IS Curriculum Models, Course Offerings, and Other Academic Myths/Hopes

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In 2010, the "IS 2010 Curriculum Guidelines for Undergraduate Programs" was released as a joint project between the Association for Computing Machinery (ACM) and the Association for Information Systems (AIS). This set of guidelines was meant to provide guidance regarding the core content of the Information Systems curriculum that should be present everywhere. However, just how present is the recommended curriculum? We investigate 509 AACSB-accredited schools in the United States to determine the penetration of IS 2010. The results show that while some of the recommended courses are found in high concentration, others have not received as much traction.

INTRODUCTION

Very few academic areas are subject to the kind of changes intrinsic to the field of Information Systems (IS). Change occurs within the boundaries of specific course offerings as technology and its deployment ripens with maturity. For example, a SAD (Systems Analysis and Design) course today, though perhaps sharing both a name and a legacy with earlier offerings, is very different from an SAD course of just a few years ago. Perhaps no component of commerce is more prone to changes wrought by both obsolescence and advancement than IS. Textbooks from "must have" courses often become irrelevant so quickly that in just a matter of a few semesters even the used book markets will not take them. The pace of change is hectic. The scope of change is extensive. Moreover, the consequences of failure to keep pace are immediate and severe. "Keeping up" is at the heart of the IS educators' mission.

What is the conceptual transference of the phrase "IS major" (or its variations, IT, BIS, MIS, etc.)? Does the meaning of the phrase that identifies programs, students, and careers have a same or similar meaning across time and geography? While there are arguments for and against the role of curriculum models, it can be said that they help establish boundaries and provide some help in standardizing meaning.

IS/IT Curriculum Models

Since the first appearance of IS/IT programs in academic institutions in the 1960's, the identification of the specific skills required for the variety of IS positions has never been an easy task (Brookshire, Hunt, Yin, & Crews, 2007). Briskly evolving technology requires educators to constantly be aware of the changing landscape and seek new content and evolving topics that perhaps should be added to the curriculum (Noll & Wilkins, 2002; Srinivasan, Guan, & Wright, 1999). The development of proposed IS/IT curriculum models to addressed this need reaches back to at least 1972 and has continued almost unabated since. Professional organizations, including ACM, AITP and predecessor DPMA, IEEE, and ISCC, and academic researchers and field practitioners have long been concerned with determining the "right" slate of topics or courses to meet current needs and project the discipline to a productive future. While there are arguments as to the necessity or efficacy of these models (Longenecker, Feinstein, & Babb, 2013), it is the case that the profession has maintained a persistent intrigue with their development. Adopted, adapted, or disregarded, they often shape curriculum discussion. Interestingly, the frequency of curriculum model updates has slowed and almost stopped since the dawn of the 21st century – a mildly surprising occurrence given the widely touted technology changes (see Table 1).

TABLE 1
HISTORY OF IS/IT CURRICULUM MODELS (Topi, et al, 2010)

May, 1972	ACM Graduate Professional Programs in Information Systems (Ashenhurst, 1972)
December, 1973	ACM Undergraduate Programs in Information Systems (Couger, 1973)
March, 1981	ACM Educational Programs and Information Systems (Nunamaker, Couger, & Davis, 1982)
1981	DPMA Curriculum for Undergraduate Information Systems Education (DPMA, 1981)
1983	ACM Information Systems Curriculum Recommendations for the 80s, Undergraduate and Graduate Programs (ACM, 1983; Nunamaker et al., 1982)
October, 1984	DPMA Secondary Curriculum on Information Technology and Computer Information Systems
October, 1985	DPMA Associate-Level Model Curriculum in Computer Information Systems
October, 1985	DPMA Model Curriculum for Undergraduate Computer Information Systems
May, 1990	ACM/IEEE Computing Curriculum for Computer Science for Undergraduates
October, 1990	DPMA IS'90 draft document (Longenecker Jr, Feinstein, Fournier, Doran, & Reaugh, 1991)
June, 1991	DPMA IS'90 Curriculum for Undergraduate Programs in Information Systems
July, 1991	ACM CS Curriculum (Tucker, 1991)
January, 1994	DPMA IS'94 Curriculum for Two Year Programs in Information Systems (Longenecker, Feinstein et al., 1994)
January, 1994	ACM Curriculum for Two Year Programs in Computer Information Systems
December, 1994	First Draft of IS'95 from the Joint ACM, AIS, DPMA Task Force (Couger, 1996; Gorgone, Couger, Feinstein, Kasper, & Longenecker Jr, 1994; H. Longenecker, 1995)
February, 1996	First Draft of IS'97 from the Joint ACM, AIS, DPMA Task Force
December, 1997	ACM, AIS, AITP IS'97 Model Curriculum and Guidelines for Undergraduate Programs of IS
December, 1999	ISCC An Industry Based Curriculum
December, 2002	IS 2002 Model Curriculum and Guidelines for Undergraduate Programs of Information Systems

The "IS 2010 Curriculum Guidelines for Undergraduate Programs," the joint product of the ACM and AIS, is the present standard. It is worth noting that it is now approaching more than a decade of existence. It may also be referred to as the "2009 Model" because of its development timeline. Since its adoption and corresponding review (Topi et al., 2010), the need for updating has been discussed, though specific efforts have received very little traction (Longenecker et al., 2013; Rosenthal, Dhariwal, & Whitehouse, 2013). While development of an updated model is reportedly under way, there are no presently reportable sources. This begs the question: Is the 2010 model that good, is it that irrelevant, or perhaps neither?

To determine if the 2010 model is being used in academic curricula, we examined over 500 AACSB International accredited schools and identified 263 schools with undergraduate programs, loosely defined as "majors," in IS/IT related fields. We then drilled down into the course offerings of each of these 263 programs. In the paragraphs that follow, we compare the offerings of these schools to the 2010 standard. We also compare the course offerings from our study to the course offerings reported by Apigian and Gambill (Apigian & Gambill, 2010).

METHODOLOGY

Five hundred nine AACSB International accredited schools in the United States were examined to determine whether they offered an IS/IT related undergraduate major. Data collection was conducted using content analysis of school websites. From among the schools that offered an undergraduate major in an IS/IT related fields; details were collected about the specific courses offered as well as the names of the programs or majors (Brooks, Gambill, Clark, & Clark, 2016). Two hundred sixty-three schools were identified as having a major in IS, and a total of 4,898 courses were evaluated and cataloged.

The AACSB International is a leading accrediting business school organization. While AACSB International, as the name implies, is worldwide in its scope this study is limited to accredited schools in the United States.

Data Collection

While schools vary in their labeling of programs of study, for the purposes of this study, the broadly interpretive nomenclature offered by Pierson, Kruck, and Teer was adopted (Pierson, Kruck, & Teer, 2008). In this approach, the term "major" is used to refer to programs labeled as "concentrations," "options," and "emphases" as well as "majors." Jointly administered programs, such as interdisciplinary programs involving multiple departments or colleges, were excluded from the data collection. If a school offers multiple relevant degrees, each of the relevant programs are included in the analysis.

Due to the time spent collecting and analyzing the data, it is possible that some changes in the website information of the schools may have occurred. For example, a major might have been added or the name might have changed. The same may be the case with the possible additions or deletions in the list of accredited schools.

Data collection involved more than one person; however, no formal rater reliability process was conducted because extensive training and checking was conducted. A training video and a structured walkthrough were used with all persons involved in the data collection. These were used to establish the same processes and standards. Verification was conducted throughout the data collection process. The training video included specific examples of the work to be done as opposed to narrative instructions.

Since many schools offer a variety of "computer related" programs, the data collection process always began at the school or university level and migrated from there to the business academic unit, usually a college or department of business. From the business academic unit, the migration continued to the specific IS/IT related program, if such a program existed. This "top down" approach was used to avoid missing data due differences in structure or names.

DISCUSSION

Current Course Offerings

The research findings include data on course offerings. Table 2 shows the 25 most frequently offered courses. The top five courses are database/data warehouse, data communications/networks, programming 1, programming 2, and systems analysis and design/systems analysis and design 1. The first four were represented at 100% of the schools. Systems analysis and design was at 95%. The next highest group of courses range from 68% to 56%, specifically MIS (68%), web development (57%), and special topics (56%). The third group of courses range from 48% to 35% representation. These include Internships (48%), project management (47%), security 1 (46%), business intelligence/analytics 1 (42%), e-commerce (38%), independent study (37%), and ERP (35%). The fourth group of courses include capstone (27%), microcomputer applications (27%), and database 2 (26%). The bottom seven courses start at 17% and conclude at 12%. These include Web development 2 (17%), Java (16%), Visual Basic (15%), DSS expert systems (14%), network 2 (14%), mobile applications (13%), and IS concepts (12%).

TABLE 2
25 MOST FREQUENTLY OFFERED COURSES

Rank	Course	Number	Percentage
1	Database / Data Warehouse	263	100%
2	Data Comm / Networks	263	100%
3	Programming 1	263	100%
4	Programming 2	263	100%
5	SAD / SAD I	249	95%
6	MIS	178	68%
7	Web Development	149	57%
8	Spec Topics	146	56%
9	Internship	125	48%
10	Project Management	123	47%
11	Security 1	122	46%
12	Business Intelligence / Analytics I	110	42%
13	E-Commerce	100	38%
14	Independent study	97	37%
15	ERP	93	35%
16	Capstone	71	27%
17	Microcomputer Applications	71	27%
18	Database 2	68	26%
19	Web Development 2	44	17%
20	JAVA	43	16%
21	Visual Basic	39	15%
22	DSS Expert Sys	37	14%
23	Network 2	36	14%
24	Mobile Apps	33	13%
25	IS Concepts	32	12%

Table 3 shows the programming courses offered. Thirteen courses are listed with the highest percentage at 35% for object oriented. The percentages drop off after that. The next highest programming

courses represented are Java (16%) and Visual Basic (15%). The remaining courses are represented in single digit percentages. In that group, starting at 8% and falling are courses like JAVA II, C++, SQL, and C#. Perhaps the most surprising course on the list is COBOL (6%), the same as JAVA II (6%). Even RPG is represented at .5%.

TABLE 3
PROGRAMMING COURSES OFFERED

Programming Language	Count	Percentage
Object Oriented	91	35%
JAVA	43	16%
Visual Basic	39	15%
Internet Program	22	8%
JAVA II	16	6%
COBOL	16	6%
C++	13	5%
SQL	12	5%
C#	8	3%
Visual Basic II	4	2%
C++ II	3	1%
ASP.Net	1	0.5%
RPG	1	0.5%

One interesting finding is project management courses being present in only 47% of the schools as a separate course. Given the publicity around failed and challenged IS projects, it is interesting to see project management courses at such a level. However, it can be assumed that systems analysis and design courses include a significant portion of project management topics, so perhaps the 47% can be explained in that fashion. Another low reported course that stands out is business intelligence/analytics at 42%. It could be assumed that industry attention to analytics would drive this percentage up. Time will tell if these courses will gain deeper penetration in to the majors. Finally, a capstone course that typically pulls together knowledge from several courses is only found in 27% of the programs studied.

By Comparison to the IS 2010 Model Curriculum

IS curriculum models date back more than 40 years (Couger, 1973) and the most recent iteration, known as the "IS 2010 Model Curriculum," is nearing a decade since its creation. Table 4 shows the overview of the guidelines. The 2010 model was developed under the sponsorship of the Association for Computing Machinery (ACM) – a long-time leading organization in the assessment and development IS curriculum – and the Association for Information Systems (AIS) and it was the result a thorough analysis and extensive reporting by a distinguished panel of IS academic leaders (Topi et al., 2010).

TABLE 4
IS 2010 COURSE SPECIFICATIONS (Topi, et al., 2010)

Core Courses
IS 2010.1 Foundations of Information Systems
IS 2010.2 Data and Information Management
IS 2010.3 Enterprise Architecture
IS 2010.4 IT Infrastructure
IS 2010.5 IS Project Management
IS 2010.6 Systems Analysis and Design
IS 2010.7 IS Strategy, Management and Acquisition
Sample Elective Courses
IS 2010.E01 Application Development
IS 2010.E02 Business Process Management
IS 2010.E03 Enterprise Systems
IS 2010.E04 Introduction to Human - Computer Interaction
IS 2010.E05 IT Audit and Controls
IS 2010.E06 IS Innovation and New Technologies
IS 2010.E07 IT Security and Risk Management

Perhaps not surprisingly, comparison of the findings of the current study to the IS 2010 Course Specifications listed above suggest a high degree of correspondence in some cases, modest correspondence in other cases, and little or no correspondence in yet other situations.

Among core courses, Database / Data Warehouse ← 100%→ to Data and Information Management, Data Comm / Networks←100%→ IT Infrastructure, and SAD / SAD ←95%→ Systems Analysis and Design map at very high rates.

MIS ←68%→ Foundations of Information Systems and Project Management ←47%→ IS Project Management map with moderate consistency. IS Concepts may (12%) also be a part of the Foundations of Information Systems mapping thus increasing that correspondence. As with the case of several of the course specifications, content ambiguity is a limitation. For example, Foundations of Information Systems may be addressed in a variety of courses and IS Project Management is often addressed in SAD courses.

Enterprise Architecture and IS Strategy, Management, and Acquisition map less clearly, perhaps due to a lack of emphasis but more likely due to nomenclature issues. For example, IS Strategy, Management, and Acquisition may be addressed in Project Management (47%), Capstone (27%), and Topics (51%), among others.

Among Sample Elective Courses, only Application Development shows a clear correspondence with mapping possibilities to Microcomputer Applications (27%), DSS Expert Systems (14%), Mobile Apps (13%), and Web Development (57%) / Web Development 2 (17%).

Enterprise Systems maps to ERP at 35% yet the ERP impact is also considered a component of Enterprise Architecture mapping. The low or absent mapping of the remaining three Sample Elective Courses – Business Process Management and Introduction to Human – Computer Interaction may reflect changing emphases or nomenclature challenges.

Notably, Business Intelligence / Analytics reports at 42% frequency though it does not clearly map to the 2010 model beyond some mention in Foundations of Information Systems. The frequency of Internships (48%) suggests support for experiential learning opportunities. The continuing presence of E-Commerce offerings (38%) provokes some potentially useful questions.

CONCLUSION

Leading professional organizations provide a valuable service to both the academic and the practitioner communities in setting standards and stimulating rich conversations through both the process and the product of curriculum model development. As previously indicated, even though curriculum models offer a degree of specificity that is not widely adopted in practice, they do provide a framework for both discussion and development that does impact, if not shape, program offerings.

If curricula models are not the direct outcome the collective judgment of professional and academic organizations, what then are the influential factors? We suggest that legacy and market, especially local / regional market, demands are significant influencers of curriculum structure. Legacy refers to the tendency to incorporate curriculum change incrementally. It may be a part of a "controllably adrift" adaptation model – holding though not tightly gripping – onto the values and resources that form the program's foundation.

While "legacy" – perhaps a sanitized way of saying "the way we've always done it" – may be viewed with suspicion or outright disdain, it is a substantial, and we submit, a valid factor in curriculum construction. Given the dynamic nature of the IS/IT field, it is easy for curriculum design to fall victim to the latest fad, the newest craze, the be-all, end-all technology or technique that it turns out has a life span of just a few very short years. Legacy thinking may be an obstacle to change but it may also serve as check and balance to short sighted impulsive action.

Market factors, especially in local and regional terms, have the potential for huge impact in shaping curricular decisions. Failure to consider market expectations is a failure in stewardship of the space and resources the program occupies in the marketplace and a failure of responsibility to the students we serve. There is often a healthy tension between the "town" and the "gown," especially in areas subject to dramatic change. Ignoring the market may be the path to obsolescence and over reliance on market cues may suggest a failure to lead.

Additionally, the lack of adherence to the IS 2010 model may stem in part from the lack of standardization of IS/IT major names. When a search of the AACSB-accredited schools in the United States finds seventy-six unique names for an Information Systems-related major program, it is possible that the curricular offerings will vary widely as well[5].

Curriculum models may be used as a structure for a market informed design discussion that reflects the reality of resources and the collected wisdom of the academy. As such perhaps the question is not whether the model is "adopted" but whether the model is useful.

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