

## 2011 MEMBERSHIP OUTREACH WORKING GROUP (MOWG)

Stephanie White, Chair

### Importance of Expanding the Number of Women in Computing

Gender diversity is important in computing as it increases the size of the available talent pool, enhances equality, promotes innovation, and has been shown to improve the bottom line. Work teams with 50:50 representation have been shown to be more innovative and more efficient. Women are significantly under-represented in the computing graduate and undergraduate computing programs and in industry. In 2009 women made up 58% of the U.S. professional workforce but only 25% of the computing workforce. In the same year, women earned only 18% of undergraduate computing degrees and 25 % of graduate computing degrees. The trends are going in the wrong direction. Between 2000 and 2009 the number of women in the U.S. computing workforce decreased 13% while the number of men increased 11%. Women drop out of the computing workforce at twice the rate of their male peers. While statistics are not as available for other countries, research shows that they are similar. With 1.4 million computing-related jobs expected to be added in the United States by 2018 and many more internationally, it is important to encourage women to pursue computing. At current graduation rates, there will not be a sufficient number of graduates to fill those jobs. In 2011, recognizing the importance of outreach to women, IEEE Computer Society MGAB established the ad hoc committee MOWG on membership outreach, and recommended that the group work on investigating international issues associated with women in computing.

### Committee Members

MOWG is comprised of members from industry, government, academia, and IEEE CS, including Vi Doan, IEEE Computer Society, Ann Galante, Dowling and LIU, Ann Gates, University Of Texas At El Paso, Pam Jones, Northrop Grumman, Kathy Land, U.S. Missile Defense Agency, Graciela Perera, Youngstown State University, Jane Prey, Microsoft Research, Stephanie White, Long Island University (Committee Lead), and Linda Wilbanks, U.S. Navy.

### Three Related Recommendations

The importance of supporting and attracting women in the computing field is well known. Other societies and organizations have accepted the mission, are making significant inroads, and are recognized for their efforts. ACM is a significant player in this arena, and stands to benefit from women in computing who could in the near future (10 - 15 years) represent 50% of students and the work force in this field. Therefore,

1. It is recommended that CS form IEEE Computer Society Women (CS-W) to complement and work with Anita Borg Institute (ABI), the National Center for Women and Information Technology (NCWIT), Committee on the status of Women in Computing Research (CRA-W) and ACM's Women in Computing (ACM-W). The mission is to support women in computing, but also to compete with ACM-W for loyalty and membership.
2. It is recommended that CS-W be organized to celebrate, inform, and support women in computing and work with others to improve the education and career opportunities, policies, and environment for technical women. This should include recognized professional and student CS-W Committees within CS chapters as it has been shown that many women drop out of

computing and collaboration helps avoid this phenomena . After the Grace Hopper Conference, we received communication from students who were interested in organizing CS-W groups on their campuses.

3. It is recommended that CS form a CS-W organizing committee, a permanent committee within MGAB to establish promote, and support CS-W.

### **What our Competition is Doing and their Recognition in this Arena**

The ACM has been very active in supporting women and attracting women to computing, and is recognized for this by companies, professionals, and students. The ACM-W's mission is to celebrate, inform and support women in computing, and work with the ACM-W community of computer scientists, educators, employers and policy makers to improve working and learning environments for women. Telle Whitney, President and CEO at ABI, and Lucy Sanders, CEO at NCWIT, are ex-officio board members. ACM is co-organizer with ABI of the annual Grace Hopper Celebration of Women in Computing (GHC). ACM provided seed money when ABI was planning the first GHC conference. At this year's conference, attended by just under 3000 women, the ACM President took part in the welcome session and explained to attendees the value in belonging to the ACM. Our competitor sponsors the poster session at GHC where undergraduate and graduate student researchers have the opportunity to explain their research. ACM and ACM-W are prominent on NCWIT's website, for example on the page showing the leadership team, and are shown together with the Computer Science Teachers Association (CSTA) as promoting K-12 computing education.

### **MOWG 2011 Activities Related to Data Collection**

In January of this year, a Project Initiation Form was submitted, titled Women in Computing in Brazil, China, India, and South Korea. The goal is to understand where the percentage of women in computing and IT is significant or growing, and what those countries, universities, and businesses are doing to encourage women to enter and stay in the field. The proposal recommended collecting data from reliable sources about women in computing in different countries and regions where IEEE has an increasing presence, namely India, South Korea, China, and Brazil. For additional MOWG activities see the section on accomplishments and results, which follows this section.

The committee reviewed related literature, held discussions during telephone meetings, held a teleconference concerning available data with Caroline Simard, VP of Research & Executive Programs at the Anita Borg Institute for Women and Technology, sent a representative to the National Center for Women and Technology (NCWIT) Summit, and had an IEEE Computer Society exhibit booth at the Grace Hopper Celebration (GHC) of Women in Computing. A request for assistance in data collection was included in the November Chapter Connections Newsletter. At NCWIT and at the GHC Senior Women's Summit we identified our research agenda and asked for support with data collection.

### **Data Collection**

The committee is collecting the following data, and has asked chapter chairs for their support.

1. Which countries have a high representation of women in computing, and what cultural, societal, or educational practices have encouraged this?
2. Have women advanced as quickly as men in these countries and to high levels? Why or why not?

3. How can we make use of the above knowledge to increase the number of women studying and working in computing in countries where there is not a high representation of women in computing?
4. We also would like to understand how a professional society, in our case the computer society, can help women to advance in their chosen field.

More specific questions are:

For your country or region, with respect to education:

- Years of compulsory education (free), e.g. K-12
- Required science during years 9-12 (U.S. high school equivalent, e.g. biology: 1 year)
- Required mathematics during years 9-12 (U.S. high school equivalent, e.g. algebra, 2 years)
- Educational attainment of women: (1) Percentage of women completing pre-college requirements related to all students completing pre-college requirements, and trend if available; (2) Percentage of women studying computing by degree and level (Degrees: computer engineering, computer science, information technology, information systems, other; Levels: Bachelor, Masters, Ph.D.)

For your country or region, with respect to the work force:

- Percentage of women in computing fields (identify the fields)
- Salary comparison to men
- Speed of advancement
- Do the above differ according to whether the job is corporate, government, academic, entrepreneurship?

## Accomplishments and Results:

### Increased CS Visibility Among Women

Graciela Perera, Vi Doan and Stephanie White staffed a CS Exhibit Booth at the Grace Hopper Celebration of Women in Computing (GHC) Conference this November 2011. The Anita Borg Institute provided CS with a GHC free booth and registrations worth a total of \$3,575 in exchange for an ad in *Computer* and a conference announcement on the CS website for women that MOWG maintains.

<http://www.computer.org/portal/web/membership/Women-in-Computing>

We collected contact information from 250 interested women students, faculty, and industry representatives at GHC (v. 118 collected in 2010). The CS intends to contact them and encourage membership. Our booth made the CS more visible to the over 2,900 attendees (over 95% women); many stopped to talk.

## Contacts for Data Collection

During the GHC Senior Faculty Summit, we collected names of three women who were interested in helping with data collection and mentoring. Claudia Bauzer Medeiros, Ph.D., Full Professor, Institute of Computing, State University of Campinas, Brazil (cmbm@ic.unicamp.br) signed up to help and we spoke afterwards at the CS booth. As a result, she forwarded Brazilian government statistics for 2009 related to trends for women in computing at Brazil's universities. As this is in Portuguese, Graciela Perera volunteered to translate.

Other women at GHC who offered to send data and/or mentor students were:

- Dr. Anne C. Elster, Assoc. Professor, Dept. of Computer and Information Science, Norwegian University of Science and Technology, Trondheim, Norway, [elster@idi.ntnu.no](mailto:elster@idi.ntnu.no)
- Dr. Annemieke Craig, Assoc. Professor, School of Information Systems, Faculty of Business and Law, Deakin University, Geelong Victoria, Australia, [annemieke.craig@deakin.edu.au](mailto:annemieke.craig@deakin.edu.au)
- Debra Danielson, Computer Associates, [Debra.Danielson@ca.com](mailto:Debra.Danielson@ca.com)

## Data Collection Results

During the year, the MOWG held several teleconferences. One of the telephone conferences was with Caroline Simard, VP of Research & Executive Programs at the Anita Borg Institute for Women and Technology. Caroline Simard conducted a large scale research study for ABI with the Michelle R. Clayman Institute for Gender Research at Stanford University, titled "Climbing the Technical Ladder: Obstacles and Solutions for Mid-Level Women in Technology" ([http://www.stanford.edu/group/gender/ResearchPrograms/TopTech/Climbing\\_the\\_Technical\\_Ladder.pdf](http://www.stanford.edu/group/gender/ResearchPrograms/TopTech/Climbing_the_Technical_Ladder.pdf)). In this study, Caroline and other researchers interviewed seven high tech Silicon Valley companies, and reviewed literature. They concluded that a major issue in computer science is that there is a small pipeline of women which is decreasing in size. It is typical of these companies to employ 21% women in technology, who are distributed at the bottom of the ladder. Men are three times as likely to be in top positions. Isolation is a major factor preventing advancement. People network with people who are like them (there is unconscious bias), so women have less access to information and mentors. Thus their pattern for advancement is more difficult. Forming communities that support and encourage women is a way to address this problem.

Caroline mentioned that it is difficult to compare countries, as definitions of computing and technical vary. For example should we equate a call center position with a more technical position? Based on her research, she provided the following international data on women in computing.

India: It is hard to get data. The culture encourages women to get technical degrees, but then encourages them to leave the workforce once they marry. Women in computing are about 30% of the workforce in India. Some companies have 40 - 50% women. Most women are trained in Engineering B Technical Colleges where there are 20% women. Many people enter the program, but approximately 50% drop out.

Japan: Japan has high motivation as they are losing their competitive edge. They are closed to immigration and see increasing the number of women in technology as the answer. Their target is 25% women in science overall, and they are starting at 11%.

Romania (In the former Soviet Union and Eastern Block): Romania has over 30% women in computing / technology.

Asia: TBD

Malaysia: Caroline mentioned the work by Vivian Anette Lagesen, which we had also found, see the Outreach Committee archive for research on Malaysia. Lageson's article points to cultural factors that lead a larger percentage of women to enter the computing workforce than in the United States.

China: Getting reliable data is tricky as the data comes directly from the central government. Most women in computing in China appear to end up in academia.

South America: TBD

Brazil: Is similar to U.S. in numbers with women being 20% of the technology workforce. Brazil lumps computing and other fields.

Venezuela: In the UNESCO report, engineering and manufacturing are lumped together.

Uruguay has a higher number of women in computing than the U.S.

Chile has 20% women in the computing workforce.

Nordic European Countries: Have a higher percentage of women. Advancement is high.

Of interest is Harvard's Project Implicit, which represents a collaborative research effort between researchers at Harvard University, the University of Virginia, and University of Washington. While the particular purposes of each study vary considerably, most studies available at Project Implicit examine thoughts and feelings that exist either outside of conscious awareness or outside of conscious control. They found that people in 70 countries associate technology with males, and people define men as more competent in technology than women.

Caroline expressed her belief that the CS has a great opportunity to make a difference and made the following excellent suggestions for our committee:

- (1) Survey our membership for the information we are now trying to obtain.
- (2) Engage male leaders in IEEE and CS to promote women in computing.
- (3) Provide role models of successful technical women.
- (4) Women in CS chapters and women supporting ABI Regional Celebrations should collaborate on conference leadership and programs.
- (5) Create videos and other material that attracts high school students. ABI created a video of women at ABI saying "I am a Technical Women." A positive response was received from many high schools concerning the effect this video had on female students.

## Literature Concerning Countries with a High Percentage of Women in Computing

In A Cyber feminist Utopia? Perceptions of Gender and Computer Science among Malaysian Women Computer Science Students and Faculty, Vivian Anette Lagesen writes that in Malaysia "There are large numbers of women in computer science, and computer science is not perceived as "masculine." Rather, it is deemed as providing suitable jobs and good careers for women. This reflects an understanding of gender where femininities are constructed by association to office work, commonly recognized as a woman-friendly space because it is seen as more safe and protected than, for example, construction sites and factories. The findings suggest that "gender and computer science may be more diversely coproduced than commonly believed in Western research."

## Recommended Literature

1. Barriers to the Advancement of Technical Women, Anita Borg Institute (2007 review of the literature)
2. UNESCO Report (Engineering 2010)
3. Networking and Information Technology Workforce Report (May 2009)
4. Professional Women and Minorities, Commission on Professionals in Science and Technology (CPST), (17th ed. Nov. 2008)
5. Climbing the Technical Ladder, Obstacles and Solutions for Mid-Level Women in Technology, Michelle R. Clayman Institute for Gender Research at Stanford and Anita Borg Institute (2008)
6. International Workshop on Gender, Science, and Innovation for Development (Workshop Report, Jan. 2010)
7. Why So Few, Women in Science, Engineering, Technology, and Mathematics (AAUW Report, 2010)

## MOU with ABI

ABI and CS are concluding work on an MOU to formalize the informal alliance that already exists. Final agreement is expected in January. Postponement has been due to ABI priorities with GHC (November) and GHC, India (December).

## Research on Women in Computing

Pam Jones, a member of MOWG, worked with IEEE Research to survey over 1300 women asking 15 questions related to their goals, motivation, concerns, and what the IEEE can do to help them. Responses were received from women in all 10 IEEE regions, with slightly over 50% coming from the United States.

## ICC Recommendations Include Permanent Committee for Outreach to Women

At Jim Isaak's (Chair, Intersociety Cooperation Committee) request, we completed an MOU checklist concerning NCWIT for the CS ICC. The ICC recommended that MOWG establish a formal relationship with NCWIT but was not ready to make NCWIT a Sister Society as the CS is trying to reduce the number of Sister Societies. ICC also recommended that the MGAB establish a permanent committee on outreach to women, a suggestion with which we wholeheartedly agree; see above recommendations.

Below are a few pictures of our CS presence at the 2011 Grace Hopper Celebration of Women in Computing Conference.



**Dr. Stephanie White and Dr. Graciela Perera discuss CS membership with students at the Grace Hopper Conference**



**Dr. Stephanie White, Chair, CS Membership Outreach Working Group, with student attendee at Grace Hopper Conference**



**Dr. Graciela Perera, CS Membership Outreach Working Group member, discusses CS membership with a student at Grace Hopper Conference**