Silicon Valley Women in Engineering Conference – Creating Community and Nurturing Engineering Identity

Belle Wei
Charles W. Davidson College of Engineering
San Jose State University
San Jose, CA, U.S.A
belle.wei@sjsu.edu

Amy Strage
Center for Faculty Development
San Jose State University
San Jose, CA, U.S.A
amy.strage@sjsu.edu

Jinny Rhee
Charles W. Davidson College of Engineering
San Jose State University
San Jose, CA, U.S.A
jinny.rhee@sjsu.edu

***Abstract*—This innovative practice paper presents a work-in-progress project that aims to nurture engineering identity development of women engineering students. Affirmative engineering identity development helps women students better chart a successful academic and professional trajectory. Participating in communities of practice furthers their identity development process. This paper describes the 2017 Silicon Valley Women in Engineering Conference in which students learned from and socialized with role models from industry, as well as reflected upon how what they were learning was aligned with their sense of their own professional identities. Examining the impact of attending the conference has produced some promising insights as we strive to create viable career pathways into fields where women have heretofore been significantly underrepresented.**

Keywords—engineering identity, identity development, women in engineering, women in technology, women in computing, communities of practice

I. INTRODUCTION AND BACKGROUND

To address global problems of climate change, national competitiveness and security, the United States needs more engineers and programmers. Recruiting, retaining, and supporting women's success in engineering and computing to fill this gap has become ever more critical. In 2015, for example, women accounted for 57% of bachelor's graduates [1], but only 18% of engineering and computing graduates [2].

Common approaches to drawing more women to the field include developing targeted admissions policies and outreach efforts [3]; providing academic and social support services [3][4] as well as financial assistance and scholarships [4][5]. These approaches have succeeded in recruiting more women into the pipeline and supporting them as they fulfill their degree requirements. But research reveals that they are still at risk of not persisting because of gender marginalization [6][7].

This project was supported in part by the U.S. National Science Foundation Grant (DUE-1626600), the Carolyn and Mark Guidry Family Foundation, Applied Materials, and Synopsys.

The literature points to the critical role of social and affective factors as possible solutions. Identity and identify development [8] have played a critical part in determining the course of prospective engineers' early professional trajectory. Referencing the framework of "possible selves" [9], Bennett and Male [10] note the need to encourage students to explore potential future roles as they think about potential engineering careers. Further, according to Wenger [11][12], identities are shaped as individuals participate in communities of practice and boundary processes among them. Learning takes place at the boundaries as personal experience interacts with social competence that characterizes communities of practice. Also important are social connections that include peer networks and professional networks, as well as opportunities to interact, first-hand, with role models [13]–[15].

In addition, a number of studies [8][16]–[19] point to the benefits of reflecting on how these experiences combine to form a coherent and nuanced engineering identity. Engineering identity could be measured by a variety of indicators ranging from students' declaration of engineering majors to multi-factorial profiles of their internal states and external contexts [20]–[23].

II. THE SILICON VALLEY WOMEN IN ENGINEERING CONFERENCE—A COMMUNITY OF PRACTICE

Drawing upon this research, we implemented a Silicon Valley Women in Engineering (WiE) Conference for women engineering students to socialize with peers and role models from industry, to explore professional career pathways, to learn cutting-edge topics, and to reflect upon how what they were learning was aligned with their sense of their own professional identities.

In this paper, we report on the experience of participants in the 2017 Silicon Valley WiE Conference. The one-day program included four keynote speakers, four career panels (Information Technology; Electronics and Biomedical; Semiconductor Equipment and Aerospace; and Building, Infrastructure and the Environment), 15 technical sessions, nine

978-1-5386-1174-6/18/$31.00 ©2018 IEEE

sessions on personal growth and development, and a network reception and dinner. Technical sessions cover topics such as renewable energy, applied computing, machine learning, cybersecurity, smart grids, self-driving cars, drones, bioinformatics, virtual reality, and robotics. Participants included 391 students as well as 90 presenters, most of whom are women, from 49 companies and organizations.

III. Assessing the Conference Impact

Online surveys were sent to conference attendees one week before and one week after the conference. Responses to the pre-conference survey were received from 160 participants; responses to the post-conference survey were received from 109 participants; and 62 attendees responded to both the pre- and post-conference survey, reflecting 41%, 28% and 16% response rates, respectively. Approximately one fifth of the respondents to the pre-survey (30 of 160, or 19%) indicated that they had attended a prior Women in Engineering conference.

A. Pre-conference Survey

This instrument was designed to encourage participants to begin to reflect upon what they hoped to derive from the day and how best to ensure that their goals in attending the conference were achieved. The survey consisted of four open-ended questions: (1) What were participants' reasons for attending the conference? (2) How does the conference relate to their educational goals? (3) How does the conference relate to their career goals? And (4) How have they prepared for the conference?

Overall, responses to these prompts suggest that students took the opportunity to participate in the conference seriously: Half (50%) looked forward to the networking, and a quarter (26%) anticipated learning about particular technical topics, careers or industry trends. Nearly half studied the program (45%); over a quarter revised their resumes and prepared business cards (26%); and a number researched the presenters (15%). The most common theme running through responses to the question of why students planned to attend was the *opportunity to meet and connect with inspiring role models from industry*. Below are sample responses:

- Having the opportunity to listen to the guest speakers' stories about how they got to where they are today. I'm attending this conference because I am interested in learning more about being a woman in my field and what it takes to be successful.
- I want to hear the experience of other engineers and get exposure to what they do in their daily lives.

Respondents noted *numerous specific ways in which the conference related to their educational and career goals*, citing specific topics from within their majors and topics they hoped to take on in their professional lives beyond academia. Below are sample responses:

- Gives me an idea of how my education and knowledge can be applied.
- I am a mechanical engineer, and this will help me figure out what special interest area I want to focus on.
- I believe it would help me to have a rough perspective of how this field is going to look like in a real world, and give me a direction for what I might have to prepare before getting into the real world.

And lastly, the majority of respondents indicated that they had taken *specific steps to prepare for the conference*. Themes running through their responses included researching speakers, preparing resumes, and ensuring that they could present themselves professionally. Below are sample responses:

- I have done some research regarding the conference itself and what will be happening so that when the keynote speakers come up, I am prepared and ready to learn and engage in all they have to say.
- Did my research on current presenters.
- I have revised my resume, objectives, and purchased conservative professional clothing, along with shoes I can walk in for 12 hours. And I found a way to hide the blue in my hair.

B. Post-conference Survey

This instrument was designed with two purposes in mind: First, to gather feedback about what participants had gleaned from the day, and second, to provide respondents with an opportunity to reflect upon their experiences throughout the day and upon how those experiences related to their interests and goals.

The first two questions asked respondents to indicate their academic major as well as their year in school. As summarized in TABLE 1, the vast majority of 109 respondents were engineering or computer science majors, and as summarized in TABLE 2, they were fairly evenly distributed across the years of college.

TABLE 1: Academic Majors of Conference Attendees

Major	Percent of respondents (%)
Engineering/Computer Science	94
Other	6

TABLE 2: YEAR IN SCHOOL OF ATTENDEES

Year in School	Percent of respondents (%)
High School	7
Freshman	12
Sophomore	35
Junior	26
Senior	18

Overall, most participants reported the conference to have been a worthwhile use of their time. As summarized in TABLE 3, their expectations were fulfilled; their interest was piqued. They gleaned useful information about career paths, about skills to develop and about courses to take to support their career development. Slightly more than half indicated that they had taken the opportunity to network.

TABLE 3: SUMMARY OF POST-CONFERENCE SURVEYS

Did the 2017 Women in Engineering Conference...	**Percentage of respondents answering "Yes"**
a. fulfill your reason(s) for attending?	98.9
b. increase your knowledge of technology-related careers?	93.3
c. increase your interest in technology-related careers?	80.9
d. influence which courses you might consider taking in the future?	65.9
e. help you identify skills you would like to improve upon?	84.3
2. Did you have opportunities to network with any presenters?	57.3

No differences emerged as a function of respondents' academic level or of whether they had attended prior WiE conferences.

Attending this type of event may well serve as an effective mechanism to help draw "new" students to the arena. Analysis of participant feedback disaggregated by major indicated that while participants, as a whole, were quite positive about the experience, the five students with non-technical majors were particularly appreciative of the experience. All five reported that the conference had fulfilled their reasons for attending and that they had increased their knowledge of technical careers. Four of the five indicated they had identified courses and skills they should pursue. And all had made a point of networking during the conference.

In response to a series of open-ended prompts included in the post-conference survey, participants elaborated upon insights gleaned from the event. Themes developed in these responses include the wide range of career options and pathways available to them as well as the importance of courage, confidence, community, perseverance, and networking. Taken together, these comments reflect the emerging engineering identities of our conference participants. Below, we include sample responses to the item inviting students to provide one or two insights gained at the conference.

- Engineering is really about determination, whether it be studying hard through school, fighting adversity at your job, or climbing the promotional ladder.
- I gained awareness of how tricky it is to be a woman in this industry and I learned how I can combat the challenges effectively.
- I was inspired after hearing from such accomplished women in the field.
- More confidence in the path I've chosen.
- Networking is key.

Examination of the responses provided by the attendees for whom both pre- and post- conference surveys are available revealed that *pre-conference preparation made a difference*. More specifically, of the nine respondents who said the WiE conference had not fulfilled their expectations, or that it only "somewhat" had, three indicated that they had done nothing to prepare for the event. Of the 41 respondents who indicated that the conference had fully met their expectations, all but one cited particular activities they had undertaken to prepare. Furthermore, this was the first WiE conference for all four of the respondents who had not prepared ahead of time; every one of the respondents who had attended a prior conference cited something specific they had done to prepare for the event. These findings underscore the importance of providing scaffolding and guidance to prospective attendees, to ensure that they are able to benefit maximally from participating in such events.

IV. DISCUSSION

This conference and the data captured in our surveys expand upon an emerging consensus of the value of role modeling and learning communities. It was heartening to see the extent and variety of preparations participants undertook so as to enable them to glean the most out of this experience. It was also gratifying to note that participants who attended the conference for the second or third time reported deriving as much from the experience as those who were first-time attendees. Given that women and girls often report feelings of social isolation and self-doubt when contemplating careers in technical fields, educators need to better understand factors and best practices that can inspire the persistence and confidence necessary for an

increasingly competitive workplace. The Silicon Valley WIE conference has produced some promising insights into those practices, most noticeably regarding the utility of scheduled but relatively informal interactions among students and professionals (alongside more traditional presentations).

We plan to take three next steps: First, we will provide more detailed guidance for students to prepare for the convening so that they will better benefit from their conference participation. Second, to complement the one-day conference, we will create online interactive spaces and in-person facilitated conversations for students, thus enabling them to envision themselves as members of this invaluable community of practice. And third, we will more explicitly measure the development of participants' emerging engineering identities so that we can assess the impact of our efforts more comprehensively.

ACKNOWLEDGEMENTS

We would like to express our sincere appreciation to Blanca Sanchez-Cruz for her tireless work and leadership in the conference. We also want to thank 17 San Jose State University women faculty, nearly 40 student volunteers and 90 industry participants for making the conference a success.

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