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Information Systems Curriculum Revision in a Hostile Environment: Declining Interest, Threats from Offshore, and Proprietary Certification

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Abstract

The paradox of increased computer use in society and declining interest in computing among United States undergraduates requires addressing. As currently configured, Information Systems programs no longer seem to attract the students needed to sustain the economy or the major. In this environment, the CIS department revised its curriculum to improve interest and more clearly integrate IS offerings with student career goals. This paper focuses primarily on a redesigned core to increase access to the discipline. Additionally, it provides an overview of the new curriculum that encourages integration with other disciplines, such as Criminal Justice and Graphic Design, which are changing due to the increase in digital interaction and representation. Initial reaction, indicated by student selection, indicates that the revised curriculum may answer the threats to the major.

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1. INTRODUCTION

During a strategic realignment at the university, with an eye to a possible IT program that combines the resources of CIS (from the School of Business) and CS (from the School of Engineering) the CIS department undertook a major curriculum revision. The business school provides administrative support, financial management and reporting lines. The CIS department staffs and delivers the required IS courses for business students but also provides an independent major.

This realignment required the CIS faculty to develop a new curriculum to confront three issues:

a) declining interest in the field

b) threats from offshore competition

c) value proposition offered by certifications.

It has become a commonplace that science and technology enrollments have declined, especially in the computing field, since the heyday of the late nineties. The bubble of the entering class of 2000 has passed and current interest, based on anecdotal reports from our regional peer institutions, show that an anticipated rebound has not happened. The local trend seems to be confirmed by the most recent national reports, which suggest that interest in computing has declined 60% between 2000 and 2004, with even greater declines of 80% among women (Frauenhein, 2005).

Part of the decline in interest appears attributed to the perceived decrease in employment opportunities. This is particularly acute in New England, which has seen, first, its major technology manufacturers shuttered -- Wang (1992) and DEC (1998) -- followed by acquisitions of its major information focused corporations -- John Hancock (2003), and Fleet Bank/Bank Boston (2004).

Coupled with the raw decrease in potential jobs, are the issues of offshore competition (Freeman, 2005). While there is little evidence of how this affects student choice, two themes are in evidence.

One theme is that the preparation of foreign students is better. US students, consequently, are just not competitive. This is the perspective that Bill Gates and other public figures have taken as noted by his comments at the National Governor's Association meeting, "Training the workforce of tomorrow with today's high schools is like trying to teach kids about today's computers on a 50-year-old mainframe." (Alonso-Zaldivar, 2005).

The second theme is that foreign labor works for less (Frauenheim, 2003). These lower wages in foreign countries could leave the impression that US compensation will stagnate or be depressed in the remaining jobs. Additionally, the rise in offshore work may leave the impression that IT employment may be both unstable and simply "scut work". Just as with the previous waves of offshore labor, as in garment and manufacturing assembly work, the jobs that disappeared were characterized as only the lowest form of employment. This may create an impression that IT labor is demeaning and dehumanizing, belonging in sweatshops akin to those of sneaker manufacturers.

The final area, which seems to be unique to the IT field, is the competition from certification programs. Most other professional certifications, such as accounting, pharmacy, or engineering, require a bachelor's degree. Many IT certifications, especially proprietary certifications, do not. Some students question the cost, both financial and in terms of time, for a degree when the position postings frequently ask for certification, such as A+ or N+, or proprietary certifications, such as MSCE or CCNA. The common academic response to IT certification is negative despite its promotion in the market place (Schlichting and Mason, 2004). The prevalence and acceptance of certification by employers not only provides a competitive path for students, but the presence of certification as an alternative may also devalue the bachelor's degree in the eyes of students.

The threat of certification is also a challenge to explain to faculty colleagues, especially curriculum committees, because of the unique role of certification in the IT industry. Specialty certification in professional fields such as medicine and law, usually follow, rather than compete with or precede, the degree and academic program.

While there might be criticism that the curriculum design should not be driven by these external factors, Grubay et. al. (2004) found externalities to trump academic drivers. Given the power of the external drivers, the resulting curriculum review must address these three areas to remain a viable program.

2. THE ROLE OF MODELS

As with most curriculum redesign, the faculty began with the model curricula. The leader in the IS field is IS2002 Undergraduate Information Systems Model Curriculum (IS2002). Competing models range from the more technical ABET (ABET) to the more managerial Organizational Systems Research Association (OSRA). The faculty also considered more focused models, such as the National Workforce Center for Emerging Technologies (NWCET) and the international model from the International Federation for Information Processing (ICF 2000).

The primary observation from examining these models is that they seemed to lack of emphasis for the current skills in demand, especially security. Just as the IS'97 curriculum had missed the rise of web technologies, in part because its design had begun just as the web technologies moved from a research project to a commercial product, there was concern that these curricula models may be reaching the period of revision.

The curriculum for the IT field is a particular challenge because the field is still nascent and not built upon largely immutable physical laws, as is physics. Consequently, the curriculum must adapt not only to developments from the laboratory but also to the social dimensions of its applications. The latter can be unexpected. Just as the rise of eBay was an unanticipated application of e-commerce to the yard sale, so is the current frequency of security threats an unintended consequence of ubiquitous digital interconnectivity.

Furthermore, other disciplines, such as physics, absorb paradigm shifts in cycles over centuries, with Einstein following Newton by some 250 years. IS, however, must account for changes in architecture, from mainframe to client-server, or programming, from procedural to object-oriented, in cycles of a few decades. As a developing field, this demands a more flexible curriculum and makes adaptation to major change unique to IS curriculum planning.

These model curricula, however, agreed in their overview of the program design. All include a core set of skills. All recognize that the technology itself is not the goal of the program, as in an engineering curriculum. Consequently, all combine applications of technology in a business domain, requiring an understanding of business fundamentals.

In addition to the models, the faculty had to consider the local conditions. They observed that applications of digital technologies, originally the preserve of the IS department, have become pervasive in the curriculum across the disciplines at the university. This is similar to mathematics, which is required of all students, but is taught from different perspectives for different majors, such as business math, engineering calculus, or statistics for psychology. Unlike mathematics, however, the disciplinary component of information technologies has often migrated to the subject department. Whereas IS used to teach the basics of imaging, and its application across business needs from document digitizing to enhancing a web site, the graphics and design department now teach more focused courses on digital imaging. Similarly, where IS alone used to teach electronic project management tools, many of those who used to enroll for a general perspective have migrated to planning and estimating courses in construction management because that is their major field.

3. REVISED CURRICULUM

The primary goals of the redesign reflected the external factors that drove the curriculum revision. Three areas were targeted:

a) improve the interest

b) minimize the offshore threat

c) answer the certification issue.

A revised core selection and better curriculum integration addressed the issue of improved interest. While the offshore threats and the certification issues were primarily addressed through developing two tracks for the major. One track focused on Networks and Security and the other on Web Applications and Systems Development.

Two dimensions influenced "improved interest". First, the barriers to entry for majors had to be examined. The top students in IS are those who have taken AP Computer Science in high school, are comfortable with abstraction, or find it easy to assimilate theory then apply it to practical settings (Hagan and Markham, 2000). Our program had to appeal to second tier students, those with little or no experience in high school who require theory bundled with application.

Second, the curriculum for minors had to be more accessible. The faculty specifically decided to target the interest in other majors for more IS course work. For example, Justice Studies students recognized the increased role of security just as Graphic Design students recognized the importance of extending the web from the browser interface to other services. In this environment, we had to improve both the security and web offerings.

The curriculum includes three introductory courses for the major. The first is a hardware course, where students build an Intel based personal computer. Many of our students, who come with an interest in computing, know the computer only from the screen and are less aware of the components that make it function. This course additionally allows us to introduce the basics of networking, provides a means to introduce not only the function of an operating system, but also to include exposure to Windows and Linux through installation and testing of these operating systems.

The second introductory course is an introduction to programming. The programming course has long been the gatekeeper for computing programs. Its role in computer science is well known and similar to that of organic chemistry, which is the bane of premed students.

While not as extreme, introductory programming plays a similar discouraging role in IS. In particular, programming has been an impediment to attracting women to the field. To change this, we adopted Alice, a programming environment funded by the

National Science Foundation that allows students to learn programming through building virtual worlds (Stage3 Research Group, 2005). Evidence indicates that the Alice environment has been successful in increasing the rates of success among students in subsequent programming courses (Moskal, et. al., 2004). This approach is also expected to lower barriers for women and other students who are less comfortable with the traditional abstract and more mathematical approach by providing a more tangible experience of interacting with objects. Subsequent research will address the effectiveness of this approach for a business-oriented program.

The third course in the introductory sequence is an applications course. This course, which is also required of all business students, reinforces the business context. The course centers on database driven websites and focuses on database design, HTML authoring, and their integration using client and server-side scripting. This has become the dominant model of business computing in the 21st century.

Upon completing this three-course sequence in computing, students have touched on all the three aspects – hardware, software (programming), and software (application) – that they will develop in greater depth through the major. The next three courses in the core are a programming course in Java, a database course that takes a more theoretical approach and addresses enterprise issues, and a basic networking course.

These six courses form the core of the IS curriculum. Following their completion, students elect to focus on one of two tracks: a Web Applications and Systems Development track or a Network and Security track. Figure 1 gives a graphic representation of the curriculum.

Majors begin the program in their first year. They take the introduction to business course, which is required of all business majors. This course both provides a context for their IS work as well as gives them a sense of academic identity with a peer group in the business school. Students in the Web Applications and Systems Development track are required to minor in business, while students in Network and Security track are required to take courses in logical and legal reasoning. The expectation is that the greater depth provided by the tracks and the improved context for the program will counter the sense of a lack of preparation from the working world. Majors are also required to take a Systems Analysis and Design course in their senior year so that they interact with their peers in the different tracks, as they will be expected to when employed.

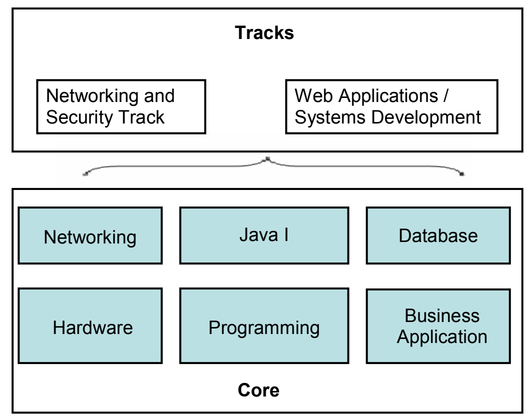

Fig. 1 Curriculum Overview

Minors, on the other hand, are not required to declare their program until the 6th or 7th semester. The structure for the minors builds on the e-business model, which required students to combine marketing and computing courses. The targeted majors outside the school of business include Criminal Justice, Graphic Design, Communications, Architecture, and Computer Science. While the core courses are required of all majors to give them a perspective on the breadth of the IT field, they are not always prerequisites for the track courses. For example, a Criminal Justice major may begin the security sequence for the minor based on completing legal reasoning, or a graphic design student may begin the web applications sequence after an introductory web design course.

To respond to the certification issue, the faculty members have begun negotiations with the professional development unit at the institution. The current proposal for students who complete specific courses is to be able to take the matched certification course as a lab component of the course. Therefore, students could get both the certification and an additional credit as a lab course. For example, the hardware course leads to the A+ certification. If a student elected and passed the A+ exam, the university would record the course as a four-credit course giving the one additional credit for the certification. Additional matches of the courses include N+ and the networking course. The student chapter of AIT had organized a self-study program on a more informal level, which indicates the interest among students for certification. Coupled with the matches of specific courses, completing the core sequence prepares students for independent certification such as the Core IT Knowledge and Skills offered by ICCP.

4. PRELIMINARY RESULTS

As the revised curriculum will be implemented this year, an assessment is premature. However, acceptance and support of the program from both institutional and student perspectives give initial indications that the program appears to answer the threats.

The proposed curriculum passed the review of the curriculum committee and has been supported by the faculties and deans in the other programs. Some courses have been cross-listed, such as the introductory security course in Criminal Justice, and the networking course in Computer Science. A revised Graphics Design major has also included require courses from the IS department.

To measure interest in the new program, 60% of the enrollment in the hardware course is from student 'conversions' – that is undeclared majors from the prior class year electing CIS as a major. While our numbers for entering declared majors continue to be low, reflecting national trends noted earlier, converting students to the major is an important measure of changing interest. Interestingly, the majority of these conversions result from the required database driven website course. This indicates that technology exposure in the right context may kindle interest among students unaware of the interaction of the technology components.

A second measure of interest has been the enrollment of about 30% in the security courses from outside the major. These courses had begun in 2004, a year prior to this curriculum revision. While this number is small, representing only three or four students, it is significant in that their presence makes the quota to allow the upper division courses to run. Institutional policies regarding course enrollments have worked against maintaining a traditional program in the face of declining interest.

A third measure of interest has been the sponsorship of three employees by a local major regional employer. These employees are returning to school to complete bachelor's degrees after completing associates and proprietary certifications on-the-job. A particular appeal for the students and the employees were the focused tracks within the program.

With these three positive response to launching the program, the faculty members look forward to external validation of the content through the student participation in certification. The hope is that students who elect this program will find the employment opportunities they expect. The Bureau of Labor Statistics (2002) shows four of the top ten growth areas between 2002 and 2012 are in information systems related fields. The students who elect CIS as a major should be well rewarded for their contrarian choice.

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