warehouse and data mining, was provided in the questionnaire to obtain some inputs from the MIS/CIS practitioners for establishing the proper academic MIS/CIS program curriculum. Table 4 presents a 5-point Likert-type scale from "do not teach" to "emphasize" used by the survey organizations to indicate the importance of concepts and techniques in the MIS/CIS curriculum.

Surprisingly, the responding organizations marked the project management techniques as the most important concepts/techniques should be emphasized in the MIS/CIS program. The responding organizations also favor the concepts/techniques of structured analysis methods, structured design methods, telecommunications, prototyping, data warehousing/ data mining to be included in the MIS/CIS curriculum.

Table 4: Concepts and Techniques That Should be Taught in MIS/CIS Programs

Concepts/Techniques	Mean/ Medium	Do Not Teach					Emphasize
Structured Analysis Methods (n = 45)	3.98/4	0	3 (6.7%)	12 (26.7%)	13 (28.9%)	17 (37.8%)	
Structured Design Methods (n = 44)	3.95/4	0	3 (6.8%)	11 (25.0%)	15 (34.1%)	15 (34.1%)	
Project Management Techniques (n = 46)	4.28/5	2 (4.3%)	0	6 (13.0%)	13 (28.3%)	25 (54.3%)	
Cost/Benefit Analysis Techniques (n = 45)	3.51/4	2 (4.4%)	4 (8.9%)	16 (35.6%)	15 (33.3%)	8 (17.8%)	
Telecommunications/ Client-Server (n = 46)	3.93/4	1 (2.2%)	1 (2.2%)	11 (23.9%)	20 (43.5%)	13 (28.3%)	
Information Systems Planning Methods (n=44)	3.45/3	0	7 (15.9%)	16 (36.4%)	15 (34.1%)	6 (13.6%)	
Logical Models and Physical Models (n = 44)	3.50/4	0	6 (13.6%)	14 (31.8%)	20 (45.5%)	4 (9.1%)	
Data Warehousing/ Data Mining (n = 46)	3.37/3.5	1 (2.2%)	7 (15.2%)	15 (32.6%)	20 (43.5%)	3 (6.5%)	
Fourth-Generation Languages (n = 44)	3.45/3	0	6 (13.6%)	17 (38.6%)	16 (36.4%)	5 (11.4%)	
Prototyping (n = 42)	3.83/4	0	2 (4.8%)	11 (26.2%)	21 (50.0%)	8 (19.0%)	

It is interesting to note that less than 50% of the responding organizations have thought that the fourth

Table 5: Tools for Structure Development That Should be Taught In MIS/CIS Programs

Tools for Structure Development	Medium/Mean	Do Not Teach					Emphasize
Data Flow Diagrams (n = 45)	3.67/4	1 (2.2%)	4 (8.9%)	15 (33.3%)	14 (31.1%)	11 (24.4%)	
Data Dictionary (n = 45)	3.64/4	0	5 (11.1%)	13 (28.9%)	20 (44.4%)	5 (15.6%)	
Entity Relationship Model (n = 43)	3.83/4	0	2 (4.7%)	13 (30.2%)	18 (41.8%)	10 (23.3%)	
Walkthroughs (n = 41)	4.00/4	0	1 (2.4%)	7 (17.1%)	24 (58.5%)	9 (22.0%)	
Other (n = 7)	4.57/5	0	0	0	3 (42.9%)	4 (57.1%)	

generation language is an important subject in the MIS/CIS program. This might due to the lack of a unique and long lasting fourth generation language being used in the responding organizations. More over, the popularity of the fourth generation language has been replaced by the object-oriented languages such as Visual Basic and Java.

Table 5 presents a 5-point Likert-type scale from “do not teach” to “emphasize” used by the survey organizations to indicate the importance of tools for structured development in the MIS/CIS curriculum. The majority of responding organizations have tended to agree that every tool for structured development should be included in the MIS/CIS curriculum with the emphasis placing on the walkthrough to ensure the accuracy of the computer application program.

There are three responding organizations express specifically that they would like to see the object oriented tools be emphasized in the MIS/CIS program. In addition, two responding organizations also strongly believed that building interfaces between different computer information systems should be part of the MIS/CIS program. This might be an important indication that the individuals with the skills of object oriented tools [3] [7] and software integration [11] knowledge will be more marketable and employable in the view of responding organizations.

Table 6: Automated Aids That Should be Taught In MIS/CIS Programs

Automated Aids	Medium/Mean	Do Not Teach				
		Do Not Teach		Emphasize		
Front-End Case Tools (n = 42)	2.81/3	6 (14.3%)	9 (21.4%)	16 (38.1%)	9 (21.4%)	2 (4.8%)
Back-End Case Tools (n = 43)	2.77/3	6 (14.0%)	9 (20.9%)	17 (39.5%)	11 (25.6%)	0
Integrated Case Tools (n = 43)	2.95/3	6 (14.0%)	10 (23.3%)	12 (27.9%)	10 (23.3%)	5 (11.6%)
Rapid Application Development Tools (n = 43)	3.91/4	1 (2.3%)	2 (4.7%)	9 (20.9%)	19 (44.2%)	12 (27.9%)
Data Normalization Tools (n = 43)	3.56/4	0	4 (9.3%)	17 (39.5%)	16 (37.2%)	6 (14.0%)
On-Line Analytical Processing Tools (n = 44)	3.36/3	1 (2.3%)	5 (11.4%)	20 (45.5%)	13 (29.5%)	5 (11.4%)
Other Automated Aids (n = 2)	4.50/4	0	0	0	1 (50.0%)	1 (50.0%)

Table 6 presents a 5-point Likert-type scale from “do not teach” to “emphasize” used by the survey organizations to indicate the types of automated aid should be placed in the MIS/CIS curriculum. It is not surprising that every case tool, on-line analytical processing tools, and data normalization [9][10] have lost it popularity in the responding organizations due to the high learning curve. On the other hand, the majority of the responding organizations agree that rapid application development tools are important development tools to be incorporated in the academic MIS/CIS curriculum.

It is worthwhile to report that two responding organizations have written in their returned survey questionnaires that they would like to see some testing tools and quality assurance tools to be part of MIS/CIS programs to reduce the errors and bugs in computer information system. This fact reinforces the high marks for walkthroughs in the tools for structured development. The high quality of computer information system is one the major objective to be achieved by the responding organizations.

A proper academic curriculum of the MIS/CIS programs based on the survey results in terms of the concepts/ techniques, tools, and automated aids should emphasize those course materials that will equip students with the knowledge, skill, and practice of (1) controlling the schedule and allocating scarce resources to delivery a computer information system on or before time and within the budget; (2) developing a flexible computer information system to reduce the future maintenance effort; (3) creating an error free and high quality computer system to meet the exact requirements defined by the end users; (4) establishing some strategic computer information systems to gain the competitive edge for the organization; and (5) integrating and connecting legacy computer information systems, off-the-shelf software package, and newly developed computer information systems to improve the processing productivity and reduce the overall cost for the organization.

Table 7: Skills in MIS/CIS Graduates

	Frequencies				
Rank:	1	2	3	4	5
Communication Skills:					
Written	9	1	4	4	4
Oral	14	6	6	1	4
Team	14	5	5	2	6
Enthusiasm	4	4	3	5	0
Problem Solving	15	5	7	5	4
Project Management	8	2	4	4	4
Technical Skills:					
Database	3	4	3	1	2
Programming	10	8	6	3	1
Systems analysis	4	8	6	4	7
Telecommunication	0	2	2	2	1
Work ethic	16	5	3	8	5
Other:	2	0	0	0	0

The survey has attempted to find the appropriate skills of MIS/CIS graduates when they are applying a new position in the fields related to the MIS/CIS. Table 7 illustrates the results from responding organizations where a scale 1 (the most important) to 5 (the least important) has been used for ranking the preferred skills among new applicants for a MIS/CIS related position. The responding organizations have rated the work ethic, problem solving, team work, oral communication, and programming being the most important attributes when they screen and select candidates for potential future employees.

This finding suggests that the MIS/CIS programs should (1) incorporate oral presentations and group projects in the curriculum to create a team working environment for students to practice their communication and coordination skills; (2) emphasize case studies to equip students with the ability of not only identifying problems but also the proper techniques to solve the problems; (3) implement object oriented programming language courses to enable students to work with e-commerce related computer information systems, and (4) stress the concept of work ethic in every course through out the entire MIS/CIS program.

The final question on the questionnaire, responding organizations were asked to identify the top three most significant services that academic MIS/CIS programs could provide to the information technology community. Table 8 has been developed to show the results rated by responding organizations. As indicated, Encourage MIS student internship/cooperative education experience with information technology firms, allow executives/professionals review/advice on MIS/CIS curricula, and use information technology executives/professionals as guest lecturers appear to be the most favorable services liked by the responding organizations. However, offering consult services to information technology firm is the least attractive service to the responding organizations.

Table 8: Services of MIS/CIS Programs to IT Community

	Frequencies		
Rank:	1	2	3
Use IT Executives/Professionals as Guest Lecture	5	5	9
Offer Consulting Services to IT Firms	0	1	3
Offer Short Course to IT Firms	7	2	8
Send Distance-Learning (Television) Courses to IT Firms	5	4	4
Allow Executives/Professionals Review/Advice on MIS/CIS Curricula	16	11	3
Allow Executives/Professionals Advising to MIS/CIS Students	8	9	5
MIS/CIS Internship/Cooperative With IT Firms	27	8	5
Other	1	1	1

These results suggest that academic MIS/CIS educators should actively create every opportunity to involve local organizations in (1) shaping the overall curriculum of MIS/CIS programs to meet their employment needs; (2) establishing internship and cooperation programs to enhance student's working experience; (3) providing guest speakers in related classes to educate student's with real information technology development processes and management issues; and (4) advising student to select proper information technology career after graduation. On the other hand, the academic MIS/CIS educators could also provide appropriate information technology training courses to enhance the knowledge of employees for the local organizations.

3. Conclusion

A survey of information system and information technology professionals has indicated that MIS/CIS practitioners in different types of organizations encounter more challenges in terms of developing and implementing the computer information system in today's information era. In one hand, they have to identify and create error free strategic information systems to help organization to gain the competitive edge. On the other hand, they have to build these systems not only in a short time frame but also within limited information technology resources. This environment has pressured organizations to hire MIS/CIS graduates who have the abilities and experiences to fulfill the new requirements of information technology demand.

It is the most important responsibility of the academic educators MIS/CIS programs to constantly revise their curriculum in order to remain the vital information supply agencies of employable graduates for organizations. According to the survey, the MIS/CIS programs should (1) teach project management, walkthrough, object-oriented techniques, structured analysis and design techniques, walkthrough, system integration, rapid application development tools, data warehouse, data mining, and telecommunications; (2) emphasize the team work, communication and problem solving skill; and (3) establish close relationship with MIS/CIS practitioners in the organizations.

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