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THE IT / IS / SME HIERARCHY: CURRICULUM AND PRACTICE

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ABSTRACT

The area known as Information Technology (IT) can be divided into three distinct but overlapping sub areas that form a hierarchy of expertise. Being aware of this hierarchy will assist in the design of curricula that will be well suited to the needs of students and the organizations that will employ them. Furthermore awareness of this hierarchy will assist in the development of IT applications that are effective, useful, and aligned with the mission of the organization. The purpose of this paper is to specify these sub areas and explain how they are delimited; to explain how they interact to form the broad concept of what we now call Information and Communication Technology (ICT) and finally specify curricula that would support this hierarchy.

Keywords: IT Curricula, Subject Matter Experts, Application Design, IT Alignment

INTRODUCTION

History

As educators we desire to provide the best curriculum for our students. For over 20 years research has been carried out to provide guidance for curriculum development in the area of Information Technology. One of earliest was an attempt to find out the expectations that employers have for computer science graduate [1]. Most recently research was carried out to determine the degree to which current IS curricula implement the IS2002 Model Curriculum Guidelines [2]. During this time a number of model curriculum were proposed, developed, and revised. Most notably would be the IS Model Curricula. Note that the IS'95 guidelines and the IS'97 guidelines preceded the IS2002 Model Curriculum Guidelines [3, 4, 5]. The frequent change in these guidelines reflects the rapid evolution of the support technology needed to develop applications that facilitate business processes (e.g., structured program design evolving to object oriented program design; file based systems evolving to relational database systems, etc.). In addition, these guidelines reflect the development of new technologies that led to new business models (e.g., e-commence) and also new ways of implementing existing applications (e.g., web based applications).

In addition, during this time of curriculum evolution, surveys of businesses, students, faculty, and alumni were conducted and analyzed. In general these research activities attempted to determine if the curricula of universities are currently meeting the needs of business and further if these curricula designed to meet future needs of businesses. As a result, a sizable body of literature has grown around this subject. As one reviews this literature, one is struck by the preeminence of one research project. The research reported by Lee, Trauth, and Farwell in 1995 [8] is cited or referenced in most subsequent research in this area. In some cases the subsequent research confirms some of the claims made by Lee, Trauth, and Farwell in 1995 [9]. For the purposes of curriculum development these authors make an important classification and specify equally important implication of their research.

Taxonomy of IS Knowledge and Skills

When discussing the development of measures for different types of critical IS knowledge and skills they decide upon classifying the critical knowledge and/or skill according to a taxonomy understood by both practitioners and academics. This taxonomy is "…(1) IS technology, (2) IS Process, and (3) AACSB Common Body of Knowledge" [6 pp. 321-322]. The impact of this decision will be seen in the ideal curriculum discussed below.

An Implication

When discussing their recommendations for curriculum design they begin with statement of an important implication of their research. They state, "… IS curriculum design must be driven by a clear vision of the career path for the graduates" [6, p. 333]. As we will see below that vision is defined by the practitioner's need for IS/IT graduates.

CURRICULUM IN THEORY

Themes in Computing Curricula

In general, in the US there are two types of degree programs that offer an emphasis in IT. These are the Bachelor of Science and Bachelor of Arts degree. These differ on the amount of course work a student completes in science courses and liberal arts course respectively. Each degree type has a major area of study that generally qualifies the major area to be "IT". Landry, Pardue, Longnecker, and Feinstein [7] have identified five types of programs that have an IT emphasis. These types are Computer Science, Information Technology, Information Systems, Information Science, and Computer Engineering.

Based on their research these five programs can be divided into two distinct clusters. One cluster is made up of IT, Information System, and Information Science programs where the common emphasis is information and knowledge, managerial issues, and business applications. Computer Science and Computer Engineering programs place more emphasis on algorithm development, computer architecture, and operating systems. However both clusters did agree on the importance of system development tools and techniques, interpersonal skills, systems implementation and testing, systems development methodologies, and management of systems development.

As shown below the program cluster made up of Information Technology, Information Systems, and Information Science programs can be further classified.

IT / IS / SME

In general the area where information and communication technology is used to design, build, and deploy computer based information systems that enhance business processes is referred to as "Information Technology". However a distinction needs to be made between technology specialties and technology management. Lee, Trauth, and Farwell [8] previewed this distinction

in 1995. In their 1995 paper they classify critical IS (their term) knowledge/skills into four categories. These are:

1) Technical Specialties (e.g., operating systems, programming languages, etc);
2) Technology Management – how to deploy technology to meet business objectives
3) Business Functionality – knowledge of the functional areas of business (accounting, finance, marketing, productions & operations, and human resources);
4) Interpersonal and Management Skills and Knowledge.

Item 1) above would be Information Technology (IT) and item 2) can be referred to as Information Systems (IS). And item 3) can be understood as subject matter expertise (SME). These classifications can be revised to account for the change in technology that has taken place over the last ten years. The updated classifications are as follows.

Academic Definitions of IT/IS/SME

IT

IT may be defined by the academic material associated with the structure and functions of hardware and system software, principles of good program design and testing (Software Engineering), design and implementation of databases, and user to computer interfaces.

IS

IS may be defined by the academic material associated with user requirements elicitation, system development approaches, IS management, project management, and technology adoption, infusion, and diffusion.

SME

SME maybe defined by the academic material associated with a particular field of study. For example in the area of business one could have the subject matter expertise of accounting, or finance, or marketing, or production and operations, or human resources. In particular someone who has SME would know the requirements that define the functionality of the field.

The IT and IS classifications above are also suggested in the IS 2002 Model Curriculum Guidelines. When the authors organize the suggested courses into presentation areas they create six categories. These courses and categories are listed below. The source of the following is [6]

P. Prerequisite
IS 2002.P0 Personal Productivity with IS Technology
A. Information Systems Fundamentals
IS 2002.1 Fundamentals of Information Systems
IS 2002.2 Electronic Business Strategy, Architecture and Design
B. Information Systems Theory and Practice
IS 2002.3 Information Systems Theory and Practice
C. Information Technology
IS 2002.4 Information Technology Hardware and Software
IS 2002.5 Programming, Data, File and Object Structures
IS 2002.6 Networks and Telecommunications

D. Information Systems Development
IS 2002.7 Analysis and Logical Design
IS 2002.8 Physical Design and Implementation with DBMS
IS 2002.9 Physical Design and Implementation in Emerging Environments
E. Information Systems Deployment and Management Processes
IS 2002.10 Project Management and Practice

Areas C and D roughly correspond to the definitions of IT and IS given above.

CURRICULUM IN PRACTICE

Recent research [2] has shown that the three most commonly courses taught from the IS2002 Model Curriculum are: Database Design and Implementation, Systems Analysis and Design, and Programming, Data, File and Object Structures. This was based on their review of the curricula of 130 AACSB-accredited business programs. Moreover of the ten courses suggested the IS2002 Model Curriculum it was found that no school required all ten. And 85% of the schools survey required at most six and 64% required at most five. The authors conclude that in spite of these curriculum guidelines students are not receiving the proper type of education necessary for future information systems professionals.

Failure to fully implement the IS2002 Model Curriculum is caused in most cases by lack of time and expertise. In small to medium size colleges and universities attempting to implement the model curriculum in a single academic unit, a school of business or academic department, will result in a limited implementation. For AACSB accredited schools of business it is difficult to and require all ten courses and meet the business core and remain at the or near the minimum number of credit hours required for a degree. In addition, for the AACSB schools, satisfy the 50/50 credit hour rule. For an academic department is it difficult to afford the faculty resources to fully implement the model curriculum.

This difficulty is caused by attempting to develop in one student the expertise required in all three components that make up Information Communication Technology. Rather than a student becoming proficient in IT and IS and SME they should only specialize in one area. Providing three types of degree programs can do this. For example the SME area can be satisfied by a BBA with and IS minor; the IS area can be satisfied with a BA in Information Systems with a business minor; and the IT area can be satisfied with a BS in Information Technology with a minor in Information Systems. This approach is depicted in Figure 1.

It is important to note that the minor areas of study are as important as the major areas. It is these minor areas that “knit” together the hierarchy. These minor areas form the interface between the experts in each major area. Each layer in this hierarchy knows a bit about the expertise in the layer above and below that layer.

Accounting	Finance	Marketing	Human Resources	Production and Operations
Subject Matter Expertise - Business Core				
BBA with IS Minor Student will be a subject matter expert with information systems awareness - SME/ISA IS minor is composed of: Programming Techniques (2 semesters), Database Systems, Systems Analysis & Design, & Project Management				
Interface between SME and IS Expert				
BA in Information Systems & Business Minor Student will have information systems expertise with subject matter awareness - ISE/SMA Business minor will be at least two semesters of Economic and Accounting, Finance, and Organizational Behavior or Organization and Management.				
Interface between IS personnel and IT personnel				
BS in Information Technology Student will have information technology expertise with information systems awareness - ITE/ISA ISA will be achieved by completing the IS minor specified for SME requirements.				

Figure 1. The IT / IS / SME Hierarchy – Business Perspective

CONCLUSION

We must realize that no one academic unit can provide all the expertise needed in each of the areas that make up Information and Communication Technology. These areas can naturally be broken out into other academic units. For example the SME/ISA area can be satisfied by a BBA with and IS minor curriculum in a school of business; the ISE/SMA area can be satisfied with a BA in Information Systems with a business minor curriculum provided by a IS department; and the ITE/ISA area can be satisfied with a BS in Information Technology with a minor in Information Systems provided by a school of applied studies.

The implementation of this curriculum hierarchy requires the coordination among academic units and a willingness to share faculty and courses. To do this requires an efficient and effective method of articulating the three curricula as they are developed in each of the different academic units. Perhaps the best way to do is for faculty members to have dual appointments in the academic units. For example a faculty member in the school of business would also be in the IS department and a faculty member in the IS department would be in the school of applied studies. Or at the least a faculty member in the IS department might be required to teach a class for business credit in the school of business. This particular course could be designed to fit into the interface layer between SME and IS Expert (c.f. Figure 1). A course like that could cause

difficulties for the Dean of the school of business and the Dean of the school that housed the IS department.

An obvious benefit of this hierarchical approach to an ICT curriculum is that the time and resource problem is resolved for a single academic unit attempting to implement a complete ICT curriculum since they only need to implement and staff those courses relevant to their degree. Moreover an academic institution would not need to implement all the layers of the hierarchy. It could implement only those layers for which it has the time, resources, and student demand.

This approach parallels what is occurring in IT departments in nonacademic organizations whose area of business is not IT. As those businesses focus on their core activities they recognize the fact that they are able to outsource the information technology that support those activities. They do this by first outsourcing the IT infrastructure, then application development either to through offshore outsourcing or using COTS solutions. Moreover with the increase in the reliability and ease of use of IT infrastructure less in house IT, as defined by the IT/IS/SME Hierarchy, expertise is required. In addition with the increased of use of application development tools that are more end user friendly (e.g., .Net, user configurable COTS products, etc.) less in house IS, as defined by the IT/IS/SME Hierarchy, expertise is required. What will remain within these organizations will be the SME/ISA layer of the IT/IS/SME Hierarchy. These subject matter experts with IS skills will be able to develop IT applications that are effective, useful, and aligned with the mission of the organization.

If ITC curriculum are designed and implement using this IT/IS/SME Hierarchy model graduates of those curricula will be a better fit in IT departments as they are evolving today. Obviously further is required is to determine to what extent organizations are phasing out their IT and IS components of their ITC infrastructure.

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