Recruitment is Never Enough:
Retention of Women and Minorities in the IT Workplace

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ABSTRACT

Women, as well as African Americans, Hispanic Americans and Native Americans are represented in the information technology (IT) workforce in percentages that are far lower than their percentages in the population as a whole. While recruiting efforts are crucial for increasing the participation of women and minorities, it is equally important that we retain those already in the IT workforce. Here we present an assessment of the relevant literature addressing retention issues for women and minorities. Some issues that arise from this literature can be applied directly to changes that must take place in the IT workplace such as; the development of gender/race/ethnic appropriate mentors, sponsors or role models in the work environment, the development of involvement of the family and/or community in support of the work environment, the development of a nurturing work environment to offset internalized out-group status, the development of a truly multicultural work environment that values gender/race/ethnic differences, the development of recognition of and assistance with stress from financial issues and social/family obligations, and the eradication of institutional practices that marginalize women and minorities. There is a need to deepen our understanding of retention issues for women and minorities in order to inform intervention strategies. This work addresses this need by providing an in-depth examination of factors affecting attraction, development and especially retention of minorities and women in IS.

Categories and Subject Descriptors

K Computing Milieu, K.1. Management of Computer and Information Systems, K.6.1 Project and People Management

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1.0 INTRODUCTION: THE IT WORKFORCE CRISIS

It's cheaper to retain staff. Employee turnover is a costly problem for business. The hiring process, training, lack of experience and other factors drive up the cost of doing business. These costs are passed along to consumers and often limit a company's ability to create new jobs or increase salaries and benefits for its existing workforce. In the U.S., one in ten IT jobs goes unfilled, with the ITAA currently estimating 342,000 unfilled IT jobs. In the next seven years, a million new IT workers will be needed in the U.S., but less than 25,000 computer science graduates enter the work force each year. Couple that with the IT baby boomers starting to retire, and there will be a major shortfall in the IT workforce. [1 2002 #226]

Companies, having to fill critical openings, are turning to luring permanent staff from other companies. They'll go overseas to poach staff. "Foreign" labor can be hired for less money and, because of visa limitations, they remain locked in to the consulting company. In addition, there is the cost of hiring to replace people lured elsewhere, and the hidden costs of missed deadlines. The cost of replacing an experienced IT professional has been estimated to average $20k.

Since the year 2000 several major studies ([1 2002 #226, 2] have been completed that suggest that the number of skilled IT professionals is vastly lower than the number of IT positions. In some cases the shortage of IT professionals has been described as a crisis. "…employers will create a demand in this country [USA] for roughly 1.6 million IT workers this year [2000]. The demand for IT workers continues to rise. Jamrog, the Executive Director of the Human Resource Institute, St. Petersburg, Fla. states that there will be a 40 million worker shortage by the year 2015. [3] From ITAA data, there are currently near one million tech jobs available, yet employers were unable to fill 578,000 job openings. There is a consistent fifty percent "gap" between supply and demand of IT workers during the past three years, despite the fact that demand fell off during 2000-2002 recession. [1 2002 #226] With demand for appropriately skilled people far exceeding supply, half of these positions--843,328--will likely go unfilled. In a total U.S. IT workforce of 10 million, that shortfall means one job in every dozen will be vacant."[1 2002 #226]

The problem is compounded by the fact that there is also a demand for high-skilled, creative, IT workers that is also under supplied. IT World claims that a preponderance of IT workers are under-skilled in such areas as management of technology, HR practices, leadership, communication, organizational and analytic skills [4].

As the generation of programmers who created the legacy systems in the 1970s and 1980s begin to retire and the demand for highly skilled IT professionals rises, the question of how to train, recruit and retain IT employees becomes essential to answer.

From the Commerce Department's report, America's New Deficit: The Shortage of Information Technology Workers prepared by the Office of Technology Policy, Andrew Pincus, the General Counsel states that the deficit of IT workers in the United States is a growing and serious problem. [5]He suggests several possible solutions including:

> increasing the participation of underrepresented groups,
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> improving the image of the info-tech professional,
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> basic math and science competencies,
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> responsiveness of education and industry to each other's needs,
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> skill upgrading of the current workforce, and
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> quality and productivity issues.

This work focuses on Pincus' first point, increasing the participation of underrepresented groups in the IT workforce. According to the National Science Foundations, Division of Science Resources, white males account for 60 percent of college graduate IT workers. The proportion of IT workers with a college degree who were women declined from 33 percent in 1990 to 26 percent in 2001. [6] Nielsen, von Hellens, Wong and Trauth [7, 8] find that although there has been a small rise in female participation in the traditionally male-dominated profession of science, engineering and medicine, there has not been a corresponding trend in the information technology sector. They state that since 1990 there has been a steady decline in women's participation in the IT workforce despite the looming shortages of IT workers. "What makes the low participation of women in IT education and work a significant problem to study is its contribution to the IT skills shortage."[7]

Over the past three years, the IT sector in the United States has experienced a dramatic downturn. We have witnessed declining stock prices, stagnant computer sales, unprecedented layoffs, and the 'reverse brain drain' as foreign-born technologists return home. The number of temporary work visas, known as H1-Bs, has dropped from more than 163,000 in 2001 to a projected 90,000 in 2002 [9]. Other contributing factors include the decline in the number of American students obtaining IT-related undergraduate and graduate degrees, and the low penetration of broadband technologies in the US compared with other countries. Some industry analysts suggest that these worrisome trends point to growing evidence of a decline in overall U.S. technology dominance. Microsoft strategist Craig Mundie ominously states, "If the U.S. cedes its leadership in IT, there will not be a second chance". However, "America cannot emerge as a world leader economically, socially or politically while leaving one third of our population (African Americans, Latinos and Native Americans together constitute 30% of the college age population) outside of the profession that is critical to our technological infrastructure, essential to our continued economic growth, and fundamental to the evolution of modern life" [10].

The IT industry has a problem overall that perhaps training, recruiting and retaining women and minority employees would, in part, solve. "At the end of 1999, women represented just 29 per cent of the workforce in the US technology sector", according to a study by the White House's Council of Economic Advisers. That is down from 40 per cent of the workforce in 1986. Another study,

conducted by Spencer Stuart, the recruitment and research group, supports this theory. It found that women account for just 3 per cent of the board members of new-economy companies. This compares with 11 per cent at Fortune 1000 companies, according to Catalyst, the research organization." [11]

IT employers are faced with the need for an adequate pool of well-trained applicants from which to hire new employees from. Yet, while the number of qualified employees is dwindling, there is an increasing need to retain well-trained employees and to lower search, hire, training and general turnover costs, to boost employee loyalty and morale, and to maintain a highly productive and creative workforce. All of these problems could be addressed with more consistent, higher quality and institutionalized, systematic industry-wide efforts at recruiting and retaining women and minorities in the IT workforce.

Minority status is a social construction, and as such it is subject to great variability. "Minority" in the discussion of minority retention is sometimes used to refer to disabled, lesbian/gay/bisexual/transgender, or first generation employees. Most commonly, however, "minority" is commonly used to refer to employees who are members of ethnic minorities, particularly African American, Hispanic and Native American employees and not Asian American employees (given the high persistence rates of the latter group). Caution should be taken, however, when aggregating any minority. For instance, the success of Japanese Americans in U.S. employment is very different from that of Vietnamese Americans.

Women, as well as African Americans, Hispanic Americans and Native Americans are represented in the information technology workforce in percentages that are far lower than their percentages in the population as a whole. These populations are also underrepresented in the educational programs that prepare people for careers as IT workers. [12]

While recruiting efforts are crucial for increasing the participation of women and minorities, it is equally important that we retain those already in the IT workforce. It is clear that nothing is gained by bringing women and minorities into the workforce to simply have them drop out or be weeded out. IT recruiters suggest that replacing an IT employee can cost twice his or her salary because hiring a new IT person comes with the inherent recruiting and training costs, and the inevitable downtime during the job change [13]. Turnover rates of 25%-35% have been reported in Fortune 500 companies during the late 1990s, and this 'turnover culture' in IT can hamper the organization's ability to achieve strategic business goals [14].

If we are to successfully counter the negative affects of the IT turnover culture, there is a need to deepen our understanding of retention issues for women and minorities in order to inform effective intervention strategies. In fact, the National Science Foundation broadened its funding portfolio to include descriptive research as well as implementation and intervention projects that are designed to increase the representation of women and underrepresented minorities in IT [15]. The lack of role models and mentors who are knowledgeable about career opportunities, perceptions of computing as a solitary occupation, and images of the "glass ceiling" contribute to the isolation and discontent experienced by these populations. According to a study by the Computing Research Association, many of the issues that discourage minorities are similar to those for women [16]. However, we do not make the implicit assumption that the effects of diversity among women and

minorities are homogenous [17], but experience has shown that sustained and programmatic efforts can make a significant difference for these under-represented groups. This work addresses this need by providing an in-depth examination of factors affecting attraction, development and especially retention of minorities and women in IS.

2.0 IT, ORGANIZATIONS AND THE UNDERREPRESENTED: THEORETICAL BASES

In this section we draw from the relevant literature that addresses IT workforce diversity and retention issues. The majority of the literature focuses on the conditions for women IT workers, however a growing body of literature sees a commonality between the issues that discourage women and those that discourage minorities [18]. Few organizational and managerial studies have attempted to tackle the issue of minority employee retention directly [19]. According to Cheng [20, p. 553], "although women-in-management research has become mainstream, other diversity issues are almost entirely ignored, particularly racism, patriarchy, class, heterosexism, sexuality, sexual identity, religion, postcolonial issues, physical ability and so on."

This work grows out of sociological inquiry into the nature of and intersection between IT and organizations. Goals of this field are to identify and explore relationships among IT organizations and innovation, organizational culture and structural patterns, and the roles of IT in both. We draw from the social construction of technology literature to address information and communication technologies (ICTs) and work, neither privileging the social or technological factors in constructing accounts of their creation, use and implementation.

"With few exceptions, research has proposed that changes in communication technologies are tightly linked with changes in organizations."[21] Workplaces and information and communication technologies have changed dramatically in the last fifteen years. Since the early 1990s "…we are now seeing a new type of postindustrial, post bureaucratic, post-Fordist workplace…" [22] While most authors agree that a change has taken place, they are divided as to the nature of the change. On the utopian side, this new workplace has been characterized by social scientists as having a decentralized locus of control, a reduction of hierarchy, an upskilling of work, a centrality of educated knowledge workers, and more flexible democratic forms of work environment. [23-28] Hammer and Champy (1993) state "…the real power of technology is not what can make the old processes work better, but that it enables organizations to break old rules and create new ways of working—that is, to reengineer," [29]On the critical side of this debate the belief is that although workplaces have changed they have remained highly centralized and have adopted new forms of managerial control, including new forms of peer driven and self driven control, along with a polarized workplace involving expert and non expert sectors bringing up strong issues for gender and race [22, 30-36].

Gender can be seen as a set of patterned, social produced, differences between male and female, which usually involve the subordination of women, concretely or symbolically[37-39] . Acker identifies four elements that combine to create gendered processes in organizations including the production of gender divisions, the creation of symbols and images that justify and support the divisions, interactions between employees of both sexes that reinforce subordination and dominations, and lastly, the creation of internal mental constructions of gender appropriate behavior and attitudes. We draw from these views of gender in which much of the processes that take place within organizations on a daily basis are imbued with gender attitudes and behaviors and that have strong implications for power, exploitation and control in the workplace.

According to the s bio- psychological theory, the physical differences between males and females account for the participation levels of women in IT, implying that women are somehow physically unsuited for the IT profession [40, 41]. This essentialist perspective has also been applied to minority workers. However, biological concepts are replaced with sociological ones such as assimilation and cultural pluralism. Research emanating from the paradigm of assimilation and cultural pluralism center on the questions of why racial minorities were not becoming incorporated or assimilated into business organizations [19]. Theories of assimilation are basically individualistic in their orientation, and race is conceptualized as a problem of prejudiced attitudes or personal and cultural inadequacies of racial and ethnic groups. Assimilation theories are posed as a one-way process in which minorities are pressed to change to fit the dominant culture, and research questions tend to be stated in terms of "why minorities are not like us, or how can they become more like us?" This approach is also silent on the historical and social dynamics of capitalistic systems in creating and maintaining inequality in organizations [19].

Cultural pluralism theories allow for group differences, and are often posed as an alternative to those of assimilation. This approach is often found in the "managing diversity" management literature that calls for the celebration of difference. However, proponents of cultural pluralism still maintain the existence of an allegedly "normal" majority culture. Minority workers, in this discourse, are often described in demeaning terms such as being less likely to have had satisfactory schooling and training, and possessing language, attitude, and cultural problems that prevent them from excelling on the job.

Several theorists assert that a masculinization of the IT workplace has occurred during the past 30 years due to the strong link between economic power and success of technologists. The prominence of the computer's place in the social and economic horizons has solidified the link between man and machine. Males have made solid their claim of computers as a highly valued resource. Although these authors have made no claim as to this perspective's application to minority relationships with computers, the implications of this perspective are that those who hold power, typically White (Anglo) males, have claimed the IT industry for themselves and erected boundaries to prevent others from having access to such a valuable resource [41-43].

The social construction perspective posits the development of and maintenance of a masculine and White (Anglo) IT culture that systematically excludes women and minorities from IT work and all educational and professional steps leading up to IT work [41, 44-47]. Although recognizing that there are no universally male or female cultural traits, the social construction standpoint emphasizes that within the IT workplace certain cultural characteristics are gathered together in a cultural unit that have come to be seen as "male" and the excluded cultural traits as "female". Female IT workers are faced with two choices: either to masculinize

themselves and 'fit in', or to the challenge the cultural system and attempt to feminize the workplace [7, 8, 45, 48].

Henwood [49] adopts the social constructionist view, and asserts that information technology cannot be understood unproblematically as a neutral tool that can be mastered simply by obtaining the required set of skills. Women are perceived as being somehow deficient so there is a need for women to 'catch up' or 'fit in' with men. These deficiencies are assumed to be overcome by offering women the same opportunities as men to acquire some recommended set of technology-related skills. Consequently, recommended interventions promote 'compensatory strategies' such as increasing the pipeline of women entering IT careers, making it easier for women to choose IT careers, and promoting a more feminine image of computing. From Henwood's perspective, there is a need to go beyond attempts to find ways to attract women to information technology. Socio-cultural studies are needed to understand, analyze and challenge the ways that gender and technology are currently constituted. Researchers also need to question the neutrality of technology, and seek to understand why and how women are excluded from IT education and occupations. Prior research in this area provides useful concepts for addressing recruitment and retention issues.

Although IT organizations express strong concern with diversity in the workplace, little scholarship is available to guide these efforts. For example, research that examines the intersection of race and gender in IT organizations is largely non-existent. While gender research is more plentiful, within the women-in-management literature there is an underlying assumption of "womanhood" or shared experiences. The universalizing tendency of this perspective is political in its reductionism for it typically emphasizes a single characteristic of gender while ignoring the effects of race, ethnicity, sexuality, and social class on the self-identity of women. Consequently, it gives rise to interventions that fail to deal with the diverse and fragmented nature of women's experiences and needs [49].

Finally, research that goes beyond black and white conceptualizations of race are needed because Hispanic, Asian and Native American women and men may be different from those of African American and white women and men [50]. Researchers tend to adopt the conventional practice of merging Asians, blacks, Native Americans, and Hispanics into single categories such as "nonwhite" or "other". This is also a political act in that it ignores and trivializes the uniqueness of men and women of various racial, and ethnic backgrounds. Race is not a biological characteristic; it is the result of the historical construction of racial categories, the shifting meaning of race, and the crucial role of politics and ideology in shaping conceptions of race [51]. Reducing the diverse voices of people of color omits from discussion the voices of nonwhite people as subjects who engage with IT for a whole range of reasons, and who face unique challenges in the areas of recruitment, retention and promotion within business organizations.

3.0 RECRUITMENT AND RETENTION OF WOMEN AND MINORITIES IN IT

Two recurring themes in the recruitment literature are the belief that women and minority groups perceive a career in the IT workplace negatively, and the perceived lack of technical skills among women and women's negative self perception of their technical skills. For several reasons women and minorities have perceived the IT industry as not having the qualities they require in a job. They have framed the work as difficult, isolated, lacking necessary social interaction, and lacking work family balance. In addition, there is a common perception that the IT industry is a male and a stereotypical "geek and nerd" domain. Fewer women are entering computing courses at the university level and IT education continues to be represented in a way that discourages girls to participate [7, 52-55].

A second common perception is that women are not suited for technical positions. Women are viewed as mostly 'concept' people, and are more interested in the overall view and the wider implications of software and systems in operation rather than the technical details. There is also a perception that a large majority of women underestimate their abilities with regards to IT and computers. These free-floating perceptions deter women from entering IT educational programs and the IT workforce [7, 52].

While recruitment focuses on attracting women and minorities into IT-related careers, retention concentrates on not only keeping these employees in the organization but also in their upward mobility within the organizational structure. The retention literature has identified several pertinent factors that include cultural fit, expectation gaps, mentors and role models, career satisfaction and organizational commitment, and role ambiguity and role conflict. IT computing culture has been described as having certain characteristics that are unique to the industry and unique to White male culture. The IT culture is described as largely white, male-dominated, anti-social, individualistic, competitive, all encompassing and non-physical. This ascetic culture has strong in-group and out-group dualisms in which the needs of the disembodied intellect subsume emotional, physical and sensual needs. This dualism translates into expert and non-expert and to male and female behaviors, attitudes and values. IT workers are expected to pare-down their non-technical lives, to become tireless pioneers on the technical frontier, and to prioritize work life over all other things. This culture has the potential to exclude women and minorities if they do not conform [45, 47, 48, 56, 57]

Igbaria et al. [58] suggested that women and minorities are marginalized in promotion, salary raises, termination, and layoffs. These experiences negatively affect stress, performance, productivity, satisfaction, and cohesion while positively increasing turnover rates [50]. Many women feel their expectations of their careers and job discretion are not met, and these unmet expectations may produce feelings of unfairness and inequity. Research also suggests that morale and productivity decrease when women don't achieve their expectations [59, 60]. Reskin, McBrier and Kmec [50] contend that the sex and race composition in the workplace affects organizations themselves, including their performance, hiring and promotion practices, levels of job segregation, wages, and benefits. However, more research is needed to specifically address the joint effects of race and sex.

Women and minorities tend to have less access to mentors, sponsorship and role models that can provide the advice and social contacts that are crucial for rising through the corporate ranks. Social support from supervisors and colleagues also helps to minimize turnover intentions among female and minority computer professionals [7, 59, 61-63]. Within the traditional IT culture, a strong value is placed on individualism and pioneering behavior. However, a culture that prizes individual effort may impede the creation of mentoring networks that support female and minority IT employees. In addition, white (Anglo) men have traditionally held the highest ranking and the most privileged positions in IT but may

face difficulty in relating to their female or minority employees. For instance, Ibarra [64] hypothesized that sex-based conflict is less likely in predominantly male than in mixed-sex settings in which the presence of women constitutes a greater threat to men's prerogatives. Work group homogeneity also fosters interpersonal attraction and trust, and both of these factors positively affect group cohesion [65].

Roger Herman (1999) gives five reasons why employees leave. These five reasons can be easily applied to women and minorities working in the IT workforce. First employees are concerned about fitting into a corporate culture. They are also concerned with the company's reputation; the physical conditions for comfort, convenience and safety; and the clarity of the firm's mission. Second, Herman claims that even though leaders value employees, they don't tell them often enough. If people don't feel important, they're not motivated to stay. If they are regarded as expendable, they'll leave for a position where they're appreciated. Third, when IT employees are frustrated by too many rules, red tape, incompetent supervisors or co-workers, inadequate tools and equipment, or insufficient information, people look for other work places. The fourth issue is training. IT employees want to learn, sharpen their skills and hone new ones. If workers don't find growth opportunities with one company, they'll seek another employer where they'll grow. Lastly, IT employees want fair compensation, but the first four reasons take priority.

Job satisfaction is another factor that is often discussed as an affective response to specific aspects of a job, while commitment is an affective response to an entire organization. Women and minorities who have high organizational commitment are likely to stay. Commitment to an organization stems from salary, promotability, job rewards, boundary spanning activities and long-term employment with a single organization. Successful women tend to be committed to a single organization. Igbaria [58] found that women and minorities in IT are in general younger, less educated, lower paid, in lower level positions and receive less exposure outside their departmental boundaries compared to White (Anglo) men. Moreover, men tend to be motivated by tangible, extrinsic rewards while women tend to be motivated by intangible, intrinsic rewards [58, 59, 66-70].

Finally, stress generated by role conflict and role ambiguity has been seen to contribute to retention issues in women and minorities in IT. Role conflict occurs when the IT worker is expected to fill multiple social roles that make demands on time, energy and effort that come into conflict with one another. Role ambiguity is the process by which roles are left undefined while retaining high expectations. Causes for these stressors are organizational restructuring and the lack of sufficient staff and resources, unclear expectations of needs and objectives, excessive and unrealistic time pressures and deadlines. The development of a time famine and a crisis based office environment raise anxiety levels and increase stress perhaps leading to retention issues. The argument is that due to non-work related social commitments to family and community women and minorities feel these stressors and anxieties more often and more deeply [59, 67, 71]. Women and minorities are also highly visible to members of the majority group. As a consequence of this increased visibility, they are subjected to increased stress that derives from higher performance pressure [72].

4.0 DISCUSSION

IT employers are faced with the need for an adequate pool of well-trained applicants to hire new employees from in a time when those numbers are dwindling, the need to retain well-trained employees and to lower search, hire, training and general turnover costs, to boost employee loyalty and morale, and to maintain a highly productive and creative workforce. All of these problems could be at addressed with more consistent, hirer quality and institutionalized, systematic industry-wide efforts at recruiting and retaining women and minorities in the IT workforce.

Drawing from the literature discussed above, we recommend the following practices to employers wishing to address some of the critical issues facing the IT workplace: the development of gender/race/ethnic appropriate mentors, sponsors or role models in the work environment, the development of involvement of the family and/or community in support of the work environment, ,the development of a nurturing work environment to offset internalized out-group status, the development of a truly multicultural work environment that values gender/race/ethnic differences, the development of recognition of and assistance with stress from financial issues and social/family obligations, the eradication of institutional practices that marginalize women and minorities.

In an earlier study of the retention efforts of post secondary educational institutions [12] we have learned that these institutions have developed and created programs to address and alter the problem of women and minorities dropping out at a rising rate. Most of these programs have fallen into three categories, bridging programs, mentoring programs and academic intervention programs. Kezar (2000) says that model bridge programs are, "…individualized, have strong faculty support and involvement, are tied to the institutional mission, have partnerships with area K-12 schools, are supported by senior administrators, use small group collaborative learning, build community, and conduct student assessment/evaluation." [73, 74]Borden, Burton, Evenbeck, and Williams' (1997) study of mentoring programs at one institution found a peer-mentoring program to have most impact on persistence. Levin and Levin [75] list six critical components of academic intervention programs: proactive interventions; small-group tutorials; teaching of study skills, learning strategies, and test-taking techniques in the context of courses in which the students are enrolled; development of basic language skills; quality instruction.

The organizational and post-secondary education literature on women and minorities that is reviewed in this work leads us to the understanding that retention is a multi-sourced problem stemming from cultural, institutional and individual norms and behaviors. In both areas, the culture of the institution is framed as hostile, unchangeable and the source of barriers to women and minorities who wish to enter them and find success. Also, in both areas, the individual women or minorities tend to be seen as possessing cultural values and behaviors that are seen as antithetical to those desired and rewarded by the institution. It appears that in order for women and minorities to find a comfortable home in the IT workplace either the IT workplace will have to change its culture, or the women and minorities will be forced to masculinize and Anglocize themselves in order to fit-in. We advocate for the creation of mechanisms that move the two cultural systems closer to one another. In the remainder of this work, we use this perspective to provide recommendations for addressing IT workforce retention issues as they pertain to women and minorities.

Table 1: Recommendations for Management

Individual	Informal mentoring
	On-going training opportunities
	mid-year raises
	retention bonuses
	employee referral bonuses
Institutional	Formal mentoring programs
	Diversity and multicultural training for all IT employees
	Hiring more women and minorities into management positions
	Educational efforts to change cultural perceptions of IT as male domain
	Work-Life programs to bridge the work-life gap
	Work-community programs to bridge the community-work gap
	Counseling programs such as stress management and psychological support
	Human Resources policies designed for consistency, ready availability, fairness and equity (job descriptions; compensation; benefit information; clear, equitable and public hiring, promotion, and reward programs)
IT Managers Can:	Expose women and minority IT employees to the same key developmental jobs that have traditionally led to senior management positions for their white, male counterparts.
	Support open dialogue to discuss perceived discrimination that could impede women and minority IT advancement.
	Give timely and specific feedback about performance to ensure internal support to help advance women's and minorities' IT career goals.
	Advocate upward mobility for minority and women IT employees through informal mentorship.
	Offer internships and scholarships to women and minorities interested in an IT career.
	Give women and minority IT employees the authority to impact the broader picture of the organization and contribute to decisions and strategy, problem solving and policy making.
	Support women and minority IT employee networks in the workplace.

Quite simply, academic institutions that are successful in retaining minority students facilitate minority students' academic, social, and personal development [76] Brotherton suggests, "Colleges and universities that succeed in retaining today's students pay close attention to students' backgrounds, needs and expectations and then take action to accommodate them."[77] Martin [78] offers a list of characteristics of successful minority retention programs: freshman year experience; academic support; student service contacts; recruitment activities and incentives for participation; dedicated staff and directors; and an important role on campus.

These lessons from academic institutions drive us to offer the following recommendations to the employers of the IT workforce. We believe that a combination of individual efforts and institutional changes would have the greatest impact on retaining women and minorities in the IT workforce.

Among the efforts aimed at individual employees we suggest the development and implementation of individual informal mentoring programs, on-going training opportunities, mid-year raises, retention bonuses, and employee referral bonuses. We believe that these efforts would address the need for developing at work support networks, a continuous learning environment and reduce financial stressors.

Among the efforts aimed at institutional changes we recommend the development and implementation of formal mentoring programs, diversity and multicultural training for all IT employees, hiring more women and minorities into management positions, educational efforts to change cultural perceptions of IT as male domain, work-life programs to bridge the work-life gap, work community programs to bridge the community-work gap, counseling programs such as stress management and psychological support, human resources policies designed for consistency, fairness and equity (job descriptions, compensation, benefit information, readily available. clear, equitable and public hiring, promotion, reward programs). One program that is reportedly being used very successfully throughout the country to reduce turnover is the concept of Employer Assisted Housing (EAH). Typical EAH benefit choices include home buyer education, matched savings programs, loans or grants.

These efforts are directed at changing the nature and perception of IT from that of a male and White domain to one for all IT workers. Managers can help to advance the psychological,, financial and social needs of organizational members by offering institutional support systematically to all employees, integrating home-life and work-life, and creating a workplace with a strong feeling of equity, rules and fairness.

REFERENCES

1. *ITAA's annual workforce survey*, M. Bynum, Editor. 2002, 2001, 2002, Information technology Association of America.

2. *Recruiting and Retaining Information Technology Staff in Higher Education*. 2000, Educause: Washington, DC.

3. Raasch, C., *Amid Joblessness Woes, Analysts See Worker Shortage Ahead*, in *The Salt Lake Tribune*. 2003: Salt Lake City.

4. . 2001, ITWorld.com.

5. Pincus, A., *America's New Deficit: The Shortage of Information Technology Workers*, in *Office of Technology Policy*. 1997.

6. Foundation, N.S., *Information Technology Workforce (ITWF) Program Solicitation", Directorate of Computer and Information Science and Engineering, Division of*

Experimental and Integrative Activities. 2003: Washington D.C.

7. von Hellens, L.A., S.H. Nielsen, and E.M. Trauth. *Breaking and Entering the Male Domain. Women In the IT Industry.* in *2001 ACM SIGCPR*. 2001. San Diego.

8. Trauth, E.M., S. Nielsen, and S. Von Hellens. *Explaining The IT Gender Gap:Australian Stories.* in *Australian Conference On Information Systems.* 2000.

9. Brown, E. and D. Kirkpatrick, *The Reverse Brain Drain*, in *Fortune*. November 11, 2002.

10. Campbell Jr, G., *Breaking the Science Barrier.* Black Issues in Higher Education, 1999. **16**(2): p. 38-39.

11. in *Finacial Times.* 2000.

12. Tapia, A., L. Kvasny, and E. Trauth, *Is there a Retention Gap for Women and Minorities?The Case for Moving In vs. Moving Up*, in *Strategies for Managing IS/IT Personnel*, M. Igbaria and S. Conrad, Editors. 2004, Idea Group Publishing: Hershey,PA. p. 143-164.

13. Reimers, B.D., *Keeping Talent from Taking Flight*, in *Network Computing.* 2001. p. 42-45.

14. Moore, J.E. and L.A. Burke, *How to Turn Around 'Turnover Culture' in IT.* Communications of the ACM, 2002. **45**(2): p. 73-78.

15. National Science Foundation, *Information Technology Workforce (ITWF) Program Solicitation.* 2003, Directorate of Computer and Information Science and Engineering, Division of Experimental and Integrative Activities: Washington D.C.

16. Freeman, P. and W. Aspray, *The Supply of Information Technology Workers in the United States.* 1999, Computing Research Association: Washington, D.C.

17. Chambers, M., S. Oskamp, and M. Costanzo, *Diversity in Organizations: New Perspectives for a Changing Workplace.* 1995, Thousand Oaks, CA: Sage Publications.

18. Kvasny, L. and E.M. Trauth, *The 'Digital Divide' at Work and Home: The Discourse about Power and Underrepresented Groups in the Information Society*, in *Global and Organizational Discourse About Information Technology*, E. Whitley and E. Wynn, Editors. forthcoming, Kluwer Academic Publishers: New York.

19. Nkomo, S., *The Emperor Has No Clothes: Rewriting 'Race in Organizations'.* Academy of Management Review, 1992. **17**(3): p. 487-513.

20. Cheng, C., *A Review Essay on the Books of bell hooks: Organizational Diveristy Lessons from a Thoughtful Race and Gender Heretic.* Academy of Management Review, 1997. **22**(2): p. 553-574.

21. Fulk, J., and DeSanctis, G.,, *Electronic Communication and Changing Organizational Forms.* Organization Science, 1995. **6**(4).

22. Burris, B.a.D., G.,, *Technocratic Teamwork: Mitigating Polarization and Cultural Marginalization in an Engineering Firm*, in *The Transformation of Work*, S. Vallas, Editor. 2001, Elsevier: New York. p. 241-262.

23. Block, F., *Postindustrial Possibilities.* 1990, Berkeley: University of California Press.

24. Clegg, S.R., *Modern Organizations.* 1990, Newbury Park, Calif.: Sage Publications.

25. Hirschhorn, L., *Beyond Mechanization.* 1984, Cambridge, MA: MIT Press.

26. Piore M. and Sabel, C., *The Second Industrial Divide.* 1984, New York: Basic Books.

27. Powell, W., *The Capitalist Firm in the 21st Century: Emerging Patterns in Western Enterprise*, in *The Twenty-First Century Firm: Changing Economic Organization in International Perspective*, P. DiMaggio, Editor. 2001, Princeton University Press. p. 33-68.

28. Smith, V., *New Forms of Work Organization.* Annual Review of Sociology, 1997. **23**: p. 315-339.

29. Hammer, M., Champy, J., *Reengineering the Cooperation, A Manifesto for Business Revolution.* 1993, New York.

30. Vallas S.P. and Beck, J.P., *The Transformation of Work Revisited: The Limits of Flexibility in American Manufacturing.* Social Problems,, 1996. **43**(3): p. 339-361.

31. Vallas, S.P., *Rethinking Post-Fordism: The Meaning of Workplace Flexibility.* Sociological Theory, 1999. **17**(1): p. 68-101.

32. Prechel, H., *Economic Crisis and the Centralization of Control Over the Managerial Process.* American Sociological Review, 1994. **59**: p. 723-745.

33. Hodson, R., *Worker Resistance: An Underdeveloped Concept in the Sociology of Work.* Economic and Industrial Democracy, 1995. **16**: p. 79-110.

34. Hodson, R., *Dignity in the Workplace Under Participative Management: Alienation and Freedom Revisited.* American Sociological Review, 1996. **61**(5): p. 719-738.

35. Hodson, R., *Group Relations at Work: Co-worker Solidarity, Conflict, and Relations with Management.* Work and Occupations, 1997. **24**(4): p. 426-452.

36. Hodson, R., *Organizational Anomie and Worker Consent.* Work and Occupations, 1999. **26**(3): p. 292-323.

37. Acker, J., *Gendering Organizational Theory*, in *Gendering Organizational Analysis*, A.J.a.T. Mills, Peta, Editor. 1992, SAGE Publications: Newbury Park. p. 248-260.

38. Acker, J., *The Future of Gender and Organization: Connections and Boundaries.* Gender, Work and Organization, 1998. **5**(4).

39. Acker, J.a.H.v., Donald R., *Differential Recruitment and Control. The Sex Structuring of Organizations*, in *Gendering Organizational Analysis*, A.J.a.T. Mills, Peta, Editor. 1992, SAGE Publications: Newbury Park. p. 15-30.

40. Venakesh, V. and M.G. Morris, *Why Don't Men Ever Stop To Ask For Directions: Gender, Social Influence And Their Role In Technology Acceptance And User's Behavior.* MIS Quarterly, 2000. **24**(1): p. 115-139.

41. Wajcman, J., *Feminism Confronts Technology*. 1991, Cambridge.

42. Webster, J., *Shaping Women's Work: Gender, Employment And Information Technology*. 1996, London: Longman.

43. Woodfield, R., *Women, Work And Computing*. 2000, Cambridge.

44. Adam, A., et al., *Women, Work And Computerization: Breaking Old Boundaries-Building New Forms*. 1994, North Holland-Amsterdam.

45. Hacker, S., *The Culture Of Engineering: Woman, Workplace And Machine.* Womens' Studies International Quarterly, 1981. **4**(2): p. 341-353.

46. Hovenden, F., H. Robinson, and H. Davis, *The Software Maverick: Identity And Manifest Destiny*, in *The Subjects Of Technology: Feminism, Constructivism And Identity*. 1995, Center For Research Into Innovation, Culture And Technology: Brubel.

47. Glastonbury, B., *The Integrity Of Intelligence: A Bill Of Rights For The Information Age*. 1992, Basingstoke.

48. Sproull, L.S., S. Kiesler, and D. Zubrow, *Encountering an Alien Culture.* Journal Of Social Issues, 1984. **40**(3): p. 31-48.

49. Henwood, F., *From the Women Question in Technology to the Technology Question in Feminism: Rethinking Gender Equality in IT Education.* The European Journal of Women's Studies, 2000. **7**(1): p. 209-227.

50. Reskin, B.F., D.B. McBrier, and J.A. Kmec, *The Determinants and Consequences of Workplace Sex and Race Composition.* Annual Review of Sociology, 1999. **25**: p. 335-361.

51. Omi, M. and H. Winant, *Racial Formation in the United States: From the 1960s to the 1980s*. 1986, New York: Routledge and Kegan Paul.

52. Joshi, K.D. and K. Kuhn. *Gender Differences in IS Career Choice: Examine the Role of Attitudes and Social Norms in Selecting IS Profession*. in *ACM SIGCPR*. 2001. San Diego.

53. Kuosa, T., *Masculine World Disguised As Gender Neutral. Women, Work and Computerization Charting a Course to the Future*, E. Balka and R. Smith, Editors. 2000, Kluwer Academic Publishers: University of Tamperee. p. 119-126.

54. Ramanee Peiris, D., P. Gregor, and et al., *Women and Computing Breaking the Cycle of Imbalance at the Interface. Women, Work and computerization Charting a Course to the Future*, E. Balka and R. Smith, Editors. 2000, Kluwer Academic Publishers: Department of Applied Computing, University of Dundee, Dundee, UK. p. 34-41.

55. Symonds, J., *Why IT Doesn't Appeal to Young Women. Women, Work and Computerization Charting a Course to the Future*, in *The Open Polytechnic of New Zealand*, E. Balka and R. Smith, Editors. 2000, Kluwer Academic Publishers: New York. p. 70-77.

56. Cringley, 1993.

57. Keller, 1990.

58. Igbaria and Greenhaus, 1992.

59. Sumner, M. and W. Kay. *The Impact of Gender Differences on the Career Experiences of Information Systems Professionals*. in *ACM SIGCPR*. 2001. San Diego.

60. Sumner, M. and F. Niederman. *The Impact of Gender Differences on Job Satisfaction, Job Turnover, and Career Experiences of Information Systems Professionals*. in *ACM SIGCPR*. 2002. Kristiansand, Norway.

61. Wajcman, J., *Managing like a Man: Women and Men in Corporate Management*. 1998, University Park: The Pennsylvania State University Press.

62. Lee, W., *Striving Toward Effective Retention: The Effect of Race on Mentoring African American Students.* Peabody Journal of Education, 1999. **74**(2): p. 27-43.

63. Lee, P.C.B. *The Social Context of Turnover Among Information Technology Professionals*. in *ACM SIGCPR*. 2002. Kristiansand, Norway.

64. Ibarra, H., *Homophily and Differential Returns: Sex Differences in Network Structure and Access in an Advertising Firm.* Administrative Science Quarterly, 1992. **37**: p. 422-447.

65. South, S.J., et al., *Female Labor Force Participation and the Organizational Experiences of Male Workers.* American Sociological Review, 1982. **47**: p. 587-599.

66. Baroudi, 1985.

67. Igbaria, 1995.

68. Williams, C.G. and Hazer, 1986.

69. Cotton and Tuttle, 1986.

70. Cougar, 1988.

71. Perlow, L., G. Kunda, and L.C. Moore, 2000.

72. Jackson, P.B., P.A. Thoits, and H.F. Taylor, *Composition of the Workplace and Psychological Well-Being: The Effects of Tokenism on America's Black Elite.* Social Forces, 1995. **74**: p. 543-557.

73. Kezar, A., *Summer Bridge Programs: Supporting All Students*. 2000, ERIC Clearinghouse on Higher Education: Washington DC.

74. Kezar, A., *Do Early Intervention Programs Work> A synthesis of the Research.* Eric Review, 2000. **10**(1): p. 21-26.

75. Borden, V.M.H., et al., *The Impact of Academic Support Programs on Student Performance and Persistence.* Research Brief, 1997. **4**.

76. Wright, D.J., *Minority Students: Developmental Beginnings*, in *Responding to the Needs of Today's Minority Students*, D.J. Wright, Editor. 1987: New Directions for Student Services, 38.

77. Brotherton, P., *It Takes a Campus to Graduate a Student.* Black Issues in Higher Education, 2001. **18**(8): p. 34-39.

78. Martin, S.A., *Early Intervention Programs and College Partnerships*. 1999, ERIC Clearinghouse on Higher Education: Washington DC.