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THE MASTER'S DEGREE PROGRAM IN INFORMATION SYSTEMS

Chair: **Gordon B. Davis**, University of Minnesota, U.S.A.

Panelists: **David Feinstein**, University of South Alabama, U.S.A.
Ted Stohr, New York University, U.S.A.
Joe Valacich, Washington State University, U.S.A.
Rolf Wigand, Syracuse University, U.S.A.

There has been significant recent activity related to model undergraduate curricula in information systems and suggestions for curricular improvement in content and pedagogy. Although these major efforts were modeled within the context of the North American university degree program structures, they are useful for consideration in curricular design in other systems as well. Two major studies were the recent report for undergraduate degree programs in information systems (IS'97, available on the CD-ROM containing these Proceedings) and the soon to be published NSF funded study: ISCC'99 (Educating the Next Generation of Information Specialists in Collaboration with Industry). This panel addresses the related issue of a Master's degree program in information systems.

The most recent model curriculum for a Master's in information systems developed in 1982 by a committee of the Association for Computing Machinery (ACM). Although there has been some work and conferences around the subject since that time, no new report has been published. A joint committee of the Association for Information Systems (AIS) and ACM was established for a Master's degree program in Information Systems. A short paper describing the work of the joint ACM/AIS committee and containing responses to questions that have been raised in sessions with faculty members follows. The paper provides background for the ICIS panel discussion.

THE INFORMATION SYSTEMS MS CURRICULUM FOR THE TWENTY-FIRST CENTURY: BREADTH, DEPTH, AND INTEGRATION

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Abstract

This paper presents the interim results of the work of the joint ACM/AIS Curriculum Committee on IS Curricula. This Curriculum Committee was appointed in January 1998 with the charge to recommend curriculum guidelines for MS programs in Information Systems. The paper describes the design and presents the answers to frequently asked questions about the curriculum. The design of the curriculum is being discussed at a number of international meetings, including ICIS, to obtain input and feedback from the IS community prior to issuing a final set of recommendations.

1. INTRODUCTION

Starting in 1995, at each of AIS Americas meetings, a session for faculty from MS programs in IS was held under the chairmanship of Paul Gray and John Gorgone. As a result of the first meeting, a study of existing programs was undertaken and published in Gorgone and Kanabar (1997). The results were presented at AIS Americas '96. In brief, the study found approximately 50 MS programs in the U.S., with half in business schools and half elsewhere in the university. The content and length of these programs varied widely. It was clear that the most recent graduate model curriculum, issued in 1982 (Nunamaker, Couger, and Davis 1982), needed extensive revision.

While Curriculum '82 is still a useful course reference, course content has changed extensively. The external job market has also changed. New technologies have appeared: World Wide Web, end-user computing, data warehouses, rapid application development, and more. New concepts have appeared or have become important: competitive and strategic use of IS, project management, change management and collaborative work. More skills are needed in graphical user interfaces and object-oriented design.

Based on these results, a Joint Curriculum Committee of ACM and AIS was appointed in January 1998 by Gordon B. Davis, President of AIS. The members of the Curriculum Committee are:

Invited Session

- John T. Gorgone, Co-chair, Bentley College
- Paul Gray, Co-chair, Claremont Graduate University
- David Feinstein, University of South Alabama
- George Kasper, Virginia Commonwealth University
- Jerry Luftman, Stevens Institute of Technology
- Ted Stohr, New York University
- Joe Valacich, Washington State University
- Richard Welke, Georgia State University
- Rolf Wigand, Syracuse University

The Curriculum Committee first held two interactive meetings over the Internet, using AIS's Virtual Meeting Center (VMC), run by M. Mandviwalla of Temple University. The first considered a "straw model" curriculum and the second focused on what the content of a graduate "IS core" should be. A meeting of the full Curriculum Committee at Bentley College followed these virtual meetings from June 18-20, 1998. Since that time, the curriculum has been presented at a number of academic and industry meetings, including the AIS Americas '98 meeting in Baltimore Maryland, the INFORMS meeting in Seattle Washington, and the Conference Board meetings in Chicago and Los Angeles.

The Committee concluded that the MS degree program for the 21st Century needed to provide students with breadth of understanding of the field, with sufficient depth in at least one field for them to follow a career within IS, and with integration.

Before describing the results, it is important to point out that what is described is not a final model program. Rather, it is designed to be discussed by the IS community and hopefully lead to consensus. The procedure being followed is similar to the procedure for the undergraduate program known as IS '97 (Davis et al. 1997).

The following topics considered by the Joint Curriculum Committee are discussed:

- Input skills and output characteristics of potential MS students
- The philosophy and principles underlying the MS program
- The program building blocks
- The suggested program

2. INPUT SKILLS AND OUTPUT CHARACTERISTICS

MS programs attract students with a wide range of backgrounds. Those entering straight from undergraduate college may have a BS degree in IS, computer science, business, or some outside field. The graduate program also draws individuals with experience, including both IS professionals and those seeking career changes.

The output should create people with the following characteristics:

- Broad business and real-world perspective
- Communication, interpersonal, and team skills
- Analytical and critical thinking skills
- Integrated IT and business foundations, a core of IS, and specific skills leading to a career.

3. UNDERLYING PRINCIPLES AND PHILOSOPHY

The following underlying principles and philosophy were developed for the MS in Information Systems:

- The MS is a professional degree that integrates *information* and *organizational* cultures.
- The degree adds *value* to students beyond the bachelor's degree and to the organization emphasizing them.
- The curriculum is flexible for students with differing backgrounds, skills, and career objectives.
- The degree includes a consistent IS core across institutions so that employers can be confident that students with an MS in IS degree are grounded in a common set of fundamentals.
- The program focuses on current and emerging concepts.
- The program has the following themes running through it:
 - ethics and professionalism
 - oral, written, and graphic presentation skills
 - promoting ideas and negotiating
 - people skills
 - business skills
 - customer orientation
 - real-world focus

4. OPERATING PRINCIPLES

The underlying principles lead to the idea that programs should ensure that students have solid foundations in both information systems and organization. Furthermore, students should have a common body of knowledge (i.e., a core) yet the content should be sufficiently flexible to meet both institutional and student needs and objectives. Students should also have the opportunity to obtain practical experience through practicums in industry.

The length of the program depends on the specific regulations for MS degrees in a student's organization. We assumed that the MS curriculum had to be capable of being offered within 30 units¹ (10 courses) but that options should be available to expand the program to as many as 60 units.

From an operational point of view, flexibility implies that students may gain advanced standing credit and/or substitute other courses for material they already know, thus enabling them to take electives inside and outside information systems. Advanced standing credit (ASC) can shorten a student's program to a minimum of 30 units. Undergraduate or graduate courses previously taken may be eligible for ASC (if equivalent), which may reduce the number of courses needed for completion of a program that is more than 30 units. ASC may be granted for any or all of the foundation and core courses. In order to complete the necessary minimum 30 units, students receiving ASC for courses in the IS core may substitute elective courses, as necessary, for those IS core courses that are waived.

The program that is described in section 5 is designed so that a student entering with an undergraduate IS degree in a business school could complete the program with 10 courses (30 units), whereas a student with no experience and a non-technical degree would be required to take 16 courses (48 units).

5. STRUCTURE OF THE PROGRAM

The building blocks of the program are:

¹A course was assumed to be three semester units. Hence, a 30-unit program involves 10 graduate courses.

Invited Session

- Business foundations
- IT foundations
- IS core
- Integration courses
- Career tracks

The content of each of these blocks is described below. The IT and business foundations courses would typically be taken prior to undertaking the MS degree program. If a student is accepted into an MS program without the necessary preparation, she or he would take these courses as prerequisites. The IS core deals with the fundamental elements of the field. Integration refers to a new course that ties together all that has been learned. The career tracks are designed to give the student the knowledge that will lead to a (or reinforce an existing) specialized skill that can be used in their post-degree employment.

5.1 Business Foundations

Business Foundations	Minimum requirement of 3 courses including financial accounting and organizational behavior
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Because IS people are two-culture individuals who must understand both the IS and business cultures, the student is required to learn the fundamentals of business. The minimum number of courses recommended is three, with two specified and one selected according to student and/or faculty preference. These courses should preferably be at the graduate level. Not required of students with a business degree.

5.2 IT Foundations

IT Foundations	Minimum requirement based on IS '97. Fundamentals of IS (IS'97.1) IT Hardware and Software (IS'97.4) and Programming, Data and Object Structures, (IS'97.5).
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A student entering the MS program is expected to know the fundamentals of IT. Students entering without this background would be expected to take these courses before undertaking the IS core. These prerequisite courses are defined in IS '97 (Davis et al. 1997). Although students can complete these prerequisites with three courses, the Joint Curriculum Committee strongly recommends that a two course sequence be taken in programming (i.e., IS'97.5). The IT foundations sequence would not be taken by students with an undergraduate IS degree.

5.3 IS Core

IS Core	Five courses: (1)enterprise information management; (2) analysis, modeling, and design; (3) enterprise-wide network architecture (4) project and change management; (5) IS policy and strategy.
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The IS core must be taken by all students. A few of the five courses in the core have been included in previous curricula, although the content of these courses in the 21st century will be far different than they were in 1982, 1992, or 1996 because of the rapid changes in the field. For example, the first course, enterprise information management, deals with the technical and managerial aspects of data base. The new course in the core is project and change management. This course (which had previously involved two unrelated electives) reflects the expectation that MS graduates will take leadership roles in their organizations or consulting firms. To do so, they need to be able to manage projects and the radical organizational changes that they engender. In addition, the policy and strategy course, which had in previous curricula been designed to offer a capstone, has been designed to be a view of the organization by the CIO or senior IS manager.

5.4 Integration

Integration	One of three alternative courses that tie the Core together
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The integration course is a new feature. It is designed to unite the individual pieces that the student learned in the foundation and core courses. There are three alternatives. Each course will survey the three aspects and then take one aspect in detail.

- integrating the organization
- integrating the IT resource
- integrating technology

Because this course is a unique feature of the proposed program, it is discussed in detail in section 6.

5.5 Career Tracks

Career Tracks	Three or more related electives that prepare a student for an emerging specialization.
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In keeping with the philosophy that students taking an MS program should be able to specialize, the program includes a career track. Representative topics for this track are listed in Table 2. Each school would choose tracks based on its local market and its faculty expertise. For example, the Knowledge Management track might require a survey course in Knowledge Management followed by electives chosen from such topics as data warehousing, organizational memory, text management, and by a Practicum with a knowledge management consultancy. The pre-Ph.D. track is designed for students intending to undertake a research career. The Joint Curriculum Committee strongly recommends that a Practicum be included in the career track.

Table 2. Sample Career Tracks

Change Management	Entrepreneurship	New Ways of Working	Systems Analysis & Design
Consulting	Globalization	Network Applications	Technology Management
Data Management	Human Factors	IS Functional Areas	Telecommunications
Electronic Commerce	Knowledge Management	Pre-Ph.D.(research)	
ERP	Managing the IS Function	Project Management	

6. INTEGRATION

The Integration course was introduced into the degree because the Joint Curriculum Committee members believe that the student must be able to understand the interrelationships among the various courses. Integration is a multi-billion dollar industry that attracts senior people. It is also a subject that has been virtually neglected in IS education.

The need for integration is driven by the need for innovation, coordination, and speed. These three characteristics are the result of competition, globalization, emerging technologies, and organizational change. These phenomena demand integration of organizational and technological perspectives.

As indicated in section 5.4, integration takes three forms: (1) the organization, (2) the IT resource, and (3) the technology. Students need to be exposed to all three forms.

The Joint Curriculum Committee proposes three alternative integration courses. Each of these courses would begin by surveying all three forms. The courses would then concentrate on one form of integration.

6.1 Integrating the Organization

Objectives:

- Integrated view of the firm and its relation with suppliers, customers
- IT as a driver and enabler of new organizational forms

Content includes business architecture, integrating business process, intra-organizational architectures/processes, and ERP.

6.2 Integrating the IT Resource

Objectives:

- Improve competency in managing day-to-day IT function
- Effective/efficient IT business processes, technology scanning, systems integration, human resources, and governance

Content includes IT processes, CIO role, IT value, governance, managing emerging technologies, outsourcing, organizational considerations, change management, HR considerations.

6.3 Integrating Technology

Objective:

- Understand management considerations in providing a cohesive technology blueprint.

Content includes architectural choices, priorities, and policies for networks, data, and applications; integrating old and new technologies.

7. FREQUENTLY ASKED QUESTIONS

The curriculum described above has been discussed with a number of people, most notably a group numbering over 60 attending the AIS Americas '98 conference in Baltimore, Maryland in August 1998. A number of questions were asked and responded to. In this section we present some of the most frequently asked questions (FAQ's) and the Joint Curriculum Committee's response to them. For convenience, the questions are presented by topics.

7.1 Topic: Foundations

Comment 1: Schools should use competency testing to make sure a student knows the Foundations that are prerequisite to an IS core course before permitting them to register for the core courses.

Each school determines competence on Foundation prerequisites. If a student took a course on the topic as an undergraduate with an acceptable grade from an accredited school, some schools will allow transfer whereas others may require competence testing. The Joint Curriculum Committee believes this is an issue for individual schools rather than a policy matter.

Comment 2: Why do the IT Foundations require programming courses?

The Foundations include one to two courses covering programming and data and object structures. The specific programming requirement within these two courses is generic. The amount of programming required depends in part on the nature of the MS

program being offered at a particular school. For example, in a school that focuses on organizational issues, the ability to program in a simple language might be sufficient whereas in a more technical MS program, C++ might be required.

Comment 3: An MS program not associated with a Business School may not want to require business courses for all students.

The Curriculum Committee believes that a graduate with an MS in IS needs to know a number of business-related topics to survive if he/she is to function well in an IS job, particularly if that job involves managing in a private or a public organization. The topics shown in the proposal (accounting and organizational behavior) are believed fundamental. The intent is that the student knows this foundation. They do not need to be taken in a business school.

Comment 4: For programs not part of a Business School (and half the current MS programs are not part of a Business School) it is difficult to obtain spaces in Business School courses.

The intent is to obtain the knowledge. Students can satisfy the Foundation Courses in business by taking equivalent courses in other departments. For example, Industrial Engineering often teaches accounting; Psychology or Sociology teaches organizational behavior. Furthermore, foundation courses can be taken at a senior undergraduate level.

Comment 5: The Curriculum Committee does not specify what the third Business Foundation course should be. Reviewer suggestions for the third course include Economics, Operations Research, Decision Science, Managerial Accounting, Production and Operations Management, and Statistics

The Curriculum Committee believes that 3 courses in business topics (whether they are given in the Business School or elsewhere in the college or university) are a minimal set of knowledge for MSIS graduates. The program is conceived as being a two cultures program, including both the IS and business cultures. Given that IS graduates will work in firms and will interact with business-educated people, they will need to be able to communicate with people who have a business background. Since many of these people are not likely to learn the IS field, it becomes the responsibility of the IS people to become culturally bilingual. Three courses in business topics is considered the minimum they will require. The Curriculum Committee believes that the ability to understand financial accounting and the ability to understand how companies are organized and how people behave in organizations are required of all IS people. The third course can be tailored by the student and the faculty advisor to what is available in a particular school and is compatible with the Career Track chosen by the student.

Comment 6: Not enough business courses are required or perhaps even allowed.

Schools that wish to increase business content through formal business course work can do so. However, they will create a longer program because the curriculum recommends requiring 10 courses (5 core, integration, and 4 career track). The idea of the curriculum is that business considerations are covered within all courses, particularly in the core and integration courses. It is also feasible for a school to create a business track for students who want a pure managerial orientation. However, in that case, students may be better off taking an MBA with a concentration in IS. The present curriculum is not oriented toward the IS concentration within the MBA.

7.2 Topic: IS Core Courses

Comment 1: Core courses should enhance what is covered in undergraduate courses, not waived by undergraduate work in the same subject.

The Curriculum Committee was faced with the difficult task of providing a curriculum that could range from 30 to 60 units (10 to 20 courses) because of the different requirements for MS degrees among Universities. We agree that core courses should not

be waived by presenting undergraduate equivalents. However, in the case of short (10 course) programs for students entering with thorough technical preparation (IS'97 or an undergraduate Computer Science degree), the value added considerations change. Thus, for example, for a CS student with thorough grounding in database and telecommunications, it is more important that the student learn the fundamentals of IS and of business rather than repeating material that may be offered at a lower level than undergraduate CIS.

Comment 2: Project management and change management do not require a full course. Change management is dealt with in the Organizational Behavior business course.

The Curriculum Committee believes that project management is an important topic for the core at the MS level because it is a capability that an MS degree guarantees. Similarly, almost all IS projects involve transforming an organization from its existing ways of doing things. Such changes are often radical and traumatic to the people involved. Although change management may or may not be included in an organizational behavior course, students should understand and be able to implement the changes that an IS project creates. The concept of the core course is to reinforce the ideas of the organizational behavior course and make the relation between the technical and organizational aspects of projects concrete for MS students in IS, particularly those who come from technical backgrounds.

Comment 3: The required core courses are too traditional. The result is a rigid core for a constantly changing field.

The Curriculum Committee agrees that the course titles for the core are conventional. However, what is inside these courses does change over time as the field changes. Thus, for example, new system design techniques, such as RAD and object orientation, are now found in most systems analysis courses. Other topics such as CASE have moved in and out of some courses. We anticipate that the content of the core courses will change. However, we believe that graduates of the MS programs should know the latest in the five fields selected for the core.

7.3 Topic: Career Tracks

Comment 1: The curriculum contains too many tracks.

The tracks listed are an indication of the range of topics that tracks may cover. It is anticipated that schools will choose only a small number of tracks for their own curriculum, where the criteria for selection include:

1. industry needs in the geographic regions
2. capabilities available within the school.

Tracks can (and should) be multidisciplinary, involving courses in two or more departments, depending on the nature of the track. For example, a student following an Electronic Commerce track might take e-commerce courses in IS, marketing, economics, and management.

Comment 2: Additional tracks should be specified beyond such traditional topics as Software Engineering or Human-Computer Interfaces so that careers are more futuristic and "stretch" students,

The list of tracks is illustrative. Different schools will offer different tracks depending on their market and their own capabilities. Experimentation with tracks is recommended. The only thing certain is that some tracks will become obsolete over time while new ones will emerge as the IS field changes.

Comment 3: The MSIS curriculum should provide outlines of specific courses in tracks since many courses cover new topics not now available.

We believe that such specification would require so much time that it would delay the issuance of the Curriculum. We leave it to individual schools to be innovative here. We anticipate that the next iteration would carry course outlines.

7.4 Topic: Relation to IS '97

Comment 1: How does the MS differ from IS '97. How is it an advance over IS '97?

The MS program envisions a range of students from those who are novices to IS and are changing fields at one end to students who come out of a solid IS '97 program. The MS therefore calls for foundation courses that will bring the novices up to speed. The core courses are graduate level courses that, like MBA courses, treat subjects covered at the undergraduate level with a graduate perspective. That is, they cover more material at a more conceptual level. The integration course and the career track are unique to the MS program.

7.5 Topic: Missing Elements and Over-all Comments

Comment 1: The program lacks a customer orientation.

Customer orientation has been included under the philosophical points of professionalism, business skills, and people skills. It is part of Principles and Philosophy (Section 3). The Curriculum Committee plans to expand its discussion of how the Principles and Philosophy cut across the courses in a matrix format.

Comment 2: The "integrated" concept should happen throughout the core.

Once the integration course is established, integration concepts would inevitably be brought into the individual core courses.

Comment 3: The program is too strongly centered on the IT realm and does not accomplish the goal of integrating "information and organizational cultures."

We agree that integration is discussed primarily at the philosophical level. The details of this integration need to be worked out.

Comment 4: Not much is being done about communications/persuasion skills.

This topic is in the Principles and Philosophy (section 3). Details of how it is to be integrated into the MS still remain to be worked out.

8. CONCLUSIONS

This paper has presented the initial findings through October 1 of the Joint ACM/AIS Curriculum Committee. These findings are a work in progress. The objective of the panel at ICIS is to present the curriculum and its underlying assumptions to the IS community for input. The dialog at ICIS is one of several that are being undertaken. It is anticipated that a final product will be presented in August 1999 at the AIS Americas '99 conference.

The curriculum presented builds upon the ACM Curriculum '82 (Nunamaker, Couger, and Davis 1982), yet changes that curriculum extensively. Rather than presenting a fixed list of courses required of all MS students, the curriculum recognizes that students matriculate with different backgrounds and different aspirations. It also recognizes that schools have different MS degree requirements and that the MS in IS is housed outside a business school as often as within one. The curriculum is divided into background skills, a core, an integration course, and a career track tailored to the student and the school. The core guarantees both students and employers that holders of the MS degree have a common, useful set of skills. In short, we believe that the proposed curriculum has the breadth (through the core), the depth (through the career tracks) and the integration that will be needed by students in the 21st century.

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