

Designing Undergraduate And Doctoral Level Programs To Advance The Career Potential Of Women In Information Technology

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Abstract

This paper focuses on the design, innovations and outcomes of undergraduate through doctoral level programs in the information systems field, with a major emphasis on the successful assimilation and enhancement of the career potential of women. Despite expanding opportunities and substantial financial incentives, women are significantly underrepresented at both the collegiate and professional levels of the information sciences. Furthermore, there is much evidence that women experience a cumulative disadvantage, in computer terms, that begins in grade schools, continues through the college years, then subtly manifests itself as discrimination at the corporate level. Thus, this study examines the effect of the ongoing strategies employed for the integration of women in the computer information system discipline at Robert Morris College and surveys the corporate computing environment of Pittsburgh and Southwestern Pennsylvania. The issue of discrimination against women in corporate information technology departments is raised, along with the strategies used to combat such practices. Finally, the Robert Morris doctoral program initiatives are employed to address these problems and integrate them into the curriculum.

Keywords: IS gender issues, IS curriculum design, corporate IS discrimination, mentoring programs

1. INTRODUCTION

Robert Morris College (RMC), with 5,000 students and two campuses, is the eighth largest independent four-year institution of higher learning in Pennsylvania. The school awards degrees in 30 undergraduate majors, as well as a master of science and master of business administration at the graduate level. A doctoral program was initiated in the Fall 1999 semester.

As part of their cooperative education job responsibilities, the authors make approximately one hundred on-site visits each year to the 47 corporate workplaces where our students are employed. Along with reviews of student performance, information is gathered from various levels of information systems management concerning the corporate environment, employee job duties, salaries, mobility, hardware, software, employment criteria, legacy systems, subcontracting and myriad other subjects. These corporations and institutions range from large multi-national corporations to health care institutions, government facilities and small businesses with less than 15 employees.

Not all information systems managers were willing or able to reveal hard statistics in this sensitive area. Most, however, were cooperative in making data available or, in some cases, supplying reliable anecdotal evidence. Additionally, our access to the college student database allowed the capture and analysis of enrollment, retention and graduation data.

The U.S. Bureau of Labor Statistics reports that women make up 51% of the American population, 45% of the total work force, but just 30% of the hi-tech work force. A salary gap of about 20% exists in comparison to males, which tends to increase as an employee moves up from one job level to another. Interestingly, two of the fastest growing career areas are that of computer scientist and systems analyst (Pittsburgh Post-Gazette September 8, 1997). The shortage of technology workers is so critical that placement agencies are now recruiting in foreign countries, India most prominently, for the purpose of filling the demands of American corporations.

Pittsburgh, as the fifth largest U.S. commercial software center in the United States, would seem to be an ideal city for the rapid assimilation of women into the computing field. A small-city ambience, combined with

a low cost-of-living ratio, a lessened incidence of crime and highly-concentrated health-care and research facilities are advantages that seem to indicate equality in cyberspace. There is some encouragement in the fact that 36% of computer science workers in the area are women (Pittsburgh Post-Gazette 1997). This is marginally better than the national average, but certainly not the goal that we would prefer. The corporations that are included in this report have hired Robert Morris Information Science graduates at an average yearly salary of \$38,500 overall, with a top of \$63,000. The job placement rate was 100% in the most recent year.

Inequality of computing does not start at the corporate level. The U.S. Department of Education reports that the number of women computer science graduates declined from 37% in 1984 to 28% in 1994. Notably, female enrollment in the undergraduate computer science major at the University of Pittsburgh reached only 11% recently. The RMC experience describes a much more favorable trend.

The cumulative disadvantages that often handicap the young female computing hopeful at the college level are somewhat easier to define and more widely-accepted than the corporate rationale. It is, however, still controversial and arguable. By surveying male and female college freshman and college seniors concerning their attitudes towards computing activities, certain consistent issues arose. First, women felt anxiety and apprehension when confronted with computer technology, whereas few of their male classmates were intimidated. The "I hate computers" syndrome was fairly widespread, and the feeling that one has to be a obsessive "nerd" to actually prefer to use computers was a frequent comment by young females. While most students felt that there was sufficient opportunity to study computer technology in high school, it was mostly males who had the desire and pursued the availability to use computers at home (Frenkel 1990). Only the on-line experience of "surfing" the Internet seemed to arouse the interest of females almost as ravidly as males. Finally, most young female college students tend to underestimate their abilities to pursue and master computer technology. However, by the time that female information science majors approach graduation, their attitudes concerning their place in the computer technology spectrum show a marked improvement over earlier years. Perhaps the dawning of the Internet age with all its connective resources will give women the rationale to link themselves fully to the computer information revolution.

2. STRATEGIES

The strategies developed at RMC to enroll, retain and integrate women students into the computer technology program originated as an open-ended and ongoing plan

to enroll and retain all students (not specifically females) in the computer information systems major. However, it was quickly recognized that the components of the plan might prove more beneficial to women students than to men students. Many of the listed strategies are currently in place, while others are awaiting integration into the system.

The first element--and nucleus--of the program took the form of a far-reaching and expansive curricular innovation. Simply stated, the previous Information Systems offering was a one-dimensional "love it or leave it" affair that concentrated mainly on the development of competent computer programmers. It was replaced by a track system that was more responsive to student needs, yet dove-tailed cleanly into the escalating corporate demand for specialty skills. Students would normally enter on the "open" track, which would allow time to ponder the relative merits of each specialty until such time as the choice became apparent. Five tracks are available to the student:

- 1) Computer Information Systems
- 2) Health Care Information Systems
- 3) Network Administration
- 4) Accounting Information Systems
- 5) Office Information Systems

Prior to the curricular change, only the programming-oriented Computer Information Systems option was available.

The five-track option quickly became the catalyst for the entire program. Previously, students who were unhappy with the narrowly-defined major had but two choices: drop out of college (Frenkel 1990) or transfer to a new major. With the introduction of the track system, students could concentrate on the specific niche within the discipline that energized and rekindled the learning process. While the rate of retention increased for both men and women students since the program took hold in the fall of 1993, the retention rate for women advanced from 60.11% to 79.35% by 1997. The corresponding data for men show an advance from 69% to 83% over the same time frame. Thus, the retention improvement factor for women was 32%, while the male factor improved by 20%. The rationale, as voiced by the women students, was that health care, accounting and office information systems were traditional areas of female interest and aspiration, but still solidly grounded in the computing sciences. Moreover, the programming and networking tracks were not abandoned by women majors, but were no longer the predominant choices.

The alchemy of change was by no means limited to the track options, although it was certainly the sine qua non of the progression. Another college initiative that precedes and complements the job placement efforts of

graduating students is the cooperative education, or internship program. The student may gain college credit, real world corporate experience and a healthy paycheck by enlisting in the career service offering during the junior and senior year. Traditionally, there have been more male students enlisted in the program than female. However, in the summer of 1998, for the first time, the number of male and female computing interns was exactly 50% each. The extremely positive feedback of the participating students and their evangelistic dissemination to other students is, in itself, a positive retention factor.

The significance of mentoring is not lost on the college student. A matter of vital concern to the corporate employee's career path, upward mobility and ultimate success, it is just as crucial to the progress of the computer science student (Frenkel 1990). Because collegiate computer science faculty are predominantly male, this often leads the female student to accept a male mentor. While not the ideal situation, and certainly not as comfortable to the female student, a male faculty member with the proper sensitivity to the problems of women in the information systems field, and a strong commitment to the mentoring process, could serve as a viable alternative. Many have volunteered to do so.

Finally, an array of common sense practices that are wholly within the college's purview have been established. These include providing safe, timely and efficient access to campus computer labs and resources, eliminating pornographic and otherwise offensive displays, tracking the progress of female students and providing counseling when necessary, and engaging students in intensive communication skills integration in the computing courses.

Two years after the start of the RMC program in Pittsburgh, another city institution, Carnegie Mellon University (CMU), initiated a similar strategic plan that focused on increasing the number of female students selecting the Computer Science major (Pittsburgh Post-Gazette August 20, 1999). Within four years, female enrollment rose from 8% to 37% in the department (Post-Gazette 1999). There remains, even within the faculty of CMU, the question of whether this will translate to higher retention and graduation rates. Given the rigorous standards of the university, it is by no means a certainty.

The statistical breakdown of college male and female enrollment and retention trends are valid within a four-year time frame. However, the average RMC student does not graduate within the traditional four years. In fact, here and at many other colleges the common in-college time to graduation is approximately six years. As additional years are added to the statistical mix, a more complete picture will emerge.

In the final analysis, we believe that the rapid growth of our department from less than 400 students in 1991 to 915 students in 1998, while somewhat a reflection of the steady rise in the vitality and prominence of the computing marketplace, is also a result of innovative collegiate and departmental policies. The remarkable improvement in the retention of women in computer system studies indicates that it is a stubborn but solvable problem. We believe that we have taken the first meaningful steps toward that solution.

3. THE CORPORATE CONTINUUM

The survey of 47 corporations in the Pittsburgh metropolitan area has attempted to determine the corporate response to the recruitment, retention and promotion of women in the Information Sciences. Specifically, the following questions have been posed:

1. What specific strategies are employed by corporations to capitalize on the resources provided by women in Information Technology?
2. Has the "glass ceiling" been shattered at the middle and upper levels of the corporate technology world?
3. What are the three specific barriers, according to highly-placed Information Technology managers, that are most often raised to suggest the reason for the absence (if such absence exists) of women at the highest levels of Information Technology?

It is interesting to note that some inconsistencies exist in the Pittsburgh metropolitan area. The Report of the Progressive Policy Institute stated that Pittsburgh, in concert with the state of Pennsylvania, scored 19% above the national average for the extent in which it used information technology to deliver services, an indicator of the area's ability to fully utilize its resources (Progressive Policy Institute June 23 1999).

However, according to the University of Pittsburgh's Center for Social and Urban Research 6th Annual Report, women with college degrees in the area earn less than 50% of the wages of their male counterparts, and were 50% less likely than men to be employed in executive or managerial capacities, a considerable notch below that of other American cities (University of Pittsburgh 1999). This would not indicate optimum usage of women's potential. Would professional women in the Information Technology field descend to these dismal levels?

Most corporate managers of information technology, both male and female, have suggested various reasons for unequal treatment of male and female technology workers. Few believe that a formal "glass ceiling"

exists. Those who grudgingly speculated on that possibility suggested that it is a surmountable obstacle, not an immovable object. The number of respondents who felt that their corporation harbored such a barrier was zero.

In fact, the U.S. Department of Labor, in conducting "glass ceiling" reviews since 1992 in the Pittsburgh (Mid-Atlantic) area, has verified that nearly 40% of reviewed corporations have been identified as "non-compliant" practitioners of subtle practices that discriminate against women. The most recent finding resulted in significant financial penalties levied against a large corporation in the Pittsburgh area that is one of the 47 companies included in this survey (Post-Gazette September 30, 1999).

The most difficult task of this study was to determine what, if any, strategies existed to retain and promote women. Nearly every manager felt that the corporation had in place a number of initiatives to further the careers of women, but it was difficult to nail down exactly what they were, how they worked, and how formally they were integrated into actual company policy. It was felt that mentoring, for example, was always available to the Information Technology employees of the company. Yet, little was known concerning the implementation of the plan, and whether it was available to (and used by) women as well as men. Most managers felt that mentoring was a common, selective, unregulated, natural facet of the corporate culture, and downplayed its importance to the female aspirant. In fact, most studies have shown that mentoring is arguably the most important factor affecting the female corporate progression. A recent survey by CIO Magazine found that 70% of upper-level Information Technology women considered that the lack of a mentor was the greatest barrier to corporate advancement (CIO September 29, 1999). The following statistics display the most often-mentioned strategies, and the percentage of companies that employed them in a somewhat structured or formal manner.

4. STRATEGIES FOR WOMEN IN INFORMATION TECHNOLOGY

Recruitment and retention	23%
Career development	17%
Identification of high-potential women	47%
Mentoring by upper-echelon employees	6%
Providing internal support	17%
Establishing training programs	6%
Providing Clear paths of responsibility	53%

The majority of managers did agree, however, that the relatively smaller number of women with computer-related degrees, the corporate inflexibility on family issues, and the simple fact that women have not been in

the information technology pipeline long enough to become fully integrated into the corporate design for career advancement, were the deciding factors resulting in the less-than-satisfactory use of the female technology resource in the corporate sphere.

5. RATIONALE OF INFORMATION TECHNOLOGY MANAGERS:

Family/flexibility issues	64%
Not in pipeline long enough	55%
Fewer women with I.T. degrees	19%

A critical factor in determining the viability of women at various corporate Information Technology levels is the percentage of workers at the entry and lower managerial level, and the percent at the senior managerial levels. The senior managerial level is considered to range from the director of technology through the vice-presidential and CIO levels. This information is derived only from the 47 corporations surveyed in the Pittsburgh area, not all corporations in the area.

6. PERCENTAGE OF WOMEN TECHNOLOGY WORKERS.

Entry/lower managerial	38%
Senior managerial	8%

In light of these statistics, it would appear that there is no significant lack of job potential for women at the corporate hiring level. At the upper strata of the Information Technology hierarchy, however, it is apparent that women are in a distinct minority. Whatever the real or imagined reasons for this discrepancy, it results in a loss for society as well as for women. To clarify the issue, we may draw a parallel with the world of sports, in which the best players always compete, with no discrimination. In view of the dramatic growth of the Information Technology field, it is clear that every effort should be made to attract, retain and promote all the best "players".

7. THE DOCTORAL PROGRAM IN INFORMATION TECHNOLOGY

The responses of the local corporate community, as well as national statistics, served as input into phases of the doctoral program. As an example, consider that only 18.8 percent of those seeking doctorates in computer science in the United States are women (Post-Gazette March 19, 2000). Certainly, this became a program priority issue to be addressed. Because technology allows for mobility and remote accessibility, women are empowered by taking advantage of flexible work schedules, telecommuting facilities and job-sharing. The doctoral program attempts to incorporate similar flexibility into its structure.

Enlightened corporations and institutions that are severely impacted by the shortage of information and knowledge workers are rushing headlong into the development of formal mentoring programs. When in place, such programs have resulted in increased employee retention and upward mobility (Information Week April 2000). How could this process be integrated into the doctoral program? Would it be as effective for women as for men? Would it produce results as significant as undergraduate program innovations?

The Doctor of Science in Information Systems and Communications (D.Sc.) degree program was debuted in the Fall of 1999. This doctorate was conceived as a professional degree to meet the needs of industry for "specialized generalists" who are capable of performing rigorous applied research and problem solving. Specifically, the program was designed to address the expanding needs of professionals who manage information resources, and solve information, communication and technology-related problems in businesses and other organizations. The program has three distinct characteristics: it is a full-time program in an executive format (three year program with one seven day residency and three weekend residencies in each of the six terms), it is cohort based, and it is interdisciplinary.

Within four months of the program's initial announcement, an application pool of nearly ninety individuals had formed. The application requirements included a strict minimum of five years managerial experience at the mid-corporate level, and an intensive interview process with the doctoral faculty.

After the admission review process was completed, fourteen applicants were admitted. Of these, ten were women. These ten women included three CEO's, the Chief Information Officer of a major urban metropolitan police department, a technology section leader of a large international corporation, and two executives in the steel industry. These women were quite special in that they constituted the majority in a technology-based program that was the equivalent of a high-risk venture--a first year program with neither a history nor a reputation. Under these circumstances, it is interesting to note that, of the entire applicant pool, 58% were women.

When the admitted women were informally asked why they were attracted to this program, they all stated the three unique characteristics cited previously: executive format, cohort based study, and interdisciplinary composition. The most interesting comment, however, was that they perceived that the cohort support and administration of the program with a faculty member

assigned to each student to be the mentoring ideal that was essential to their success.

All faculty members partnered with doctoral students have maintained a presence and availability to their assignees. They have contributed their own academic input into the process and integrated their corporate or institutional information technology experience, as well as their ongoing consulting activities, into the fabric of the mentoring program.

During the student's final term, a comprehensive critical technology infusion project will be designed and implemented in conjunction with local corporations and their key information technology managers, who will function as facilitators, consultants and knowledge experts, thus completing the mentoring cycle.

Three rationales were reported in this study to explain the lack of upward mobility of women in information technology. Two of those rationales--the time-in-the-pipeline issue and the family/flexibility issue can not be properly addressed in this study. The third rationale, which underscores the relatively low number of women with information technology degrees, is a pervasive but solvable problem that we have begun to address.

8. CONCLUSIONS

Curricular program innovations, carefully structured in a bottom-up approach, can relieve many of the disadvantages that women in Information Technology career paths have been subject to. Because the problem is a persistent one that surfaces in successive stages, intertwined among undergraduate, graduate and corporate experiences, it required an across-the-educational-spectrum approach. The outcomes at RMC have been gratifying, thus far. The most subtle and elusive aspect of the study is taking the known discrimination factor at the corporate level and attempting to remediate it at the graduate level. Let us take a glimpse at one of the initiatives of the doctoral program. The mentoring facility, according to the women enrolled, is an effective tool to facilitate learning and integration of corporate and educational experiences. But will that translate into actual career success for women in Information Technology? Will the "glass ceiling," which our survey (and government investigation) has shown is clearly still in place, slowly shatter? Our study continues.

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