Information Systems Draft Accreditation Criteria and Model Curricula

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Abstract

Information systems is a discipline that covers both the technical and managerial aspects of computing. As a discipline matures it becomes necessary to define it through the accreditation of undergraduate programs. There are a number of model curriculums that have been developed for information systems. This paper is a look at the proposed curriculum accreditation criteria and the match of these criteria to existing curriculum models. Recommendations for modifications to the models are made to assure conformation to accreditation requirements.

Keywords: Model curricula, accreditation, information systems courses, professional societies

1. INTRODUCTION

The accreditation of information systems academic departments has been a topic of interest since the creation of the discipline from computer science and business administration. The Computing Sciences Accreditation Board (CSAB) already accredits Computer Science departments. The Association to Advance Collegiate Schools of Business (AACSB) accredits business departments. AACSB accreditation of business programs includes a look at IS within these schools.

The Association for Information Systems (AIS), the Association for Computing Machinery (ACM), the IEEE-Computer Society (IEEE/CS), and the Association for Information Technology Professionals (AITP) joined together to work with the CSAB in establishing criteria for the accreditation of Information Systems Programs (Gorgone 1999). The CSAB is also in the process of joining with the Accreditation Board of Engineering and Technology (ABET), the primary accrediting body for engineering programs in the United States. Thus, under the auspices of CSAB, draft criteria for accrediting information systems programs has been written. In the end, IS programs will be accredited by an ABET body responsible for IS.

An information systems curriculum consists of technical and management topics which the accreditation criteria and the three curriculum models presented here address. Topics range from a basic understanding of computing, through the design of practical applications for complex computer systems. These topics collectively represent the body of IS technical knowledge expected of a recent IS graduate (Scime 2000, 2001). This paper is a look at the match of the draft criteria's curriculum requirements and three commonly implemented information systems model curricula.

2. INFORMATION SYSTEMS ACCREDATION CURRICULUM

The draft accreditation curriculum is divided into 5 sub-sections. It includes the entire 4-year (120 semester credit hour) curriculum for information systems. The IS knowledge necessary is discussed, as well as, co-requisite and general education requirements. The curriculum includes a minimum of 30 semester-hours of IS topics, 15 hours in an application area, 30 hours of general education and 9 in quantitative and qualitative analysis. This leaves 36 credits of unspecified electives (Gorgone and Lidtke 2000).

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Information Systems
These courses include a broad-base core of fundamental information systems material providing basic coverage of hardware and software, a modern programming language, data management, networking and telecommunications, analysis and design, and the role of IS in organizations. Programming and systems analysis and design should include laboratory work, using modern software tools. Theoretical foundations, analysis, and design must be stressed throughout the program. Exposure to a variety of information and computing systems is required. At least 12 semester hours must be advanced course work that builds on the core to provide depth. Finally, 6 semester credits of IS electives provide breadth.

Information Systems Environment
A cohesive body of knowledge in an area (such as business, health, or criminal justice) is necessary to demonstrate the application of information systems.

Quantitative Analysis
The curriculum must include at least 9 semester hours of quantitative analysis beyond pre-calculus. Specifically, statistics and calculus or discrete mathematics must be included.

Additional Areas of Study
Oral and written communications skills and collaborative skills must be developed and applied. The equivalent of at least one semester-hour of coverage in the social and ethical implications of computing is required.

3. INFORMATION SYSTEMS MODEL CURRICULA

IS is not your typical field of study. It has had diverse origins. IS's origins are management, computer science, and engineering (Denning 1998; Freeman and Aspray 1999; Myers and Beise 1999; Watson et al 1999). At any given school, the IS discipline originated from one of these reference disciplines. In business computers were first used in accounting departments to track accounts receivable and accounts payable. This quickly led to university business departments investigating and teaching computing, as it applied to management control and accounting. Computer science provides the theoretical foundation in the algorithmic and logical nature of programs. Computer science departments began to apply this theory to large systems to solve problems. Engineering looked originally at computer hardware components and related software as an engineering problem. This resulted in the application of engineering principles to systems design. In different academic settings, IS may have originated in the business department focusing on business systems management, the computer science department focusing on software development, or in engineering as systems design. This resulted in different perspectives as to the definition of information systems. It has lead to different models of IS programs.

Information Systems '97 Model
The Association for Information Systems (AIS) Model Curriculum for Information Systems, IS '97, is excellent in providing the technical aspects in information systems as well as a foundation in business processes. The AIS's model comes from a body of knowledge developed from surveys of practitioners and academics and from a mapping of topics from Computer Science and other computer disciplines (e.g. software engineering).

This model is strong in fundamental computing and information systems knowledge. The curriculum contains three components. This first level stresses the development of small office and personal systems, the effective use of organizational systems, and the identification of a quality system. The second part specializes in technology; courses in the hardware and the software of information technology, software programming, and systems analysis and design. Emphasizing teamwork in the design, development, and implementation of information and database systems, and project management is the final portion of the model (Davis et al 1997).

The curriculum is divided into ten required technical courses and one technical prerequisite. These courses cover material in programming, the role of IS, data management, networking and telecommunications, analysis and design, hardware and systems software, and project management. The prerequisite course provides students a basic knowledge in office applications such as word processing, spreadsheets, databases, presentation graphics, e-mail, the Internet, and Web searching. There are no specified electives.

Because IS professionals need to be able to effectively communicate within a business organization; courses in communications, quantitative and qualitative analysis, and organizational functions are necessary. Courses outside of IS are also necessary to provide technical background and breath in business functions. Therefore, non-technical required, but not specified, courses include courses in communications, mathematics, and business functions. The communication course should include listening and speaking as well as written communication. Mathematics includes statistics, and the quantitative and qualitative techniques of discrete mathematics and calculus. Business courses cover the functions of economics, accounting, distribution, finance, human resources, marketing, production, and international business (Davis et al 1997).

Information Systems-Centric Curriculum '99
A collaborative Academe/Industry Task Force has developed a model known as the Information Systems-

Centric Curriculum '99 (ISCC '99). It is heavy in ethics and practical skills. The authors are seeking the endorsement of AIS, ACM, and IEEE/CS.

This curriculum looks at information as an enterprise asset, which must be managed. The management is accomplished through large-scale, complex information systems that must be built. It is the building of the complex system that takes precedence in this curriculum. It takes an engineering development approach to large-scale information systems. The focus is on the needs of industry in systems development not management. However, it does not exclude interpersonal skills, which are necessary in the teamwork environment of development.

The key components of the ISCC '99 curriculum are the close relationship with industry and education through teamwork. By using innovative pedagogical techniques such as teaming, just-in-time learning, and guy by the side, the courses place students into an active learning role. The last course is a project that comes from an industrial sponsor of the program (Lidtke et al 1999).

Student skills are developed in computation and analysis. Students are given practice in the analysis of trends and establishing metrics, and the mathematics of digital equipment and data representation. Personal responsibility for systems developed and managed is instilled in the students. They learn to work as part of a group in solving a common problem. The operations of complex business and technical environments are used to provide the students with the concepts of information systems design and implementation and to develop practical experience.

The curriculum consists of 11 required full courses and 2 required half courses as well as 4 required foundation courses. Material covered in these courses includes programming, the role of IS, data management, networking and telecommunications, analysis and design, and ethics. The model also contains 4 technical electives and identifies a number of non-technical courses to bring in business aspects such as economics, project management, and business functions like accounting, finance, operations management, marketing, and human resource management. The model, also, encourages students to include in their studies courses that require interpersonal, systemic thinking, and problem solving skills (Lidtke et al 1999).

Information Resource Management Model

The Information Resource Management Association's (IRMA) model takes a business approach to IS. There is less development and more management. IRMA believes "insufficient education in business and management information theories is a major deficiency in the primarily (overly) technical education of IS managers" (Cohen et al 2000).

IRMA views IS as primarily a business function. IS is a go-between between end-users and the technology and technology staff. The preparation, therefore, for IS professionals revolves around the application of IS to business problems. Effective oral and written communication, time management, leadership, and delegation of authority skills, as well as, sufficient technical understanding to act as the go-between express this application.

Taking a top down approach to IS education this model stresses learning general principles before specific implementation details. Specifically, programming is left to the third course after the concept of information as a resource is well understood. The overall emphasis of the IRM curriculum is the impact of computing on the organization; the fit into the organizational structure, and how all managers in the firm can use information.

The curriculum consists of 10 courses of which the student must complete 7, 5 required and 2 electives selected from the remaining five (Cohen et al 2000). The required courses cover the topics of programming, the role of IS, data management, networking and telecommunications, and analysis and design. The traditional application programming, systems programming, and computer hardware are touched upon lightly. The management of information and the management, not construction, of computer systems which produce, store, and disseminate information is the curriculum. How information is used in decision-making and how information effects the various components of a business are the basis of the courses. The curriculum begins after a general business education foundation has been laid. The first course has as a prerequisite an Organizational Behavior or Introduction to Management course. The elective courses provide management refinement and specialization (Cohen et al 2000).

4. ACCREDIATION REQUIREMENTS AND CURRICULA MODELS

The accreditation criteria are specified in the Computing Sciences Accreditation Board's (CSAB) Draft Criteria for Accrediting Programs in Information Systems (Gorgone and Lidtke 2000). The courses in the models were assigned to the accreditation criteria most closely matching the course. This provides for a comparison of courses to the accreditation criteria and between the models, as shown in Table 1. The table does not discuss the depth of knowledge or imply equivalence between the courses. It only shows the coverage by course of the topics. For example, the Advanced Systems Analysis and Design criteria has assigned IS '97.7, IS '97.9, ISCC-42, ISCC-53, and IRM6. All of these courses discuss elements of requirement analysis, system design, development, implementation and maintenance. It is possible that criteria are covered in courses of a model

but not specifically identified as such a course. For example, the ethics of computing in the IS '97 model

Table 1. Information Systems Requirements *(electives in Italics)*

Accreditation Requirement	IS '97	ISCC '99	IRM
Core material in data management, networking and telecommunications, and analysis and design	IS '97.3 Information Systems Theory and Practice	ISCC-11 Information Systems in Enterprises	IRM2 – Information Systems Technology *IRM 10 - Seminar Course in Information Resources Management*
Role of IS in Organizations	IS '97.1 Fundamentals of Information Systems	ISCC-44 Dynamics of Change	IRM1 – Information Resources Management Principles *IRM 8 - Global Information Management*
Core Hardware/Systems Software	IS '97.4 Information Technology Hardware and Software		
Modern Programming Language	IS '97.5 Programming, Data and Object Structures	ISCC-21 Information Systems Architecture I ISCC-31 Information Systems Architecture II	IRM3 - Algorithm Concepts and Information Management
Advanced Networking	IS '97.6 Networks and Telecommunications	ISCC-43 Telecommunications and Networking Issues and Methods ISCC-51 Distributed Systems	*IRM 7 - Communication Technology and Information Management*
Advanced Systems Analysis and Design	IS '97.7 Analysis and Logical Design of an IS IS '97.9 Physical Design and Implementation with a Programming Environment	ISCC-42 Human Computer Interaction and Methods ISCC-53 Comprehensive Enterprise Information Systems Engineering	IRM6 – IRM Design and Implementation
Advanced Database	IS '97.8 Physical Design and Implementation with DBMS	ISCC-41 Information Databases and Transaction Processing *Data Warehousing & Data Mining*	IRM5 - Data Resource Structures and Administration
Advanced Project Management	IS '97.10 Project Management and Practice		
Ethics – 1 credit		ISCC-22 Computer Ethics I (1/2 course) ISCC-52 Computer Ethics II (1/2 course)	
Electives in IS – 6 credits		Electives – 12 credits	Electives – 6 credits
	IS '97.P0 Knowledge Work Software Tool Kit IS '97.2 Personal Productivity with IS Technology	ISCC-45 Applications of AI in Enterprise Systems ISCC-61 Comprehensive Collaborative Project *Automated Decision Making* *Decision Science*	IRM4 - Data Warehousing, Data Mining and Decision Support Systems *IRM 9 - Executive Information Systems Management*

may be discussed in the Overview of IS course. Whereas, the ISCC '99 model has two specific half-courses.

Information Systems Courses

The three model curricula with slight modifications have the capacity to meet the curriculum requirements of the proposed accreditation.

IS '97: The IS '97 model curriculum provides for both the business and technical aspects of IS. The structure recognizes that some IS knowledge is important to everyone. The IS '97.P0 course in the model is a prerequisite computer literacy course. Students are assumed to have this knowledge before starting the IS curriculum. Course sequences are provided for all college students, IS minors as well as IS majors. The building nature of these sequences allows students to start slowly and continue or switch majors without loss of effort.

The IS '97 curriculum is the model on which the accreditation criteria were originally based (Gorgone and Lidtke 2000). The courses of the IS '97 model meet most of the criteria. The model has no specific ethics credit, however this may be satisfied by the inclusion of ethics in another course or spread between a number of courses. The six credit advanced elective requirement may be satisfied by the two courses required in the model, but not specified in the accreditation criteria. IS '97.2 deals with advanced development of personal computing applications, such as spreadsheets, document production, and databases. IS '97.9 is an implementation course of the advanced systems analysis and design requirement.

ISCC '99: Industry has found new IT graduates not competent to work on medium and large- scale systems. They also cannot apply systemic thinking to complex problems; they are unfamiliar with business processes and they cannot determine how computers can help (Lidtke 1999). The ISCC '99 model contains much the same content as a computer science curriculum, but orients toward a practical system design and implementation approach as opposed to automata theory. This model is the most technical while stressing the need for teamwork in problem identification and solution. This problem solving process includes decomposing the problem, identifying and evaluating candidate solutions, and implementing, testing and fielding the selected solution. The focus is on the construction of the tools necessary for information management.

ISCC '99 has more than sufficient credit hours to satisfy the accreditation criteria. However, it is missing the advanced project management and hardware/systems software courses. Project management may be partially satisfied during the comprehensive project (ISCC-61), but the design and implementation aspects of such a project may over shadow the project management portion, depending on the specific project. The hardware/systems software requirement may be met in the information systems architecture courses (ISCC-21 and ISCC-31) in the context of the specific programming language. This may be acceptable as the accreditation requirement is for only one programming language course.

IRM: Computer-based Information Systems are the hardware and software components of IS. The IS manager also needs an understanding of organizational behavior and management today. They need knowledge of IT and the business and its customers (Cohen et al 1999). IRM provides a business management approach to IS education. This model is the most business like treating information as a business resource, which needs efficient and effective management. To manage the information it is necessary to manage the production and storage tools (hardware and software) and to understand the business needs.

The IRM model has sufficient required and elective courses but also falls short in hardware/systems software, project management, and ethics. Because the model stresses management over development it is difficult to see where the core hardware/systems software material would fit. A new course may be necessary. Project management may become part of either of the electives IRM8 or IRM10, or the core material in IRM1. This would make the selected elective a required course. The advanced networking elective (IRM7) needs to be required to meet the accreditation criteria. Again the one credit requirement in ethics may be met by discussions of ethics in another course such as IRM1, IRM8, or IRM10.

Non-IS Courses

The information systems draft accreditation calls for specific types of courses outside of IS. These are compared to the models in Table 2.

All of the models fit a 4-year college education, which provides for general education courses outside the major. Each model also stresses the importance of oral and written communications and learning to work as part of a team. The IS '97 and ISCC '99 models specify sufficient mathematics to meet the accreditation requirements.

None of the models specifically outline the employment of IS to an application area other than business. The IRM model, fitted to a standard business program provides one possible application area. All the models can be organized in conjunction with a minor in another discipline, such as education, political science, or biology, to meet this application area requirement.

Table 2. Non-IS Requirements

Accreditation Requirement	IS '97	ISCC '99	IRM
Application Area – 15 credits	Unspecified economics, accounting, distribution, finance, human resources, marketing, production, and international business.	Unspecified economics, project management accounting, finance, operations management, marketing, and human resource management	Fits within a standard Business curriculum
Mathematics above Pre-Calculus	Calculus		
Discrete Mathematics	Discrete Mathematics	Discrete Mathematics	
Statistics	Statistics	Probability and Statistics	
	Quantitative and Qualitative Techniques	Quantitative Methods	
Oral and written communications skills and collaborative skills	Communications And covered in various courses	Covered in various courses	Covered in various courses
General Education – 30 credits	Not specified but fits in the standard 4 years of college		

5. CONCLUSION

Information systems involve the design, development, implementation, support and management of software and hardware artifacts (ITAA 1997). Most information systems bachelor degree recipients get jobs after graduation; a few attend graduate school (Freeman and Aspray 1999). They enter the work force because of the tremendous demand for the IS skilled professionals. This means students (and employers) are looking for a sound, practical education. Such an education necessitates a variety of approaches to work in various computing careers. "The traditional career path of programmer to systems analyst to project manager and eventually to IS manager" no longer holds (Urquhart et al 1996). As with many careers, paths are needed along varying academic tracts to start students in their careers.

Model curricula are intended to provide schools with guidance on the topics to teach in a discipline. Accreditation is an evaluation of a specific school's success in teaching a discipline, as determined by an accreditation group. This paper has identified the strengths and weaknesses of three commonly implemented model curricula with respect to the emerging accreditation criteria. A school closely following any of the three models, with a little curriculum modification, should be able to satisfy the curriculum requirements for CSAB accreditation.

Information system accreditation is an important factor in certifying graduates as new professionals. A school that follows a model curriculum and is accredited is assuring the employers and graduate programs that their graduates have the requisite knowledge necessary to develop, manage, or conduct research in information systems.

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