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# **Curricula for Information Systems Undergraduate Education for the Future**

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## **Introduction**

While national standard IS curricular models have been available for 24 years, information systems employment in business has far exceeded expectations of such a new academic field to approach two million U.S. employees in the early 90s. IS degree graduates constitute only a small fraction of this IS workforce, but will comprise a larger proportion of future hires. In the two decades of model IS curricula, the business world of information technology has altered radically (Whinston, 1994). For instance this period encompassed, among other things, the advent of microcomputers, LANs, client server networks, multimedia, internet/World Wide Web, CASE tools, object oriented programming, spreadsheets, and widespread IT outsourcing. It is likely that the next two decades will give witness to an equivalent set of discoveries/innovations, some of them unknown commercially today.

This paper examines long-term trends in IS model curricula. It investigates parallel long-term trends in the domestic IS workforce and in IS job hiring and refers to rapid technological change. The first objective of the paper is to assess the appropriateness of the latest model curricula to the projected workforce and anticipated hiring trends. The second related objective is to recommend curricular changes for the future. The study may be useful in the context of reduction in IS undergraduate enrollment in the U.S. in the past five years. Curricular planners must address the issue of the profile and extent of future IS workforce, the changing IS job requirements, the type of future undergraduate curricula to best prepare students for those jobs, and the issue of curricular depth versus breadth.

The first IS national model curriculum was introduced in 1972. Among twenty nation model IS curricula that appeared since then, seven were for undergraduates (Longenecker et al., 1994) and nearly all were under the sponsorship of ACM and/or DPMA. In addition, hundreds of IS curricula have been introduced by IS programs and departments.

## **Undergraduate IS Curricular Trends**

Six IS curricula of the years 1983-1996 are examined regarding trends and changes. The ACM83 involved major development effort and was widely referenced and adopted in the 80s (ACM, 1983). It provided balanced coverage of IS fundamentals, operating systems, management of IS, systems analysis/data-bases, telecommunications, and IS project. Since the micro had just appeared commercially in 1983, ACM83 was oriented towards mini/mainframe technology.

DPMA86 was very similar to ACM83, but differed somewhat by including micro and information center courses and several electives (DPMA, 1986). DPMA90 also resembled ACM83. It differed by including more IS foundation courses and substantial coverage of CASE tools (DPMA, 1991). It divided systems analysis content into two courses emphasizing single-user and multiple-user, overlaying data-bases for each. It dropped telecommunications course, even though communications had started to surge in industry in the late 80s and early 90s.

Three contemporary IS curricula are studied, Georgia State's 1994 undergraduate curriculum (abbreviated as GS94), the IS '96 model curriculum, and the curriculum of the Office Systems Research Association. IS '96 was originally known as IS '95. The Georgia State curriculum is included because of its innovation and zero-based approach.

The IS96 resembles the ACM83 in courses but differs by breaking the body of knowledge into detailed learning units and modernizing the content. The main difference in course structure is that IS96 adds two courses, Knowledge Work Software Toolkit (IS 96.P0) and Personal Productivity with IS Technology (IS 96.2). The systems analysis/data-bases courses are consistent in total length but arranged differently topically, while the IS96 courses are much more current in content.

Georgia State's curriculum is more technical than IS96, while the OSRA96 curriculum is more managerial, end-user oriented, and organizational than IS96. Georgia State drops IS management content from the major while strengthening programming and development tools. On the other hand, OSRA96 deletes programming and data-base courses and adds coverage on end users, organizational aspects, management of end users, and human elements in IS (O'Connor, 1996).

The common threads running through the six undergraduate IS curricula are remarkable. ACM83 set a standard course framework that persisted in large part with the other curricula, except perhaps OSRA96. The framework has remained largely intact, although individual topics and model course content have been greatly modernized. Does a stable curricular course framework reflect a solid and robust core of disciplinary knowledge or curricular stultification and resistance to change. Light is shed on this question by modeling trends in the IS workforce and considering recent studies of criteria for future IS job hiring.

### **Trends in IS Job Hiring**

The IS labor force was projected by adjusting U.S. Department of Labor occupation projected for the period 1990-2005 (U.S. Dept. of Labor, 1992). Out of many hundreds of occupations, there are six identified as IS-related. These are managerial and administrative, management analysts, computer scientists and system analysts, computer programmers, computer and peripheral equipment operators, and DP equipment repairers. Several of these categories were adjusted for likely IS contribution, for instance the U.S. government category 'management analysts' was assumed to be fifty percent IS-related. Since the Labor Department does not disaggregate IS management as a separate category, IS managers were estimated as five percent of the eligible government category 'managerial and administrative.' Five percent reflects IS as a proportion of budget in U.S. industry.

Results reveal that the dominant IS job categories are systems analyst, computer programmer, and IS manager. These are projected to be 663,000, 882,000, and 318,000 respectively in year 2005. The U.S. Labor Dept. also projects by occupation the 'growth plus net replacement needs.' This category is defined as net hiring that takes account of net job separations as well as changes in population age distributions. (U.S. Labor Dept., 1992). Making adjustments again for IS-relatedness, the annual net job replacement, i.e. annual IS hiring is estimated at 74,000. This figure is in marked contrast to the approximately 3,000 bachelors degrees in information systems awarded annually (U.S. Dept. of Labor, 1992).

It is important to underscore that the rate of growth in information systems jobs 1990-2005 of 48 percent exceeds the fifteen year rate of growth of the entire labor force by 28 percent. This much higher growth rate reflects individual IS occupational job categories, in particular systems analysts, computer programmers, management analyses, and DP equipment repairers, that are among the highest of the hundreds of occupations (U.S. Dept. of Labor, 1992).

The implication of these findings is that IS curricula need to continue to provide substantial professional qualifications for the two largest job categories of systems analyst and programmer, which will continue to grow rapidly. Thus, forward looking IS curricula should continue to fully educate in these areas.

Of concern to future curricula planning is not only how many people will be hired into IS jobs, but what qualities employers and recruiters will seek from IS undergraduates. This is particularly pertinent since applicants possessing IS degrees form a very small proportion of the applicant pools. In other words, IS degree holders compete for IS jobs against graduates with majors in engineering, computer science, business and management, and even computer-skilled graduates of liberal arts curricula. Recent studies consistently point out that recruiters and employers have the greatest IS hiring interest in interpersonal communication skills, business and management skills, and systems analysis skills, followed by IS technical skills such as programming and data-bases (Jiang, 1994; Tye, Poon, and Burn, 1995). Applying these concepts to GS94 and IS96, they appear to have a principal focus on the technical aspects of IS. It is important to draw inputs from the recruiters and consider adding more required content in the areas of organizational behavior, interpersonal communications, teamwork and management business.

## Conclusion

Corporate information systems has had major even radical change over the past fifteen years, as business world computing technologies and applications have shifted greatly. One only needs to think what cutting edge academic computing was like in 1982, versus what it is like today to understand the radical change. On the other hand the course structure of IS national model curricula has been stable over the thirteen years since the first model curriculum was introduced. The detailed IS body of knowledge has been expanded and considerably modernized.

The current GS94 and IS96 curricula structures are validated by the projected IS labor force growth continuing in two principal jobs of systems analyst and computer programmer. However, looking more deeply at what type of skills industry is seeking in hiring, namely interpersonal communications, business, and systems/IS technical skills, with increasing micro orientation, the current model curricula are not entirely appropriate. For instance, IS96 expanded to include content on micro platforms, but did not include a substantial amount of multimedia content . On the other hand, OSRA96 included topical coverage of end users, international communications, and more business/management content, but OSRA96 lacked the core technical areas of programming and data-bases.

The goal would be for undergraduate IS curricula to produce a fully capable and well-rounded graduates who have good IS technical backgrounds as well as good interpersonal skills, teamwork skills, and business/management knowledge and experiences. The problem is that there is not enough room today in an undergraduate IS curriculum to cover full the range of interpersonal communication, systems analysis, technical, and business/management concepts and skills. Several areas can be emphasized in the curriculum, but in that case, other areas must be reduced.

Among the possible solutions enabling IS students to acquire a large proportion of the body of knowledge are the following

- Masters degree in IS. Upping the accepted industry requirements to masters degree would fill in much needed technical background. As it would become more widely accepted, masters in IS would also increase the professional standing and competence of IS professionals. In fact, its adoption on a widespread basis would eventually elevate the whole status of the IS profession versus other professions. Drawbacks are the educational cost and time, and hiring costs, but consider the necessary curricular lengthening and higher training/salary costs for lawyers and doctors.
- Professional certification in IS. There are many professional certificates available from software vendors (Novell, Microsoft, etc.), universities, and private certification companies. A weakness, however, for most certificates, is lack of national standards to protect and insure the certification quality.
- Corporate/outside IS training. Today, most large firms have some type of internal or external IS training. Other working age students take for-credit training workshops through colleges and

- universities, while others have opted for outside commercial workshops. A detrimental factor here is that internal or external training is costly and the quality is uncertain.
- Lifelong learning. College and universities are increasingly recognizing the importance of the concept of lifelong learning, i.e. that an individual should continue to study throughout his/her life span. This concept has already de facto been in place for any IS professional who strives to keep on top of IT technology and applications. The justification is that the IS body of knowledge turns over rapidly. This approach requires personal motivation and often corporate support.
  - Greater specialization within the IS major. Although this solution dilutes the content of a generic IS major, it may be justified in allowing greater depth to actually cover all the necessary IS topics.

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Table of *Projected Growth in IS Occupations, 1990-2005* available upon request from the author.