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Addressing the IT Skills Crisis: Gender and the IT Profession

PANEL

ADDRESSING THE IT SKILLS CRISIS: GENDER AND THE IT PROFESSION

Chair: **Denis M. S. Lee,** Suffolk University, U.S.A.

Panelists: **Sue Nielsen**, Griffith University, Australia
Eileen M. Trauth, Northeastern University, U.S.A.
Viswanath Venkatesh, University of Maryland, College Park, U.S.A.

At the same time that unprecedented opportunity exists for IT professionals around the world, the field is experiencing an IT skills crisis that stems from the shortage of qualified IT professionals. It is, therefore, ironic that despite significant growth in the IT professions, there remain segments of the population under-represented in IT. Among those under-represented in IT are women. In some countries there is evidence of declining participation by women in the IT profession.[1] The question on the minds of those concerned with IT human resources and the development of qualified IT professionals is: Why? A deeper understanding of this question is necessary for the development of appropriate IT human resource strategies.

According to the National Science Foundation, the under-representation of women and minorities in the American IT workforce is sufficiently serious to warrant systematic research efforts to address this national problem (NSF 2000). The panel addresses this issue by presenting the results of current research that represents three different theoretical perspectives on gender and IT. These different viewpoints on gender are reflected in recent literature about women's engagement with IT and participation in the IT field.

The *differential psychology* perspective looks at gender differences in technology acceptance. This view offers a socio-cognitive explanation for observed gender differences. Another view is that IT is *socially constructed* as a male domain. Therefore, women, who are subjected to different social influences, need to adjust to this male domain in order to be successful in the IT field. A third perspective is that there exists a continuum of *individual differences* with respect to IT capability and interest that cuts across both genders. This view holds that attitudes about gender and IT are socio-culturally constructed at the individual level.

Each panel presentation will address the following questions from the vantage point of its perspective on gender and IT:

- Are women physically, psychologically, socially, or culturally unsuited to IT work, to the IT profession?

- Does a woman have to be "different" in order to be successful in IT?

- What is the prevailing view in different countries regarding women working in IT?

- What do the answers to these questions imply about future directions for research and practice in the IT field?

The panel chair will introduce the panel topic and structure. In responding to the questions, each panelist will articulate his or her own world view on this topic and how it has informed his or her research. The chair will conclude the formal part of the panel with a high level summary of the different perspectives. The floor will then be open for discussion.

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[1]See, for example, Freeman and Aspry (1999), and National Information Technology Workforce Convocation (1998) for a discussion of gender and the skills crisis in the U.S.

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Eileen M. Trauth is Professor of Management Information Systems in the College of Business Administration at Northeastern University. She conducts research into socio-cultural influences on IT and IT professionals as expressed in the organizational context.

Viswanath Venkatesh is Assistant Professor in Decision and Information Technologies in the Robert H. Smith School of Business at the University of Maryland at College Park. His research focuses on understanding user acceptance of computer and information technologies in the workplace and homes.

References

Freeman, P., and Aspry, W. "Women, Minorities and Older Workers," in *The Supply of Information Technology Workers in the United States*, Washington, DC: Computing Research Association, 1999, pp. 111-116.

National Information Technology Workforce Convocation. "Building the 21st Century Information Technology Work Force: Underrepresented Groups in the Information Technology Workforce," *Task Force Reports*, National Information Technology Workforce Convocation, Berkeley, CA, January 1998.

National Science Foundation (NSF). "NSF Emphasizes Research into the Information Technology Workforce," *NSF News*, NSF Office of Legislative and Public Affairs, March 23, 2000 (http://www.nsf.gov/od/lpa/news/press/00/pr0013.htm).

Annotated Bibliography

Addressing the IT Skills Crisis

Information Technology Association of America (ITAA). *Bridging the Gap: Information Technology Skills for a New Millennium,* Arlington, VA: ITAA, April 2000.

This study explains how information technology has dramatically changed the composition of the U.S. workforce by producing an incredible demand for IT workers. Using the eight "career clusters" developed by the Northwest Center for Emerging Technologies (NWCET), this study offers findings regarding (1) the overall size of the IT workforce, the demand for qualified workers and the gap between supply and demand; (2) the most in demand jobs; (3) the skills workers need to obtain these jobs; (4) the best ways for workers to acquire these jobs.

Information Technology Association of America (ITAA). *Help Wanted: The IT Workforce Gap at the Dawn of a New Century*, Arlington, VA: ITAA, February, 1998.

This report by the Information Technology Association of America examines the gap between companies' growth needs and the current supply of skilled IT workers. The results reveal employers' inability to find enough employees skilled in information technology needed to grow, expand, and compete.

Lee, D. M. S. "Information Seeking and Knowledge Acquisition Behaviors of Young Information Systems Workers: Preliminary Analysis," *Proceedings of the 1999 Americas Conference on Information Systems*, Milwaukee, WI, 1999a, pp. 856-858.

This research project investigates the information seeking behavior and work activities of young information systems (IS) workers. Specifically, it examines the process of how young IS workers acquire new technical knowledge and how they solicit user requirements and coordinate work activities with other colleagues. The study also investigates the role of the supervisors, mentors and team members, as well as the effect of social ties in influencing the information seeking patterns and job performance of young IS workers.

Lee, D. M. S. "Knowledge/Skill Requirements and Professional Development of IS/IT Workers: A Summary of Empirical Findings from Two Studies," white Paper delivered as testimony before Panel on Workforce Needs in Information Technology, National Academy of Sciences, Framingham, MA, December 9, 1999b.

Summarizes results from two multi-year, empirical studies that examine the professional development of information systems/information technology (IS/IT) workers and explores the policy implications for effective development of IS/IT human resources. Specific findings and implications were grouped according to five areas: (1) Characteristics of skills/ knowledge requirements of IS/IT work; (2) Educational background of IS/IT workers; (3) Linkage between academic preparation and industrial needs; (4) Work-based learning; and (5) Organizational support and work-based human resource development.

Lee, D. M. S., Trauth, E. M., and Farwell, D. "Critical Skills and Knowledge Requirements of the IS Profession: A Joint Academic/Industry Investigation," *MIS Quarterly* (19:3), 1995, pp. pp. 313-340.

Investigates anticipated changes in the information systems field and the impact of these changes on the skills and knowledge requirements of information systems (IS) workers. Findings show that industry will demand a cadre of IS professionals with knowledge and skills in technology, business operations, management, and interpersonal skills to effectively lead organizational integration and process reengineering activities. Aligning IS solutions with business goals and needs as well as building the infrastructure for technological integration are becoming the top priorities for IS activities.

Trauth, E. M., Farwell, D., and Lee, D. "The IS Expectation Gap: Industry Expectations versus Academic Preparation," *MIS Quarterly* (17:3), 1993, pp. 293-307.

Examines the fit between the skills and knowledge that will be required of future IS professionals, and the education they are currently receiving. Results of a field study of IS managers, end-user managers, IS consultants and IS professors revealed a gap between industry needs and academic preparation.

Gender and the IT Profession

Camp, T. "The Incredible Shrinking Pipeline," *Communications of the ACM* (40:10), 1997, pp. 103-110.

The ratio of women involved in computer science from high school to graduate school has been dwindling at a startling pace over the past decade. There is a critical labor shortage in CS and although women are more than half the population, they are a significantly under-represented percentage of the population earning CS degrees.

Freeman, P., and Aspry, W. "Women, Minorities and Older Workers," in *The Supply of Information Technology Workers in the United States,* Washington, DC: Computing Research Association, 1999, pp. 111-116.

The purpose of this study is to improve understanding of the supply of and demand for information technology (IT) workers in the United States and the surrounding contextual issues. Cites data showing that while the number of computer and information science degrees awarded decreased every year between 1986 and 1994, the decrease is occurring at a faster rate proportionately for women. This trend is in contrast to general trends in U.S. graduation figures for those same years which show an increase in the percentage of degree recipients who were women.

Ignite. IT&T Careers Website (http://www.ignite.net.au, accessed on September 3, 2000)

Contains information about careers in the Australian information technology and telecommunications industry. It is designed to help job seekers find new opportunities and training courses. A section of this website is specifically devoted to women in the IT industry.

National Information Technology Workforce Convocation. "Building the 21st Century Information Technology Work Force: Underrepresented Groups in the Information Technology Workforce," *Task Force Reports*, Berkeley, CA: National Information Technology Workforce Convocation, January, 1998.

Women and some minorities are under-represented in most technical fields, including those related to information technology. As a result, while many employers struggle to recruit adequate numbers of workers with computer-related skills, large pools of potential talent remain untapped. In 1996, men were three times more likely to choose computer science as a field of study than women.

National Science Foundation (NSF). "NSF Emphasizes Research into the Information Technology Workforce*, NSF News*, NSF Office of Legislative and Public Affairs, March 23, 2000 (www.nsf.gov/od/lpa/news/press/oo/pr0013.htm).

   The National Science Foundation (NSF) announced on March 23, 2000, that it will support new research addressing the under-representation of women and minorities in the information technology workforce (ITW). This emphasis responds to a documented shortage of qualified IT professionals among these groups, which contributes to an overall gap of IT workers nationally.

Truman, G. E., and Baroudi, J. J. "Gender Differences in the Information Systems Managerial Ranks: An Assessment of Potential Discriminatory Practices," *MIS Quarterly* (18:2), 1994, pp. 129-142.

   This paper examined the extent to which gender discrimination is a force affecting the senior managerial ranks of the information systems occupation. The findings show that women receive lower salaries than men even when job level, age, education, and work experience are controlled.

Differential Psychology Perspective

Bem, S. L. "Gender Schema Theory: A Cognitive Account of Sex Typing," *Psychological Review* (88:4), 1981, pp. 354-364.

   Presents Gender Schema Theory as a powerful paradigm for investigating a socio-cognitive basis for gender differences research. This theory holds that gender-based cognitive structures organize and guide individual perception and that how such structures are invoked is based on cognitive availability. Empirical results suggest that individuals are able to encode, process, and organize schema-consistent information more readily, and thus, make highly differentiated (i.e., on the basis of gender) judgments consistent with the internalized schema of the individual.

Bem, S. L. "The Measurement of Psychological Androgyny," *Journal of Consulting and Clinical Psychology* (42), 1974, pp. 155-162.

   Discusses the scale development of Bem's Sex Role Inventory (BSRI) designed to provide a cognitive account of gender. Scoring the BSRI allows individuals (regardless of biological sex) to be categorized as "masculine sex-typed" (high on masculine characteristics, low on feminine), "feminine sex-typed" (high on feminine characteristics, low on masculine), and "androgynous" (high on both masculine and feminine characteristics), and "undifferentiated" (low on both sets of characteristics).

Gefen, D., and Straub, D. "Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model," *MIS Quarterly* (21:4), 1997, pp. 389-400.

   Extends the technology acceptance model (TAM) with the social presence information richness (SPIR) addendum by incorporating gender. The authors postulate that gender is a fundamental aspect of culture and that there are reliable differences between gender groups in their perceptions and beliefs about technology. Study findings found gender differences in perceptions of e-mail but not in overall use of the technology.

Maccoby, E. E., and Jacklin, C. N. *The Psychology of Sex Differences,* Stanford, CA: Stanford University Press, 1974.

   A comprehensive guide and discussion associated with the psychology of gender. Presents diverse theoretical and empirical perspectives on the topic.

Tashakkori, A. "Gender, Ethnicity, and the Structure of Self-Esteem: An Attitude Theory Approach," *Journal of Social Psychology* (133), 1993, pp. 479-488.

   This study uses an information processing perspective on the development and maintenance of self- esteem for men and women. Empirical results indicate that there are underlying sociological and psychological differences in the determinants of self-esteem between women and men.

Venkatesh, V. and Morris, M. "Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and their Role in Technology Acceptance and Usage Behavior," *MIS Quarterly* (24:1), 2000, pp. 15-140.

   This study employed the Technology Acceptance Model (TAM) to examine the moderating influence of gender on key determinants of new technology adoption and use. Data from users in five organizations indicate that men were solely influenced by perceptions of usefulness. Women were influenced by perceived usefulness, ease of use, and subjective norm.

Venkatesh, V., Morris, M., and Ackerman, P. "A Longitudinal Field Investigation of Gender Differences in Individual Technology Adoption Decision Making Processes," *Organizational Behavior and Human Decision Processes,* forthcoming.

A longitudinal study of workers in four organizations revealed that men's adoption and sustained usage of technology were strongly influenced by instrumentality whereas women exhibited "balanced" decision-making patterns which included instrumentality, subjective norm and perceived behavioral control.

Social Construction Perspective

Nielsen, S., von Hellens, L. A., Greenhill, A. and Pringle, R. "Conceptualising the Influence of Cultural and Gender Factors on Students' Perceptions of IT Studies and Careers," *Proceedings of the 1998 ACM SIGCPR Computer Personnel Research Conference,* New York: ACM Press, 1998, pp. 86-95.

This paper explores the effect of gender and national culture on students' perceptions of IT careers. It is suggested that the students' perceptions and aspirations of an IT career are influenced and shaped by their attitude toward group work.

Nielsen, S., von Hellens, L., Pringle, R. and Greenhill, A. "Students' Perceptions of Information Technology Careers: Conceptualising the Influence of Cultural and Gender Factors for IT Education," *GATES* (5:1), 1999, pp. 30-38.

Focus group interviews and surveys of first year students in an IT degree course in Brisbane, Australia indicates that there are three sets of reasons that the students value computing and IT skills. The first is "escapism" from work and study. The second is to secure employment and status. The third is to accomplish flexible work arrangements by enabling a range of job choices.

Nielsen, S., von Hellens, L., and Wong, S. "The Women in IT Project: Uncovering the Pride and Prejudices," *Proceedings of the Sixth Australasian Women and Computing Workshop,* Griffith University, Brisbane, 2000, pp. 45-55 (www.sqi.gu.edu.au/wic2000).

This paper summarizes the results of a longitudinal study investigating the influences of cultural factors on female participation and success in IT education and work.

Pringle, R., Nielsen, S., von Hellens, L., Greenhill, A. and Parfitt, L. "Net Gains: Success Strategies of Professional Women in IT," *Proceedings of the Seventh IFIP Working Group 9.1 (Computers and Work) Women, Work and Computerization Conference,* Dordrecht, The Netherlands: Kluwer Academic Publishers, 2000, pp. 26-33.

The women studied for this paper tacitly acknowledged the existence of both direct and indirect discrimination, but to them, the difficulties lay more in how to network within a masculine organizational culture than with women's aptitude with or interest in technology. The question remains whether women need to adapt to this male model or whether the increasing numbers of women in upper management may provide different paths to success.

Trauth, E. M., Nielsen, S. H. and von Hellens, L. A. "Explaining the IT Gender Gap: Australian Stories," *Proceedings of the Tenth Australasian Conference on Information Systems,* forthcoming.

Four major themes that resulted from the WinIT study of IT professionals were used as the framework for a deeper exploration of the current position of Australian women in IT through open-ended interviews. The findings of this study revealed the influence of socio-cultural factors on gender in the Australian IT profession.

von Hellens, L., Pringle, R., Nielsen, S., and Greenhill, A "People, Business and IT Skills: The Perspective of Women in the IT Industry," *Proceedings of the 2000 ACM SIGCPR Computer Personnel Research Conference: Electronic Commerce and Internet Business: Roles, Relationships, Skills and Strategies for the New Millennium,* New York: ACM Press, 2000, pp. 152-157.

Many of the women in this study had moved into IT from other non-IT careers. The skills acquired in earlier professions provided an excellent basis for successful careers in IT, as they were able to transfer these skills to the management and people skills needed in IT. While this entry point contributes to an improvement of the gender balance in IT industry, it does not to address the gender imbalance in IT education.

Individual Differences Perspective

Kwan, S. K., Trauth, E. M., and Driehaus, K. C. "Gender Differences and Computing: Students' Assessment of Societal Influences," *Education and Computing* (1:3), 1985, pp. 133-150.

This study explored high school students' views of the influence of four societal factors on interaction with information technology by gender. While all of these high achieving, college preparatory students from a high socio-economic background rejected the societal stereotype of computing as a male domain, the female subjects were more adamant in their rejection of gender stereotypes than were the males.

Mitroff, I. I., Jacob, T. and Trauth Moore, E. "On the Shoulders of the Spouses of Scientists," *Social Studies of Science* (7:3), 1977, pp. 303-327.

This study of the impact of gender on the emotional life of scientists shows that female scientists experience a role conflict. On the one hand, these women have had to affirm traditionally male values insofar as they identify strongly with the role of a scientist. On the other hand, these women still affirm strongly a traditional female value: that of displaying emotional concern. Even though they are scientists as well, it still largely falls on the female scientists to support the emotional life of their families. They face a twin role that neither female non-scientists nor male scientists must adopt.

Trauth, E. M. "Australian and New Zealand Women in IT: Individual Differences," Griffith University School of Computing and Information Technology Research Reports, 2000a.

Results from a study of women in the IT profession in Australia and New Zealand are used to develop a framework of gender and IT as socio-culturally constructed at the individual level. That is, women, as individuals, experience a range of different socio-cultural influences that result in a range of different responses regarding inclination to participate in the IT profession. This framework is used to argue that the *individual differences* perspective inhabits the middle ground between the *inherent differences* and the *social construction* perspectives on gender and IT.

Trauth, E. M. "A Family Man," Chapter 4 in *The Culture of an Information Economy: Influences and Impacts in the Republic of Ireland,* Dordrecht, The Netherlands: Kluwer Academic Publishers, 2000b, pp. 101-141.

This chapter compared male and female explanations for lower participation by women in the Irish IT sector, particularly at senior levels. Women pointed to institutional barriers in the educational system, gender attitudes in Irish society and the workplace, and the dual roles of homemaker and IT professional they are required to play. While some men acknowledged these factors, other men believed that men were more naturally suited to studying technical topics or that there were simply not that many women who were interested in furthering their IT careers.

Trauth, E. M. "Educating Information Technology Professionals for Work in Ireland: An Emerging Post-industrial Country," in *Global Information Technology Education: Issues and Trends,* M. Khosrowpour and K. Loch (eds.), Harrisburg, PA: Idea Group Publishing, 1993, pp. 205-231.

This paper examines the educational issues associated with creating an appropriated qualified labor force for Ireland's rapidly emerging information economy. Among the challenges of constructing an IT workforce was that of overcoming gender barriers. Women who wanted to work in the IT sector encountered barriers in their attempt to obtain appropriate educational qualifications.

Trauth, E. M. "Women in Ireland's Information Industry: Voices from Inside," *Eire-Ireland* (30:3), 1995, pp. 133-150.

This paper from a study of Ireland's emerging information economy examines ways in which culture enhances or inhibits a woman's opportunities in the IT field. Interviews with women in the Irish IT sector revealed that while there are opportunities for them in the IT sector, they are also experiencing barriers. The tension between career and family holds some women back from fuller participation in the IT sector. They also acknowledged barriers to advancement that are embedded in societal institutions and in attitudes about women's place in Irish society.