

---

## **AC 2012-4599: WOMEN BECOMING WISE: GENDER, PROFESSIONAL DEVELOPMENT, AND PROGRAMMING FOR SUCCESS**

**Mrs. Sarah Miraglia, Syracuse University**

**Ms. Sharon W. Alestalo, Syracuse University**

Sharon W. Alestalo, M.S., is the Program Director for Syracuse University's Women in Science and Engineering (WISE) program within the colleges of Engineering and Computer Science and Arts and Sciences at Syracuse University. Alestalo came to the university with 25 years of practical and executive experience in social action venues and eight years in higher education settings. Her bachelor's and master's degrees are from the University at Albany in sociology and rehabilitation counseling, respectively. In addition to managing programs in the academy, Alestalo has worked with adults with a variety of disabilities and with children and families in both service and administrative capacities. During this time, she has developed an expertise in girls and women's issues, cultural competency, managing not-for-profit agencies, and program development and evaluation.

**Dr. Shobha K. Bhatia, Syracuse University**

Shobha Bhatia's areas of specialization are geotechnical and geosynthetic engineering. Her research is funded through an extensively funded research program, and she has produced more than 80 technical publications in prestigious journals and conference proceedings, along with invited participation in national and international conferences and key note addresses, short-courses, and service and leadership on numerous technical committees. Bhatia's extensive research has achieved both breadth and depth, ranging from the material characterization of soils to the application of geosynthetics and natural materials in waste containment, road and building construction, and erosion control. She has held numerous offices such as Vice President of the North American Geosynthetics Society (NAGS) and member of the prestigious Technical Committees Council and International Activities Committee Task Force of the Geo-Institute of the American Society of Civil Engineers (ASCE). Her collaborative research is further evidenced by her new vision which brought together the leaders in the field, ranging from psychology, management, law, public policy, and sociology to deal with a variety of issues concerning women and leadership. A case in point is the awarding of the ADVANCE Institutional Transformational Award for Women in Engineering Leadership Institute (WELI) (National Science Foundation, May 2003-2006). This multi-institutional proposal was accomplished by Bhatia and other internationally-renowned leaders from Utah University, Iowa University, University of California at Davis, University of Central Florida, Guelph University, and University of Louisiana. The main findings and contributions resulted in a co-authored book entitled "Engineering Women and Leadership," published by Morgan & Claypool Publisher, La Porte, Colo.

# **Women Becoming WiSE: Gender, Professional Development and Programming for Success**

## **Abstract**

While women have made great strides in science, technology, engineering and mathematics (STEM) disciplines, considerable gender based inequalities persist. The Women in Science and Engineering Future Professionals Program (WiSE-FPP) at Syracuse University (SU) is a program for women STEM doctoral students developed by Women in Science and Engineering (WiSE) through a collaboration with the Graduate School and the Colleges of Engineering and Computer Science, and Arts and Sciences that seeks to redress these inequalities. WiSE-FPP offers programming that confronts tensions surrounding the multiple and competing demands made on women's lives. Through workshops, panels, programs and informal events, WiSE enlists the support of experienced women faculty to guide and mentor WiSE-FPP participants in the subtleties of effectively practicing and engaging others with the professional and interpersonal skills that are increasingly necessary for career success. This essay introduces the reader to WiSE-FPP and its programs, and then offers evaluative evidence of the need for, and efficacy of, the program as reported by former and current WiSE-FPP Associates. We find that mentoring for career success, access to a community of like-minded women and the development of strategies for maintaining a viable work/life balance continue to be important to women's perseverance in STEM fields and show how WiSE-FPP supports women's persistence and resilience.

## **Introduction**

The science, technology, engineering and mathematics (STEM) worlds of academia and industry underwent undeniable changes in composition over the last half of the 20<sup>th</sup> century.<sup>i</sup> Once the exclusionary domain of white men, both sectors have made strides towards gender diversity in employment. Though notable improvements have been made, the pace of change has been uneven across fields of study and industry, and STEM fields have proven to be particularly resistant to change. In the academy in 1983, for example, women were 9.3% of full professors in science and engineering. In 2008, that number has unevenly risen to just over 20%, according to NSF's report *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011*. The report similarly finds that women as a percentage of full time junior faculty has risen to 42.3% from 30.1% in 1983.<sup>ii</sup> While clear progress has been made overall in STEM fields, engineering continues to be a largely male dominated domain with women comprising only 12.7% of total tenured or tenure track faculty. This figure represents the average percentage of women faculty in engineering, and an examination of the gender composition of engineering subfields reveals the unevenness of the gains women have made. For example, women make up 20.9% of tenured or tenure track faculty in environmental engineering and 19.4% in biomedical engineering, but only 8.6% in aerospace engineering and 10.1% in mechanical engineering.<sup>iii</sup> That academia and industry have been structured through predominantly male participation has

given rise to misconceptions, stereotypes and organizational cultures disadvantaging women entering into those spaces. The politically charged gendered landscape, what Julie Desjardins (2010), a noted author on the historical context of women in STEM, calls a ‘cult of masculinity,’ assumes that science is the province of men and the extent to which women are capable of being scientific is measured by their ability to assume a masculine posture.<sup>iv</sup> Thus, while women have made gains, the climate continues to be “chilly” for STEM women faculty and industry professionals.<sup>vivii</sup> Though policies may change, attitudes, norms, and values are not as pliable, as noted by Mason et al: “...assumptions about the “ideal worker” prevail, including a de facto requirement for inflexible, full-time devotion to education and employment...”<sup>viii</sup> The Women in Science and Engineering Future Professionals Program (WiSE-FPP) recognizes the persistence of challenging work norms and values in the lives and aspirations of STEM woman graduate students. The political debates shaping women in science continue to impact the personal lives of individual women. WiSE-FPP operates at this individual level to support women’s persistence and success in STEM. By offering programs and events that provide skills and strategies for negotiating gender-based inequalities in academia and industry, WiSE-FPP seeks to undermine these systems of inequality one STEM graduate at a time.

## Gender Matters

In the 1970’s, the women’s rights movement coined the phrase, “the personal is political.” The statement reflects the belief that women’s personal struggles reach beyond their individual lives to inequalities embedded in institutional contexts. In regards to women in STEM fields, the political contexts shaping their lives includes the underrepresentation of women in STEM fields, and an associated work culture that operates to exclude or inhibit career success and aspirations. While women have made strides towards greater representation in STEM fields, the pace of change has been slow and uneven across different disciplinary contexts and at different stages in the career trajectories of academic STEM women. For example, 2011 NSF data reports shows that in 2008, women earned 50.4% of all doctoral degrees awarded. However, gender continues to shape the degree process: in 2008 women earned only 22% of PhD’s awarded in computer science, 18% of PhD’s awarded in physics, and 21.6% of PhD’s awarded in engineering. By contrast, women earned 72% of PhD’s awarded in psychology, and 50.6% of PhD’s awarded in the biological sciences.<sup>ix</sup> The disciplinary breakdown largely corresponds to differences in sex/gender roles and expectations. While women are making inroads into STEM fields, their progress appears to be greatest in those fields that remain consistent with traditional gender schemas.

Women’s persistence in academic STEM has often been characterized by referencing “a leaky pipeline” where fewer and fewer women advance through each stage in their career.<sup>x</sup> The ‘leaky pipeline’ metaphor similarly applies to women’s employment in industry where the norms, values and informal networks that shape professional life are deeply embedded in a masculine orientation to working life, what Fox refers to as the “social and organizational context of science.”<sup>xi</sup> These informal structures can either be a barrier or an asset to success. A recent study published by the Harvard Business Review (HBR) finds that more than 52% of women in science, engineering and technology industries leave their private sector jobs. The HBR report

examines five characteristics of organizational cultures that contribute to these high attrition rates, including: ‘hostile macho cultures’ that limit women’s full participation; the isolation felt when women are a minority of the workforce; ‘mysterious career paths,’ or the uncertainty in regards to paths to advancement, a product of women’s exclusion from informal networks; ‘systems of risk and reward’ where women’s isolation leaves them feeling at greater risk of failure; and ‘extreme work pressures.’<sup>xiii</sup> Taken together, the authors find that these characteristics of STEM organizational cultures form a barrier to women’s advancement and persistence in employment, culminating into a gender based ‘brain drain’ that compromises the goal of hiring and retaining the best and brightest in STEM fields, whether in academia or industry.

Given that the male dominated cultures of research universities and industry positions have contributed to barriers to women’s success in STEM fields, WiSE programming operates at the personal level of these political tensions to provide support to women as they formulate a career path that furthers their professional and personal aspirations. Thus, while the personal is political mantra is applicable to an understanding of the status of women in STEM; the efforts of the WiSE program are focused on the inverse relationship of this mantra, i.e., the political as personal. That is, WiSE strives to effect change at the level of individual women’s lives by supporting the persistence and success of women in STEM. The point of intervention for WiSE, then, is individual women and groups of women in STEM striving towards a future in academia or industry.

## Overview of WiSE and WiSE-FPP

The WiSE umbrella program began in 1999 in response to a growing recognition of the underrepresentation of women faculty and students in the STEM departments. WiSE was created

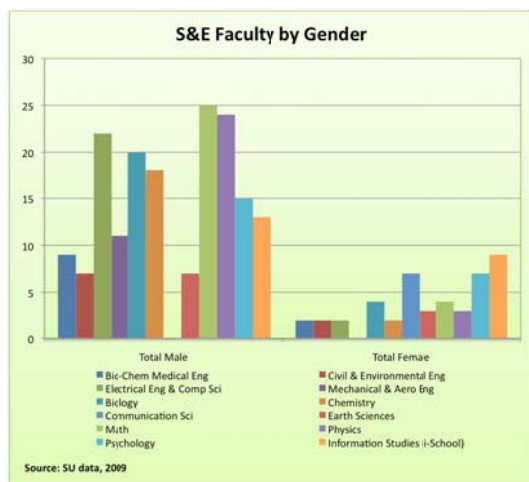


Chart 1: S&E Faculty by Gender

Working with Chancellor Nancy Cantor as Principal Investigator, WiSE wrote a successful National Science Foundation ADVANCE: Institutional Transformation grant in 2009 to address

the recruitment, retention and advancement of women STEM faculty at SU. WiSE has grown from a mentoring program and lecture series to a dynamic umbrella program that includes programs and events for undergraduate, graduate and faculty STEM women. Seeing corresponding concerns for persistence in STEM among doctoral students, WiSE created in 2006 and piloted in the 2007-2008 academic year, WiSE-FPP (Future Professionals Program), which has become one of the primary programs that addresses the needs of graduate women in STEM at SU.<sup>xiv</sup> As a result of these varied efforts, SU is addressing gender equity for women STEM faculty and students, and we see the numbers rising.

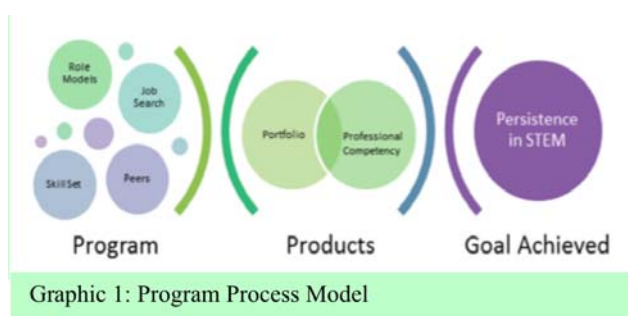
Since its inception WiSE-FPP has served a total of 69 MS and PhD graduate student women for 1 or 2 years.<sup>xv</sup> WiSE Associates are drawn from 13 departments with both male and female faculty nominating their students. Each department has referred at least one student, though the majority of the associates come from the physical and life sciences. This percentage has increased over time, which is attributed to the differing sizes of the colleges and the responsiveness of junior faculty. Chemistry and Psychology Departments have nominated the most associates at 12 and 9 apiece. The Biology and Biomedical and Chemical Engineering Departments round out this leadership group with 8 referred associates each. Of the 55 different professors nominating associates since its inception, 20% have nominated 2 or more students for WiSE-FPP participation. The number of associate positions available for the 2008-2009, 2009-

Information	Year 2008-2009	Year 2009-2010	Year 2010 - 2011
Total Served	20	21	28
Percent PhD students	95%	95%	93%
Percent of International	40%	48%	46%
Percent Engineering & CS	35%	24%	21%
Percent Arts & Sciences	65%	76%	79%

Table 1: Demographics

2010 and 2010-2011 academic years were 20, 21 and 28 (Table 1) respectively, though year end figures differ somewhat due a first year dropout rate of 25%, which is mostly due to the scheduling difficulties resulting from the rigor of pursuing a doctoral degree in STEM and conducting research. The sizes of the cohorts are driven in part by funding needs, which include sponsoring or co-sponsoring the panels, discussions and workshops offered to students, as well as a small stipend for WiSE-FPP Associates. The WiSE-FPP budget consists of allocations for professional and program staff, faculty allowance, associate stipends and of course event expenses. Faculty receive a small allowance to help relieve the pressure created by service outside of their faculty responsibilities. These funds can be designated for research, workstudy students, supplies for community programs they run, etc. Event costs vary by type but can include travel for guest presenters, printing, food & beverages and other logistical expenses. Stipends and event costs combined average about \$10,000 per year. In addition to budgetary constraints, however, the WiSE-FPP focus on mentoring is most effective when WiSE faculty leaders and volunteers are able to focus on smaller groups of WiSE-FPP Associates. WiSE Associate cohorts are consistently diverse; on average 45% of all participants are international students, including (but not limited to) students from China, Turkey, India and eastern European countries. The diversity embedded in the WiSE program mirrors the increasing diversity of the professional world. The interdisciplinary mix provides an additional layer of skill and knowledge necessary for success as associates become more familiar and comfortable with peers from outside their discipline.

In the midst of its fifth year, WiSE-FPP is an active and growing program, whose efforts are concentrated on providing support, career preparation and augmenting the professional skills, competencies and capacities of graduate women in STEM. This last area of emphasis reflects the ABET engineering accreditation criteria which includes not just technical skills but six professional skills essential to educating future engineers.<sup>xvi</sup> These skills included communication, teamwork, ethics and professionalism, engineering in a societal/global context, life-long learning and knowledge of contemporary issues (awareness skills). Higher education studies have shown that the way that graduate students are socialized into their graduate program and supported does make a difference. This process of socialization is influenced by department climate and student support services.<sup>xvii</sup> STEM women graduate and doctoral students face many challenges that affect their resiliency. STEM faculty (male and female) nominate students to the WiSE-FPP for a two year commitment that is rewarded with a certificate and small stipend. Faculty nomination ensures that the students are in good standing and that the faculty member supports the student’s commitment to WiSE-FPP. Students enter into the program at various stages of degree completion, the latent benefits of which include informal mentoring from more senior graduate students to graduate students early in their educational careers. Thus a culture of success for women and a strong community of women in STEM at the institutional level are



created within the WiSE-FPP program. Given these focal points, WiSE-FPP offers programming that helps STEM women to address the multiple and competing demands made on them and supports their professional competency and resilience (Graphic 1). It enlists the support of experienced women faculty and other role models to guide and informally mentor WiSE-FPP associates in the subtleties of effectively practicing and

engaging others with the professional and interpersonal skills that are increasingly necessary for career success. One student said, “The numerous guest speakers provided deep insight, guidance and first-hand knowledge that no other program or resource can provide.” In addition to workshops and programs that address job search and professional skills development there are forums for interacting with and learning from peers. “Through WISE, not only did I shape my professional development but I also met colleagues from diverse fields which has broadened my research interests.” The professional skills include career mapping and job searches, networking, communication, teamwork, self-awareness and evaluation, and conflict management to name a few. By gaining competence in each of these domains, women doctoral students can address the challenges created by the pervasive masculine norms and values that have taken shape in STEM. In addition, WiSE-FPP through skills workshops and peer and professional critiques helps these women to develop their professional portfolio in preparation for a career in the academy or industry. The program component table (Table 2) above lists all the program expectations. Through an application of these components over a 2-year period, WiSE-FPP uniquely seeks to provide

WiSE –FPP Program Components
Faculty Nomination
Two-year Commitment
Monthly Program Activities
Interactions with Role Models and Peers
Portfolio and Job Search Skills Development
Portfolio Critique
Certificate and Stipend
Table 2: Program Components

STEM women doctoral students with the environment and knowledge that builds upon their considerable potential for success in STEM fields.

## **Evaluating the Success of WiSE-FPP**

Measuring the success of programs geared towards supporting women in STEM is a complex task. This complexity is set within a context of debates regarding what should be measured and how to measure. Is success measured by the entrée of women into previously male-dominated disciplines or by reduction of the attrition rate? But what if the attrition means that some women have moved on to a better situation such as a more prestigious research group or a positional promotion? Shouldn't that be considered success? Do numbers alone determine success, or is there something about institutional change that should be measured as part of an evaluation? Are women's attitudinal changes important to an evaluation of success, and what metrics might be used to address this aspect? The debates surrounding the issue of measuring success for women in STEM inform the evaluative work that WiSE engages. However, the WiSE-FPP program is relatively new, which limits the evaluative data that can be drawn on. As such, the current evaluative focus centers on the perceptions of WiSE-FPP participants in regards to the benefits of participation in specific WiSE programs, and in the WiSE-FPP program in general. We understand our mission as one that provides support, informed by the research on resilience, to women in STEM and thus, our evaluations center on a determination of the efficacy of those support systems as they are experienced by WiSE-FPP Associates.

As a dynamic program WiSE-FPP consistently evaluates the impact of its programming, which includes workshops, lectures, panel discussions, and informal social and networking events, which are led by male and female faculty and professionals. Standardized evaluations are distributed and collected for each session, thus permitting analyses of each workshop individually, and analyses across time and topic. We make use of this evaluative data to hone the effectiveness and fit of the program for the women it serves. Typically we have 12-18 Associates attending any given event, and routinely receive evaluations from 90% or more of those participants. In addition to these individual evaluations, WiSE administers an end of year interview evaluation through which WiSE-FPP Associates are asked a series of opened-ended questions aimed at elucidating their experience with WiSE. Finally, WiSE recently administered an online survey to WiSE alumnae. Out of the 69 women served, 17 have thus far responded (a roughly 25% response rate) to the online survey, many of whom are in the final stages of completing the dissertation. The following discussion summarizes some of the main themes that emerged from a meta-analysis of the data from the individual workshops, the year-end evaluations and the online survey administered to WiSE-FPP alum.

## **Mentoring for Success**

While gender based concerns are increasingly being addressed in institutional landscapes and gendered divisions of labor are more egalitarian, the need persists for gender appropriate mentors

and role models for future professionals in STEM disciplines. While notable changes in gender roles and expectations are occurring in academia, these changes are not always felt at individual levels of experience. While formal shifts in institutional policies change, there is a lag time between changes in policy and changes in practice.<sup>xviii</sup> These changes are not solely the province or responsibility of male colleagues and academics. Women have also “internalized a set of assumptions about how to succeed professionally: work “24/7,” do not have children, spend more time in the lab to do better-quality work, and accept that current demographics of the STEM workforce reflect a meritorious selection process.”<sup>xix</sup> As such, women’s participation and implicit consent to these professional standards similarly extends the life of male-dominated work cultures. WiSE seeks to upend the subtle forms of gender inequality – those in institutions, but also those held as personal beliefs – that continue to affect women’s chances and opportunities for success.<sup>xx</sup> This is accomplished by offering a diverse array of workshops, lectures, panels and discussions that provide WiSE-FPP Associates with the tools, tips and strategies for success that women in academia and industry have found to be useful. These workshops are individually beneficial to the Associates, as they offer models of success for their own career aspirations. Additionally, however, WiSE programming supports them as they create and imagine their career portfolios. Listening to and learning from both male and female academics and industry professionals broadens the horizons of what is permissible, possible and desired by future employers. Given that women frequently underreport their accomplishments, these experiences create a space where STEM women begin to envision and articulate their skills and capabilities as marketable assets.<sup>xxi</sup> While new topics and programs are introduced every year, WiSE-FPP consistently offers a core package of programs that facilitate and support women’s success. These include:

- A CV/Resume Development workshop led by career service professionals representing both academia and industry
- A CV/Resume Roundtable Review that brings together industry leaders from the local community and WiSE-FPP Associates seeking careers in industry. The 2011/2012 CV/Resume Roundtable also included a WiSE Faculty Leader who reviewed the CV’s of those students who indicated their interest in pursuing an academic career path
- A Job Interview Skills workshop, led by WiSE Faculty leaders, as well as industry representatives
- A Strengthening References workshop, led by professionals in academia and industry

While the information offered at these workshops is content that is largely relevant to male and female audiences alike, the gender impact of the programming lies in the sharing of experiences by the workshop leaders coupled with research and insight regarding the informal gender biases that impact women’s professional development and career advancement. These biases are subtle and oftentimes unacknowledged, as Virginia Valian points out: Gender schemas skew our perception of women’s skills, knowledge and abilities. These skewed perceptions culminate in an accumulation of disadvantages for women in STEM, disadvantages so pedestrian that they are frequently dismissed at the level of individual experience and interaction. However, what is seen as molehills of small experiences for individuals become a mountain of deterrents that jeopardizes women’s achievement.<sup>xxii</sup> In this context, the value of sharing of authentic experiences and tested solutions in a safe environment alongside formal mentoring for career development is that this nuanced approach begins to chip away at the mountains that stand in the way of women’s success. Taken together, these workshops provide WiSE-FPP Associates with



an assemblage of skills, tools and resources that are understood alongside a firm grounding in the subtleties of gender bias in STEM career fields.

The CV/Resume Development workshop and review instructs students in the subtleties of creating documents that highlight the skills and competencies the students have gained. The workshops cover various topics, including the differences between a CV and a resume, highlighting the items of critical importance, creating a persuasive CV or resume, properly accounting for one's accomplishments and skills, and tailoring the document to the position being applied for. These workshops are designed to facilitate what Rankin, Nielsen and Stanley (2010) call 'tacit knowledge,' or knowledge gained through inclusion in informal networks. Here, they argue, women tend to lack access to the networks through which these types of norms circulate, thus limiting women's abilities to make well-informed decisions about their academic lives and goals. WiSE workshops serve as arenas through which women gain access to this critical information, and the evaluative evidence from WiSE-FPP Associates suggests that this information does indeed fill a gap in mentoring and support. The CV/Resume workshop is consistently highly rated by WiSE Associates. For example, 13 of the 15 (86.7%) of attendees at the 2010/2011 workshop and 100% of the 10 attendees of the 2011/2012 workshop strongly agreed or agreed that the content was relevant to their careers. Further, 100% of attendees of the 2011/2012 workshops strongly agreed or agreed that they were provided with strategies they can make use of.

Qualitative evaluations similarly illustrate the extent to which the workshop is felt as necessary and of practical use. For example, the following strategies were highlighted as useful: tailoring the CV to the position applied for, organizing the CV to make it reader friendly, and making use of font, content and headings to highlight key skills. Importantly, several of the participants of the 2010/2011 workshop found the discussion of the distinctions between a CV and a resume useful. One participant notes that the discussion was useful for her because so much of her graduate schooling centered on conducting research, rather than developing professional skills and capacities. For WiSE-FPP Associates, these workshops fill a critical gap in knowledge and provide a firm understanding of the skills necessary for success. WiSE-FPP Associate evaluations make clear the extent to which WiSE-FPP is successful in its mission to support the persistence of women in STEM. In particular, WiSE-FPP Associates value the mentoring provided by faculty STEM women and STEM women in industry. Take for instance, the following statement made by a WiSE-FPP alumnus: "I was really encouraged by other women who have made it to the top and I believe that is why I keep striving to make an impact in my career as a teacher." Similarly, another WiSE-FPP alumnus notes the following: "During the fellowship with WiSE-FPP, I had the opportunity to meet women who do exemplary work, and who have a variety of expertise and experience. The guidance that I received from them helped me approach the academic job search with more confidence." In both of these examples, the mentoring offered through WiSE-FPP was a crucial component of envisioning and striving for success in STEM fields. For women in STEM, meeting and listening to the stories of women who have achieved success in their chosen fields validates their own goals for professional success and provides a model of attainment that is congruent with their experiences and challenges as women.<sup>xxiii</sup>

Entering the job market is an uncertain period for most graduate students. Women in STEM fields, however, face particular challenges as they seek employment in academic departments and in industries where women continue to be underrepresented. Establishing their merit as researchers and/or faculty members is a daunting task, one that WiSE-FPP lends support to through workshops designed to provide students with tools for successfully navigating their own career paths. The workshops offered by WiSE-FPP are consistently well attended and highly rated by WiSE Associates. The 2010/2011 Research/Teaching statement workshop is one such example. This workshop provided students with an understanding of how to effectively self-promote through the personal statement, and how to understand and highlight important distinctions between statements created for academic vs. industry positions. The reception of this workshop was excellent. The vast majority – 90% - of participants stated that the workshop was relevant and noted that it should be repeated in future years. The write-in portion of the evaluation included the following positive responses regarding lessons learned: the workshop gave me “a better understanding of writing the documents for a professional portfolio,” how to “develop a teaching philosophy,” and “how to write a proper research statement.” Though accomplished women, they are often uncomfortable with identifying themselves as such. Learning to understand what personal/professional traits make them an excellent hire, and how to communicate these effectively are skills they must cultivate. Consequently, WiSE also holds workshops geared towards improving job interview skills that provided students with valuable and practical advice. Once again, 90% of participants (18 out of 20) stated that the workshop was relevant and 95% (19 out of 20) believed it should be offered in the future. The qualitative responses were particularly strong for this workshop. Students noted that they learned how to ‘evaluate themselves before an interview,’ ‘turn negatives into positives,’ ‘prepare for possible questions,’ ‘prioritize strengths and weaknesses,’ and ‘how and when to follow-up after the interview.’ Taken together, these workshops form a foundation for success that Associates find helpful and necessary.

### *A Sense of Community*

The graduate school experience can be isolating; the rigors of academic life often leave little room for socializing outside of one’s department or research lab. For graduate women in STEM fields, the isolation is compounded by the dearth of women in their departments. As a woman-centered program, WiSE offers a space for women from different disciplines and backgrounds to come together and share ideas, stories and experiences across multiple categories of difference (e.g., nationality, age, race, life course, field of study). Importantly, these largely informal exchanges are also opportunities for peer mentoring. As one WiSE-FPP Associate noted, “the informal social thing can help us exchange our ideas. [...] Sometimes when you’re under pressure, you don’t know what to do, you can consult with others and see whether they have the same problem and how they handle it.” Similarly, another WiSE Associate noted, “it is really kind of nice to open up to peers. You know, not that we have a lot of experience, but there were people who were older. I was a first year last year, and there are people who are in their third year or graduating, and we could continue conversations in the larger sense with people who are more experienced...” In both cases, the students are expressing the benefits of learning from

women in other disciplinary contexts and the value of hearing how others manage the stressors of academic life.

The sense of community engendered through participation in WiSE provides yet another benefit for graduate students: camaraderie. Throughout the brief history of the program, WiSE has provided the time and space for women from different disciplines to come together as friends and colleagues. Students consistently report that they enjoy the time spent with other graduate women. As one Associate notes, “I think for me, it was kind of nice to build more of a network of women around me that had similar career goals. Sometimes you feel cramped up in your office and, you know, you only have your immediate colleagues and some of them are male and some are female, but kind of branching out and having that support from other women who have similar career goals, similar interests was important...” Similarly, WiSE Associates have noted the value of recognizing and appreciating similar goals and desires across disciplinary boundaries, as seen in the following statement: “I met someone in math the other day and we had a great conversation about how she wants to be a math educator and I want to be a science educator, and it just seemed like a good fit to talk about similar career goals.” As this reflection suggests, WiSE events provide a space for women to lend support to one another, to share goals and aspirations, and to voice concerns and frustrations with someone who understands. Professionally, the value of a supportive network was highlighted in the evaluations of voluntary research presentations delivered to the group by WiSE-FPP Associates. Some of the lessons gained from these workshops include: learning to separate critiques from personal attacks, learning to critique in a direct but polite manner, taking the risk of presenting research, learning how to be a good listener, and seeing different presentation styles and which were effective. For the presenter, the value of these experiences is evidenced in her evaluation: “I gave a presentation and it was good to give it to a general audience, so I actually would have to explain math to a general audience, and that was a good thing to do.” As these evaluations suggest, creating an open and safe space where young scholars can constructively engage both as presenters and audience members is essential for building professional skills, but also for engaging with other women whose experiences of graduate school are similar to their own.

### *Work/Life Balance Issues*

Women graduate students in science and engineering fields are acutely aware of the demands that are placed on their time in order for them to be successful in their chosen fields. They are also keen observers of their advisors and often question if the level of personal sacrifice made by both men and women in academic and research science and engineering arenas is worth it. Despite the emergence of more egalitarian divisions of labor within the home, many women continue to experience the dual burdens of paid and unpaid labor. Further, though various workplaces have begun to address gender inequalities, the predominance of a male norm has been historically constructed and thus cannot be reversed overnight. As research has shown, concerns over achieving a work/life balance are felt more acutely by women than men in STEM fields. For instance, a research survey of graduate students, postdoctoral fellows and tenure track/tenured faculty found that more graduate student women than men (28.5% of women vs. 7.2% of men) are concerned that a career in science will be detrimental to their plans for a family

(Ecklund and Lincoln 2011: 4).<sup>xxiv</sup> For many women – and some men – these concerns persist beyond the graduate experience. For example, a 2009 National Research Council of the National Academy of Sciences report found that women who receive a doctorate in science and engineering are less likely than men to seek academic research positions, and are more likely to drop out of the academy before tenure when they do pursue a faculty position.<sup>xxv1</sup> A November 2009 report by the University of California, Berkeley conducted research to understand the reasons behind this phenomenon. The study authors, Goulden et al, found that women are most likely to leave after marriage and starting a family when the pressures of searching for funds, long work hours, time constraints and publishing requirements become increasingly difficult to manage while carrying the responsibilities of caregiving and household duties.<sup>xxvi</sup> As these studies illustrate, there are discernible gender-based inequalities that inhibit the full participation of women in STEM. Carrying a double workload is a burden that is not sustainable for long-term success.

The applicability of this research to the lives of WiSE-FPP Associates is evidenced in their concerns over seeing their STEM faculty woman advisors and mentors carry out the double workload of paid employment and unpaid labor in the home. The overall picture appears as one where women are expected to manage two exclusive and competing aspects of their lives. As one WiSE Associate noted: “...I heard from my advisers that if you want to go to academia before you have tenure...[you] think [of] nothing but your research. That’s horrible! Especially for women, right? Because that’s the best time of your life...from 20’s to 30’s. [...] If in that period you don’t do anything but research you might miss the good time of life to get marr[ied] and have kids.” To address these concerns, WiSE routinely hosts ‘Work/Life Balance’ workshops aimed at providing women graduate students with tools, tips and strategies for negotiating the multiple and competing demands women encounter. Student evaluations of the Work/Life Balance workshops have continuously shown that students find these workshops necessary, useful and enlightening. There is a bit of a discrepancy in the data, however. While qualitative evaluations nearly universally in favor of the work/life balance workshops and their usefulness and applicability to their lives, the quantitative evaluation measures are not as universally positive. For example, evaluations from the workshop held in the 2010/2011 academic year found that out of 23 participants, 18 (78.3%) strongly agreed or agreed that the information was relevant to their experience. Similarly, evaluations from the 2011/2012 academic year showed that 8 out of 13 (61.5%) participants strongly agree or agree that the content was found to be relevant to their academic and professional careers. While these figures suggest a lukewarm response, qualitative evaluations, in the form of written evaluations and interview responses, are positive about the tools and strategies gained from these workshops and appreciative of the opportunity to hear how professional families manage their lives. And this sentiment is also found in the alumni surveyed. Both groups continue to point out the need for these types of discussions for women in STEM. For example, evaluations from the 2010/2011 work/life balance workshop include the following responses to the question, “What did you learn from the workshop?” “The real stories are very helpful.” “That it [a work/life balance] is possible. It’s hard to see the light at the end of the tunnel when your spouse is living in another state.” “Strategies and attitudes needed to cope with the reality of being a couple in academia.” The numerical data may represent lingering uncertainties in regards to achieving a full and sustainable work/life balance, while the qualitative evaluations represent the hope and beginnings of achieving a healthy work/life balance.

Similarly, qualitative evaluations from the 2011/2012 work/life balance workshop showed that WiSE-FPP Associates found the skills and strategies offered essential while also registering some overall dissatisfaction with the workshop. This workshop focused on balancing work/life duties in such a way that allowed for an integration of personal values with professional goals. This point of entry into a work/life balance discussion provided the Associates with a view of professional life as wholly embodied a perspective that works against the divided work/life model that currently dominates academic and organizational cultures. The value of this approach is reflected in Associate evaluations: “The most useful technique for me was to try to incorporate something that I love into my everyday life.” Another stated that she gained an appreciation for how to “use soulful values in professional life.” Similarly, one Associate stated the following as important for her: “Finding a job that fits into your passion areas.” The importance of these qualitative responses lies in their ability to challenge and undermine the classic conundrum women in academia and industry face: the challenge of having a successful career and a family. In these responses we can see a newfound sense of hope for a rewarding and full future, one where professional and family lives don’t stand in opposition to one another, but where each are complementary to one another and where both are vital to personal success. As these examples indicate, WiSE-FPP Associates are clear that these workshops do indeed support women’s persistence. The interventions afforded by the workshops work against the prevailing view that women must sacrifice or put off a family if they want a career.

## **Conclusion**

Perhaps the greatest measure of success is the extent to which WiSE Associates gain a sense of empowerment and autonomy in their professional and personal lives and choices. The mentoring facilitated by WiSE faculty and speakers opens up space for new ways of thinking about their futures. This sentiment is represented in the end of year evaluation interviews conducted by WiSE. One WiSE Associate, for example, notes that she has begun to think more broadly about her career path: “When I joined the program, I was pretty committed to joining to be a science teacher educator...and I still think I want to pursue that, but I’m also curious about the other options that I might pursue that might not be in academia. I’ve recently become more interested in policy work and wondered how could I use my PhD when finished to maybe influence education policy, rather than confine myself to one career goal.” Here, the student is reflecting on an enlarged sense of possibility for the future, one that was facilitated by WiSE programming, faculty and guest speakers.

WiSE-FPP uniquely seeks to bolster women’s abilities to flourish professionally and become WiSE women using key skills and knowledge to brilliantly navigate within these male dominated fields. It is often the panels of women professionals and academicians that gain the most appreciation from the Associates as they discuss the pressing concerns for women in STEM. One of our first Associates from 2007-2008 recently wrote to us to say that “The work-life balance panel was interesting and something I’ve often reflected on.” Another said, “The

numerous guest speakers provided deep insight, guidance and first-hand knowledge that no other program or resource can provide.” One former Associate sums it up as follows:

*“The events organized by WISE has exposed us to life in academic, industry and the skills required to balance work and personal life by role models from the field. The numerous guest speakers provided deep insight, guidance and first-hand knowledge that no other program or resource can provide. In addition, the portfolio development and reviews provided by faculty gave us a head start in my career path. The faculty, mentors, staff and fellow members at WISE were an integral part and contributed a major role in my aspirations for a better future. Through WISE not only I was able to shape my professional development but also met colleagues from diverse fields, which has broadened my research interests.”*

While becoming wise women, Associates benefit greatly from relationships with WiSE women. As C.S. Lewis once said “The next best thing to being wise oneself is to live in a circle of those who are.” WiSE-FPP is that circle.

Acknowledgments : The authors wish to thank the STEM women faculty and industry professionals who have spent many volunteer hours to create relevant and content savvy programs as well as a circle of support for WiSE-FPP associates. Furthermore, Chancellor Nancy Cantor and Provost Eric Spina have provided unparalleled support for the work of WiSE and we are deeply appreciative.

## References:

- 
- i Kohlstedt, S.G. 2004. “Sustaining Gains: Reflections on Women in Science and Technology in 20th – Century United States.” *NWSA Journal*, 16.1: (1-26).
  - ii National Science Foundation, Division of Science Resources Statistics. 2011. *Women, Minorities, and Persons with Disabilities in Science and Engineering*. Special Report NSF 11-309. Arlington, VA. Available at <http://www.nsf.gov/statistics/wmpd/>.
  - iii Gibbons, M. 2010. “Engineering By the Numbers.” American Society for Engineering Education.” Washington, DC: ASEE. Available at: <http://www.asee.org/papers-and-publications/publications/college-profiles/2010-profile-engineering-statistics.pdf>
  - iv Desjardins, Julie. 2010. *The Madame Curie complex: the hidden history of women in science*. New York, NY: The Feminist Press, CUNY.
  - v Xu, Y.J., Martin, C.L. 2011. “Gender Differences in STEM Disciplines: From the Aspects of Informal Professional Networking and Faculty Career Development.” *Gender Issues*, 28: (134-154).
  - vi Hughes, R.M. (2010) “Keeping University Women in STEM Fields.” *International Journal of Gender, Science and Technology*, 2.3: (416-436).
  - vii Chesler, N.C., et al. 2010. “The Pipeline Still Leaks and More Than You Think: A Status Report on Gender Diversity in Biomedical Engineering.” *Annals of Biomedical Engineering*, 38.5: (1928-1935).
  - viii Mason, M., Goulden, M., and Frasch, K. 2009. “Why Graduate Students Reject the Fast Track.” Washington, DC: American Association of University Professors.
  - ix National Science Foundation, Division of Science Resources Statistics. 2011. *Women, Minorities, and Persons with Disabilities in Science and Engineering*. Special Report NSF 11-309. Arlington, VA. Available at <http://www.nsf.gov/statistics/wmpd/>.
  - x Kaminski, D., and Geisler, C. 2012. “Survival Analysis of Faculty Retention in Science and Engineering by Gender.” *Science*, 335: (864-866).
  - xi Fox, M. 2001. “Women, Science, and Academia: Graduate Education and Careers.” *Gender and Society*, 15.5: (654-666).
  - xii Hewlett, S., Buck Luce, C., Servon, L., Sherbin, L., Shiller, P., Sosnovich, E., and Sumberg, K. 2008. *The Athena Factor: Reversing the Brain Drain in Science, Engineering, and Technology*. Harvard Business Review Research Report, Center for Work-Life Policy. Harvard Business School Publishing Corporation.

- 
- xiii Burack, C. and Franks, S.E. 2004. "Telling Stories about Engineering: Group Dynamics and Resistance to Diversity." *NWSA Journal*, 16.1: (79-95).
- xiv Bhatia, S., and Priest Amati, J. 2010. "'If These Women Can Do It, I Can Do It, Too': Building Women Engineering Leaders through Graduate Peer Mentoring." *Leadership and Management in Engineering*.
- xv As of fall 2011, WiSE-FPP includes PhD students only. This is because program is structured for 2 years of participation, a commitment that is not always feasible for MS students.
- xvi Shuman, L.J., Besterfield-Sacre, M. and McGourty, J. 2005. "The ABET "Professional Skills" – Can they be taught? Can they be Assessed?" *Journal of Engineering Education*, 94.1: (41-55).
- xvii Bieber, J.P. and Worley, L.K. 2006. "Conceptualizing the Academic Life: Graduate Students' Perspectives." *The Journal of Higher Education*, 77.6: (1009-1035).
- xviii Bix, A.S. 2004. "From "Engineeresses" to "Girl Engineers" to "Good Engineers": A History of Women's U.S. Engineering Education." *NWSA Journal*, 16.1: (27-49).
- xix Rankin, P., Nielsen, J., and Stanley, D. 2010. "Weak Links, Hot Networks, and Tacit Knowledge. Why Advancing Women Requires Networking." *Transforming Science and Engineering: Advancing Academic Women*, Stewart, A., Malley, J., and LaVaque-Manty, eds., . Ann Arbor: University of Michigan Press (pgs. 3-47).
- xx Clewell, B.C. and Campbell, P.B. 2002. "Taking Stock: Where We've Been, Where We Are, Where We're Going." *Journal of Women and Minorities in Science and Engineering*, 8: (255-284).
- xxi Zeldin, A.L., Britner, S.L., and Pajares, F. 2008. "A Comparative Study of the Self-Efficacy Beliefs of Successful Men and Women in Mathematics, Science, and Technology Careers." *Journal of Research in Science Teaching*, 45.9: (1036-1058).
- xxii Valian, V. 2006. "Women at the top in science – And elsewhere." Why aren't more women in science? Top researchers debate the evidence, S.J. Ceci and W.M. Williams, eds., American Psychological Association, Washington, D.C., 27-37.
- xxiii Gorman, S.T., et al. 2010. "Women in the Academy: Female Leadership in STEM Education and the Evolution of a Mentoring Web." *Forum on Public Policy Online*, 2: (21 pgs). Available at: <http://forumonpublicpolicy.com/spring2010.vol2010/spring2010archive/gorman.pdf>.
- xxiv Ecklund, EH and Lincolne, AE. 2011. "Scientists Want More Children." *PLoS ONE* 6(8): e22590. doi:10.1371/journal.pone.022590.
- xxv National Research Council, "Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty" (Washington, D.C.: National Academies Press, 2009).
- xxvi Goulden, M., Frasch, K. and Mason, M., "Staying Competitive: Patching America's Leaky Pipeline in the Sciences." (Berkeley, CA: The University of California, Berkeley, Berkeley Center on Health, Economics & Family Security and The Center for American Progress, November 2009).