

## THE DIGITAL DIVIDE: GENDER ISSUES, INITIATIVES AND EMERGING TRENDS IN THE CORPORATE AND ACADEMIC SPHERES

Donald J. Caputo, Robert Morris University, [caputo@rmu.edu](mailto:caputo@rmu.edu)

---

### ABSTRACT

*Despite expanding opportunities and substantial financial incentives, women are significantly under-represented in both the academic and professional environments of the information sciences. Furthermore, there is much evidence that women experience a cumulative disadvantage, in computer terms, that begins early in life in the grade schools and continues through the college and corporate experience. A qualitative survey-based approach was conducted in the study of 111 regional corporations. It focuses on the ongoing strategies employed for the integration and retention of women in the computer information systems discipline at Robert Morris University, with an outlook and survey of the corporate computing environment of Pittsburgh and Southwestern Pennsylvania, and the gender effects of a decline in the occupational and educational dimensions of the discipline in the early years of the 21<sup>st</sup> Century.*

**Keywords:** IT Gender Issues, Women in Computing, Gender Effects in IT, Academic/Corporate Trends in IT

### INTRODUCTION AND OVERVIEW

Robert Morris University, with 5,000 students, two campuses, and numerous satellite facilities, is the eighth-largest independent four-year institution of higher learning in Pennsylvania. It awards three Information Science degrees on the undergraduate level, as well as six areas of Information Technology at the Master's degree level, and culminates in the Doctor of Science in Technology degree program. It is one of only a handful of universities in the United States to be fully accredited by the ABET (Accreditation Board for Engineering and Technology) commission.

The Pittsburgh Technology Council, with more than 1,600 member corporations in Southwestern Pennsylvania, was instrumental in providing corporate data, guidance and contact information for the study. More than 100 corporations were surveyed with 116 individual IT management personnel responding. These corporations range from large multi-national entities, health care institutions,

government facilities, financial firms, small entrepreneurial start-ups and e-commerce/internet-based firms. Additionally, access to the university 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 50% of the American population, 45% of the total work force, but just 30% of the high-technology work force. A salary gap of about 20% exists in comparison to male employees, which tends to increase as the employee moves up from one job level to another.

Pittsburgh, the fifth largest U.S. commercial software center in the United States, seems to be an ideal city for the rapid assimilation of women into the computing field. A small-city ambience, combined with low cost-of-living ratios, 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 [2]. This is marginally better than the national average. Inequality of computing, however, 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 [4].

The cumulative disadvantages that often handicaps the young female computing hopeful at the college level are somewhat easier to define and more widely-accepted than the corporate rationale [1]. 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 often felt anxiety and apprehension when confronted with computer technology, whereas few of their male classmates were intimidated. 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 [3].

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.

### **The Academic Environment**

The strategies employed at Robert Morris University 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 female students than to male students. All 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 were 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 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 1994, the retention rate for women advanced from 60.11% to 79.35% by 1998. 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 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 [3]. Because collegiate computer science faculty members 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.

Finally, an array of common sense practices that are wholly within the university’s purview has been established. These include tracking the progress of female students, providing counseling when necessary, and engaging students in intensive communication skills integration in the computing courses.

Two years after the start of the Robert Morris University program in Pittsburgh, another city institution, Carnegie Mellon University, initiated a similar strategic plan that focused on increasing the number of female students selecting the Computer Science major [2]. Within four years, female enrollment rose from 8% to 37% in the department [4]. There remains, within the CMU faculty, the question of whether this will translate to higher retention and graduation rates.

A few inconsistencies enter the enrollment and retention picture, it should be noted. While we attempted to derive statistics based on a four-year enrollment and retention cycle, the average Robert Morris University student does not always graduate within the traditional four-year time frame. In fact, here and at most other colleges in the United States,

the common in-college time to graduation is approximately five to six years.

In the final analysis, we believe that the rapid growth of our department from less than 400 students in 1991 to nearly 750 students in 1999, 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 Corporate Environment**

The survey of corporations in the Pittsburgh metropolitan area has attempted to determine the professional 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 important to note that all information in the study was gained through in-person, on-site qualitative interviews with an accompanying objective questionnaire instrument.

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 [5].

However, according to the University of Pittsburgh’s Center for Social and Urban Research 6<sup>th</sup> Annual Report, women with college degrees in the area earn less than 60% 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 [6]. 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.

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 [8]. The following statistics display the most often-mentioned strategies and the percentage of companies that employed them in a somewhat structured or formal manner.

**Table 1.** Corporate Strategies for Women in Information Technology

Strategy	% of Companies Employing Strategy
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.

**Table 2.** Rationale of Information Technology Managers

Management Reason	%
Family/flexibility issues	64%
Not in pipeline long enough	55%
Fewer women with IT 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 111 randomly-selected corporations surveyed in the Pittsburgh area, not all corporations in the area.

**Table 3.** Percentage of Women Technology Workers

Managerial Level	% of Women
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 of potential for women at a critical juncture in the rapidly-evolving IT discipline.

**CHANGE AND EFFECT: 2001-2005**

The downturn in the tech economy, with the attendant outsourcing movement rapidly gaining in corporate favor, fueled a half-decade period of corporate and academic retreat in the Information Technology arena, nowhere more pronounced than in the in subset of women’s issues. The corporate

sphere, lagging the precedence of the prior academic experience by a few years, has not yet felt the full impact of the diminishing number of qualified females in the Information Technology workforce. Universities, on the other hand, are now sensing the attrition of female technology majors accelerating at an unprecedented rate.

By means of a follow-up study of the same corporations originally surveyed during the late 1990s, it was found that, within the 2004-2005 time frame, the corporate strategies matrix for women in Information Technology did not significantly change. The perceived factors regarding the less-than-satisfactory use of female resources resulted in the following matrix.

**Table 4.** Rationale of Information Technology Managers

Management Reason	%
Family/flexibility issues	65%
Not in pipeline long enough	53%
Fewer women with I.T. degrees	24%

The increase in the perception that fewer women with IT degrees are entering corporate careers may be the initial impact of the paucity of female IT majors at the collegiate level.

The percentage of women technology workers in the later study resulted in the following matrix.

**Table 5.** Percentage of Women Technology Workers

Managerial Level	% of Women
Entry/lower managerial	35%
Senior managerial	9%

This matrix underscores the beginning stage of the decrease in entry-level women into the corporate sphere of Information Technology. Accordingly, the attrition of the female IT major at the undergraduate level at Robert Morris University shows an alarming trend. The following matrix denotes the enrolled freshman Information Technology major ratios by year.

These figures correlate significantly with the experiences of all universities throughout the United States, as published by the National Science Foundation [9].

**Table 6.** Male/Female Enrollment of Information Technology Majors

Year	Male	Female
2001-2002	62%	38%
2002-2003	64%	36%
2003-2004	66%	34%
2004-2005	70%	30%
2005-2006	72%	28%

It must be noted that freshmen interest levels have been an accurate predictor of trends in the number of degrees granted four, five or six years later [9]. It follows, then, that there will be a sharp decline in the number of degrees granted in Information Technology during the next decade. With such a future scenario, it is virtually certain that, when the demand for computer technology workers finally returns to expected levels, it will fall short of capturing the resources derived from one-half of our work force.

**REFERENCES**

1. Frenkel, K. (April 1991). Women and Computing, *Communications of the ACM*, 35.
2. Pittsburgh Post-Gazette, September 8, 1997, *Jobs beckon to women in computer science.*
3. Frenkel, K. Women and Computing, *Communications of the ACM*, November 1990.
4. Pittsburgh Post-Gazette. (August 20, 1999). *Cyber Women.*
5. Pittsburgh Technology Council Outreach. (June 23, 1999). *Report of the Progressive Policy Institute,*
6. University of Pittsburgh Center for Social and Urban Research 6th Annual Report, 1999.
7. Pittsburgh Post-Gazette. (September 30, 1999). *Denying bias, corporation to pay women.*
8. CIO On-line Magazine. (September 1999). *Self-assessment survey.*
9. Frauenheim, E. & Gilbert, A. *Opening Doors for Women in Computin*”, C/NET News.Com, February 7, 2005.