

# Exploring the Gender Bias Experienced by Engineering Faculty

## Abstract

The purpose of this study is to identify patterns of implicit gender bias that females working as engineering faculty face in the workplace. Using data collected from a larger study on engineers conducted by the Center for WorkLife Law, UC Hastings College of the Law, and the Society of Women Engineers in 2016, this paper focuses on the responses of 335 female and male engineers working in academia.

Using the four basic patterns of implicit bias defined by Williams & Dempsey (2014), this study offers insights into the personal experiences of female engineers in academia. Data show that compared to males, female engineering faculty reported higher levels of implicit bias in the academic workplace than their male counterparts.

## Purpose

*“...The gender issues feel overwhelming to me and I constantly consider leaving engineering for another line of work. I feel it is so unfair that I want to quit. ALL THE TIME.” – Female Tenured/Tenure-Track Faculty*

Attrition is an issue for women in STEM, particularly within engineering. After about 12 years, half of women working in STEM have left to work in other fields (Corbett & Hill, 2015). Studies have found that workplace climate and culture are strong influences in women’s decisions to leave the STEM workforce (Fouad, Singh, Fitzpatrick, & Liu, 2012; SWE, 2016). Social psychologists have been interested in understanding how gender and racial bias can impact the career trajectories and retention of minorities and women in STEM (Bertrand & Mullainathan, 2004; Biernat & Kobrynowicz, 1997; Correll, Benard, & Paik, 2007; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Reuben, Sapienza, & Zingales, 2014). However, most of these studies have taken place within social psychology laboratories.

The purpose of this study is to identify patterns of gender bias that female engineers working in academia face in the workplace, using personal experiences to understand the influence of bias on the workplace environment. Unlike most studies of gender bias in STEM, this study is not experimentally-based. Rather, it was presented to study participants as a survey on the engineering workplace environment and not as a study of gender bias in the engineering workplace. Hence, the results are based on personal experiences, and they indicate that biases in the academic workplace – particularly in higher education – may be negatively impacting workplace climate and culture.

## Theoretical Framework

This study frames the experiences of female engineers in academia using the four basic patterns of implicit bias against women as identified and outlined in the book “What Works for Women at Work” by Williams & Dempsey (2014). Williams created a four-type categorization system to

describe implicit biases experienced by women in daily workplace interactions: the Prove-It-Again bias, Tightrope bias, Maternal Wall bias, and Tug of War bias.

Prove-It-Again bias refers to the stereotypes and in-group favoritism that require women to be more competent than white men in order to be seen as equally competent. Though this may be caused by bias on a unconscious level, evidence of this bias pattern appears when women have to prove that they are qualified and competent over and over again. Studies have shown that women are often held to higher standards than their male counterparts (DesRoches & Zinner et al., 2010; Foschi, 1996, 2000; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012; Wenneras & Wold, 1997).

Tightrope bias is when women feel pressure to behave in feminine ways and receive backlash when they behave in masculine ways. Women often have to balance between being seen as “too masculine” (being respected, but not liked) and “too feminine” (being liked, but not respected). The backlash against women who behave in masculine ways – being assertive and ambitious, for example – can make it difficult for women to reach leadership levels. This narrow range of acceptable behavior from women versus men has been documented for decades (Bowles, Babcock, & McGinn, 2005; Rudman & Fairchild, 2004; Rudman, Moss-Racusin, Phelan, & Nauts, 2012; Glick & Fiske, 2001; Heilman, Wallen, Fuchs, & Tamkins, 1995).

Maternal Wall bias is the penalty against motherhood due to assumptions of negative competence and commitment to the job. For mothers who are viewed as competent and committed, they may be considered less warm and less likeable (Correll & Benard, 2010). Over 20 years of studies have documented this bias (Crosby, Williams, & Biernat, 2004; Heilman & Okimoto, 2008; Cuddy, Fiske, & Glick, 2004; Halpert, Wilson, & Hickman, 1993). The stigma against women who take family leave or request a reduced schedule can also trigger Maternal Wall bias. Men can also experience a form of Maternal Wall bias when requesting similar flexibility benefits or taking on caregiver responsibilities (Berdahl & Moon, 2013).

Tug of War bias results when gender bias against women fuels conflicts among women. Women who perceive that there is just one or very few slots available for women in their male-dominated workplace may end up competing against other women for those coveted spots. Studies have found that women who have experienced discrimination in male-dominated environments early in their careers often distance themselves from other women and try to assimilate into the environment or the “boys’ club” (Derks, Van Laar, Ellemers, & de Groot, 2011; Duguid, 2011; Duguid, Loyd, & Tolbert, 2012)

## **Methodology and Data Sources**

This mixed-methods study utilizes data collected from a larger study conducted by Professor Joan Williams at the Center for WorkLife Law (CWLL), UC Hastings College of the Law, and the Society of Women Engineers (SWE) in 2016. The context of the study centered on understanding the experiences of gender bias patterns by both men and women in the engineering workplace. More than 3,000 engineering professionals from a variety of industries completed the Workplace Experiences Survey online, including over 300 engineers working in academia. All survey respondents were over 18 years of age with at least two years of experience

as an engineer. This paper is based on the responses obtained from 215 female engineers and 120 male engineers working in academia, with particular attention given to the 116 female engineers and 74 male engineers who indicated they are tenured or tenure-track faculty (not in administration), as engineers working in academia could include consultants and K-12 teachers. Table 1 lists the demographic distribution of the sample.

The Workplace Experiences Survey consists of 39 Likert scale questions asking respondents to choose an answer on a scale from one to six, from strongly disagree to strongly agree. For this study of engineers in academia, we dichotomized the Likert scale variables, combining strongly agree, agree, and somewhat agree into the “agree” category, calculating the percentage of male and female respondents who agreed with each statement. One question was later removed from the analysis due to statistical reliability issues.

In addition, over 30% of engineers working in academia left comments in response to an open-ended survey question. All participants were informed of the confidentiality and anonymity of the data. Comments were uploaded and analyzed in Dedoose against the four patterns of implicit bias.

## **Results**

Prove-It-Again: Six Likert scale questions were analyzed under the Prove-It-Again bias pattern. Table 2 lists the percentage of female and male engineers working in academia that agreed with each statement. Respondents were not required to answer every question, so the percentages are based on the total number of respondents to each question.

Overall, women in academia reported high levels of Prove-It-Again bias, with 62% of women agreeing that they are held to higher standards than their colleagues. For women in tenured or tenure-track positions, that percentage jumped to 70%. Women in tenured or tenure-track positions were also more likely to report being mistaken for administrative or custodial staff, with 72% percent indicating this has happened to them. Women in academia were much more likely than men to report that they repeatedly have to prove themselves to receive respect and recognition: 73% of women reported this versus 43% of men. Alternatively, men were much more likely to indicate that their suggestions and ideas are respected: 81% of men agreed with this versus 60% of women.

*“My boss does not know he is prejudiced against women. He just sees me as deserving of less pay with a PhD than a male person with a Master's degree. He has changed the metrics for performance for our team than the other team.... Meanwhile, he is comparing us and will then determine the metrics which will support the pay difference.” – Female Academic Administrator*

*“Women are seldom respected. Opinions or suggestions are rarely implemented and have many times been mocked during a meeting.” – Female Tenure/Tenure-Track Faculty*

Tightrope: Ten Likert scale questions were analyzed under the Tightrope bias pattern. Table 3 lists the percentage of female and male engineers working in academia that agreed with each statement.

Women in academia indicated that they are interrupted in meetings more often than their colleagues, with 54% of women agreeing with this statement versus 20% of men. Women were also more likely than men to report that they feel pressure to let others take the lead: 42% of women agreed with this statement versus 18% of men. The influence of this appears to impact the results seen from the statement “People at work see me as a leader,” with 74% of women agreeing with this versus 90% of men. These results mirror what women in tenured or tenure-track positions report as well.

*“I get comments about my appearance, rather than my teaching ability, in my teaching reviews from college-age students.... I feel I am overly concerned about how I dress. I want to be professional but not too 'sexy.'...When I brought up my concern about teaching review comments to my supervisor (male) he blew them off saying they're always a few individuals who make such comments - rather than offer to look into how common an occurrence it is, which is what I wanted. If it's common, then it would be worth addressing (in my opinion) as it can severely undermine the confidence of women in academia.” – Female Graduate Research Assistant*

*“I am considered to be aggressive because I am assertive. People say that they fear me, yet men who are more assertive than me get respect.” – Female Department Chair*

Maternal Wall: Six Likert scale questions were analyzed under the Maternal Wall bias pattern. Table 4 lists the percentage of female and male engineers working in academia that agreed with each statement.

Women in academia were much more likely than men in academia to report bias triggered by parenthood, with 45% of women with children reporting that having children did not change their colleagues' perceptions of their work commitment or competence versus 69% of men. Women were also more likely to experience a flexibility stigma, with 47% of women and 58% of men agreeing that asking for family leave or a flexible work arrangement would not hurt their career.

*“...I've heard others in other fields say they would not want their daughters to become engineers because of the horrible work/life balance for engineers, which I cannot contradict.” – Female Engineer in Academia*

Tug of War: Five Likert scale questions were analyzed under the Tug of War bias pattern. Table 5 lists the percentage of female and male engineers working in academia that agreed with each statement.

Women in academia were more likely to feel socially isolated at work than men, with 41% of women agreeing with this versus 26% of men. Women were also more likely than men to report that some women engineers do not understand the level of commitment required to be a successful engineer, with 27% of women agreeing with this statement versus 12% of men. For women in tenured or tenure-track positions, 23% felt that they had to compete with their female colleagues for the “woman’s slot.”

*“The isolation is profound. If you like being a loner, this career will work for you! There are bright spots (a few individuals who will step away from the pack and befriend you) but dang, they are few and far between.” – Female Entrepreneur in Academia*

*“I’ve been able to establish a support network with other women that has been beneficial for me. What has been incredible disappointing is the competitive attitude I’ve faced from the only other female faculty member in my department.” – Female Tenured/Tenure-Track Faculty*

## **Recommendations**

Based on the findings from this study as well as prior research that indicates that employees’ perceptions of bias are correlated with turnover intentions, addressing a hostile climate within the workplace is critical if academic institutions want to increase the diversity within engineering faculty. Alternative options are available for engineers seeking employers who value diversity. Trainings on strategies to interrupt bias could be effective in addressing climate change, but these efforts must accompany changes to the business systems to address implicit biases in hiring, promotion and tenure, salary decisions, etc.

## **Significance**

This study aims to identify patterns of gender bias that female engineers experience working in academia. These biases must be recognized and addressed as they jeopardize our efforts to diversify the engineering profession, not least by potentially reducing role models and mentors for female engineering students. Diversifying the profession cannot happen solely by recruiting more women into engineering programs. Female engineers need to be supported in all stages of their careers. By addressing the implicit biases that are negatively impacting the academic workplace, we can help reduce the attrition of female engineers in both industry and academia.

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**Table 1: Demographics and Summary Statistics of the Sample**

Total Sample = 335

<b>Demographic</b>	<b>Observations</b>	<b>Proportion of Responses</b>
Gender		
Women	215	64%
Men	120	36%
Academic Position		
Tenured/TT Women	116	35%
Tenured/TT Men	74	22%
Race/Ethnicity*		
White	272	81%
African American	8	2%
Latino/Latina	10	3%
Asian American	22	7%
Native American/Alaskan Native	5	1%
Middle Eastern/Arab American	10	3%
Other	10	3%
Age		
18-24 years old	6	2%
25-34 years old	66	20%
35-44 years old	70	21%
45-54 years old	95	28%
55-64 years old	67	20%
65+ years old	25	7%
Prefer not to respond	6	2%
Highest Degree Completed		
Bachelor's degree or below	19	6%
Master's or professional degree	70	21%
Doctorate degree	246	73%
Years with Current Employer		
< 2 years	49	15%
2-5 years	96	29%
6-10 years	70	21%
11-20 years	71	21%
21-30 years	35	10%
30+ years	13	4%

\* Multiple responses permitted

**Table 2: Prove-It-Again Comparisons**

Question	% Female	% Male	% Female T/TT	% Male T/TT
"I feel I am held to higher standards than my colleagues."	62%	44%	70%	43%
"My suggestions or ideas are respected as much as my colleagues'."	60%	81%	60%	76%
"In meetings, other people get credit for ideas I originally offered."	62%	38%	62%	34%
"After moving from an engineering role to a project management/business role, people assume I do not have technical skills."	59%	30%	56%	31%
"I have to repeatedly prove myself to get the same level of respect and recognition as my colleagues."	73%	43%	72%	47%
"I have been mistaken for administrative or custodial staff."	66%	17%	72%	19%

**Table 3: Tightrope Comparisons**

Question	% Female	% Male	% Female T/TT	% Male T/TT
"Being vocal about my work and accomplishments is rewarded."	57%	61%	54%	60%
"I am expected to be a 'worker bee', which means I should work hard, avoid confrontation, and not complain."	59%	51%	63%	51%
"People at work see me as a leader."	74%	90%	72%	88%
"I feel free to express anger at work when it's justified."	41%	50%	42%	48%
"As compared to my colleagues in a comparable role with comparable seniority and experience, I am more likely assigned to high-profile tasks or work teams."	44%	59%	47%	56%
"I seldom receive pushback when I behave assertively."	40%	58%	41%	58%
"I feel pressure to let others take the lead."	42%	18%	41%	22%
"I have had the same access to desirable assignments as my colleagues."	61%	79%	61%	78%
"I am interrupted at meetings more than my colleagues."	54%	20%	53%	25%
"As compared to my colleagues in a comparable role with comparable seniority and experience, I more often do office housework – finding a time everyone can meet, taking notes at a meeting, planning office parties, etc."	52%	32%	53%	35%

**Table 4: Maternal Wall Comparisons**

<b>Question</b>	<b>% Female</b>	<b>% Male</b>	<b>% Female T/TT</b>	<b>% Male T/TT</b>
"I have to spend more time working to compensate for the schedules of my colleagues who have children."	19%	24%	25%	33%
"My colleagues have communicated to me that I should work fewer hours because I have children."	19%	8%	19%	12%
"My colleagues have communicated to me that I should work more hours because I have children."	2%	0%	2%	0%
"I feel pressured to work long hours to show my commitment, even when the workload does not really justify the overtime."	46%	42%	48%	43%
"Asking for family leave or flexible work arrangements would not hurt my career."	47%	58%	47%	60%
"Having children did not change my colleagues' perceptions of my work commitment or competence."	45%	69%	47%	73%

**Table 5: Tug of War Comparisons**

<b>Question</b>	<b>% Female</b>	<b>% Male</b>	<b>% Female T/TT</b>	<b>% Male T/TT</b>
"I am socially isolated at work."	41%	26%	38%	30%
"Some women engineers just do not understand the level of commitment it takes to be a successful engineer."	27%	12%	27%	8%
"I find it difficult to get administrative personnel to do the kinds of support work for me that they do for other engineers."	26%	14%	30%	16%
"I feel I have a lot in common with engineers of my own gender."	77%	75%	77%	71%
"I am regularly competing with my female colleagues for the ""woman's slot.""	21%	N/A	23%	N/A