A PROPOSED MIS CURRICULUM MODELED ON ANTHONY'S PYRAMID

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ABSTRACT: This paper describes a management information systems (MIS) curriculum modelled on Anthony's Pyramid. In contrast to past and present models that tend to organize course content around technologies and methodologies, the proposed model structures course content by type of problem: operations, management, and strategic. After completing two courses covering organizational and technological foundations, the authors propose a two-course sequence at each pyramid level. The first course in sequence emphasizes concepts while the second course emphasizes application of concepts through integrated projects. After presentation of proposed course structures and sequences, curriculum issues are considered.

KEYWORDS: Curriculum, Management Information Systems, Curriculum Model

INTRODUCTION

Determining the best information systems (IS) curriculum design provides educators with an opportunity for continuing debate. What should the emphasis of the curriculum be? What courses should be required? What content should each course include? Scholars and practitioners have offered many opinions [1, 2, 3, 4, 5, 6, 7]. Likewise, professional organizations such as the Data Processing Management Association (DPMA) have attempted to answer these questions by publishing model curricula [8]. But even with model curricula in place, IS programs are often criticized for not equipping graduates with the "right" tools for success [9, 10, 11, 12, 13].

Time and time again, articles written about IS curricula often recommend achieving a better balance between technical, business, and communication skills. Although arguments are often made about which technical skills are most important, students are perceived as adequately prepared in this area. The business and communication skills are most frequently considered deficient.

The authors believe that a fundamental change in curriculum structure could achieve a better balance among skills, particularly between business and technical skills. While the curriculum models to this date could be primarily characterized as CIS, the purpose of this paper is to propose a model for MIS curricula. In contrast to other paradigms that emphasize technologies and methodologies, the model proposed here structures course content around the type of problems to be solved as defined by Anthony's Pyramid.

The cornerstone for building an organization's information system across levels and functions is data.

SETTING THE STAGE FOR A NEW MODEL

Many definitions have been put forth regarding what constitutes a management information system. Likewise, differences of opinion exist regarding the purpose of MIS curricula. For the purpose of this paper, we will use Kroenke's definition of MIS. According to Kroenke [14], MIS is the "development and use of effective information systems in organizations (p. 6)." We will further assume that the purpose of a management information systems curriculum is to teach students the concepts and skills needed for development of effective information systems (IS) in organizations.

To provide a framework for instruction about MIS, Kroenke defines three IS dimensions represented as a cube (p.102). The Why dimension describes the goals of MIS — strategic planning, management control, operational control, improved product delivery, and improved product quality. The What dimension

identifies the components for building MIS — hardware, programs, data, personnel, and procedures. Finally, the How dimension describes processes for developing MIS — the systems development life cycle, prototyping, and CASE.

Although all three IS dimensions play a role in the organization of traditional IS curricula, past and present models tend to emphasize the second and third dimensions. That is, course content has tended to be structured around some component (particularly hardware and software) or phase of the development process. Consider, for example, the following common course titles: Microcomputer Applications, Telecommunications and Networks, Systems Analysis and Design, or Advanced COBOL Programming.

Emphasizing the **Why** dimension over the **What** and the **How** dimensions provides several advantages in curriculum design:

1. The **Why** dimension is the major characteristic that distinguishes information systems from other computer-based curricula such as computer science. The applications of IS to business should be inherent in IS course structures.
2. Of the three dimensions defined by Kroenke, the **Why** dimension remains relatively constant over time. That is, our reasons for developing IS stay the same even though technologies and methodologies change. Organization by **What** and **How** will implicitly require more curriculum maintenance.
3. Finally, organizing by the **Why** dimension focuses learning on technology as a means for solving problems, not as an end itself. Wiersba explains the importance of this focus:

> *Business . . . criticizes that MIS graduates tend to concentrate solely on the technical aspects of information systems - the "how", rather than on the competitive advantage the system might provide - the "why". They feel their objective is to "computerize" everything. (p. 52)*

For these reasons, we propose a management information systems curriculum with the **why** focus. The curriculum shares many of the same themes as the DPMA's IS'90 Curriculum such as life cycle, organizational hierarchy, and conceptual integration. However, in contrast to the most recent DPMA recommendations, the proposed model organizes course structure around a frequently used model for describing **Why** organizations use information systems, Anthony's Pyramid [15].

> ***Consistent with changes in systems development methodologies and organizational realities, the IS curriculum itself will change from process-driven to data-driven.***

THE PROPOSED CURRICULUM MODEL

The curriculum based upon Anthony's Pyramid organizes content around the development of information systems for operational control, management control, and strategic planning (See Figure 1). The foundation for building systems at any level requires an understanding of both technological and business concepts. Once these are in place, fundamental operations IS can be studied and developed, followed by those used for management control and strategic planning.

The cornerstone for building an organization's information system across levels and functions is data. To reflect this reality in the proposed curriculum, data concepts and skills are assumed to be the cornerstone upon which other competencies are built. Unlike past curricula, writing procedural code is no longer viewed as the foundation for systems development. Instead, successful progress through the curriculum will depend on mastery of data-related competencies. Consistent with changes in systems development methodologies and organizational realities, the IS curriculum itself will change from process-driven to data-driven.

PROPOSED COURSE STRUCTURE AND SEQUENCE

The proposed curriculum encompasses eight courses, illustrated in Figure 2. The initial Group I Foundation courses set the stage for comprehensive study of information systems at the operations (Group II), management (Group III), and strategic levels (Group IV). For Groups II, III, and IV, a course emphasizing concepts is followed by a course emphasizing practice. Based upon the listed prerequisites, minimum completion time for the program is five semesters.

Group I: The Foundations

In the Foundations group, **MIS 1** is devoted to learning about organizational concepts and systems theory. Some of this content might be gleaned from the typical Principles of Management course. However, the experience of the authors is that such coverage is inadequate for information systems majors. Furthermore, this content is needed by the MIS student prior to its inclusion in the typical business curriculum.

MIS 2 is devoted to the technological foundations which the MIS major needs with strong emphasis on data fundamentals. For instance, data storage concepts, data and file structures, and data design would be presented. Also included in this course would be basic hardware and software fundamentals, communications concepts, and application development tools needed for systems development in subsequent courses.

Group II: Operations IS

In **Group II** courses, the emphasis on operations IS provides an understanding

Figure 1: A DECISION-ORIENTED CURRICULUM MODEL

Strategic:	Analysis, design, implementation, and maintenance of systems for ill-defined problems primarily at higher levels of the organization requiring the availability of internal and external data.
Management:	Analysis, design, implementation, and maintenance of systems for budgeting, performance evaluation, and resource control built upon systems developed at the operations level.
Operations:	Analysis, design, implementation, and maintenance of support systems for transaction processing, administration, and process control.
Organizational:	Concepts relating to systems theory and organizational structure that provide an understanding of the functional roles of the organization and the use of information in support of these roles.
Technological:	Understanding of hardware, hardware/software relationships, communications technology, data structures, and logical data design.

of (1) what "operations" means, (2) the goals of the typical operations system, (3) the types of applications that are traditionally developed for operations, (4) the typical components of such a system, (5) the process of developing that system, and (6) the issues involved in managing and maintaining the operations IS. Course **MIS 3** emphasizes the conceptual basis for such a system; **MIS 4**, on the other hand, includes the practical issues of actually developing such systems, including the necessary stages of planning, designing, developing, testing, and implementing.

Group III: Management IS

The sequencing of **Group III** courses parallels that of Group II. The **MIS 5** course emphasizes concepts of management information systems including goals, applications, components, methodologies, and management issues. The actual development of an MIS takes place in **MIS 6**.

The **MIS 6** project should be coordinated closely with the results from MIS 4 to reinforce the relationship between operations and management information systems. For example, data generated by the operations IS could be extracted and used by the management IS to generate performance and control reports. The components (what) and methodologies (how) used in practice would be selected based upon (1) those appropriate for development of MIS and (2) those already learned in MIS 4.

GROUP IV: STRATEGIC IS

The sequencing of **Group IV** courses also parallels that of Groups II and III. In this case, the **Group IV** courses focus on IS for strategic planning such as forecasting and modelling applications that require use of external as well as internal data. Repeating the same structure as Groups II and III, **MIS 7** will emphasize concepts of strategic IS while **MIS 8** will stress the development practice.

To reinforce the relationship between strategic IS and lower-level IS, **Group IV** practice projects must be coordinated closely with those developed for Groups II and III. Design of **MIS 8** projects will need to consider existing systems developed during MIS 4 and MIS 6. Again, components (what) and methodologies (how) should be chosen to reflect (1) those that are appropriate for strategic IS and (2) those for which the students need hands-on experiences.

At each level, multiple applications in different functional areas should be developed to reinforce both business and technical expertise. By moving through the entire process of systems development and management for each pyramid level, students have the opportunity to (1) understand different types of business activity and related problems (the **Why**) and (2) explore different technologies (the **What**) and methodologies (the **How**) required for success in the work place.

IMPLICATIONS OF THE MODEL

In contrast to many of today's curricula that organize course content around technology, the proposed model defines the role of technology as a vehicle for solving problems. Depending upon the

Figure 2: PROPOSED COURSE STRUCTURE

I. FOUNDATIONS

MIS 1: Organizational Concepts — Prerequisites: none

Systems theory, organizational structure, functional areas

MIS 2: Technological Concepts — Prerequisites: none

Data storage, data structures, files, data design
Hardware, software, communications, application development tools

II. OPERATIONS INFORMATION SYSTEMS

MIS 3: Concepts of Operations IS — Prerequisites: MIS 1,2

Goals, applications, components, development, management

MIS 4: OIS Development Project — Prerequisites: MIS 3

Analyze, design, and develop an operations information system

III. MANAGEMENT INFORMATION SYSTEMS

MIS 5: Concepts of Management IS — Prerequisites: MIS 3

Goals, applications, components, development, management

MIS 6: Management IS Development Project — Prerequisites: MIS 4,5

Analyze, design, and develop a management information system based upon the operations information system constructed inMIS 4.

IV. STRATEGIC INFORMATION SYSTEMS

MIS 7: Concepts of Strategic IS — Prerequisites: MIS 5

Goals, applications, components, development, management

MIS 8: Strategic IS Development Project — Prerequisites: MIS 6,7

Analyze, design, and develop a strategic information system based upon the projects completed in MIS 4 and MIS 6.

educational environment and the perceived job market for graduates, the model is flexible enough to allow for using different foci for each of the components at each level of the pyramid so that every school's curriculum can be customized to its needs, while at the same time maintaining the identical structure.

By emphasizing the types of problems to be solved, the proposed course structures provide technology-independence. That is, the curriculum framework will remain constant even though technology is rapidly changing. However, focusing on technology as a tool for solving problems requires careful planning and coordination. The only way to ensure that those technologies deemed important actually are presented to and experienced by the student is to draft a strategic plan. An example of such plan is shown in Figure 3. At each level of decision-making for which supporting systems will be developed, the following determinations must be made:

Figure 3: A SAMPLE CONTENT FRAMEWORK

	Problem Focus	Environment Focus	Tools Focus	Data Focus	Methodology Focus
Strategic	DSS, ESS eg. Sales Forecasting, Modeling, Graphics	Mainframe/Mini/PC Local Area Networks	4GLs and Tools Application Packages Expert Systems	Decentralized Personal Internal, External data	Prototyping CASE
Management	MIS eg. Sales Performance, Exception Reporting	Mainframe/Mini Wide Area Networks	4GLs and Tools 3GLs	Distributed Workgroup Internal, External data	CASE SDLC
Operations	TPS eg. Sales Processing Batch, Online	Mainframe/Mini Centralized Processing	3GLs	Centralized Organizational Transaction data	SDLC

1. Problem Focus. For what type of business problem(s) should an information system be developed?
2. Environment Focus. What are the architecture and operating environment for building the information system?
3. Tools Focus. What software tools will be emphasized in the development of the information system?
4. Data Focus. What type of data organization should be emphasized in designing and developing an application? What will the sources of data be?
5. Methodology Focus. What type of systems development approach will be used to develop the information system?

The operative word when examining the content framework illustrated in Figure 3 is "sample." The authors have rather arbitrarily chosen the cell values shown in the table based upon the skills perceived as important by their students' employers. The implementation for a specific curriculum would vary depending on such factors as available resources and student employability. Fourth generation tools and personal computers could certainly be used to develop operations IS. The flexibility of the model allows for similar curricular outcomes to be achieved through various combinations of components and methodologies.

The advantage of the content framework for implementation of the proposed curriculum model is simply that technology instruction can be integrated for solution to a particular problem. The major drawback to using the content framework for organizing technology instruction is faculty coordination. Agreement among faculty would be needed to organize problems and technologies within the context of the framework.

In contrast to the typical MIS curriculum today that tends to emphasize process, the model proposed here emphasizes both MIS process and product. By blending concepts and skills for information systems at each level of Anthony's pyramid, students learn both the technical and business expertise needed to succeed as an MIS professional.

CURRICULUM ISSUES

Such a modular curriculum presents some problems. The authors perceive the issues below as presenting the largest obstacles to overcome in curriculum implementation:

Faculty Coordination

A much greater degree of cooperation and coordination among faculty would be required than is currently the case. As mentioned before, using a content-framework approach to define various foci will requirement faculty cooperation and agreement.

Instructional Materials

Current textbooks and instructional materials are not organized to provide instruction as proposed in this paper. Without such materials, a burden would be placed on instructors to develop their own or to use a hodge-podge of sources.

Curricular Compatibility

Because the structure of this curriculum is based on the **Why** dimension of MIS, determining course equivalencies with other model curricula is difficult. This presents a problem especially for transfer students attempting to receive work from previous IS programs.

CONCLUSION

In summary, although such a curriculum offers a number of challenges to the faculty responsible for developing it as well as the students enrolled in it, the authors believe that the benefits far outweigh the costs. If the goal of the MIS program is to assist the student in developing the concepts and skills to be a competent professional in today's evolutionary environments, our emphasis must change from the **How** or **What** of MIS to the **Why**. Only in this way can the curriculum evolve to meet the needs of the student and the work place.

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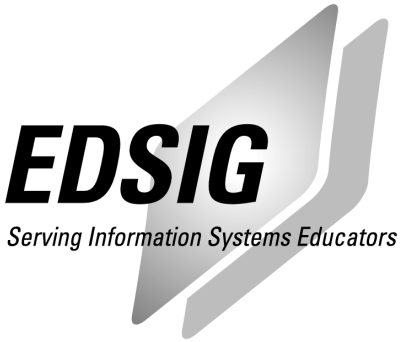

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