A COMPREHENSIVE SURVEY OF USA AND CANADIAN UNDERGRADUATE PROGRAMS IN INFORMATION SYSTEMS

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ABSTRACT: A survey was undertaken to develop a comprehensive description of undergraduate programs of information systems (IS) in the United States and Canada. Currently there are two primary curriculum models that describe IS programs: 1) The ACM 1983 Model, and 2) the DPMA 1986 model. [1,2] This survey was undertaken to form the basis for an update or revision of the existing models. Surveys were mailed to 1002 programs. The data presented is from 161 responses as of August 1989. The survey showed little difference between those who have implemented the ACM and/or DPMA curriculum in terms of program objectives, course content for IS and supporting courses. These data would suggest that a single curriculum model could support all IS curricula. Therefore, the results were used in the formulation of IS '90. [3]

KEYWORDS: Information Systems, ACM IS Curriculum, DPMA Model Curriculum, IS Faculty, IS Body of Knowledge, Computing, Curriculum, Survey.

INTRODUCTION

Existing curriculum models for baccalaureate information systems (IS) programs are somewhat outdated for a field that relies on rapidly changing technology. In order to define a more current IS curriculum model, a comprehensive survey was undertaken to determine the status of existing IS programs. The primary objectives of the survey were to evaluate IS in terms of

1. Demographics of the programs,
2. Jobs and Careers of IS Graduates,
3. IS Program Course Requirements,
4. Supporting Course Requirements,
5. Supporting Computing Facilities,
6. Program Faculty,
7. Program Advisory Units, and
8. Perceptions of DPMA and ACM Curricula.

DEFINING THE SURVEY SAMPLE

A major problem in conducting the survey was that no single source was available that identified the undergraduate IS programs. There are several professional societies that have defined IS Curricula including the Association of Computing Machinery (ACM), and the Data Processing Management Association (DPMA). [4,5] There are also several conferences that attract individuals interested in IS (for example: International Conference on Information Systems (ICIS), Information Systems Education Conference (ISECON), TIMS, Decision Support Institute (DSI). Thus, the initial task became generation of a list of programs and program directors (chairs, heads, deans, etc.).

Three sources were used. Peterson's guide to colleges and schools identified a set of 572 programs and directors. DPMA provided a list of 441 programs who were identified as users of the DPMA 1986 model curriculum. Finally, ICIS furnished a list of 426 programs and directors. A dataflex system (Data Access Corp., 1988) was used to merge the three lists with a common format and eliminate duplication. The mailing list was organized in zip code order to search manually for possible duplicate programs. From a total of 1439 entries from the three sources, 1002 unique entries were identified. Entries were identified in all states and provinces of the United States and Canada with several international entries.

Initial responses were received from 161 institutions representing 16% of the surveys mailed. This relatively small response may have been caused by the length of the survey and the distribution

over the summer, traditionally a vacation time for academics. Large faculty workloads could further explain the small response rate to the survey. However, even these set of responses show useful results, as described in this paper.

Programs were identified with 122 different titles. Table 1 contains a list of unique program names. Programs were also found in a wide variety of settings ranging from subunits within departments to stand-alone colleges.

PROGRAM CHARACTERISTICS

Table 2 shows the year the program was established. Most programs were developed in the late 70s and early to mid 80s. The median date is 1981.

Table 3 shows professional affiliation or participation of the program directors. Several of the respondents were members of more than one organization. Approximately half of the respondents were members of the DPMA or ACM with less than 25% identifying affiliation with IEEE-CS.

Table 4 shows the models used by the respondents. All respondents used either of the two IS curriculum models (DPMA or ACM) or a hybrid of the two. Also shown are the number of programs housed within AACSB accredited units.

Table 1: Unique Names For IS Programs

Accounting
Accounting Information Systems
.
Business Data Processing
Business Information Systems
.
Computer Science
Computer and Information Science
Computer and Information Systems
.
Decision and Information Sciences
Decision Science
Decision Systems
.
Informatics
Information Science
Information Systems
.
Management Information Systems
Management Science
.
Software Engineering
Software Information Systems
.

The academic calendar was divided with 82% of the programs using the semester system and 18% using the quarter system.

SURVEY METRIC

Table 5 shows the metric used in the survey. The response descriptors were designed to clarify the meaning of the individual categories. The table below is the metric that was used within the survey, and was later used to evaluate and prioritize the surveyed responses. Results are presented using the numeric score. Most results are shown separately for users of the ACM or DPMA models and for the combined survey sample. [6]

GOALS AND OBJECTIVES OF IS PROGRAMS

As shown in table 6, three general areas or objectives were constructed to ascertain broad program emphasis. The general areas are as follows: IS in

Table 2: Year IS program was established

Date Range	Cumulative Percent	Percent in Range	
1960 - 1970	11.6 %	11.6	
1971 - 1975	23.1 %	11.5	
1976 - 1980	46.3 %	23.2	
1981 - 1983	66.9 %	20.6	median = 1981
1984 - 1986	86.0 %	19.1	
1987 - 1990	100.0 %	14.0	

Table 3 Professional affiliation of respondents

Membership	Number of Respondents	Percent of Respondents
ACM	84	52.2%
DPMA	69	42.9%
IEEE-CS	37	23.0%
ICIS	30	18.6%

Table 4 Model curriculum adopted or AACSB accreditation

Model	Number of Respondents	Percent of Respondents
DPMA	70	43.5%
ACM	40	24.8%
Hybrid	51	31.7%
AACSB Accreditation	48	29.8%

Table 5 Survey Metric Definition

Numeric score	Mark	Meaning of Mark		
100	A	required	essential	definitely
50	B	good	important	maybe/some
0	C	optional	not sure	uncertain/minimal
-50	D	not helpful	unimportant	probably not
-100	E	detrimental	irrelevant	certainly not

Essential	scores between 100 and 50
Good	scores between 25 and 50
Non-essential	scores less than 25

Table 6 IS/MIS General Goals and Objectives

Curriculum Model ALL	ACM	DPMA	IS/MIS Program Level Objectives
69	65	68	IS in Organizations organizations, goals, organizational dynamics, organizational behavior, management, planning, measurement and control of activity, physical flows, utility of IS, facilities control and auditing, policy, systems theory
90	88	90	Computer Systems and Software Technology hardware, languages, compilers, operating systems, database, network and data communications
91	90	94	IS Development formal problems, analysis, design, implementation, conversions, change management, documentation, contract law, ethics, billing, prototyping, and project management

organizations, computer systems and software technology, and IS development. As shown in the table, there was general agreement in the ordering of relative importance of the objectives. The high scores indicate the importance of these areas. Respondents were given the opportunity to add other areas.

GRADUATION CAREER GOALS

Job titles of graduates are shown in Table 7 in rank order. There may be some ambiguity whether the respondents were indicating entry position or career goal. Systems analysts and programmers are the most common positions. There also is a significant trend for the graduates to work alone in a small business with considerable interest in MS and MBA programs.

The primary goal of the survey was to determine the respondents' views on the most important topics for an undergraduate IS degree.

RECOMMENDED COURSES FOR THE IS MAJOR

Recommended courses for the IS major are shown in Table 8. The primary goal of the survey was to determine the respondents' views on the most important topics for an undergraduate IS degree. In an effort to adhere to the most common terminology, course titles and textbook titles were used in the survey. There seems to be strong agreement that the primary thrust of the IS course work should emphasize life cycle concepts associated with analysis, design and implementation of information systems. There is little difference between the ACM and DPMA respondents recommendations.

SUPPORTING COURSES

Information Systems are designed to support organizational objectives. Even

Table 7 Jobs for IS Graduates

Curriculum Model			
ALL	ACM	DPMA	Job Titles for IS Graduates
Most Likely Careers			
87	97	89	Systems Analyst
80	85	88	Applications Programmers
75	85	79	Information Systems Analyst
67	76	73	Data Processing Department of a Small Business
66	71	76	Computer Programmers
61	73	65	Information Systems Designer
59	75	63	MBA Candidate
57	64	60	Information Systems Manager
57	56	49	Data Processing Manager
51	57	51	Computer Consultant
50	61	51	MS Candidate
47	63	51	Data Base Administrator
45	53	43	Information Center Specialist
Possible Careers			
29	26	26	Small Business Executive
20	28	23	DSS Specialist
19	21	19	Communications Analyst
16	32	23	Systems Programmer
10	21	2	Ph D Candidate
9	-2	-9	EDP Computer Auditor
Unlikely Careers			
-6	-2	-8	DBA Candidate
-9	-5	-1	Operations Research Programmer
-9	-2	-9	Security Administrator
-9	-42	-34	Computer Operator
-10	-6	-4	Computer Operations Manager

Table 8 General IS Course Requirements

Curriculum Model			
ALL	ACM	DPMA	General IS Courses Requirements
Essential			
92	94	95	Data Files and Database
91	92	94	Information Systems Design
87	82	92	Introduction to Computer Information Systems
84	83	87	Introduction to Business Applications Programming
81	78	83	Systems Development Methodologies
74	62	75	Information Analysis
73	65	76	Networks, Data and Computer Communications
72	76	75	Data, Information and File Structures
72	79	80	Intermediate Business Applications Programming
68	61	75	Microcomputer Applications in Business
67	67	69	Information Systems in Organizations
60	47	60	Decision Support and Expert Systems
57	55	57	Fourth Generation Languages
55	57	75	Algorithm Development and Problem Solving
55	58	60	Advanced Business Applications Programming
53	61	62	CASE
53	48	59	Operating System Concepts
51	64	54	Software Engineering
Good			
41	25	40	Information Resource Planning and Management
32	25	28	Information System Policy
30	29	31	Rapid Prototyping and System Simulations
28	16	31	Artificial Intelligence
26	23	24	Information Center Functions
24	25	24	Office Information Systems
27	14	23	Computer and Audit Controls
Non-essential			
14	11	18	Facilities Management
12	5	25	Assembler Programming
8	3	9	Systems Programming and Compilers
7	-2	9	AI Programming
0	-3	8	Advanced Data Management with SAS
-14	-21	-9	Robotics

though a significant number of the IS programs surveyed resided outside of business schools, as shown in Table 9, there seemed to be general agreement on the importance of the course, usually related to the common business core.

GENERAL REQUIREMENTS IN SUPPORT OF THE IS MAJOR

In the tradition of a bachelor's degree, the survey indicated a general acceptance of the importance of courses in the humanities, fine arts, social sciences and sciences. It was also felt that both written and oral communication skills were necessary. Finally, mathematics beyond algebra was considered essential. The details are shown in Table 10.

PROGRAMMING LANGUAGES IN THE IS CURRICULUM

Table 11 shows how the respondents viewed the use of programming languages in the curriculum. A range of programming languages from assembler through several fourth generation tools was surveyed. COBOL still (yes, it's still true) dominates the IS community. LOTUS and dBASE were considered important. It was felt that RPG was not important for the IS major nor were the common algorithmic languages such as Pascal and FORTRAN.

HARDWARE AND SOFTWARE SUPPORT

Table 12 summarizes the hardware and software support necessary for an IS bachelor's program. Personal computers running MS-DOS were considered to be the most common equipment. Networked PCs were found to be important. There is also considerable interest in UNIX, MVS and VMS running on mini computers and mainframes. It was found that the Macintosh was not considered important for the IS student.

SURVEY OF IS FACULTY CHARACTERISTICS

Table 13 summarizes the IS faculty characteristics. It was found that there were heavy teaching loads with little

Table 9 Supporting Business Courses

Curriculum Model ALL	ACM	DPMA	Business Courses for IS
	Essential		
85	76	85	Principles of Management
78	71	79	Financial Accounting
77	74	83	Managerial Accounting
72	71	79	Principles of Finance
77	83	84	Quantitative Methods in Business
75	49	57	Production and Operations Management
68	72	71	Principles of Organizational Behavior
66	69	75	Principles of Marketing
60	61	69	Macro Economics
60	62	71	Micro Economics
57	52	57	Operations Research 1: Quantitative Tools for Management
55	48	55	Business Policy
55	42	60	Business Law 1: Legal Systems, UCC, Contracts
	Good		
43	40	43	Operations Research 2: Scientific Problem Solving, Simulation
42	52	44	Cost Accounting
17	5	20	Business Law 2: Partnerships, Corporations and Agencies
	Non-Essential		
9	-5	13	Industrial Quality Control
7	6	14	Marketing Research
7	-5	9	Employers, Employees and Work Measurement
4	-8	11	Money and Banking

Table 10 IS Supporting Courses

Curriculum Model ALL	ACM	DPMA	
			Mathematics
	Essential		
91	94	95	College Algebra
91	94	95	Statistics 1: Basic Statistics
76	83	76	Calculus for Business
72	71	72	Statistics 2: Statistical Methods
Good But Not Required Courses			
35	41	32	Linear Algebra
26	45	27	Discrete Mathematics
26	33	31	Calculus 1: Differential Calculus
20	27	26	Calculus 2: Integral Calculus
			Written and Oral Communications
	Essential		
91	86	92	Composition
91	88	92	Organizational and Writing Skills
82	77	81	Technical Writing
85	77	85	Public Speaking
57	39	54	Small Group Discussions and Dynamics
			Social Sciences and Philosophy
	Essential		
58	59	58	Ethics
53	48	51	Introduction to Psychology
	Good		
43	39	46	Logic
26	23	23	Behavioral Science
	Non-Essential		
19	20	12	Sociology
15	25	15	Western Philosophy
-5	-3	-10	Anthropology
			Laboratory Science
	Good		
36	36	40	Laboratory Science (Chemistry or Physics)
27	18	24	Laboratory Science (Biology)

Table 11 Programming Languages

Curriculum Model ALL	ACM	DPMA	Language
	Essential		
95	94	96	COBOL
70	68	74	LOTUS / QUATTRO / SUPERCALC
62	54	60	DBASE III+ / FOX BASE
	Good		
46	54	43	ORACLE
40	33	42	C
37	45	27	Pascal
29	26	35	RBASE
26	8	32	BASIC
25	17	32	SAS
	Non-essential		
20	2	20	Desk Top Publishing
13	9	24	Assembler
4	3	4	Prolog
4	-2	4	CAD/CAM
3	-3	5	RPG
-3	-12	-2	LISP
-4	-6	2	ADA
-4	-8	-3	PL/I
-6	-5	-11	Dataflex
-6	-18	-2	FORTRAN
-7	-7	-11	Small-talk

Table 12 Hardware and Software Support

Curriculum Model ALL	ACM	DPMA	
			Software Operating Systems
	Essential		
88	86	90	MS/PC DOS
52	59	52	UNIX
	Good		
44	41	43	OS/2
43	39	48	MVS
41	47	45	VMS
35	32	39	VM
18	23	16	Mac DOS
-2	0	-3	PICK
			Computer Systems
	Essential		
91	88	91	IBM or Compatible PC
74	77	71	Networked PC's
74	73	74	Mainframes
	Good		
44	57	45	Minicomputers with Terminals
25	34	14	Macintosh

Table 13 IS Faculty Characteristics

Average Department size	6
Average number of faculty with terminal degrees (30% in Business)	2
Courses Taught per year	7
New Preps per year	4
Distribution of time	
Teaching	66%
Service	26%
Research	8%

research. In addition it was found that only one third of the faculty were terminally qualified and of these, only 30% held terminal degrees in business. For related information on faculty characteristics, the reader is directed to articles by Sanders, Scraggs, and Raymond. [7,8,9]

ROLE OF AN INDUSTRY ADVISORY GROUP TO IS DEPARTMENTS

The results regarding the importance of an industrial advisory board are ambiguous as shown in Table 14. There seems to be general consensus that such a board would be important; however, few institutions actually have one in place. In fact, many said they have tried to form a board but that the boards are now inactive.

SUMMARY AND CONCLUSIONS

The survey indicated the relative youth of IS as a discipline. The average age of academic IS programs was less than ten years. Departments are relatively small with few terminally qualified faculty, heavy teaching loads and little research. There was strong agreement about the importance of personal computing in all aspects of the curriculum. The results of the survey showed general agreement among the respondents regardless of professional affiliation indicating a single general curriculum model may be appropriate and useful. The survey has formed the basis for the new IS curriculum, IS '90.

ACKNOWLEDGEMENTS

Funds for this survey were provided by the Data Processing Management Association, The University of South Alabama, and Custom Information Systems. We would like to thank Loni Longenecker for her help with compiling the mailing list and the students at the University of South Alabama for their help with the mechanics of assembling over 1000 surveys. Finally, Jim Longeno spent considerable effort in helping analyze the results.

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Table 14: Relation of IS Program to Its Industry Advisory Board

ALL	DPMA	ICIS	ACM	IEEE	
Essential and Important to Curriculum					
64	68	76	59	68	Need for Industry Advisory Board
53	54	47	47	39	Board hiring of students
Good But Not Essential in Curriculum					
47	53	75	40	42	Board assists in student training
46	51	53	41	38	Board assists in curriculum planning
24	30	16	17	20	Board desires for Accreditation
21	27	20	15	12	Board assists in faculty consulting
20	22	36	14	12	Board uses IS program to train staff
13	12	8	15	16	Board determines IS program policy
8	9	5	1	11	Boards desire for certification
Probably Unimportant to Curriculum					
-2	4	-3	-9	0	Board provides teachers for program
-12	-7	-10	-14	-20	Board trains IS program faculty

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ISSN 1055-3096