

Minority Women in the Workplace: Early Career Challenges and Strategies for Overcoming Obstacles

Nicole Yates, National Society of Black Engineers

Nicole Yates currently serves as the Senior Research Analyst for the National Society of Black Engineers. She graduated from Stanford University with a Master's degree in Psychology and completed a thesis that focused on gender differences in reasons for switching from STEM to non-STEM majors. Her background is in research and academia.

Ms. Roberta Rincon, Society of Women Engineers

Dr. Rincon joined the Society of Women Engineers in February 2016 as the Manager of Research, where she oversees the organization's research activities around female engineers from elementary through college and into the workforce. With over 15 years of experience in higher education administration, including as a Senior Research and Policy Analyst for The University of Texas System, her focus has been on understanding the factors that impact student success and influencing the policies that support students from high school through college completion. Her responsibilities have included managing various award and faculty recruitment programs, analyzing the impact of state legislative actions, coordinating efforts to increase resilience among college students, and preparing white papers on topics ranging from classroom utilization to student success. Dr. Rincon received her B.S. in Civil Engineering from The University of Texas at Austin, an MBA and an M.S. in Information Management from Arizona State University, and a Ph.D. in Educational Policy and Planning from The University of Texas at Austin.

Minority women in the workplace: Aspirations, roadblocks and success strategies

Abstract

Approximately one in four women leave the engineering profession within the first five years, a rate much higher than their male counterparts^[7]. Studies of STEM professionals have found that women encounter numerous challenges in hiring and reviews of performance due to implicit bias^[12]. Women of minority backgrounds are held to stricter standards of competence than whites and are less likely to be recognized for their skills^[21].

The purpose of this study, a joint venture between two professional engineering associations, is twofold:

1. Determine what challenges underrepresented minority female engineers have experienced early in their careers
2. Identify the strategies underrepresented minority female engineers employ to cope with those vocational challenges

The target population for this study is underrepresented minority women who are one to five years into their engineering careers. We chose this population because women comprise approximately half of all employed college graduates, but they represent only 12% of those with college degrees working in engineering occupations. Minority women make up less than two percent of engineering professionals^[20].

The study explores the external support systems that assist these women through the beginning stage of their careers; of particular interest is support provided by professional associations and whether or not that support is adequate.

Data is collected through one-on-one interviews of underrepresented minority female engineers who graduated from an ABET-accredited university with a bachelor's degree between 2011 and 2015. The data collected is analyzed to identify patterns and themes around the challenges that underrepresented minority female engineers have experienced early in their careers and the strategies they have employed to cope with those challenges.

Introduction

Though demand for diversity in engineering fields continues to increase, minority women comprise less than 2% of all engineering professionals^[20]. Only 20% of all engineering bachelor's degree holders are women^[24] and for women of color, the statistics are even more dismal. Fewer than 4% of engineering bachelor's degrees are awarded to Black, Hispanic, and Native American women *combined*^[24]; for African American women, that percentage is declining^[22]. With so few women of color entering the engineering workforce, more attention must be given to retaining those individuals. Researchers have identified several factors that contribute to the dearth of minorities and women in engineering; however, little research specifically addresses the unique challenges of minority women in engineering professions. The following summarizes a few documented deterrents for women of color in the workplace.

Stereotype threat may subconsciously discourage women of color from pursuing engineering careers. When a demographic with negative stereotypes associated becomes salient, individuals who fit that demographic will often experience poor performance due to the fear of confirming those stereotypes^[23]. Thus, individuals experiencing stereotype threat often become self-fulfilling prophecies. Studies have consistently shown this effect on minorities and women as it related to academic and engineering performance^[2,3,4]. Within the workplace, if a woman of color is the only one (which she often is), she may tire of her preoccupation with defying stereotypes and choose a different career^[21].

Research suggests that women of color may encounter difficulty advancing in their careers due to the lack of role models in engineering companies. Role models demonstrate that success is possible for individuals who look similar to them^[14,18] and many provide direct assistance to others serving as mentors. Of the 682 highest-level executives at 5 top technology companies that employ thousands of engineers, only 8 are black or Hispanic women^[13]. This is unsurprising, given the low numbers of minority women who pursue engineering, and perpetuates the image of a CEO as an old, white male. Women who do pursue engineering careers often experience difficulty advancing, meaning that the companies themselves are directly responsible for the dearth of role models in upper management. Being passed over for a promotion in favor of a white and/or male candidate can certainly lead to attrition of women of color in engineering^[21]. Women of color are subjected to overt discrimination in the workplace that is often more severe than what their white female counterparts experience. One African American woman shared her story of how she discovered that she was receiving a lower salary than her male coworkers with similar job titles. Furthermore, she found that a recently hired white female engineer at her company was earning more than she, even though she had a Master's degree and years of work experience over the neophyte^[1]. These narratives are unfortunately common among women of color in engineering.

Some professional engineering organizations (PEOs) have shifted their rhetoric to adopt an anti-deficit framework for research focused on minority female engineers. Organizations such as the National Society of Women Engineers, Society of Women Engineers, and Society of Hispanic Professional Engineers provide services and support to minority women that can help them succeed in their careers^[6]. However, it is still unclear how useful women of color find these resources and where gaps exist.

Broadening participation in engineering has been an ongoing task of universities, researchers, companies, PEOs, and several other stakeholders. Real, systemic change has been and will continue to be a top-down process, so how can stakeholders immediately support minority women looking to start careers in engineering? Unfortunately, solution-oriented research in this area is scant. However, we believe that by collecting and sharing the stories of minority women who have already overcome early-career challenges, researchers can highlight tangible strategies for aspiring female engineers to use.

Theoretical framework

The Social Cognitive Career Theory (SCCT) was chosen as the framework for this study, to allow a greater understanding of the supports and strategies that minority females utilize to overcome obstacles and challenges when embarking on their engineering careers after college graduation. Lent et al. (1994) states that in the SCCT framework, the person, environment, and behavior variables can affect one another through complex, reciprocal linkages^[17]. These variables can impact a person's formulation of their career interests, the influence of these variables on the career choices made, and the level of success in pursuing educational and occupational goals. SCCT is a framework that has commonly been used to understand factors that have contributed to the underrepresentation of women and racial-ethnic minorities in STEM^[11].

Applications of SCCT have focused primarily on the choices made among middle and high school students, though more recent studies have begun applying this framework to understand choices made in college and the workplace. Within the field of engineering, Lent et al. (2003) utilized the SCCT framework to understand the interests, goals, and performance of Black engineering college students attending historically black universities and found that indirectly providing supports that positively influence the personal goals and actions of students can help them persist in engineering^[16]. A recent study applying the SCCT framework found that social supports, particularly from friends and family, were important factors in Black and Hispanic college students' persistence towards an engineering degree^[10].

The current study focuses on environmental variables, specifically the supports provided by universities, colleagues, and professional associations, as well as the strategies that minority women apply to overcome early career challenges.

Promoting the narratives of early-career women of color in engineering and sharing their insights is the primary purpose of this exploratory study. The research questions that guided the study are the following:

1. What challenges to minority women in engineering professions face early in their careers?
2. How have these women overcome those challenges?
3. What types of support from professional engineering organizations are most impactful to these women?

Methodology

A qualitative research design is used to identify the challenges that minority women in engineering face early in their careers, as well as the strategies and supports used to overcome these challenges. Qualitative data collected from one-on-one interviews allows a closer look into the experiences of minority women in the early stages of their engineering careers, providing a more nuanced view than is typically available through quantitative methods.

The findings presented in this paper are based on data obtained from interviews of 21 eligible minority women. To be eligible for this study, women must have graduated on or after May 2011 and been employed in the engineering workforce after graduation. Participants were identified through purposive sampling, using social media outlets available through NSBE and SWE to

recruit eligible individuals. One-on-one semi-structured interviews were conducted between October 2016 and March 2017, an approach which allowed for clarification and follow-up questions. All participants signed IRB-approved consent forms and were informed of the confidentiality and anonymity of the data. Interviews ranged from 15 minutes to one hour in length.

Once the interviews were conducted, the audio files were transcribed by an outside entity. Transcriptions were uploaded into Dedoose, an online web application, and the data was then analyzed through open and axial coding, looking for categories and emerging themes. Of particular interest were themes associated with the challenges encountered, the strategies applied, and the external supports that women expressed having utilized in their job search and in early career.

Participant demographics

We interviewed 23 women for this study. Two participants were ineligible to be included due to their graduation dates. The following table lists the demographic information of the 21 women that are included in the study:

Table 1: Participant Demographics

Race		Count
	Asian/Pacific Islander	2
	Black or African American	12
	Hispanic or Latina	6
	Mixed Race	1
Age (years)		
	< 25	4
	25-29	13
	30+	3
	No Response	1
Marital Status		
	Married	6
	Single	15
Children		
	Yes	2
	No	18
	No Response	1

Most of the women interviewed were African American. Six women interviewed were Hispanic, two were Asian American, and one was of mixed race. There was no eligibility criterion placed on age, but most of those interviewed were under 30 years of age. Of those interviewed, 25% were married, and only two had children. As shown in Table 2, the diversity of engineering disciplines was apparent, with the majority having earned mechanical engineering degrees (the most popular engineering degree earned by both men and women), and most participants had between two to five years of work experience in engineering. A couple of participants indicated a little less than two years of experience, and three had over five years of experience because of employment during college.

Table 2: Participant Work Experience

Area of Specialization		
	Aerospace Engineering	3
	Chemical Engineering	2
	Civil Engineering	3
	Computer Science	1
	Electrical Engineering	1
	Industrial Engineering	2
	Manufacturing Engineering	1
	Mechanical Engineering	6
	Software Engineering	1
	Systems Engineering	1
Years of Work Experience		
	< 2 years	2
	2-5 years	16
	5+ years	3

Results

Responses to interview questions were coded to uncover emerging themes associated with the challenges, strategies, and supports that minority women utilized during their search for an engineering job after college graduation and their first years in the field.

1. Challenges

In response to the first research question, this section focuses on the challenges that minority women face as they transition from college into the engineering workplace. As we attempt to understand the strategies and supports that help women overcome barriers and obstacles, we must first understand the types of challenges that they experience before, during, and after transitioning into the workforce. Though some participants mentioned challenges associated with parental expectations and university preparation, the majority of responses focused on the challenges associated with workplace biases and inequities.

For some women, the challenges began at home. In some cases, parents were quite blunt about their thoughts on having a daughter pursue an engineering degree.

“My dad always said, “You’re probably never going to do anything with engineering.” That was my life. But he said “Engineering is probably never going to happen for you” - Latina Engineer

Others’ parents expressed reservations because they knew the challenges that a minority female engineer experiences in the workplace.

“I remember when I told my dad I was doing mechanical engineering. He was like, ‘Are you sure?’ He’s one as well. He’s worked for an oil company for about 40 years. As a black man, he’s like, ‘This is going to be hard. And you’re also a woman. Are you sure you’re ready for this?’ And all through school, he was like, ‘Are you sure? Are you sure?’ And even after I graduated, ‘Are you sure?’ And now that I’ve been at work for a couple years, I know exactly what he meant. I just thought he was being skeptical and didn’t want to think that he was pushing me into something.” – African American Engineer

Universities are tasked with preparing students to enter the engineering workforce. Studies have found that women are particularly drawn to careers that they believe have social impact, which is seen as one explanation for the higher female representation in the life sciences. Some women expressed disappointment that their chosen path was not offering the level of impact that they sought, and they blamed their schools for setting unrealistic expectations.

“When you go to engineering schools, they kind of tell you you’re going to have the opportunity to change the world and have opportunity to make big changes in your team and owning your own code and do a lot of the stuff. And when you go to a lot of these companies, these companies are already kind of a rigid system. And you feel like a cog in this big machine.” – Asian American Engineer

“You really don’t make the difference that you think you’re going to make.” – African American Engineer

Numerous participants shared their experiences of realizing that they were a minority in the engineering workplace, and the difficulty of fitting in.

“I’m Hispanic. I didn’t really see a lot of Hispanics. And I was kind of very surprised in the sense. This is very surprising because of the fact that during my internship, it was so colorful. I come here.... I couldn’t really speak Spanish with anyone. It was just hard not to be able to speak Spanish fully and comfortably and stuff.” – Latina Engineer

“When I was in Baltimore, it was all white male. And that actually was something I was very uncomfortable with because I was the only female in the room and sometimes the only person of any type of minority status.” – Latina Engineer

“I know I’m 1 percent of people that...look like me. I’ve known that through most of college. I’ve always counted. So sometimes when I do feel insecure, it does bring up that you’re also the only person of color or female in there.” – African American Engineer

“...When I first walked into the first project meeting, I was the only female in a room full of male engineers and project managers. The average age was 50 years

old... I was the first to be hired just out of college. Everyone else [had] five to 10 years of work experience in the field.” – Asian American Engineer

While some participants indicated feeling uncomfortable or isolated in their workplace, others focused on specific biases that they experienced. Some were gender based:

“I do think not only being a woman in engineering but also a woman in tech, it is also hard because people don’t expect you to be technical.” – Asian American Engineer

“I think that there’s a lot of mentality – there hasn’t been a lot of women in my particular job for a couple years. There are joking comments. I think people usually apologize. Now that I’ve been there for almost two years, I feel like I’m part of the team. I wasn’t expecting the transition to be as...it was a little more gradual than I expected. I guess I didn’t expect some of those mentality jokes to still be there.” – Latina Engineer

“Well, they had gotten rid of the female restrooms in one half of the building. There was no females except for the shop workers. Most of the shop workers on that part of the building were all male. So instead of having two bathrooms, they just turned the male and female into male bathrooms. It made sense. But there was some times where I didn’t know where to go to the bathroom.” – African American Engineer

Others were race-based:

“I’m Asian, too. There’s expectation that you will be a fairly technical person, whereas if you were of a different minority, it’s definitely going to be harder for you because you don’t necessarily have that community.” – Asian American Engineer

“I think one of the biggest challenges is when the topic of diversity comes into discussion. I feel sometimes everybody kind of stares at me when that topic comes up. So then it’s kind of the awkward moment where everybody wants to be sensitive about it and not step on anybody’s toes. It’s kind of one of those awkward moments. I think that’s a little bit challenging and hoping that nobody thinks I’m not there for the right reasons when the topic of diversity comes up.” – Latina Engineer

When women start trying to balance family and career, having children can present additional challenges in the workplace. One participant shared her experience of having assignments taken away once her manager found out she was pregnant.

“...As soon as [my manager] learned that I was pregnant, he just completely stopped talking to me and gave my assignments to somebody else. At that point, I just shut down and concentrated on how to improve things at my desk because he

did not allow me to even touch the hardware. Things that I had designed, he just said he'd find somebody to replace me.” – Latina Engineer

The gender pay gap that exists in the U.S. is seen even at the new hire stage, as many women hesitate to negotiate their salary and benefits. This was also the case with many study participants, with more than 60 percent indicating that they wished that they had negotiated for more pay.

“When I first hired on, I received my offer...I asked if I could negotiate. They had told me that it wasn't really that flexible for negotiation.... When I got converted to full time, they said that it wasn't really a negotiable thing, I was like okay, I guess I won't negotiate my pay. So I didn't really negotiate anything.” – Latina Engineer

“At the time, [I was satisfied with my salary] because I didn't know any better.... After realizing how much work I was actually doing and hearing that everybody else that I worked with made a lot more money than I did, I realized that it was unfair that they were paying me such a low amount of money.” – Latina Engineer

Some women took on this challenge and were successful at negotiating a higher salary.

“I did negotiate on both jobs, actually. They asked me to throw out a number on the first one that was much higher than they thought. But they met me halfway. The second one I asked if there was any move on the salary. And they slid a little bit as well. I discovered I was actually one of the only people that did that that I knew.” – Latina Engineer

For many women, getting honest feedback and fair performance evaluations can be a challenge. Of those interviewed, only half indicated feeling that their performance was evaluated fairly. Without honest feedback and guidance on how to improve, or recognition for your achievements, it is difficult to move forward in your career.

“My manager gave me the highest performance rating at the beginning of this year. I had basically asked for a promotion because I got the highest rating. I should probably get a promotion. And she said no but didn't give me any constructive feedback as to how I can get there or do anything like that. She said that I was on track from February all the way to August. And in August, she said you're not going to get it for no reason. She said, 'Well, your attitude could be better.'” – Asian American Engineer

“I said that I'm really open to feedback. So whenever there's any potential – give me feedback. I've asked for the feedback. But sometimes – I guess when I ask for feedback and I set up that feedback meeting, all I've gotten is oh, you're doing great sort of thing. And it doesn't help. I'm just like, okay. I'll just continue doing what I'm doing.” – Latina Engineer

For some women, receiving unfair performance evaluations can result in feelings of resignation and reduction of effort.

“I had to work with quality very closely. And I had one argument at the beginning of the integration process, just because I didn’t agree with something that was going on. So I had a discussion with quality in January, and the review was in December or something. And they’re like, ‘Remember that one time when you disagreed with this person.’ Oh, yeah, God, that. ‘Well, you don’t get along well with others.’ It’s like, really. Okay. But last year, based on the year before, I literally just performed average because I knew that if I worked really hard that I wasn’t going to get any other review than average. So there’s really no point to be an overachiever when you’re just going to get average.” – Latina Engineer

Asking for benefits, including such things as professional development or a deserved promotion, can be challenging. One participant stated that her requests for such benefits were typically denied.

“When I do ask for some development... [I’m told], ‘We need to send more than one person to do that. I think it’s more beneficial for two people to do that.’ But we’re spread so thin that we can’t have time for that. And I understand that. There’s really no other options for me to try to develop. It’s kind of difficult.” – Latina Engineer

Sometimes having the courage to speak up can be a challenge. One study participant shared her experience of being ignored in favor of her male colleague, who also didn’t say anything, but was still recognized during the meeting.

“The one thing that I do bring up because it really upset me and was one time I was working with another young engineer. Neither of us knew anything about the program. And both of us needed some extra work. We had a requirement that needed to be met. And we were supposed to both be given work equally. But when we went into the meeting, I was never addressed, especially by name. We were sitting next to each other, and neither of us spoke. I mean, we both knew people in the room. But they would continuously address him and say he can be working on this; he can do that. And I zoned out at one point because I was never addressed until the last 20 minutes. And they would be like, oh, he can have it and she can too.... We were both silent. I’m easier to ignore than him is what it felt like.” – Latina Engineer

Some companies offer development programs, which a few participants indicated they were involved in. However, one study participant indicated that the value of such programs relies heavily on its implementation. Poor implementation can negatively impact a woman’s career development.

“They have this great idea of a development program and how they want to train their engineers to come in and get them on a trajectory. But they’re really bad at

the execution. They still don't even know what to do with people with my experience and my interests. They're trying to figure that out now... They don't understand what a development program is supposed to be.” – African American Engineer

2. Strategies

In response to the second research question, this section focuses on the strategies employed to overcome the challenges experienced by the women interviewed. Specifically, we analyzed certain personal factors that women called upon to address challenges during early career. Confidence and speaking up were two of the primary strategies employed to help women surmount challenging situations.

One woman indicated that she made sure she was fully prepared to tackle her job search when that time came.

“A lot of career prep that went into me just finding my job and being more prepared...very prepared. I just feel sometimes a lot of people are not as prepared as they could have been. I prepared for a bunch of career fairs months and months and months in advance.” – Latina Engineer

Other study participants indicated that they had to learn to modify certain personality traits to be taken seriously in the workplace.

“I completely changed my entire personality of work. It was horrible... I had to learn how to interrupt people.... I had to totally change my wardrobe because we would do a lot of last-minute field visits that I would never hear about... I had to completely stop making jokes. I'm not super funny. But I like to be a little relaxed. And one time I made a joke about being too lazy to do something. And they took me seriously. And it took me a solid year to recover from that – so no more jokes, jokes are out.” – Latina Engineer

One participant shared the internal struggle she faced due to the age differences of her colleagues.

“When I first started, I think what kind of surprised me was how much of an age gap there was... You had a few young packaging engineers, and then you had the 40-year-old dudes. It was just kind of hard to communicate. You're my dad's age. And my dad doesn't like it if I talk to him as one of my peers because he's my dad. And he's like, “You should respect your father.” So for me, it's kind of one of those okay, I work with you. We're technically on the same level because we're all professionals. But how do I get over the fact that you're also way older than me? And I need to respect you in that sense because you're older than me. If you say something and I disagree, it's kind of hard for me to bring that up because of the fact that – it's an age thing.” – Latina Engineer

Being able to ask questions was one of the most common challenges that women indicated they needed to learn to overcome, particularly as it related to their own self-doubt on their abilities. Learning that asking for help did not mean that they were not adequately prepared to handle their work was a tough challenge for some study participants.

“I think one of the biggest challenges I’ve had is kind of knowing when to ask questions. A lot of the times I feel I’ve asked a question maybe five or ten times. And the person I’m asking is probably thinking I don’t know what I’m doing. But I think it’s more so I’m always double-checking myself... Then there are times where I think this is the answer. But I don’t want to say I think this is the answer. I want to make sure it is the answer. It’s kind of like, do I really know this or do I not know this.” – Latina Engineer

When one study participant felt that her voice was not being heard, she started setting up one-on-one meetings with her manager.

“Things that I’ve been trying to do are set up one-on-ones with my team lead, not just my manager, to make sure that at least she can hear me out on a lot of things.” – Asian American Engineer

Others just made a point of speaking up more and being recognized.

“I think on certain things like my subject matter expertise they really listen to me now if I can interrupt them long enough to get my thoughts out.” – Latina Engineer

“I’m comfortable at this point to contribute in certain meetings; it does not scare me. But it did take me a little bit. And I did get a little bit of push back. It’s not something so overt... But at this point, it’s almost been a year since I’ve been having some of these issues. I don’t care anymore. I’m going to say what I’m going to say. And you can like it or you cannot. But I’m not going to not contribute because someone doesn’t want to listen to me. If I’m in a meeting, I’m there to contribute and do my job. And that’s what I’m going to do. I guess I kind of go head first into it.” – African American Engineer

“... [I] have started speaking up at meetings more. I make a point the first time even just making a joke – just speaking to make my presence known....” – Latina Engineer

3. Support systems

In response to both the second and third research questions, this section focuses on the external supports that women relied upon to assist them during their job search and into the first years of their engineering career. Of particular interest was the role of professional associations in

supporting women in this stage of their career, though participants expressed receiving support from various sources.

The women in this study that were most successful in their career pursuits were those that indicated that they had a strong support system in place. Some were fortunate to have support from a variety of sources, while most indicated receiving guidance, coaching, or mentoring from one or two different sources.

A few study participants were advised by family members who themselves were engineers.

“My dad does consulting. He started out as an engineer. So I do talk to him quite a bit when it comes to my career oriented things.” – Asian American Engineer

“My sister is an engineer and kind of gave me some guidance. My father works with computers. His father before him worked with computers. That’s kind of what geared that side.” – Latina Engineer

“My father is kind of a mentor because he’s also a mechanical engineer. He’s been working for about 40 years in the oil industry. So I definitely leaned on him a lot for like, ‘What do you think of this company? What do you think about [these] opportunities?’” – African American Engineer

Others found support or job search assistance from their college peers.

“The first year... we had a dorm dedicated just to freshman in engineering. And what was cool was there was one floor just for girls. It was like half a floor. So we all got to really know each other. We were all different majors. But I leaned on those people all four years – so definitely just seeking out those other girls early.” – African American Engineer

“One of the students who had graduated from my electrical engineering program at Cal State Long Beach had posted something on a Facebook group. And he said that they were looking for engineers to submit our resumes. I submitted my resume to him. And then I got a call from the SpaceX HR.” – Latina Engineer

For many women in this study, the university career centers were a key factor in getting exposure to hiring companies and prepared for professional interviews.

“My university had an amazing career center where you got resume support. And before you could post it to our online system for companies to look at, they had to approve it and review it. And you have to edit it. That was really helpful. And it also sponsored on-campus interviews. We had a great location where the companies could come. We were just on campus, so you didn’t have to travel. That was really helpful. We definitely had a career fair every semester of the fall and spring.” – African American Engineer

“[Alumni members] have been very actively helping us. They look at your resume for you, [conduct] mock interviews.” – Asian American Engineer

“[My university had] a career portal online to – the school’s administration. I’m pretty sure I got [my first job] through the web portal.” – Asian American Engineer

There were a few who indicated that academic preparation and hands-on experiences during school were factors that helped them obtain their first engineering position after graduation.

“I did a lot of leadership roles back in college. And I know it’s not like the exact same thing at the workplace. But it gives you almost a basic set of skills to just be able to develop into those roles.” – Latina Engineer

“So college for me, particularly the engineering school was the first time that I had to grapple with failure. And having that kind of safe space to fail and not having too many repercussions was definitely a blessing, I would say. The engineering really taught me how to be kind of scrappy. It was an identity crisis. But I came out of it looking at myself not as a straight A student. But I came out of it thinking I can actually be a leader.” – Asian American Engineer

A few participants indicated that they had worked as interns or during college for certain companies. They reflected on the importance of the support that they had received from their coworkers, as well as the value of having that work experience when it came time to look for a job after graduation.

“As I was going to school, I was also working full-time at the CAD designers. I worked in the industry another four years prior to working as an engineer. My coworkers were willing to help me with homework. My employer was very acceptable and very supportive of me going to school, so they allowed me to work out hours to make up those hours.” – Asian American Engineer

“I started off at Northrop-Grumman as an intern my senior year of high school. So I’ve been with the same company since I was a senior in high school. That’s how I got myself into college.” – Latina Engineer

In some cases, individuals within the company actively sought out mentoring relationships with participants.

“...I have noticed that they are a lot of women in upper management that tend to be like ‘we must take younger female engineers and help them.’” – Latina Engineer

“Right now it’s my boss’s boss. It’s pretty interesting because he’s the highest ranking of our company in our particular project office. He’s a really good resource. He kind of picked me. He’s the only mechanical [engineer] we had for

our company in that office. He said he could give me some advice. He's also good to talk to because a lot of people at my company have been there for decades, and they never leave. But he's someone that came from another company. So he has a different perspective. So that's really helpful." – African American Engineer

One woman indicated how fortunate she felt to have a woman of color as her supervisor and mentor.

"My boss right now is actually a woman of color. That's been incredibly helpful. That was a unique opportunity. I was really excited to work for her. She's been able to give me a lot of good guidance." – African American Engineer

A number of participants stated that the support that they received from their colleagues helped them be more comfortable in their workplace and cope with difficult situations that sometimes arose.

"I have an office mate who's been fantastic. He was also the new hire that got hired in the year before me. He was able to kind of introduce me to a lot of the other new hires. And it was kind of like an instant group of friends, which was always a good thing that I didn't really look into until I started. I didn't really know it was important until I started, I should say." – Asian American Engineer

"They were always saying 'Just forget what everybody says. You're doing the right thing. Just keep on doing it.' I think there was a positive coworker relationship and getting good positive feedback from them was really helpful." – Asian American Engineer

"I think I have a lot of career guidance with my manager and some mentors I found at work. People support what I want to do and help me find the steps to do that." – Latina Engineer

One woman stated that she appreciated the opportunity that her employer offered new employees to take on challenging projects rather than "grunt work."

"At the current location, they seem like they want the younger engineers to take more ownership. They're just like here, no one knows how this works, figure out this type program. And they get complete ownership over stuff. And that's something that I'm not used to. I've seen a lot more where you just get grunt work. You don't get to learn more of the system. But for my current company, I feel kind of overall...especially at my current location, you need to know the entire system; go figure it out, go mess with the hardware, go put this thing together." – Latina Engineer

Most participants were involved with professional associations during college, while all study participants indicated that they were currently members of at least one professional

association. Many of those interviewed indicated that they valued the support offered by the organizations, particularly services involving networking and job search assistance.

“I would say because I was part of SWE and went to a lot of the SWE conferences, I was better prepared for my job search. I ultimately made the transition from a collegiate to a professional engineer.” – Asian American Engineer

“I think coming to the conferences and going to the talks and hearing how different women have achieved their career goals has been sort of the support that I’ve received from SWE...kind of coming here, networking and meeting other women in a professional setting.” – Latina Engineer

“[The International Society of Automation] gave me a lot of scholarships that you can’t say no to when you’re a poor college student. They gave me a lot of scholarships. They also had a lot of mentors that would help me with my projects. But their family now.” – Latina Engineer

Some participants indicated that the opportunity to meet other female engineers allowed for social involvement and a level of support that was not readily available in their college.

“I’m grateful to SWE because I was able to meet other women who also had the same aspirations, especially the conference for the career fair.” – Latina Engineer

“I think my first conference was in college...and I think it was helpful for me to kind of meet the other girls who were also studying the same thing because most of my classes, it was maybe just me and maybe one other girl – just have a group of other women who are studying the same thing is good to see.” – Latina Engineer

“I think the most effective was probably going to the conferences and meeting all these different professionals who worked at these companies that I was considering applying to and working for. I think the type of people at these conferences, I feel they give you a sense of what type of vibes a work environment might have. It was really good to at least talk to some people and hear what they have to say.” – Latina Engineer

For those that found themselves relocating for employment, professional associations offered networking opportunities and camaraderie that helped them feel less isolated in their new place.

“I think SHPE and SWE have the biggest influence on me – a way to network and connect with people. When I moved up here, the first thing I did was seek out my

SWE section and then my SHPE section to figure out where am I.” – Latina Engineer

“Yeah, I became a member of SWE because I was struggling so much at my job. And I realized that I needed something. And SWE was the first organization I reached out to join. And it’s been amazing. Everyone is super supportive and has just been really great and wonderful.” – Latina Engineer

“It’s nice because if I go to a new location, I’m like, I’m part of SWE. Oh, me, too. Have you seen this? Or have you heard of a conference? It let me reconnect with other people at my previous positions so that was nice.” – Latina Engineer

4. Advice for others

During the interview, study participants were asked what suggestions they would have for future minority female engineering graduates. In looking back upon their own experiences, the women interviewed were able to reflect upon what worked for them, as well as what they wished they had done to better prepare themselves for the engineering workplace. Such insight can provide valuable guidance to future minority female engineers. Much of the advice centered on self-confidence.

“I would say don’t be afraid to put yourself out there. But at the same time, rejection is a natural part of the process. And don’t take it too personally.” – Asian American Engineer

“You need to learn how to speak up and not be afraid of the consequences.” – African American Engineer

“I think the advice I would give to them is not to doubt your abilities and your knowledge... I think the most important thing is you will have people that are going to – like, you’ll get the sense that they kind of almost treat you differently whether it’s because you’re young or whether it’s because of something else. You can’t let that interfere with what you’re trying to achieve.” – Latina Engineer

Others stressed the importance of gaining work experience and networking while in college.

“Before they graduate, make sure you get some internship experiences and don’t just focus on going to school. And make sure you’re involved in different organizations so you can meet new people and network and go to different conferences so you can learn different stuff.” – African American Engineer

“Just to find the diversity societies and get active in them. It’s a whole lot more encouraging when you go to a class and you know you’re the only something in that class. And then you go and you join the societies – you’re able to find some commonalities. Even though I was in one or two, in most of my classes in college,

once a month there was a room of female engineers that understood exactly how much I disliked statics.” – African American Engineer

“One thing I’d strongly recommend is the networking. That’s how I started my career, because of the networking I had. Also the communication. Being an engineer, we all think ‘I have to be technical on it.’ ... So being able to communicate, being able to network better, and also just don’t give up. A ‘C’ is not the end of the world.” – Asian American Engineer

One study participant focused on the need to be able to promote yourself.

“And self-promotion, which I’m sure comes naturally to some people but definitely does not come naturally to me. It took me until it was actively hurting my career to realize that I needed to be self-promoting and that that was okay. That comes in a lot of different forms. You don’t have to sit there and brag in a meeting. It can just be cc’ing your boss on a cool email that you’re sending.” – Latina Engineer

5. Future career plans

In qualitative research, there is an allowance for observations to be presented that were not initially included as part of the study’s research questions, if there is sufficient evidence to justify their inclusion. One such observation centered on future career plans the participants outlined. Of the 21 eligible participants, 18 indicated that they wanted to go to graduate school at some point in the near future. Some mentioned specific degrees—master’s, doctoral, MBAs—whereas others did not elaborate. However, most linked their potential degrees to advancement within their company or industry.

“I do plan on going back to school. Because of current the position I’m in, I’m definitely focused on growing more in that space, supply chain operation, going back to school for that. I definitely have executive-level aspirations.” – African American Engineer

Another engineer expressed a similar sentiment about wanting to expand upon her vocational knowledge in a graduate program.

“I’ll be starting my master’s soon, so I’m hoping that will kind of project me into a similar direction of what I’m doing now but a different field of engineering. Getting more knowledge, that’s where my goal is going towards so I can be in a supervisory capacity at a certain point.” – African American Engineer

Many engineering firms employ rotational programs so that incoming employees may try several jobs and select the one that fits best. It may be the case that some of these women are working in capacities that are adjacent, but not identical, to their areas of focus in their bachelor’s degree programs. However, another explanation could be that these women believe advanced degrees are necessary for their future appointments as managers, supervisors, and executives. (Whether

or not that is true is a question that falls outside the scope of this study, but would certainly warrant future research.)

6. Suggestions for PEOs

Given the researchers' interest in understanding how professional associations can better support women in this stage of their career, researchers asked about the support provided by professional associations during the job search and early career phases and whether or not the support received was or is adequate.

One of the most common concerns expressed was the lack of diversity the organizations offered.

"I do think that having a diverse perspective would be really great ... I'd like to see more of an age diversity in SWE. I don't really know how to encourage that. I do think that a lot of things that the youngsters in SWE are going through right now are not really being highlighted at conferences and at kind of the global, national level." – Asian American Engineer

"Sometimes when I listen to people talk, [they] had support already in the system and that's how [they] got moved forward... Hearing from people at the top – sometimes they were already in an exceptional position that helped them get there anyway – [I want to] meet people in my community in my general area and [ask] 'How do you balance with this thing?'" – Latina Engineer

"The other example that comes up is SWEFL, the SWE Future Leaders program... I think they could do better in diversifying that group because those are supposed to be the future leaders of our institution, which should reflect what we want the organization to look like." – Asian American Engineer

Another concern expressed was the difficulty in finding a professional chapter to join after a job relocation.

"Another thing is not everyone has a SWE section. The SWE Minnesota section is the entire state. And most of their events are in the Twin Cities, which is an hour and a half for me to drive. So I'm not really involved [in] what they're doing." – Asian American Engineer

"...For the professionals that are just starting and they've just got out into the world, it's really hard and kind of intimidating to all of a sudden just throw yourself into a new chapter...throw yourself into a new section sort of thing." – Latina Engineer

One participant noted the difficulties of staying active in her professional association after having kids.

“I definitely want to get more involved with SWE. But their events are somewhere in downtown LA. And with a six-month-old, I can’t really go out anywhere anymore.” – Latina Engineer

Some women indicated that they want to be more active, but the events that take place were not ones that attracted them to participate.

“It’s a really tough sell to be like, go to another happy hour. They’re starting to do some more outdoor sorts of things because we’re in Orange County like beach cleanups and that sort of thing. It’d be cool to have more of that....” –Latina Engineer

“Maybe more ways to get more technical education or ones that fit more with where I want to go in the field... When we were trying to find things that were related for us to do, most of the times the things that we did were more social.” – African American Engineer

Many participants indicated that the job search services, particularly career fairs, were important in helping them get their first job. However, one participant noted that she found her professional association’s career fair difficult to maneuver once she had experience and was seeking a new position.

“I knew it would be a lot of college hires and interns. But I didn’t know it would be pretty much all some of these companies were looking for. I wish you could search before you come and say okay, what companies are looking for people like me – like the experience level that I have.” – African American Engineer

Finally, several participants voiced a strong desire to be mentored. A few mentioned specific topics, such as help with salary negotiations and other job skills, but most were interested in simply having someone else like them to share their own experiences in the industry. One woman discussed how she would like a mentor to share her instances of failure in order to put her own failures into perspective.

“So, we talk about [how] you need to learn from your mistakes...but we don’t really spend a lot of time diving into what those mistakes were...It couldn’t have been all daisies and roses the whole way, but instead of just saying ‘Yeah, I’ve had some failures along the way, let’s stop and talk about those.’ For...early career people, because we don’t hear those failures, we don’t see that part of our careers. One mistake we make could be completely devastating and we may feel like...life is over, but in the grand scheme of life, if we had someone to give that perspective...that sort of thing would be helpful, too.” – African American Engineer

Discussion

A study by Lent et al. (2013) of women and underrepresented minority students in engineering that utilized SCCT as a framework found that personal variables, including self-efficacy and

outcome expectations, were key to maintaining the interest of students pursuing engineering degrees, but “satisfaction with the environment may then be an important part of what keeps them coming back” [15]. Though our study’s intent is to focus on the environmental factors that help minority women overcome challenges during the early career stage, the findings indicate that minority women who are successful at completing an engineering degree possess certain personal characteristics that help them overcome challenges. As one woman stated, “An engineering degree makes you a little bit more scrappy. And you do fight a lot for what you want.”

Many of the women in this study indicated the importance of developing greater self-confidence and the ability to speak up for themselves. Adequate academic and professional preparation were also mentioned, with internship and similar work experience prior to college graduation offering a level of real-world experience that helped solidify their decision to enter the engineering profession after college. This experience also helped many women develop their networks and maintain employment contacts that helped them when they began their search for full-time employment after college.

The main purpose of this study is to understand how external supports, particularly professional associations, have or can assist minority women during the transition into the engineering workforce. Keeping in mind Lent et al.’s (2013) assertion that the retention of women in the profession is primarily based upon their satisfaction with their environment, understanding the environmental challenges they face and how they address those challenges is important. Some women expressed disappointment in the low level of impact they believed they could have as an engineer, indicating that they wished that they had known this in college. Other women were unprepared for the bias they encountered in their male-dominated workplace. It was in these instances when some women forced themselves to develop their own voice and be less hesitant to express their views – even interrupting others, when necessary – so that their experience and expertise could be recognized among their colleagues and managers.

In this study, minority female engineers seem to seek out supports from mentors, colleagues, and professional associations when seeking employment and dealing with difficult work situations early in their career. Most women seemed satisfied with the supports offered during their job search, though some indicated that they relied more on their own networking skills to find a job rather than the supports offered by their university or their professional associations. There were a few women who expressed difficulties in finding employment, seeming to lack access to strong supports and feeling isolated and alone in their struggles. Most women interviewed had attended job fairs, either through their university or offered through their professional associations. Those women who received multiple job offers appeared to have more skill in developing the networks to help put them in contact with employers. What was most lacking was the knowledge of how and when to negotiate their first job offers. Given the gender pay gap that exists, it is crucial that minority women are made aware of their worth and given the tools to advocate for better starting packages.

The women in this study appreciated the support that professional associations offered during the job search stage, particularly through career fairs and networking opportunities. What stood out were the comments regarding the diversity of the organization, both in terms of leadership or role models as well as the services or access offered for women early in their career. Also of note was

the difficulty many women expressed in maintaining their active membership once they left college. Professional associations can play a larger supportive role for minority women in early career by doing more outreach to graduating engineers, directing them to events, chapters, and members that they can easily connect with. Particular attention should be paid to increasing the diversity of members, in age, race, and industry (within the confines of each organization's mission), to ensure that minority women feel that they can truly benefit both personally and professionally from their membership. By increasing the supports offered, professional associations can help reduce the attrition of minority women from the profession.

References

1. AAUW. (2013). Engineer took all the right steps but still didn't receive fair pay. Retrieved from <http://www.aauw.org/2013/07/19/engineer-unfair-pay/>.
2. Aronson, J., Quinn, D. M., & Spencer, S. J. (1998). Stereotype threat and the academic underperformance of minorities and women.
3. Aronson, J., Fried, C. B., & Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology*, 38(2), 113-125.
4. Bell, A. E., Spencer, S. J., Iserman, E. and Logel, C. E.R. (2003), Stereotype Threat and Women's Performance in Engineering. *Journal of Engineering Education*, 92: 307–312. doi:10.1002/j.2168-9830.2003.tb00774.x.
5. Bureau of Labor Statistics: U.S. Department of Labor (2015). Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity. Retrieved from <http://www.bls.gov/cps/cpsaat11.htm>.
6. Chubin, D. E., May, G. S. and Babco, E. L. (2005). Diversifying the engineering workforce. *Journal of Engineering Education*, 94: 73–86. doi: 10.1002/j.2168-9830.2005.tb00830.x.
7. Corbett, C. and Hill, C. (2015). *Solving the equation: The variables for women's success in engineering and computing*. AAUW: Washington, DC.
8. DeOrnellas, J. (2015). From curious little girl to household breadwinner. Retrieved from <http://www.aauw.org/2015/03/09/stephanie-engineering-and-cybersecurity/>.
9. DeOrnellas, J. (2015). I am the unicorn: A young woman of color prepares to enter the computer science workforce. Retrieved from <http://www.aauw.org/2015/03/19/i-am-the-unicorn/>.
10. Fleming, L. N., Moore, I. N., Williams, D. G., Bliss, L. B., and Smith, K. C. (2016). Social support: How Hispanic and Black engineering students perceive the support of peers, family, and faculty. 120th ASEE Annual Conference & Exposition, Paper ID #7227.
11. Fouad, N. A. and Santana, M. C. (2016). SCCT and underrepresented populations in STEM fields: Moving the needle. *Journal of Career Assessment*, 25(1). Retrieved from <http://journals.sagepub.com/doi/full/10.1177/1069072716658324>.
12. Hill, C., Corbett, C., and St. Rose, A. (2010). *Why So Few? Women in Science, Technology, Engineering, and Mathematics*. AAUW: Washington, DC.
13. How diverse is Silicon Valley? (2013). CNN Money. Retrieved January 27, 2017, from <http://money.cnn.com/interactive/technology/tech-diversity-data/?iid=EL>

14. Institute for Broadening Participation. (2014). Designing for success: Positive factors that support success in STEM pathways and reduce barriers to participation: What does the research say about what enables students to succeed and persist in STEM fields?
15. Lent R. W., Miller M. J., Smith P. E., Watford B. A., Lim R. H., Hui K....Williams K. (2013). Social cognitive predictors of adjustment to engineering majors across gender and race/ethnicity. *Journal of Vocational Behavior*, 83, 22–30.
16. Lent, R. W., Brown, S. D., Schmidt, J., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of contextual supports and barriers to choice behavior in engineering majors: Test of alternative social cognitive models. *Journal of Counseling Psychology*, 50, 458– 465.
17. Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance [Monograph]. *Journal of Vocational Behavior*, 45, 79-122.
18. Matusovich, H., Streveler, R. & Miller, R. (2010). Why do students choose engineering? A qualitative, longitudinal investigation of students’ motivational values. *Journal of Engineering Education*, 99, 289–304.
19. Morning, C. and Fleming, J. (1994). Project Preserve: A program to retain minorities in engineering. *Journal of Engineering Education*, 83: 237–242. doi: 10.1002/j.2168-9830.1994.tb01109.x.
20. National Science Foundation (2015). Women, Minorities, and Persons with Disabilities in Science and Engineering: 2015, p. 13.
21. Obiomon, P.H., Tickles, V.C., Wowo, A.H., Holland-Hunt, S. (2007). Advancement of Women of Color in Science, Technology, Engineering, and Math (STEM) Disciplines. Faculty Resource Network.
22. Slaughter, J. B., Tao, Y., & Pearson, W. (2015). *Changing the face of engineering: The African American experience*. Baltimore, MD: Johns Hopkins University Press.
23. Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology*, 69(5), 797–811. doi:10.1037/0022-3514.69.5.797.
24. Yoder, B.L. (2015). Engineering by the numbers. Washington: American Society for Engineering Education. Retrieved from https://www.asee.org/papers-and-publications/publications/14_11-47.pdf.