Broadening Participation of Female Students in Engineering Technology through a network of Peers

Amanda Hayley Abrew & Melanie L. Villatoro
New York City College of Technology

Abstract
There is a negative stigma centered on women’s capabilities in Engineering, which is cause for a stagnant rate of female retention in higher education. To move beyond stereotypical views of career choices for women in Engineering, the School of Technology and Design developed a peer advisement program to increase retention and enrollment of female students in associate degree programs in engineering technology. In its pilot phase, the program included civil engineering technology and architectural technology. In its current phase, the program expands to include mechanical engineering, computer engineering and computer systems technology. The program offered peer advisement, mentoring, tutoring and professional development workshops. In order to implement the program activities, experienced students were hired as peer advisors. An integral component of the role of the Peer Advisor is to create a safe environment, free of judgment, which promotes a community of support for women’s intellectual growth. The program provides female students with opportunities and support that encourages women to remain in the fields of engineering technology.

Introduction
The United States’ economy depends greatly on a citizenry that possesses scientific and technical skills within the fields of science, technology engineering and mathematics (STEM) for economic growth (Hill, 2010 in Weber, 2011). As technology advances rapidly the demand for skilled and knowledgeable individuals in STEM related fields increases. International competitiveness and homeland security focuses attention on the need to increase native participation in the U.S. science, technology, engineering, and mathematics workforce (DeCohen, 2009).

A common reason that young people become attracted to a career field is that the career appeals to their intellect and emotions: they are intellectually aware of the benefits of the work and emotionally committed to the work because of its personal relevance to their lives (Brown, 2001). For several years, educators have been worried about the relatively small number of students in general, and girls in particular, who choose science and technology in high school and undergraduate programs (Holmegaard et al. in Bamberger 2014). According to the Georgetown University Center for Education and the Workforce, “For every100 women who enter college, 12 will graduate with a Bachelor’s degree in a STEM major, 5 of them will be working in STEM after 2 years, only 3 of them will still be working in STEM after 10 years (Carnevale, Smith, & Melton, 2014). As the need for females in STEM careers continues there has been many studies designed to try to pinpoint the reason for the low representation of females in the major. Historically, researchers have pointed out gender differences in attitudes...
toward science and have noted that girls tend to percept science and its relevance to their life in a less positive way than boys (Bamberger, 2014). Women tend to seek out careers in which their work can be of help to other people and to society as a whole (Lurkin, 2010).

According to a study by the Center on Education and the Workforce at the Georgetown University, a growing demand is anticipated for that STEM workforce; in the meantime, National Math and Science Initiatives (2012) predicted a shortage of approximately three million skilled STEM workers by 2018. The need to increase the participation of women in STEM fields has never been more urgent.

Background

The American Association of University Women (AAUW) prepared a research report in 2010 studying the underrepresentation of females in STEM (Hill, Corbett, & St. Rose, 2010). Many contributing factors were reported for the low number of females in STEM as students and professionals. Three common themes were identified: the notion that men are better suited for STEM fields, lack of interest in STEM among females, and work-life balance in the STEM workplace. Educators are recognizing the importance of involving girls and minorities in technologies at an early age, when they are motivated by their own interests and not influenced by stereotypical views of career choices (Brown, 2001).

Research has shown that in the USA and Europe, students’ job aspirations still reflect the traditional men and women employment patterns. Through middle school age, students start to connect profession to gender identity (Bamberger, 2014). The public’s notion of an engineer is typically someone who wears a hard hat and routinely gets his hands dirty (Larkin, 2010). This masculine identity has not changed significantly over time and because of this, female students tend to believe they are not capable of working in such professional fields in the future.

Opportunities for women engineers have been made possible over recent years because of professional societies and organizations. Among these organizations, the Society of Women Engineers (SWE) seeks to establish engineering as a highly desirable career for women through its efforts, including training and development programs, networking opportunities, scholarships, and outreach and advocacy activities (Lurkin, 2010). The Women in Engineering Division of ASEE was established by society in 1978 (M. Gibbons, personal communication, September 28, 2009 in Lurkin, 2010). Through this division, issues common to women within all fields of engineering education are addressed. Particular emphasis is placed on the recruitment and retention of female students and on the reentry of women into the profession (e.g.; after perhaps taking time out to raise a family) (Lurkin, 2010).

For the past decade, the number of women receiving bachelor’s degrees in engineering has hovered between 14% and 18%. In 2008 the number of bachelor’s degrees awarded in engineering in the United States reached 74,170. Of this number, 18% were awarded to women (Lurkin, 2010). This number is 0.1% lower than in 2007. The disciplines granting the largest number of degrees to women were environmental (43.2%), biomedical (38.6%), and chemical (34.9%). Computer engineering ranked the lowest with 9.2% of its bachelor’s degrees granted to women (Lurkin, 2010). Despite considerable recent increases in the representation of women at all levels of STEM education, in 2006 only 26% of individuals employed in science and engineering occupations were female (Szelényi, 2013).
Studies show that retention can be improved by building students’ interest in STEM careers, creating supportive college environments, which provide adequate advising, and counteracting bias by providing female role models and mentors. Women who are in STEM fields contend with negative stereotypes that cast doubt on their abilities to perform well; same gender role models have proven an effective intervention to combat these stereotypes (Drury, Siy & Cheryan, 2011).

El Paso Community College established the Women in Technology (WIT) program to change social attitudes regarding women’s needs and abilities regarding technology. The WIT program offered technical education services for women and engaged in community outreach efforts, which included female mentors from the community. After 10 years in operation, female enrollment in technical fields at El Paso Community College has more than doubled (DiBenedetto, 1999 in Brown, 2001). A community of support and confirmation is essential for women’s intellectual growth (Gallos, 1995).

The peer advisement program focuses on creating a supportive environment for the females, providing them with positive role models, and developing skills desired in the workforce.

Peer Advisement Program

The purpose of the peer advisement program is to promote retention of female students within the major. Within this program we move beyond the implicit message to women that their unique history, training, and concerns are less important than those of men (Gallos, 1995). The program includes peer advisement, mentoring, tutoring, networking, professional development, community outreach and faculty development.

Peer Advisement - Peer advisors are available 20 hours per week to offer advice, tutoring, resume building and general college success tips on studying and time management.

Career Seminars - Students participated in seminars featuring women in nontraditional technical jobs were held. Representatives from professional societies were invited to share their experiences. Information on Research opportunities and internships was disseminated through workshops.

Soft Skills Workshops - Students participated in workshop on navigating the Cuny Portal and CunyFirst and networking and interview skills.

Networking Dinner - Faculty and Peer Advisors participated in a networking dinner and planning session hosted by the Department of Hospitality Management.

Community Outreach - Peer Advisors and program participants host monthly Family STEM workshops at the local elementary school to increase exposure of non traditional careers to a diverse population of children. Peer Advisors hosted a Girl Day event as part of National Engineers Week in an effort to recruit high school girls into the fields of engineering technology.
The program was coordinated by a student hired as a Program Coordinator, working 10 hours per week, under the supervision of a full-time faculty member. Each participating department recruited four students to work as peer advisors, each working five hours per week. The Peer Advisor’s responsibilities included: being available during schedule hours and monthly workshops; monthly advisement sessions; documenting advisement meetings and reporting any issues/concerns to the coordinator; and developing activities which promote social, academic and professional growth.

Participants in the peer advisement program were responsible for meeting with their peer advisor to create a resume to assist with internship placement. Discussing academic and career issues with peers was associated with higher professional outcome expectations, and the chances of achieving career success and combining a professional career with having a balanced personal life. Each participant was matched with a peer advisor, primarily based on class schedules. The peer advisors were available to all participants; however, each was responsible for communicating regularly with their assigned advisees. The peer advisors served as positive female role models enrolled in their same major. As they begin to think about career choices in upper-level courses, females who find role models from within the scientific community are more likely to pursue their interests in science (Austin & Sax, 1996; NRC in Weber, 2011).

Conclusion

The progress of each participant in the Peer Advisement program was monitored to provide retention rates of all program participants. Each participant had been enrolled in the department during the fall 2014 semester and they participated in the program during the spring 2015. A student is considered retained in the department if she is enrolled in department courses for the following semester. In the pilot phase, all participants were retained in their major. As Szelényi and Inkelas (2011) suggested, it is possible that the “presence of other female students as well as female peer and faculty mentors,” “the absence of men in the Living-Learning program,” “the interaction of the Living-Learning program practices, the focus on STEM, and the women-only environment,” or “the friendships and female STEM peer networks formed in Living-Learning programs” (p.363) might provide the kind of safe space that facilitates persistence in the highly competitive climate of STEM graduate education (Szelényi, 2013). Currently, there are about 50 participants in the program.

Participation in the program is designed to encourage female retention in the department and provide them with the personal and professional skills they need to successfully transition to higher levels of education and employment. Women have been asked to learn the experiences of men and accept it as representative of all human experience. When women cannot match these learning ways to their own lives or see them as relevant to their central needs or concerns, the women not the facts, theories, and curricula, have been termed deficient (e.g., Kohlberg, 1981; Vaillant, 1977 in Gallos, 1995). Strong standards, demands, and expectations are double-edged for women. They are impediments to independent thinking when women’s efforts to learn become mixed with efforts to please (Gallos, 1995). Clearly there is more work to be done; however, acknowledging that gender plays a powerful role in the college classroom and responding to the unique learning needs that women and men bring, we move closer to creating equitable learning environments for all our students (Gallos, 1995).
In a study using data from the 2007 National Study of Living Learning Programs (NSLLP), Soldner et al. (2012) found that women’s and men’s participation in STEM-focused Living-Learning programs is indirectly related to students’ likelihood of persistence in a STEM major through the social supports provided by the programs (Szelényi, 2013).
REFERENCES –


