A PROPOSED MIS CURRICULUM MODELED ON ANTHONY’S PYRAMID

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ABSTRACT: This paper describes a management information systems (MIS) curriculum modeled 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 be 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.

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
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
I. FOUNDATIONS

MIS 1: Organizational Concepts
- Systems theory, organizational structure, functional areas
Prerequisites: none

MIS 2: Technological Concepts
- Data storage, data structures, files, data design
- Hardware, software, communications, application development tools
Prerequisites: none

II. OPERATIONS INFORMATION SYSTEMS

MIS 3: Concepts of Operations IS
- Goals, applications, components, development, management
Prerequisites: MIS 1,2

MIS 4: OIS Development Project
- Analyze, design, and develop an operations information system
Prerequisites: MIS 3

III. MANAGEMENT INFORMATION SYSTEMS

MIS 5: Concepts of Management IS
- Goals, applications, components, development, management
Prerequisites: MIS 3

MIS 6: Management IS Development Project
- Analyze, design, and develop a management information system based upon the operations information system constructed in MIS 4.
Prerequisites: MIS 4,5

IV. STRATEGIC INFORMATION SYSTEMS

MIS 7: Concepts of Strategic IS
- Goals, applications, components, development, management
Prerequisites: MIS 5

MIS 8: Strategic IS Development Project
- Analyze, design, and develop a strategic information system based upon the projects completed in MIS 4 and MIS 6.
Prerequisites: MIS 6,7

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

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

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 require 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.

REFERENCES


AUTHORS' BIOGRAPHIES

Gary A. Williams is Associate Professor of Computer Information Systems at Western Carolina University where he teaches MIS, database, applications development, and related courses. His DBA is from Texas Tech University; he has taught in CIS and related disciplines for 20 years at several universities and has also managed computer lab resources and personnel.

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