



# ***WOMEN AND MINORITIES IN INFORMATION TECHNOLOGY FORUM***

**Causes and Solutions for  
Increasing the Numbers in the  
Information Technology Pipeline**

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areas of needed research and successful approaches to dealing with Information Technology  
pipeline issues, particularly as they relate to women and underrepresented minorities.

Copies of this white paper can be downloaded from the World Wide Web in PDF format at:  
<http://www.vsgc.odu.edu/html/gender/InfoTech.html>

Print copies can be purchased from the Virginia Space Grant Consortium for \$12 by calling (757) 865-0726

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**November 4-5, 1999**

**Funded by a National Science Foundation  
Transitions from Childhood to the Workforce Grant**

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# ***WOMEN AND MINORITIES IN INFORMATION TECHNOLOGY FORUM:***

## **Causes and Solutions for Increasing the Numbers in the Information Technology Pipeline**

**November 4 -5, 1999**

### **INTRODUCTION**

The National Science Foundation “Transitions from Childhood to the Workforce” initiative provided funding for the Virginia Space Grant Consortium (VSGC), in partnership with Virginia Tech, to host a Forum to stimulate and facilitate cross-disciplinary interactions among practitioners who share the common goal of understanding children’s learning and subsequent transitions to the workforce.

The purpose of this initiative was to identify research areas that would provide a better understanding of learners and the learning experience from childhood to the workforce. In the recent National Science and Technology Council report, “A Research Initiative for America’s Children for the 21<sup>st</sup> Century,” research on children’s learning was identified as one

of the six most important and pressing needs to advance our understanding of how children grow up to be healthy, active, and productive citizens.

Realizing that many disciplinary barriers exist among the areas of science that effect children’s learning and/or their transition to the workforce, this was an opportunity for experts from many fields to discuss children’s learning from various viewpoints. Our purpose was to identify the commonalties among all the divisions that can be bridged from one discipline to another.

We examined the lack of women and minorities in information technology (IT) careers as it relates to the workforce pipeline from elementary school to the workforce. This topic was chosen because of the overall shortage of

workers in high technology fields, especially in Virginia where most of the Forum participants work and teach. In 1998, there were an estimated 23,000 IT job openings in Northern Virginia, as reported by the Northern Virginia Regional Partnership (Governor's Commission on Information Technology, 1999). According to the *Supply of Information Technology Workers in the United States*, (Freeman, 1999) "... if these groups (women, Hispanics, African Americans and Native Americans) were represented in the IT workforce in proportion to their representation in the U.S. population, this country would have more than an adequate supply of workers to fill even the most dire estimate of a shortage." Therefore, it is important to identify the causes for women and minorities not entering, losing interest in, or leaving the fields of computer science and other IT career paths during their early years. These high-paying jobs offer much opportunity for career advancement for women and minorities.

#### **BACKGROUND AND EXPERIENCE OF SPONSORING ORGANIZATIONS AND THE PRINCIPAL INVESTIGATORS**

This topic was selected based on the Principal Investigators' (PIs') long-standing interest in the field of gender equity in education. Mary Sandy, PI, and Dr. Carol Burger, co-PI, have served on the Virginia Governor's Advisory Committee on Girls' Education since 1994. The Committee formally recommended to the Virginia Board of Education a strong need for professional development in gender equity for educators, counselors, and administrators. Since 1996, the VSGC has trained over 400 teachers, administrators, and other educators in gender balanced education techniques using the VSGC-developed Gender Balanced Education Training Module. A separate but relevant activity was a 1993 statewide equity study of math and science education in Virginia underwritten by the Eisenhower Regional Consortium for Mathematics and Science Education at Appalachia Educational Laboratory and led by Mary Sandy and a co-chair from the State Council of Higher Education for Virginia. In 1998, Burger and Sandy co-authored *A Guide to Gender Fair Education in Science and Mathematics* for the Appalachian Educational Laboratory. This publication provides teachers, guidance counselors, and school administrators with specific tools to encourage girls in science, math and technology education in grades K-12. The VSGC has also published the monograph, *Counseling our Future Workforce*, to help counselors with up-to-date high-tech career information, as well as strategies for encouraging underrepresented groups to pursue studies and careers in these fields. In addition, Burger served as the project director for the NSF-funded program

*Science and Gender Equity of Western Virginia* at Virginia Tech. The activities of this two-year project included summer workshops for middle school science teachers and middle school girls, school-based upgrades of science materials to make them more hands-on and female friendly, and a web site to support future changes in the grades 6-8 science curriculum.

The VSGC and Virginia Tech are now in their third year of a National Science Foundation-supported project, "Gender Balanced Education: A Professional Development Program for Educators Counseling Girls in Virginia," for which Burger and Sandy currently serve as co-PIs. This project is working with 150 Virginia K-12 school guidance counselors over three years. Its goals are to raise awareness of gender issues as they relate to the interest and success of girls in elementary through secondary schools and to give counselors the tools to provide appropriate career counseling for their students. The project has been selected for inclusion in the Annenberg/CPB Math and Science Projects' *The Guide to Math and Science Reform*. Project elements include a summer institute, school-based projects, in-service programs for other counselors and teachers, a resource-rich website, and a three-part video series broadcast by PBS. (For more information see: <http://genderequity.vsgc.odu.edu>).

#### **FORUM BACKGROUND**

The Forum was a cross-disciplinary gathering of experts and researchers in the fields of computer science, education (elementary through higher education), gender and racial equity in education, senior management and employees of Virginia information technology companies, state and education governmental leaders, and leaders from IT workforce programs (see list of participants and qualifications on inside back cover). With the exception of one participant from New York, the experts came from Virginia. The representatives from universities, community colleges, elementary schools, and high schools discussed developmental characteristics of students at all age ranges. Three members of the Governor's Commission on Information Technology, a group of key technology professionals who developed a set of recommendations for addressing the information technology workforce shortage, also participated. The Commission's recently published report, *Investing in the Future Toward a 21<sup>st</sup> Century Information Technology Workforce*, provided current data.

The project's two-day Forum consisted of large and small-group discussions and panel presentations. The panelists focused on practical solutions and strategies for solving the IT workforce needs and the development of partnerships and

programs, which can have a positive impact on the issue. This White Paper is a report of our findings and includes multidisciplinary strategies for addressing the issues and suggestions for future research directions.

The Forum was held on November 4–5, 1999 at the Old Dominion University Peninsula Center in Hampton, Va. The Forum attempted to identify the key areas that are effecting the employment growth and employee shortages in the information technology areas specifically, as they relate to women and minorities. The PIs approached the subject through four major sessions, recognizing that there would be overlap across the topics:

1. Workforce Needs and Pipeline Issues.
2. Factors Affecting Female and Minority Participation in IT Careers — Environmental, Cultural, Economic and Educational Concerns.
3. Recruitment and Retention Issues for Higher Education and Industry.
4. Workforce Training and Retraining Issues.



# ***SESSION 1***

## **Workforce Needs and Pipeline Issues**

### **PRESENTERS**

The Forum presenters in Session 1 were:

- Fred Williamson, Keynote Speaker, Assistant Secretary of Technology for Virginia
- Carl Kelly, Senior Vice President and General Manager of Higher Education, Oracle Service Industries
- Mary Sandy, Director, Virginia Space Grant Consortium
- Carol Burger, Associate Professor, Women's Studies and Biology, and Coordinator, Science and Gender Equity Program, Virginia Tech
- Cathy Ney, Third Grade Teacher, Montgomery County Public Schools
- Malynn Unser, Sixth Grade Teacher, Hanover County Public Schools
- Kusum Singh, Associate Professor, Educational Leadership and Policy Studies, Virginia Tech
- Sandy Birch, Assistant to the Head of Computer Science Department, Virginia Tech.

### **HIGHLIGHTS OF THE CURRENT RESEARCH ON THE EDUCATIONAL PIPELINE REGARDING WOMEN AND MINORITIES IN IT**

The report issued by the American Association of University Women in 1992, *How Schools Shortchange Girls*, spurred a great deal of research on girls and minorities – their education in math, science, and technology and their access to computers.<sup>1</sup> Consequently, the current research (AAUW, 1992, 1995, 1996, 1998, 1999; Sadker and Sadker, 1995; Sanders, et al., 1995) gives us a clearer picture of how girls and minorities have been excluded from access to technology. There are many resources with suggested strategies, activities, and guidelines available to teachers, counselors, administrators,

and parents. These resources show how to increase confidence and competence among female and minority students, which can help them gain access to careers in information technology.

The current research on the low numbers of women and minorities in IT careers suggests that one cause may be the national decline, starting in 1986, in women majoring in computer science at the undergraduate level. There was a peak of 35.8% of computer science degrees awarded to women in 1984 declining to 27.5% awarded in 1994, the lowest level since 1979 (Office of Technology Policy, 1999). As a result, fewer women entered the workforce with computer and information science degrees and fewer hold jobs typical for those degrees. There are also fewer women in graduate studies in these fields. Viewing the entire undergraduate population, only 1.1% of women currently choose IT-related disciplines, compared to 3.3% of male undergraduates. In the workplace, 28% of computer analysts and scientists and 31% of computer programmers are women. According to the Bureau of Labor Statistics, women represent 46% of the total workforce, but only 25% of the professional information technology workforce (Devoe, 1998), and only 10% of the top information technology jobs are held by women (Gibson, 1997). Unfortunately there is little statistical information regarding the levels of minorities in IT jobs.

Among underrepresented minorities as reported in the 1996 “*Current Population Survey*,” Blacks comprised 7% of computer systems analysts and scientists and 5% of computer programmers. Hispanics made up 2.5% of computer systems analysts and scientists, and 4.6% of computer programmers. Employment trends predict that the labor force growth of Hispanics, Asians and other minorities will be much faster than for Black and White non-Hispanics,

<sup>1</sup> For the purposes of our Forum, a *minority* is a person who belongs to one of these groups: African American, American Indian, Alaskan Native (Eskimo or Aleut), Hispanic, or Native Pacific Islanders.

partially due to the effects of immigration. Hispanics are predicted to be the fastest growing population group over the 1996-2006 period, increasing three times as fast as the overall labor force.

While conducting research for this Forum, the VSGC and Virginia Tech encountered many different definitions of an IT job used interchangeably among all of the many studies in circulation. The definition used in this White Paper, which can be found in the Governor's Commission on Information Technology report is:

*In its broadest sense an Information Technology job involves the creation, storage, exchange, and/or use of information through technological means. More specifically, it encompasses occupations that require designing and developing software and hardware systems; providing technical support for computer and peripheral systems; and creating and managing network systems and databases.*

Although there is a lack of solid data regarding the exact numbers of the sources of IT workers, there is a trend for IT workers to come from nontraditional backgrounds. Colleges and universities are still the primary sources for IT workers, but more and more workers are coming from related fields, such as engineering, math, and business management. Additional academic disciplines from which IT workers are drawn include statistics, chemistry, philosophy, music, graphic arts and industrial design. Other common sources of employees are the military and people pursuing second careers who are enrolled in distance education and certification courses, employer training and self-study. IT jobs can also be found across all industries, from financial services companies, publishers, universities, hospitals and utility companies. In this day and age, nearly every industry has a need for workers with the skills attributed to an IT job and many more "traditional" workers are being absorbed into an IT track (Governor's Commission, 1999).

It is felt that there is considerable value in examining the issue of the lack of women and minorities in information technology jobs at both the State and the national levels. Nationally, according to a 1998 study, there are approximately 2,063,000 IT jobs, and a reported 346,000 job vacancies (Freeman, 1999). Of these jobs, the overall IT job vacancies for Virginia in 1999 were estimated at 30,000 (Governor's Commission, 1999). It is important to examine the issue of why women and minorities are underrepresented in this field at both the national and state levels and at all areas of the workforce pipeline, because IT jobs are generally high-paying and can potentially provide great career advancement opportunities.

## **REASONS FOR UNDERREPRESENTATION OFFERED BY FORUM PARTICIPANTS AND CURRENT RESEARCH**

1. Lack of computer equipment in public schools prevents access to technology for many economically underprivileged minority children, households, and schools. Many minority children may not acquire the skills they need to pursue a major in computer science or IT in the higher education setting. Only 19.3% of minority households have computers in their homes, compared to 40.8% of white households (McConnaughey and Lader, 1997).
2. Few K-12 teachers and counselors are knowledgeable about the wide variety of career paths and opportunities in IT and do not have sufficient backgrounds to counsel their students about these careers (Freeman, 1999).
3. Minorities attend college in much lower percentages than whites do, so there is a smaller pool of students to enter the computer science pipeline (Freeman, 1999).
4. Women have not been encouraged to pursue high school courses in mathematics and science (AP calculus and physics) that are requirements for degree programs in computer science and computer engineering (NSF, 1999).
5. Girls are not encouraged to take things apart and put them back together on their own, a skill which is useful in many IT computer jobs. Many young men, however, are encouraged to do this sort of thing from a young age (Carver, 1999).
6. The majority of females who took the 1990 Scholastic Aptitude Test said they planned to work in the social sciences . . . When girls self-select out of math, science, and computer technology, they are making decisions that will affect the rest of their lives. Without the right high school courses, science courses in college are out of reach; and without college courses, females are filtered out of careers that remain overwhelmingly and solidly male" (Sadker and Sadker, 1994).
7. "The subtle male-dominated influences...the computer culture, parental factors, curriculum factors, biased teacher behaviors, and peer's attitudes—are real, but they don't have to be determinative...It is possible to make a profound difference in girls' lives just by paying attention to the little things in school" (Sanders, 1995).
8. Intervention programs to correct bias are worthwhile, and can have far-reaching effects.

## SUGGESTED STRATEGIES

Along with identifying the causes for the IT worker shortage, the Forum participants made the following recommendations that, if implemented, could help to solve the IT worker shortage and help get girls involved in technology. These suggestions were combined with several others published in *Technology and Learning* (McLester, 1998):

1. Provide girls with opportunities for play and open-ended exploration on the computer. Girls tend to use the computer as a tool to complete homework or other tasks and so are less likely than boys to feel “at home” with technology. Girls’ computer clubs, a girls-only lunch or after-school period, and fun, engaging software products are some of the ways to entice girls back to technology.
2. In coed groups, establish rules that insure girls get equal opportunities to perform the higher status computer-based tasks. In collaborative learning situations, girls tend to defer to boys and are often relegated the less important, off-computer responsibilities.
3. Expose students to female role models in technology. Give girls a positive “can do” message by bringing in women speakers and arranging field trips where girls and boys can see women performing important jobs in technology-related industries. Design lessons that ask students to research women’s contributions in the areas of science, math and technology.
4. Give girls responsibilities in technology-related situations. Assign girls to set up the computer labs, install software, or lead projects. Have girls organize a school technology fair.
5. Make sure that lessons integrating computer usage are designed with components that meet girls’ needs for socializing and sharing. Line up computers near one another, not in separate alcoves. Build in components for conflict resolution and regular evaluation of group interaction. Adolescent girls are often turned off by the “culture of isolation” surrounding computer use.
6. Educate parents about the need to keep girls involved in technology. More boys have sole use of home computers. More boys attend computer summer camps. Most games are aimed at the boy market. Have parents spend time with daughters in collaborative computer play.
7. Design lessons that challenge girls to think outside of the traditional “intellectual ghetto” of language arts, and entice them into the male domains of science and math. Stock market simulations, lessons that involve

multiple computer applications, such as e-mail conferencing, word processing, multimedia presentations are important.

8. When purchasing software or looking at Websites, evaluate their appeal to girls. Are women represented in the program? How? Is there a relevant, real life connection to the content? The software does not necessarily have to be “just for girls.”
9. Involve girls early. Girls form many beliefs about themselves and subject domains during the elementary school years. They need opportunities to interact in substantial ways with advanced technologies, and science and math.
10. Offer opportunities for parents to become aware of IT careers and issues of underrepresentation in order for them to motivate their sons and daughters — perhaps a Family Computing Day for mothers and daughters.
11. In science and engineering classes that are more pedagogically equitable, teachers use bicycles and sewing machines for examples, not just bombs, engines and rockets. This is more appealing to the girls and doesn’t hurt or turn off the white males who’ve already “gotten it.”
12. Design curricula to insure that a solid foundation for using computers and technology is integrated across the curriculum, and promotes the importance of IT in all disciplines.

## MODEL PROJECTS

The following model projects represent research or were discussed by Forum participants who were knowledgeable about them:

1. The Franklin Institute Science Museum in Philadelphia offers a science enrichment/outreach program for students in the Delaware Valley who are in grades 7–11. Students explore science projects with professional scientists, engineers and computer experts. Parents also attend science events and museum trips.
2. Virginia Tech /4H Extension Programs involve parents in teaching about light and electricity as a science project. It brings together parents and children of both genders, and requires parent attendance.
3. The VSGC/Virginia Tech “Counseling for Gender Equity Project” (see description on page 2).
4. Christiansburg Elementary School, located in Montgomery County, Va., encourages girls and

minorities to study science and technology through the following techniques:

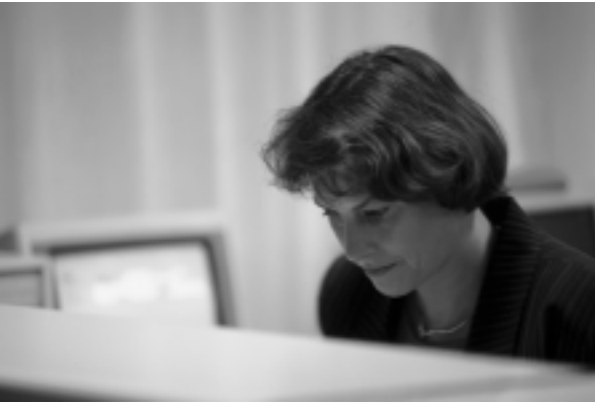
- School websites—children design and maintain websites in Montgomery County schools.
  - Students do PowerPoint presentations for peers and parents based on scientific findings and for partnerships with the Virginia Tech Institute and female Tech students.
  - African American Girls club—which provides technical support for participants.
  - Students do videotaping and media design using technology.
5. Advocates for Women in Science and Engineering (AWSEM), sponsors after-school science and math clubs and mentoring for girls. Professional women are trained to host visitors to their company. For example, 35 girls ages 12–14 were invited to visit Mentor Graphics Corporation in Wilsonville, Ore. to talk to female engineers and take apart computers and cell phones.
  6. “The Carnegie Mellon Project on Gender and Computer Science” is an ongoing, interdisciplinary program of research and action at Carnegie Mellon University in Pittsburgh. Research is conducted through interviews with computer science students. “The goal of the action component is to devise and effect changes in curriculum, pedagogy and culture that will encourage the broadest possible participation in the computing enterprise” (Fisher and Margolis, 1997).
  7. The Internet Curriculum Consortium is a task force with representatives from Federal Express, Netscape, Informix, and other companies, along with the University of Michigan. It has produced a plan for a 4-year curriculum to make sure students receive a good technology foundation in college.
  8. Kidz Online—an educational organization whose mission is to reduce the gap between “the information haves and have-nots.” This group was started in Fairfax, Va. and helps students share ideas and learn online. Children in inner-city schools can learn basic online skills from suburban kids in afterschool programs. This organization won the InfoWorld Magazine top 100 innovative company award in 1998 (<http://kidzonline.org>). The organization at first attracted mostly male students. In an effort to address this problem, a “Girls Only” program was initiated to reach out to young female teenagers.

9. Dr. Glen Bull, Professor of Instructional Technology at the University of Virginia, received funding to establish a center for integrating technology into the curriculum for K-12 teachers. This is a multi-year, multi-million dollar project that teaches teachers to think through their curriculum development using technology as an integral part of the package.
10. The U.S. military (per Fred Williamson, Air Force retiree and Assistant Secretary of Technology for Virginia) is an example of an employer that has integrated women and minorities into technical jobs that are traditionally held by men. It would be a good idea to analyze how this process was facilitated.

## RESEARCH NEEDS

After extensive discussion, the following research needs were identified:

1. Examine the percentage of people with liberal arts degrees who are now filling IT jobs. (People with liberal arts degrees, specialized training, and critical thinking skills can fill 80% of IT jobs).
2. Examine the effectiveness of K–12 programs, which are integrating technology across the curriculum through project-based learning and using hands-on problem solving (rather than a one-hour math class, one-hour technology lesson, etc.).
3. Evaluate the long-term effectiveness of intervention programs, such as summer science camps, mentoring programs and career days.
4. Implement retrospective ethnographic studies of the variables effecting the career choices of women and minorities.
5. Examine the differential effects of single sex and mixed sex science and math classes on future interest in IT careers.
6. Implement more studies examining female and minority specific workforce data (employment levels within specific IT occupations).



## ***SESSION 2***

### **Factors Affecting Female and Minority Participation in IT Careers — Environmental, Cultural, Economic and Educational Concerns**

Factors affecting the female and minority participation in IT careers were broken down into environmental, cultural, economic, and educational concerns. Forum participants addressed these concerns in small groups and developed a list of factors that affect female and minority participation in IT careers in each category. These were subsequently discussed by all participants.

#### **CURRENT RESEARCH**

##### **Economic Factors:**

Some factors that cause women and minorities to avoid IT careers:

1. Despite significant growth in computer ownership and usage overall from 1994 to 1997, there is now an even greater disparity in penetration levels between certain groups of Americans, namely between racial groups, with whites having the highest level of PC-ownership (McConnaughey and Lader, 1997).
2. There is a lack of hardware and software in poorer schools along with a lack of teacher training in lower socioeconomic areas (McKissack, 1998).

##### **Environmental Factors:**

1. School environments: Most future computer scientists are raised in the following school environment: algebra

before grade ten; academic track in high school; mathematics or science electives; good grades in math and science; above average SAT or ACT scores; extra curricular hours devoted to science or math endeavors; and a computer science major in a four-year college (Edwards, 1990).

2. Home environments: a computer scientist's childhood home environment usually involved the following circumstances: adult praise in reaction to success with mathematics; hobbies, extracurricular and/or leisure time activities that are related to science; a mother with a college degree; close parental monitoring of studies; positive reinforcement, or at least the absence of serious negative reinforcement from peers; and interaction with role models and mentors (Edwards, 1990).
3. IT career role models: Women need to see women and minorities in IT positions to which they can aspire. Kirk Mooring, President of INT Computer Services, discussed the inspirational impact on members of the community of the success of a community member who worked in the IT sector.

### Cultural Factors:

1. Many women and minorities do not have home experiences which encourage them to pursue IT careers.
2. At all educational levels, research suggests that computer science material is presented in a way that is gender-biased against females. Researchers suggest that more women would be interested in these fields if greater attention was placed on values, human issues, and social impact in instruction of math, physical sciences, and computer science courses (Martin, 1990).
3. The learning environment in computer science programs tends to discourage women and minorities, with courses typically taught by male professors, who may not regard female students seriously in the classroom, and who create a competitive rather than a cooperative environment. These factors tend to contribute to a significantly higher dropout rate among female computer science students than among their male counterparts (Martin, 1990).
4. Studies show that most female and minority undergraduate and graduate computer science students have few role models, feel isolated, and have a diminished social support structure.
5. Some foreign-born computer science professors come from cultures where women do not traditionally pursue careers. Therefore, they may not take their female students as seriously as their male students (Martin, 1990).
6. As reported by female computer science professors who attended the Forum, many women leave the science, math, engineering and technology majors in college because they don't connect with the faculty, their peers or their classes, not because of poor performance or difficulty with content (Jane Prey).
7. Women are often drawn to more creative jobs in IT, such as web page and graphics design, rather than programming (Kurt Mooring).

### Educational Factors:

1. Many elementary teachers project a negative image of mathematics without meaning to do so. For example, they say things like, "Now we get to do English" and a short time later, "Now we have to do math." A positive mind-set is important in learning any subject and the math skills are essential to success in the computer field (P.D. Scott).

2. All-male or all-white computer, math, or science clubs or teams are seen as normal. Principals and teachers may think girls or minorities are self-selecting out of these activities, not that they are intimidated by the male culture (Janice Koch).
3. Women don't have the same level of confidence as their male counterparts. Many women don't think they can be programmers or hold other demanding IT positions because they think they're not smart enough. Boys, on other hand, tend not to blame themselves for poor academic performance. They are more apt to blame the teacher for poor teaching (Carol Burger).

### **SUGGESTED STRATEGIES AND ADDITIONAL PROGRAM NEEDS**

The panel identified some needs that are not being addressed by the existing model projects and ways that these needs may be met:

1. K–12 schools should insure that ongoing technical support is provided at schools after hardware and software are installed. Dedicated personnel are needed to maintain the equipment. Teachers usually do not have the expertise or the time to run computer labs and fix networks.
2. K–12 schools should develop a solution to under-utilized computer labs during non-school hours. These resources could be open after hours to increase access to computers for students. Too many schools and labs close their doors after 4 p.m. because of security issues, cost of paying a security guard, etc. The need to access computer labs in schools after hours should be presented to the Superintendents' Association and to the Superintendent of Instruction with the State Department of Education. School systems need to "think outside of the box" in terms of providing security, as well as transportation, since many parents of at-risk students don't have cars or have only one car and aren't able to pick up their child after school. Many students need to have transportation to and from school if they stay after-hours.
3. Curricula in the K–12, undergraduate, and graduate levels needs to reflect and leverage diversity (e.g., studying female and minority scientists). For example when working problem sets during classroom instruction, lessons should be relevant to all students. Teachers can sometimes use bicycles or food processors as examples, rather than topics like rockets, which may be a turnoff to some female students.

4. Girls and minorities in grades K–12 and at undergraduate and graduate levels should meet professional women and minorities in IT jobs through in-school presentations, e-mail mentors, classroom presentations, opportunities to interview professionals, and job shadowing to form role models. Students need to know what someone in an IT job really does to help them form positive impressions of computer careers at an early age.
5. Data should be gathered on undergraduate programs with successful recruitment and retention of females and minorities in IT studies.
6. Youth agencies, K–12 schools, colleges, and other agencies could establish a “Habitat for Technology” to teach youth to repair and refurbish computers.

## MODEL PROJECTS

In an effort to identify the best practices, programs and projects that effectively address the issues of environmental, cultural, economic, and educational concerns, research was collected prior to the Forum and other projects were discussed by Forum participants.

1. The E-rate Program is a federally funded program by which schools and libraries in poor neighborhoods apply for grants for Internet hookups, hardware, software, network file servers and email. Funding is based on the number of free school lunches served. This program is being implemented in Virginia and in other states. The goal of the program is to equalize the distribution of computer technology so that it's not just the wealthier school districts that have access to computers and the Internet. (More information can be found at <http://news.cnet.com/news/0-1005-200-331305.html?st.ne.fd.mdh>).
2. George Mason University's Information Technology organization is working with the City of Fairfax on a pilot project that links the home with the classroom and the world via networked thin client computers. The Oracle Corporation is hosting on its servers specially developed software that enables students to work collaboratively within the classroom, at home, and throughout the world. In addition, the students' home and classroom computers connect to a server farm hosting application software such as StarOffice (an inexpensive type of software similar to Microsoft Office 97). The advantage of hosting all software on servers rather than on the students' or schools' machines is ease of maintenance. Installation,

troubleshooting, and maintenance are all done through the server. The pilot includes the entire 7th grade class of Sidney Lanier Middle School, Lanier County, Va. Two network computer labs using BocaVision thin client systems, were installed in the school. Remote connectivity is available in each student's home and city libraries through either thin client computers or existing PCs running Citrix Metaframe thin client software. George Mason University is providing technical, help desk, and project evaluation services. All students participating in “free and reduced lunch” programs are eligible to receive free thin client computers and remote dial-in connectivity throughout the duration of the pilot. The pilot should run approximately 2 years. Within that timeframe, there are plans to expand the pilot to the 8th graders (when the 7th graders move to 8th grade) and offer it to the new 7th graders (Joy Hughes).

3. INT Training runs a computer recycling program for 486 IBM-compatible computers. Students, most of whom are socioeconomically underprivileged minority adults, learn to upgrade and fix these computers that were considered obsolete by companies and organizations. The students receive a renovated computer of their own after they complete the INT program. As companies upgrade to more powerful machines they can donate computers to these types of programs and to schools and nonprofits.
4. Dr. Janice Koch taught several web-based courses at Hofstra University and observed that web-based college courses are effective at encouraging women and girls to communicate and reflect. The anonymity of email allows girls to openly express themselves and fosters confidence building.
5. MentorNet is an e-mentoring program run through the National Electronic Industrial Mentoring Network for Women in Engineering and Science. Women who are studying engineering or science at one of the program's participating colleges or universities are paired with professional scientists and engineers working in industry, and help them form e-mail based mentoring relationships. (More information can be found at <http://www.mentornet.net>).
6. Girls Action GREEN (Girls Ready for Environmental Education Now) Project is an NSF project, led by Dr. Janice Koch. This project is a middle school intervention designed to transform science curriculum and pedagogy and involves underprivileged, middle

school African-American girls in a variety of science experiences that they would not otherwise have and involves them in a summer camp. Through the camp, the girls learn about the area's local environment and are taught to use GIS technology to explore areas of Long Island of interest to them. The project includes after-school science clubs for the girls.

7. Math + Science + Girls = Success is an American Association of University Women program which invites industry to be an integral part of the middle school curriculum. The middle school years are a critical decision time in many girls' lives when they will choose (or not) to pursue college preparatory courses in high school consisting of higher level math and science courses.
8. The Kidtech Computer Learning Center Network is a program managed by Zel Technologies, Inc., a systems integration company located in Hampton, Va. The project is the brainchild of Jack Ezell, President and Chief Operating Officer of Zel Technologies, Inc., in an effort to give back to the community. This program targets minority youth and senior citizens, and provides them with access to computers in the afternoons and evenings. The company has provided all of the funding for the project to date, but government grants and support from corporations and foundations are being pursued to help expand the program. The project is creating another facility in an inner-city neighborhood in Norfolk, Va., about 20 miles away. Each center has a trained facilitator, who provides instruction to the students and also maintains the computers and the network. The VSGC has partnered with Zel Technologies, Inc. in a \$488,000 grant from the U.S. Department of Education (received May 1, 2000) to expand the Kid Tech concept and extend it to the Newport News Library System.
9. The West End Center is an inner city program in Roanoke, Va., which provides after-school and summer programs for disadvantaged minority youth. The program partners with industry in Roanoke to build model projects and to expose the young people to IT careers. The project also encourages minority students to go to Virginia Tech and/or Hollins College to pursue Computer Science majors (Nancy Healy).

## RESEARCH NEEDS

During the panel discussions, the following research questions were identified by the project participants as areas that need to be explored:

1. What is the effect of socioeconomic status on a student's success in the use of technology and in IT careers?
2. How effective are intervention programs for middle school non-Caucasian girls and minorities?
3. How successful are immigrant and minority women and men in IT careers?
4. What are the cross-cultural comparisons of girls' and women's success in academic technology careers?



## ***SESSION 3***

### **Recruitment and Retention Issues for Higher Education and Industry**

#### **PRESENTERS**

The Forum presenters who addressed higher education issues in Session 3 were:

- Carol Burger, Associate Professor, Women's Studies and Biology, and Coordinator, Science and Gender Equity Program, Virginia Tech
- Nancy Healy, Computer Science Instructor, Hollins University
- Sandy Birch, Assistant to the Computer Science Department Head, Virginia Tech
- Carolyn Vallas, Director of Minority Programs, School of Engineering and Applied Science, University of Virginia
- Kurt Maly, Chair, Computer Science Department, Old Dominion University.

The presenters who addressed industry issues in Session 3 were:

- Amy Dawson, Development and Program Specialist, Virginia Space Grant Consortium
- Paula Gulak, Partner, Sycom Technologies
- Valerie Perlowitz, President, Reliable Integration Services
- Lin McDermid, Vice President/Information Technology and Chief Information Officer, Virginia Power
- Wanda Miles, Eastern Regional Manager for Global Learning Initiatives, Oracle Corporation.

#### **CURRENT RESEARCH**

##### **Higher Education Issues**

Carol Burger presented the current research regarding the recruitment of women and minorities to computer careers in higher education. Women's achievements in science, math, engineering and technology courses at the high school level were examined, since that is the gateway to college-level computing courses.

The following information was highlighted:

1. Female and male students complete high school mathematics courses at a similar rate.
2. In the 1996 National Association of Educational Progress (NAEP) tests, the gender gap in math achievement for high school students has essentially disappeared.
3. Twelfth grade female students scored slightly lower than male students on 1996 NAEP science assessments.
4. There is anecdotal evidence that women are choosing information systems programs over computer science and computer engineering because they are viewed to be more "people oriented" (Freeman, 1999).

Minorities' achievement in science, math, engineering and technology disciplines was examined and the following information was presented (Burger and Sandy, 1998; Freeman,

1999; Grayson and Martin, 1997; Sadker and Sadker, 1994):

1. Percentages of Black, Hispanic, and American Indian students taking basic and advanced mathematics courses doubled between 1982 and 1994.
2. Racial and ethnic groups differ greatly in mathematics course enrollment.
3. Average mathematics scores have increased for all racial/ethnic groups since 1990.
4. Choices of professions for minority women in science and engineering are more similar to those of white women than they are to those of minority men.

## INDUSTRY ISSUES

Amy Dawson reviewed the current research regarding the difficulties of recruiting and retaining women and minorities in IT careers in industry. Women surveyed about their perceptions of the barriers precluding them from pursuing careers in IT identified the following factors (Carver, 1999):

1. Firmly entrenched, though perhaps inaccurate, expectations to work 50-60 hour work weeks with few part-time job opportunities.
2. High stress job environment due to the pressure to get products to market ahead of the competition.
3. Cultural and work ethic differences between young, single IT workers who prefer to work late hours versus those who want to get home to their families, preferring to take work home if necessary.

When examining why many women leave IT careers after a number of years in the workplace, several factors were identified. Although these are not true of every IT company, they represent the majority of reasons women leave IT positions. Many smaller companies seem to be more flexible and willing to work with women who have families.

1. Long hours are detrimental to family life.
2. Women who stay home for a year or two due to family responsibilities cannot easily return to their jobs because technology changes so quickly.
3. Managers are reluctant to allow part-time work, even if company policy permits it. If the policy is used, many women are assigned to less desirable projects and their careers are stalled.

Factors employers can use to retain their female IT workers include:

1. Providing on-site daycare.
2. Allowing flexible work hours.

3. Providing part-time employment opportunities (retaining all benefits) and/or job sharing.
4. Allowing work from home.
5. Sponsoring a company-wide mentor program for younger women entering the industry.

Some progressive IT companies, including Intuit and Oracle, are already implementing some or all of these modifications.

Barriers that were identified for underrepresented minorities in the IT workplace include (NSF, 1999):

1. Minorities are more likely to have a bachelor's degree as a terminal degree (66% vs. 55% for all scientists and engineers), limiting their ability to progress up the IT job ladder.
2. Minorities are more likely to major in social sciences, law, or medicine, which offer fewer opportunities for employment in IT jobs.
3. There are few minority role models in IT jobs to encourage youth and/or college students to pursue majors and careers in IT and to serve as mentors for younger employers.

## OTHER FACTORS

The panelists identified some additional factors and examples of reasons for the lack of women and minorities in higher education and industry:

1. Lack of Role Models and Stereotypes—At high school and college computer science competitions and in computer science clubs, the team members are predominantly white males. When the University of Virginia programming team went to an international competition in the Netherlands, 86 teams competed with three members per team. Among the competitors, there were fewer than five women. Dr. Jane Prey, a panelist who accompanied this team, feels this is due to a lack of role models and that women are not interested in spending time on hacking activities. Computer Science programs need to establish the difference between the lack of women in computer science and women as computer “users.” Women are well represented in jobs that require using computer applications. They are not as well represented in jobs that develop these programs. One solution is to have females in 50% of the computer faculty positions. Each university needs to have a dedicated staff person who is focused on the

recruitment of women and minorities in departments such as Computer Science (Kurt Maly).

2. Lack of Resources—Historically Black Colleges and Universities' computer facilities are more limited than at majority universities. Most have the hardware, but lack technical support (Freeman, 1999).
3. Little knowledge of the IT Field—The leadership of the VSGC plans to pursue a program for IT awareness, exposure and mentoring, tapping its extensive network of IT professionals and educators through a partnership with CHROME (Cooperating Hampton Roads Organization for Minorities in Engineering). School-based clubs and other activities can encourage minorities to pursue engineering majors in college. Virginia Tech plans to establish a program in the Roanoke school system similar to the CHROME program in Hampton Roads. The VSGC has received funding through the State Council of Higher Education for Virginia to provide a two-week summer computer science camp for CHROME students in July 2000.
4. Lack of support/encouragement—Old-fashioned encouragement can go a long way toward recruiting women into computer science. They often need someone, a respected faculty member or parent to say to them, "Why don't you sign up for that computer science class or join that computer club?" Women often think that they're not capable of majoring in computer science until they get into the classes and are successful (Susan Shome).

#### MODEL PROJECTS IN HIGHER EDUCATION

Several panelists representing computer science and IT programs presented model projects which succeeded in recruiting and retaining women and minorities in CS and IT majors. These projects included:

1. George Mason University is in the first year of implementation of an IT minor for liberal arts majors. Joy Hughes, Chief Information Officer and Forum panelist, has been instrumental in creating this program. Students can minor in computer science, information technology, multimedia or telecommunications. The minors were developed to help liberal arts majors gain technical skills.
2. Nancy Healy, Hollins University, has developed Computer Science concentrations and offers a "Computers in the Problems of Societies" course. This

course introduces students to computers, how they work and what you can do with them. Hollins also offers a "Microcomputers in Business" class.

3. The University of Virginia has initiated the development of a "Computing for Life" course because of a need for all students to be technology enabled. This course would be offered by the Computer Science Department to non-engineering liberal arts majors. The course will teach students how to use technology when it's appropriate and be a step above computer literacy. It will provide students with technical skills sets and will be a problem solving, thinking course, rather than a technical "how to" course.
4. Sandy Birch, Virginia Tech, offers the following recruitment and retention programs through the Computer Science (CS) Department:
  - "Women in Computing Freshman Seminar" is a one-hour per week opportunity for freshmen women to receive training on speaking and writing skills to increase their confidence. Girls also research successful women. A panel of sophomore, junior and senior women share their experiences with freshman women.
  - Virginia Tech Mentoring program—Any student who mentors a freshman in CS receives a \$150 book allowance. This project was not very successful in its first year and will be revamped. The mentors didn't feel useful and were too busy to spend much time with their mentees.
  - Virginia Tech has a recruiting program run by the Association for Women in Computing Club. Students work with local elementary teachers and students to inform them about computer careers.
  - Women in Computing Career Day involves local 7<sup>th</sup> grade girls. Girls from nearby school systems come to Virginia Tech computer labs, take apart computers, and operate a simple network. Last year, girls received a *Cool Careers for Girls in Computers* book. The project was coordinated through the school district, with buses providing transportation to and from the University.
  - E-mail pen pals (undergraduate female CS majors) are assigned to high school girls who visit the campus as prospective students.

- Computer Science Community Service Program. Volunteers (male and female) from the Computer Science Department go into the local schools as teachers, friends, and mentors for teachers and students. They teach web page development, help with networking, and teach software programs.
  - Virginia Tech sponsors a high school programming contest, in which major recruitment of females and minorities takes place.
5. VSGC provides nearly \$300,000 in scholarships each year to Virginia Space Grant Universities and community colleges, for which computer science majors are eligible. The program particularly encourages applications from female and underrepresented minority students.
  6. University of Virginia's (UVA) College of Engineering (where the Computer Science Department is housed) operates several recruitment activities, mostly centered on recruiting minorities. These programs are very successful and UVA recently received a Presidential Award for its minority recruitment efforts.
    - The MITE (Minority Introduction to Engineering) program is a competitive, week-long residential program offered in the summer for the top 10<sup>th</sup> & 11<sup>th</sup> graders across the country. In 1999, it helped 28 students, including 8 white females, 2 Asians, 14 African American women who attended. The program introduces students to careers in engineering, computer science, and other sciences. Students spend two hours per day in the computer lab and produce a project at the end of the week.
    - The Focus Program partners with industry and school systems and exposes minority students to physics, the gatekeeper course for engineering.
    - Summer Internship Program, sponsored by IBM and the UVA Medical School, brings high school students to campus.
    - The Summer Bridge Academy is an intensive eight-week program designed to assist incoming minority students in making a smooth transition from high school to college. Through participation, minority students gain first-hand college-life experience. During the program, students live in university housing and complete two university courses (Applied Mathematics and Engineering Concepts) for

credit. In addition, they receive instruction in academic survival skills, computer applications, and personal and professional development.

- Female faculty and alumni informally mentor students, and alumni assist with job placements.
- The Math Program brings students to UVA during the summer prior to 9<sup>th</sup> grade. They concentrate on algebra so that students can successfully complete calculus by the time they graduate from high school (a major gatekeeper course for computer science majors).
- Industry Programs — Students spend 1-3 days with an engineer in a specific area/industry, which exposes students to the kinds of things they're interested in and helps people in industry interact with students to identify them for future internships.

### **MODEL PROJECTS IN INDUSTRY**

Four women from large and small IT companies discussed the kinds of recruitment and retention programs and strategies that are being implemented. The women who presented included Paula Gulak, Sycom Technologies; Valerie Perlowitz, Reliable Integration Services; Wanda Miles, Oracle Corporation; and Lin McDermid, Virginia Power.

Sycom Technologies, is an 81-person company located in Richmond, Va. that does systems integration, professional consulting, and staff augmentation for mid-sized to Fortune 500 companies. Sycom's recruitment and retention efforts are focused on the following efforts:

1. They feature women and minorities in their job ads and publications and use local, regional and national job fairs to recruit employees.
2. They are very flexible, providing a 30-hour work week with (industry standard) benefits.

Reliable Integration Services (RIS), located in Northern Virginia, designs and deploys cutting edge networks and systems integration to meet the needs of commercial clients, as well as civilian and military agencies for the U.S. Government. RIS's recruitment and retention efforts are focused on the following:

1. Recruitment is done through LAMA, a Latin American group, and at Historically Black Colleges and Universities.

2. About one third of the staff is minorities and women. There are more minorities because they have a hard time finding women for employment.
3. They do a lot with the Robotics Institute at the Governor's High School for the Gifted in Northern Virginia, which exposes students to science and technology and mentors them.
4. RIS has flex-time policies and permits telecommuting.
5. They offer internships for college students.

Oracle Corporation is the world's leading supplier of software for information management. Oracle Corporation uses the following methods of recruitment and retention:

1. A team of recruiters works with Alianza, a network of professionals, students and organizations in the Latino community formed to promote educational and professional development for Latinos from all professions.
2. AMPRO, an on-line electronic career and business resource for minorities in professional services and IT, is used for recruitment.
3. The company promotes itself in *Enterprise Magazine*, a magazine targeted to blacks.
4. The Oracle Diversity Office spends a lot of time educating executives as to why it is important to have diversity within their management team.
5. Oracle recently won an award from the United Negro College Fund for its diversity efforts.
6. They operate a mentoring program focused on high potential women.
7. They have flexible hours and schedule a mandatory 2-day-per-week telecommuting at their California headquarters office due to the heavy commuter traffic.
8. They offer retraining and will pay for tuition through Oracle University, for degrees related to the job field.
9. Despite all of the efforts made, only 1-3% of the management team is black. Oracle continues to strive for better results.

Virginia Power is a utility company that employs approximately 500 IT workers and hires approximately 200 consultants annually from technology firms. Their recruitment of minority and female employees includes the following techniques:

1. They recruit at HBCUs, and technical and non-technical institutions. They also approach liberal arts and engineering programs looking for minorities.

2. Only 10% of the IT professionals at Virginia Power are minorities.
3. Forty-five percent of their employees are women, many of them in IT jobs, so they don't consider that an issue.
4. They offer flexible schedules and telecommuting.
5. People can bring children to work, if necessary.

## RESEARCH NEEDS

The following topics were identified by the panelists as areas where they think further research is needed:

1. Examine why people like working with computers at various levels and desegregate the data by women in single sex, men in single sex, and women and men in coed situations.
2. Investigate factors that result in successful internship and co-op programs.
3. Assess K-12 teachers' understanding of the value of math and science in the lower grades. What teacher preparation programs will help teachers develop greater understanding of their importance?
4. Examine the success of graduates of various IT training programs, including both adult education and undergraduate programs like the IT minor at George Mason University.



# ***SESSION 4***

## **Workforce Training and Retraining Issues**

### **PRESENTERS**

The Forum presenters in Session 4 were:

- Mary Sandy, Director, Virginia Space Grant Consortium
- Maxine Lunn, Ph.D., Director of Information Services and Technology, Center for Innovative Technology
- Kirk Mooring, Director, INT Computer Services, Inc.
- P.D. Scott, Coordinator for Certification Programs for IT, Northern Virginia Community College
- Doris Spencer, Executive Director, Institute for Excellence in Instructional Technology
- Sheryll Heard, Admissions Director, ITPro Program, Old Dominion University.

### **CURRENT RESEARCH**

Universities, training organizations, and industries working together can provide retraining of women and minorities to help them become part of the workforce pipeline and fill IT positions. These positions are found in a variety of places such as utility companies, financial services companies, manufacturers, publishers, universities, and hospitals, all of which have IT workers on staff. As more traditional workers are being absorbed into an IT track, there is a continuous need to update the skills of existing workers, as well as to find additional skilled IT practitioners. The levels of experience specified for many open IT jobs present a particular challenge. While the education and training providers within Virginia offer many opportunities for existing IT workers to upgrade their skills and some institutions have targeted the bulk of

their efforts at post-baccalaureate retraining programs for existing workers from other fields, the bulk of education and training efforts are directed at potential new entrants to the IT field. This, however, is the category of worker that was reported acceptable for only 20-25% of the vacant jobs (The Governor's Commission on Information Technology, 1999).

New IT workers may be found in the academic pipeline in traditional disciplines, such as computer science, computer engineering, and math. They may be found in nontraditional disciplines as well, such as psychology, graphic arts, music, and physics. They may even be found in the nontraditional pipeline, in short courses and certification programs (Carver, 1999).

Current research for the Workforce Training and Retraining session revealed that an effective IT worker needs a variety of skills, including a combination of the following attributes (Freeman, 1999):

1. Technical knowledge of IT to design, test, debug and modify programs.
2. Business knowledge and experience about how customers use products and their future need for products.
3. Organizational skills including formulating budgets, and completing work on time and within budget.
4. Communications skills, including the ability to work on teams and with those from diverse backgrounds, and the ability to organize and present technical material to peers, customers and management (Freeman, 1999).

Additional data on IT workers includes the following:

1. The majority of IT positions could be filled by people with liberal arts degrees, not formal degrees in IT-related disciplines. Liberal arts degree holders are critical to a successful mix of employees because a staff of all engineers and computer science majors becomes too homogenous. (Carl Kelly)
2. The most frequent IT career path is a bachelor's degree in some technical field unrelated to information technology, plus coursework in IT subjects or another closely related field (math, business, engineering) (Freeman, 1999).
3. Students over 40 represent the fastest-growing age group in postsecondary education (AAUW, 1999).
4. Employees move from job to job to gain new skill sets, and workers no longer see themselves as having a life-long or long-term commitment to one company (Freeman, 1999).

Maxine Lunn of Virginia's Center for Innovative Technology studied the differences in IT workforce needs and workers in different parts of Virginia through focus groups conducted in several regions of Virginia. Her research was part of the Governor's Commission on Information Technology report. She found that the issue of women and minorities in IT jobs was not on industry's agenda until recently. Now they are interested in recruiting women and minorities, because the labor pool from which they were drawing is shrinking. She found that across the state the taxonomy of certain terms among IT workers was not interchangeable. For example, the title of database administrator meant different things in different parts of the state. Research shows that this variation in terms for IT workers is problematic nationally, as well.

1. There are more jobs than can be filled and lack of workers in Northern Virginia versus a lack of jobs in Southwest Virginia.
2. Smaller communities feel that high salaries offered by Northern Virginia technology companies lure away their IT workers.
3. Younger IT workers want a social network of other young IT workers near where they live in order to settle into a professional life. This is a big factor when deciding where to live and which job to take.
4. Smaller cities in Virginia (Roanoke, Lynchburg) offer IT professionals a high quality of life for their families when high salaries are no longer the driving force in

people's lives and benefits, health coverage, and career development are more important.

5. The greatest number of vacancies in Virginia is in the mid-level range, requiring people with two to eight years of experience.
6. People need to have realistic salary expectations. Many new IT workers need to realize that a \$70,000 salary isn't generally offered in the first year.

## MODEL PROJECTS

During this Session, panelists described a variety of workforce programs in which they are involved. These panelists included:

- Kurt Mooring, Director, INT Computer Services, Inc.
  - P.D. Scott, Coordinator for Certification Programs for IT, Northern Virginia Community College
  - Doris Spencer, Executive Director, Institute for Excellence in Instructional Technology
  - Sheryll Heard, Admissions Director, ITPro Program, Old Dominion University.
1. Kurt Mooring introduced the INT Computer Services program, which is training low-income minorities with no prior computer background to hold entry-level jobs in the IT field. Many of these students are on welfare and are trying to gain the skills to hold a job. The program is funded through Norfolk Works, and corporations also provide grants to fund students' tuition. The program buses the students from their homes to the training facility where they receive A+ Computer Repair training and learn customer service and satisfaction skills. They learn the basic operations of the computer and software programs. The program currently has 29 students with 54% of them women. Seventy-six percent of the program's graduates are employed, with several placed at the Gateway plant in Hampton, Va. The program lasts 18 weeks and is held four days a week for four hours a day. The program has had a very powerful effect on people, giving them confidence and skills that they've never had. Many employed graduates return as volunteers and serve as role models for the students.
  2. P.D. Scott discussed several resources for IT access and initiatives that are taking place at Northern Virginia Community College (NVCC) in the IT field. Currently, NVCC has Information Systems Technology and Computer Science departments. The

enrollment in these two areas respectively, is 49/62% male and 50/37% female. The percentage of white and non-white students enrolled in these programs is nearly 50% for each, possibly due to the large number of Asian and Hispanic populations in Northern Virginia. In addition to NVCC's two-year programs in Information Systems Technology and Computer Science, the school has initiated a wide range of additional programs targeting high school students, high school dropouts, and college graduates who don't have the skills for entry-level jobs in IT. The Jump Start Program is a Welfare to Work program run through NVCC where students attend concentrated courses and receive college credit. Everyone who finishes the program receives a computer to take home. The Northern Virginia Regional Partnership, George Mason University, Department of Social Services from several jurisdictions, as well as NVCC, all supported this program to place people in IT jobs. The Trip Program is a certification program for people with a bachelors degree and no marketable skills. A 25 year-old man with an undergraduate degree in history from the University of Virginia recently entered this program after unsuccessfully trying to get a job. The program has been very successful at placing program graduates with IT companies.

3. Community groups and the public school systems of northern Virginia also have programs to support women and minorities in IT. The National Education Foundation is a national program, which provides scholarships for computer training, Internet access (and sometimes computers) for teenagers from low-income families. Tech Talk is a career-day type of program sponsored by the Northern Virginia Technology Council and it works through the high schools. Each school system in Northern Virginia participates. Many of the school systems also have partnerships with minority businesses. They also work with other organizations, including Women in Science, AAUW, and the Institute for Women in Trades, Technology and Science.
4. An Information Technology Program is Old Dominion University's response to Industry demands for qualified IT workers. ITPro provides professional retraining and job search assistance in information technology careers. Internet and networking certificates are offered in: Database Administrator,

Network Administrator, Programmer, Solution Developer, Internet Engineer, Systems Engineer, Web Developer, Web Manager, and Webmaster. Training leads to Microsoft or Novell certifications. Most certificates can be completed through part-time attendance within one year. ITPro offers: affordable training, convenient evening/weekend class schedules, academic credit, instructor-led training, Military TA eligibility, and job search assistance. Training locations are available in both Northern Virginia and Hampton Roads. (<http://www.odu.edu/~itpro> ).

5. Nearly 50% of the ITPro students have a Bachelor of Science degree and 28% of the students since the program started in 1998 have been women. Currently, 32% are African American, Asian and Hispanic. Ninety-nine percent of the students are employed and attend part-time, completing the certificate programs in a year. The program appeals to many people unsatisfied with their current income levels, but who need more credentials to enter a different field. ITPro frequently changes curricula and adds certificate tracks to keep up with technology. An industry advisory board helps them identify their industry's needs. The program helps the student develop additional business related skills, including business communications and project management, as well as offering job search assistance. (Sheryll Heard)

#### **FINDINGS OF THE VIRGINIA GOVERNOR'S COMMISSION ON INFORMATION TECHNOLOGY AND SELECTED STRATEGIES**

The following recommendations were issued based on workforce information:

1. Better communication between industry and education regarding workforce needs is desired.
2. The best training combines education, training, and experience.
3. Workforce preparation providers need to capture the real meaning of a networked environment in their products and process.
4. Workforce preparation providers should provide general education, general business knowledge, technical content, and workplace experience.
5. IT training programs can be effective for people at all levels of education and demographics.

## RESEARCH NEEDS

During the Forum, panelists identified the following research needs regarding workforce issues:

1. How effective is distance learning when used as a retraining tool?
2. What are the necessary soft skills for network administrator, programmer, database administrator and network administrator?
3. What are the IT companies' perceptions of certification programs at community colleges?
4. What data is available about successful IT workforce programs?

## SUMMARY

During a final discussion, the Forum participants voiced any additional concerns, thoughts, and potential solutions about how to increase the numbers of women and minorities in information technology and in the workforce pipeline.

The concerns that were mentioned included:

1. Helen Harvey thought that a plan should be developed for insuring that the female-dominated side of IT (web development, graphic designer, database management) doesn't become lower paying, much like teaching, nursing, and secretarial work.
2. Others felt that local technology councils, which are located in every region of the State, should work more closely with schools and with the potential local workforce to inform them of jobs and other IT opportunities.

The Forum enabled a wide range of experts from various fields and at different points in the IT workforce pipeline to share their knowledge and perspectives. The result is greater awareness of current research and factors effecting the IT workforce pipeline at all levels, as well as knowledge of programs that have been successful and an understanding of where research still needs to be done. Participants experienced both an interdisciplinary approach to the issues and the perspective of educators, trainers, and industry representatives at various points on the pipeline.

IT workers are needed in virtually all industries and there is a serious shortage in Virginia and nationally. IT jobs are generally lucrative, stimulating and offer excellent benefits. This new area of high tech growth offers unlimited opportunities for women and minorities who remain underrepresented in these fields.

Students at all grade levels need to be encouraged to access and use computers and related technology and to build a strong mathematics and science knowledge base that keeps future study and career options open.

Industry and higher education providers need to work together to ensure well-prepared IT workers with both technical and nontechnical skills. Industry and higher education partners need to work with school systems to help with recruitment and retention issues through strategies such as job shadowing, role modeling, and internships. At the K-12 level, schools and parents need to insure good access to computers and related technology, and to encourage female and minority students by including curricula that are appealing and relevant to all students.

The Virginia Space Grant Consortium and its partners will build on the strong network established by this Forum to develop programs to address the issues that have been identified and to seek necessary funding to bring these initiatives to fruition. This White Paper will be distributed to the Offices of the Secretaries of Technology and Education for the Commonwealth of Virginia, the members of the Governor's Commission on Information Technology, key Virginia Legislators and other key educators and policy makers. It will also be made available on the project's web site (<http://www.vsgc.odu.edu/html/gender/InfoTech.html>).



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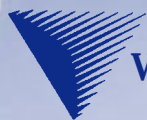


# WEBSITES

1. American Association of University Women Educational Foundation – Commission to examine gender, technology and teacher education [http:// www.aauw.org/2000/tcprbod.html](http://www.aauw.org/2000/tcprbod.html)
2. Association for Women in Computing  
Promoting the advancement of women in the computing professions  
<http://www.awc-hq.org>
3. AWSEM – Advocates for Women in Science and Engineering  
<http://www.awsem.com>
4. Carnegie Mellon Project on Gender and Computer Science  
<http://www.cs.cmu.edu/afs/cs/project/gendergap/www>
5. The Center for Women and Technology  
Website from the University of Maryland Baltimore County  
<http://www.umbc.edu/cwit>
6. Club Girl Tech <http://www.girltech.com>
7. Commission on Information Technology  
Website of the Office of the Secretary of Technology,  
Commonwealth of Virginia <http://www.sotech.state.va.us>.
8. Computer Professionals for Social Responsibility – Women and  
Computing Pages <http://www.cpsr.org/program/gender>
9. Computing Research Association <http://www.cra.org>
10. Counseling for Gender Equity  
A professional development opportunity for K-12 guidance  
counselors provided by the Virginia Space Grant Consortium with  
support from the National Science Foundation and in partnership  
with Virginia Tech. The project features summer institutes, a  
national distance learning program offered through the Public  
Broadcasting System's Adult Learning Service and the Virginia  
Department of Education Hour, Inservice Programs in Virginia  
school systems and site-based Equity Projects conducted by Virginia's  
counselors with minigrant funding offered to project participants.  
<http://genderequity.vsgc.odu.edu>
11. Current Population Survey [www.bis.census.gov/cps/cpsmain.htm](http://www.bis.census.gov/cps/cpsmain.htm)
12. Curriculum Transformation from the Diversity Web  
<http://www.inform.umd.edu/Diversityweb/Priorities/CT.html>
13. Education: Science and Technology  
A selection of articles on math and science for parents [http://  
www.fanafana.com/Consumers/Education/Science-and-Tech](http://www.fanafana.com/Consumers/Education/Science-and-Tech)
14. The E-rate Program  
A federally funded program to which schools and libraries in poor  
neighborhoods apply for grants for Internet hookups, hardware,  
software, network file servers, and e-mail. Funding is based on the  
number of free school lunches given out.  
<http://news.cnet.com/news/0-1005-200-331305.html?st.ne.fd.mdh>
15. Gender, Technology, and Computer Culture: Syllabus for a course  
taught by Dr. Sherry Turkle, author of many articles about women  
in computer science <http://web.mit.edu/sturkle/www/STS060.html>
16. ITPro Program  
The ITPro program, offered since 1998 through ODU as one of  
the solutions to the IT worker shortage. This program is currently  
offered in Hampton Roads and in Northern Virginia with  
approximately 350 students enrolled per year. The IT Pro  
program is less expensive than taking classes through a Microsoft  
provider and also awards academic credit from a University  
when the course is finished. <http://www.odu.edu/~itpro>
17. Kidz Online  
An educational organization whose stated mission is to reduce the  
gap between “the information haves and have-nots.” This group  
was started in Fairfax, Virginia, and helps kids share ideas and  
learn online. Children in inner-city schools can learn basic online  
skills from suburban kids in afterschool programs. This  
organization won the *InfoWorld Magazine* Top 100 Innovative  
Company Award in 1998. The organization at first attracted mostly  
male students. In an effort to address this problem, a “Girls Only”  
program has been initiated by the founders, to reach out to  
young female teenagers. <http://kidzonline.org>
18. MentorNet  
Mentornet is an e-mentoring program run through the National  
Electronic Industrial Mentoring Network for Women in  
Engineering and Science. Women who are studying engineering  
or science at one of the program's participating colleges or  
universities are paired with professional scientists and engineers  
working in industry, who help them form e-mail based mentoring  
relationships. <http://www.mentornet.net>



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