

Then and Now: Women Engineers' Perspectives on Changes and Challenges in the Field Since the 1970s

Understanding the career trajectories and experiences of women who came of age during the 1970s may help institutions develop better means of supporting female engineers today.

By Laura Ettinger, Ph.D., Nicole Conroy, Ph.D., and William Barr II

The number of women in engineering continues to be relatively small, and even when women enter the field, they often do not stay. Researchers have explored why these problems persist and have offered many suggestions for changing the landscape, yet problems with recruitment and retention remain, and solutions seem elusive. Although women engineers, particularly those who have been in the profession a long time, are in excellent positions to see the problems and to suggest ways to create a more welcoming and inclusive profession, they have rarely been engaged in seeking solutions. In our project, funded by the National Science Foundation, we address this limitation by inviting women engineers to share their stories.¹

Our research assesses a pivotal generation of pioneering American women engineers who graduated from college in the 1970s. In that decade, young women, encouraged in part by the women's movement and changing social expectations, flocked into higher education and, to a much lesser extent, engineering. These female students, although not the very first women to enter engineering, were the beneficiaries of new affirmative action laws, and unlike their predecessors, they were part of a small but growing cohort of women engineers. The percentage of women earning undergraduate degrees in engineering grew at a rapid rate from less than 1 percent in 1970 to 9 percent

in 1979.² Understanding the career trajectories of these women may help institutions to develop better means of supporting female engineers.

PROJECT OVERVIEW

The results presented here are part of a larger, ongoing mixed-methods study on North American women engineers who graduated from college in the 1970s. This data, from 244 participants' responses to open-ended questions on a nationwide survey, included (a) perceptions of challenges for new and experienced women engineers today and (b) how challenges have changed over time, as well as (c) advice for young women engineers.

To be eligible for the survey, a participant had to: identify as a woman, have grown up or worked in North America, have earned an undergraduate degree in the 1970s, and have majored in engineering or worked as an engineer at some point in her career. Demographic information of participants can be seen in Table 1.

Because the proportion of racial and ethnic minorities is small, the race/ethnicity of the respondents is not noted in the results below, except when a respondent discusses it.

INFLUENCES

In response to the questions “What influenced you to choose a degree and/or career in engineer-

ing?” and “What is one of the most satisfying things about being an engineer?” survey respondents reported that they were often drawn to engineering as a result of a love and/or aptitude for math and science or because of encouragement by others in “a time of space and science.” They continued to enjoy the opportunity to solve challenging problems, to do meaningful and varied work, to work with smart colleagues, and to help others in a prestigious field where they could be financially successful.

CHALLENGES THEN AND NOW

The open-ended, multipart survey question: “In your experience, what is one of the greatest challenges faced by young women engineers? By experienced women engineers? To what extent do you believe the challenges have changed over time?” yielded especially rich answers.

Some respondents distinguished between the challenges facing young vs. experienced women engineers, while others did not. Regardless, the challenges facing women engineers mentioned most frequently can be divided into three themes: 1) not getting respect, 2) not fitting in, and 3) work/family balance.

CHALLENGE #1: NOT GETTING RESPECT. The most frequently mentioned of the challenges (32 percent of respondents who answered this question) was not getting respect from peers and supervisors. This was also expressed as not being taken seriously, not being heard, having to prove oneself repeatedly, and people not believing that women can be engineers.

One survey respondent suggested that women engineers do eventually gain respect, but they have to do extra work to get it: “In mentoring young female engineers, I have found that they face most of the same problems that all women faced in the workforce when I started working and when I retired. Some male colleagues did not/do not respect the opinion or work of a female engineer, regardless of her experience or education. Until they experience the female engineer being competent and respected by others in the organization, they are disrespectful and do not listen or respond appropriately.”

Some explained that women “have to work twice as hard” as men to prove themselves. Or, as another

woman put it, “women engineers will be fully part of the field when mediocre female engineers are accepted as easily as mediocre male engineers.” She wasn't sure whether this has occurred, as she left the workforce following the birth of her children and a lack of quality child care.

CHALLENGE #2: NOT FITTING IN. Twenty-two percent of the respondents who answered this question said that one of the greatest challenges

TABLE 1

VARIABLE	(%)
Race**	
Caucasian/White	93
Asian/Asian-American	2
Latino(a)/Hispanic	2
African-American/Black	1
Other	3
Where did you grow up?	
In the U.S.	91
Outside the U.S.	9
Undergraduate degree	
Engineering	82
Math/Science/Computer science	13
Other	5
Primary employment industry	
Manufacturing	22
Education	20
Consulting	8
Electric, gas, sanitary services	5
Transportation	4
Construction	3
Public administration	3
Health care	2
Technical sales	2
Communications	2
Other	29

Sample demographic information (N = 244)

**Participants could select “all that apply”; thus the total exceeds 100 percent.

experienced by women engineers was and remains not fitting in. They articulated this as feeling or being left out; isolation; being told they didn't belong; being an oddity; and not having access to "good old boys networking."

A number of women said this was especially difficult when they were younger because women engineers were so unusual then.

"When I was a young engineer my biggest challenge was convincing others on the job that I was more than a temporary freak show."

Many women explained that the challenges of not fitting in have continued.

"The biggest challenge is being reminded that women will never be considered or accepted as true engineers. We are 'women engineers.' People don't refer to a man as a 'man engineer,' he's an engineer. We are constantly reminded that we don't truly belong. I don't believe that this challenge has changed overtime [sic]."

CHALLENGE #3: WORK/FAMILY BALANCE.

The third most frequently reported challenge (21 percent of respondents who answered this question) was work/life or work/family balance, with three interrelated components.

First, according to the respondents, supervisors and peers often see women differently once they have caregiving responsibilities.

As one respondent noted: *"Being a member of the 'model minority' [Asian-American respondent] I have encountered a LOT of subtle discrimination. When my mother got ill, my female boss demoted me so that 'You can take care of your mother.' I didn't have a choice."* Her boss assumed that the role of an Asian-American woman was to care for her elderly parent.

Second, many women faced difficulties trying both to do their jobs and care for their families. As one respondent explained, one *"of the biggest challenges remain[s]...work-life balance (particularly time-out for children or elder care). The young women engineers that I talk with face virtually the same child care problems that I did 30 years ago!"*

Third, some women altered their career paths because of their family situations. A number of re-

spondents said that once women have children, they are not able to compete with men who are in the same careers because they (the women) have more on their plates. Therefore, one woman advised:

"If you have a family, providing the flexibility to manage it will still be primarily the mother's role. Don't skip the family because of this, but just be aware of it. Don't consider yourself a failure when this reality strikes."

At the same time, a few women noted that either they or others chose not to have children because they felt they could not combine career and children.

The three components of this challenge are related because what appears to be personal choice (i.e., the decision not to seek out certain opportunities) is often constrained by external factors beyond a woman's control.

GENDER BIAS DECREASING?

Wide-ranging perspectives emerged on how the challenges of engineering have changed. The most

frequent answer was a variation of *"progress is slow."* Respondents indicated that some progress has occurred, but women still face discrimination and bias.

"The greatest challenge for me was continuing to believe in myself when all

the messages I was getting was [sic] that I would never be taken seriously or promoted or given raises, or even hired at the same rate as men who were clearly less qualified and not as smart as I was. That get's [sic] seriously annoying. Also being asked to do that in a dress. That last part has changed."

"The challenges have lessened a bit over time with more visible and capable women in leadership positions, but many of the issues faced by young women engineers are remarkably similar to those I faced nearly 40 years ago."

Many noted that the bias has become more subtle.

"It's still an old boys club at the top. It takes generations to change this. The challenges are subtle, ingrained and, to some extent, sub-conscious. It's gradually getting better but there are numerous glass ceilings along the way."

In the words of another respondent, this kind of institutional bias *"can really hurt young women because it can take them years to recognize it, by which time they may have lost a lot of ground."*

However, not all of the women reported that *"progress is slow."* Some women maintained that prejudices due to gender no longer exist, or never existed. Others said that things have gotten dramatically better for women engineers or that they have an advantage now.

"Today, young women engineers are more accepted mostly because there are just more of them. It's easier to get their foot in the door. Younger male engineers are also use[d] to working with women because they went to school with them. Therefore they don't think much of it, or why it use[d] to be such a big deal."

"When [I] first started, it was like you weren't even in the room. Now, it is not a 'thing' that the young men or women even notice when working. [M]any young women are in management — not upper, yet — and have husbands at 'home.' Nice to see attitudes and behaviors changing."

A few said that things are harder for women today. Several noted that the persistence of gender bias varies by industry.

ADVICE FOR YOUNG WOMEN

In response to **"What advice would you give to a young woman who is thinking about or pursuing a career in engineering?"** 36 percent of respondents stated enthusiastically that young female engineers should either *"Do it!"* or *"Go for it!"* In fact, only two women said they would discourage women from pursuing engineering careers.

For some of the pioneers, becoming an engineer extends beyond the satisfaction of the profession, and for others, skills translated into employment in other fields altogether. As one woman noted, an engineering degree *"gives you flexibility to work in a variety of capacities and in a variety of industries."*

While supportive, some pioneers argued that young women need more than a degree to prepare for the challenges they may face; *"being yourself"* and having *"thick skin"* were suggested as important coping strategies.

"Be persistent about it and never give up. Having a stubborn streak also helps. This is still true: a woman has to be twice as good as a man to be considered half

as good. However, this is not difficult."

Others stressed the importance of finding a supportive network.

"Understand the story of women engineers, the battles they faced, the barriers they broke and how the tactics they used to move forward can help you as you progress. Use the 'Old Girls Network' — it does exist. SWE is a good place for that, but so are other technical societies in your field. There are women there who might have encountered a similar situation that can help."

Some likewise advised identifying both male and female mentors early on.

"Find a good mentor, maybe multiple mentors both male and female and in engineering and not in engineering."

Others suggested that young women engineers should not focus on *"looking for discrimination. It may exist, but it's not productive to analyze every interaction for signs of discrimination."*

Despite acknowledging the difficulties that women are likely to face in engineering, many of the pioneers implored young women to *"follow your passion"* of problem-solving to enact change.

"I encourage young women to do it if they care about solving the world's problems. An engineering education provides a strong basis for studying a situation [or] figuring out how to make it better, so even if they ultimately decide to pursue a different field, they

Did You Earn an Undergraduate Degree in the 1970s?

To make it possible for others from this era to contribute to the conversation about creating a more gender-inclusive engineering profession, our survey, <http://tiny.cc/WomenEngineers>, will remain open until March 31, 2018, alongside in-depth interviews and follow-up questionnaires we are conducting with those who are interested. We are especially interested in hearing from women of color, who made up a small percentage of women engineers in the 1970s. For more information about the project, please visit <http://pioneers.clarkson.edu/>.

will have a fabulous foundation for decision making for the rest of their lives.”

Yet, again, others were quick to remind future female engineers of the gender-related troubles they may face.

“I would encourage them to follow their passions but also be honest that mechanical, electrical, and aerospace engineering are still a ‘man’s world’ and they need to be prepared for that.”

In sum, while some pioneers debated the impact of gender-based discrimination on young women’s futures, others advised that women engineers can succeed by following their passions, securing marketable skills, and through mentorship and networking.

DISCUSSION AND COMMON THEMES

Survey respondents overwhelmingly recommended that young women pursue engineering degrees or careers. However, most of the pioneers also reported that they faced a number of challenges, some of which they still see in engineering. While many suggested that things had improved for women in engineering since the 1970s, others emphasized that *“progress is slow.”*

The three most frequently cited challenges — not getting respect, not fitting in, and work/family balance — are connected. When you don’t fit in, whether it’s because you actually don’t fit in, you’re told you don’t fit in, or you feel you don’t fit in, you have to prove yourself repeatedly. This is what Joan C. Williams, J.D., et al. call the “prove-it-again bias,” referring to the many studies that show that “women and people of color often need to be more competent than white men in order to be seen as equally competent.”³

The challenges of not getting respect and not fitting in are connected to the third challenge: work/family balance. Work/life balance will inevitably be a challenge for women so long as institutions devalue their contributions.

RECOMMENDATIONS

Our preliminary findings suggest that although the engineering landscape has changed for women over time, it is far from equitable. To work toward the goal of greater gender inclusivity in engineering, we offer three primary recommendations:

Mentoring. Pioneers cited the importance of finding a supportive network and multiple male and female mentors. The Society of Women Engineers and other engineering organizations have long advocated and promoted mentorship. We recommend that engineering organizations create mentoring programs, based on social science research and with appropriate training for mentors and mentees, which tap specifically into the experiences and perspectives of late-career and retired women engineers. As evidenced by their rich survey responses, pioneering women engineers have valuable experiences and wisdom to

share, and a desire to do so. Today’s young women in engineering are, in a sense, still pioneers, so learning from the women who came before them can demonstrate that the young women’s experiences are neither irrelevant nor isolated incidents. We also recommend that mentoring

programs acknowledge that women need different types of mentoring at different stages of their careers and lives.

Interdisciplinary approach. Engineering has been trying for decades to increase the number of women in the profession. We recommend taking an interdisciplinary approach to this problem, as well as to address the cultural challenges facing not just engineering, but many other professions, as evidenced, for example, by the recent #MeToo and #TimesUp campaigns. Social scientists can provide an interdisciplinary framework to help dismantle the complex, structural challenges women have faced and continue to face in engineering, and that may otherwise feel insurmountable.

Empathy and action. The pioneers have generously told us their powerful stories. Their stories have the potential to create empathy and provoke necessary action.

We recommend that these stories be used to create “empathic unsettlement” — what we’re calling “empathy and action” — a concept from Dominick LaCapra, Ph.D., that suggests we should try to feel another’s struggle (empathy) while realizing that we cannot fully understand what someone else experiences. Therefore, we must be willing to be unsettled by both empathizing and knowing that fully doing so is not possible.⁴ For the profession to become more inclusive and to realize its full potential, senior management in particular, most (though not all) of whom are male, must be willing to listen for and examine their own unconscious biases. In leading these discussions by example, both men and women in positions of influence will be more willing and able to create an environment in which discussions of unconscious biases focus on questioning stagnant institutional practices.

CONCLUSION

The pioneering women engineers who responded to our survey discussed both the satisfaction and success they experienced in their careers, as well as the challenges they faced and those that continue in the profession. Given the changes in laws (in hiring, sexual harassment, and family leave, for example) and culture since the 1970s, it *seems* like women engineers should be celebrating their collective progress, and many are. The hard-to-identify challenges rooted in gender bias, however, resulted in many of the women saying: “things have changed, but ...” ✨

Endnotes:

1. National Science Foundation Award #1734500: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1734500&HistoricalAwards=false
2. American Association of Engineering Societies, “Women in Engineering,” *Engineering Manpower Bulletin* 52 (April 1981), Society of Women Engineers National Records, Box 184, Folder 5, Walter P. Reuther Library, Wayne State University, Detroit, Michigan.
3. Williams, J.C., S. Li, R. Rincon, and P. Finn (2016).

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4. LaCapra, D. (2013). *Writing History, Writing Trauma*. Baltimore: Johns Hopkins University Press.

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