A Cross-Cultural Comparison of Bias in Engineering Workplaces in the United States and India

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Abstract

The Center for WorkLife Law and the Society of Women Engineers examined and compared the workplace experiences of engineers in the United States and India in a two-part study. Despite the advances made by women earning engineering degrees, we still have yet to reach gender parity in the engineering workforce, in the U.S. and in India. In the current study, over 3,000 engineers in the U.S. and almost 700 in India were surveyed on their experiences of gender and racial bias in their engineering workplaces, and their perceptions of business systems including hiring, performance evaluations, and compensation. Our results showed that in the U.S., white men engineers tended to report lower levels of bias than women engineers and engineers of color. In India, both men and women engineers reported high levels of workplace bias. Our research suggests that women engineers were likely to report bias based on their gender, while men engineers in India were likely to report bias based on where they came from, their region of origin, or the language they spoke. Educating students about the prevalence of bias and teaching them strategies to succeed despite biased environments could have strong beneficial impacts for diversity in engineering workplaces.

Keywords: Bias, Gender, Cross-cultural, Workplace, Engineering

Introduction

Women enter into and drop out of the engineering workforce for a variety of reasons. There is a substantial body of work focused on encouraging girls to study engineering in school, but the role of bias in engineering workplaces is affecting the retention of women in the engineering workforce. The impacts of bias start accruing while engineers are still in school and continue throughout their careers. Most of the existing research on bias in the workplace is focused in the United States; however, this study takes a cross-cultural view of bias in both the U.S. and India. We drew on forty years of social science research on bias in the workplace to examine the experiences of engineers in the U.S. and India and the impacts of bias on workplace processes like hiring, performance evaluations, and compensation.

In the U.S., women earn about 21% of the baccalaureate degrees in engineering (Yoder, 2018). Women make up about half of all employed college graduates, but only 13% of people that work in engineering occupations (U.S. Department of Labor, 2018). One in four women leaves the field of engineering within the first five years, a rate much higher than the dropout rate of men (Corbett & Hill, 2015). Part of the reason for this high attrition rate is the difficulty faced by women in STEM because of bias (Hill, Corbett, & Rose, 2010).

In the 1980s, only 2% of the engineering degrees in India were earned by women compared to about 10% in the U.S. at that time (Patel & Parmentier, 2005). Twenty years later, women in India were earning 24% of the engineering degrees compared to 21% in the U.S. (Patel & Parmentier, 2005). Unfortunately, this upward trend has slowed, and now about 32% of the engineering degrees are earned by women in India (AISHE, 2018). This still exceeds the degrees earned by women in the U.S., where women's engineering degree attainment has seen far slower increases over this same time period.

The issues facing women engineering students in India are different than in the U.S. Women engineering students do not report the same "chilly climate" issues that are documented in the U.S. (Chandra, 2014). They report being treated respectfully by male peers and being included (Aspiring Minds, 2014). After graduation, they face a different set of challenges. The unemployment rate for women with engineering degrees in India is about 40%, a rate five times that of men, and it is increasing in much of the country (Goel, 2007; Patel & Parmentier, 2005).

Women engineers in India also face a different set of pressures focused on traditional gender roles. In India, 84% believe that if there is a scarcity of jobs, the jobs should go to men over women (The Economist, 2018). For married women, staying at home may enhance the family's social status, which leads to women being pressured to leave the workforce after marriage. Furthermore, when women do stay in the workforce, they are more likely to be employed in teaching roles, and fewer women go into corporate engineering (WISE, 2014).

Research on bias in the workforce in India is scarce. To conduct the current study, we built on social science research from the U.S. and used our findings to leverage our position to learn more about the state of engineering workplaces in India.

Background

There have been many experimental studies on bias in social psychology laboratories in the U.S. For example, in one randomized experiment STEM professors were asked to rate resumes for a lab manager position. Male candidates were rated as more competent and more hirable than identical female candidates, and were also offered higher starting salaries and more mentorship than comparable female candidates (Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012).

Another study asked individuals to rate two identical resumes with one difference: one but not the other was a mother. The mothers were 79% less likely to be hired, only half as likely to be promoted, offered much lower starting salaries, and were held to higher performance and higher punctuality standards (Correll, Benard, & Paik, 2007).

The current research builds off this body of experimental research by asking engineers in the workplace about their own experiences of bias. The participants in the current research were not in an experimental setting; they were simply reporting their personal experiences.

Theoretical Framework

This study stems from research conducted by the Center for WorkLife Law and a book, "What Works for Women at Work," which lays out the different types of bias reported by women in the workplace (Williams & Dempsey, 2014). The book establishes a model of four different patterns of bias that are reported by 96% of women in the workplace. The bias patterns are an issue in and of themselves, but they also play out in workplace processes like performance evaluations and promotions, and they have an impact on outcomes like belonging and intent to stay at a job.

The first pattern, Prove-It-Again bias, occurs when some groups have to prove themselves repeatedly in order to get the same level of respect and recognition that other groups are given automatically. A large body of research supports the finding that women are required to prove their competence and qualifications more than men in their workplaces (DesRoches & Zinner et al., 2010; Foschi, 1996, 2000; Moss-Racusin et al., 2012; Wenneras & Wold, 1997). Prove-It-Again is not limited to women; it can also play out along other identity dimensions including race, class, region of origin, sexual orientation, and even introversion.

The second pattern, Tightrope bias, occurs when certain individuals have to strike a balance between a narrow range of acceptable behaviors in the workplace. For women, this can mean walking a tightrope between being seen as a little too feminine (and therefore liked but not respected) and a little too masculine (and therefore respected but not liked). If women behave in a way that is deemed too masculine, they may face pushback for the same kind of assertive behaviors that men can get away with (Bowles, Babcock, & McGinn, 2005; Rudman & Fairchild, 2004; Rudman, Moss-Racusin, Phelan, & Nauts, 2012; Glick & Fiske, 2001; Heilman, Wallen, Fuchs, & Tamkins, 1995).

The third pattern, Maternal Wall Bias, is bias that occurs based on parental status. Research has shown that after women become mothers, they are faced with negative competence and commitment assumptions at work (Crosby, Williams, & Biernat, 2004; Heilman & Okimoto, 2008; Cuddy, Fiske, & Glick, 2004; Halpert, Wilson, & Hickman, 1993). If a woman shows indisputable commitment at work, she faces a different issue: she will be seen as a bad mother, and therefore not someone to like or trust (Benard & Correll, 2010). This pattern of bias can affect fathers as well: fathers are expected to be breadwinners, so they face pushback if they want to take a more active caregiving role with their children (Berdahl & Moon, 2013).

The fourth and final pattern, Tug of War Bias, occurs when gender bias in the environment fuels conflict between women. This can happen due to a perception that there is only one "woman's slot" that women need to compete for, and can result in women distancing themselves from other women in order to get ahead in the workplace (Derks, Van Laar, Ellemers, & de Groot, 2011; Duguid, 2011; Duguid, Loyd, & Tolbert, 2012). Tug of War Bias can also include pass-throughs of the other three types of bias; for example, if a woman applies

harsher standards to another woman, thinking, “that’s just what it takes to succeed here as a woman.”

Method

The purpose of the current study was to examine the workplace bias experiences of engineers in the U.S. and India. We sought to document the types of bias faced by engineers of different demographic groups, and to provide targeted recommendations for actions individuals and organizations can take to help level the playing field for engineers.

Engineers were surveyed using the Workplace Experiences Survey (Center for WorkLife Law, 2018). In the U.S., 3,093 (2,587 women) engineers participated in the survey in 2016 and in India 693 (423 women) engineers participated in the survey in 2018 (Williams, Korn, Rincon, & Finn, 2018; Williams, Li, Rincon, & Finn, 2016). Demographic information of the samples is provided in Table 1.

The Workplace Experiences Survey was refined for use in a cross-cultural sample before data collection began in India. Focus groups were conducted with women engineers in India to obtain qualitative data on how bias plays out in the engineering workplace in India. The researchers adapted the version of the survey used in the U.S. by editing questions for relevance in India and by adding new variables of interest, such as bias based on region of origin.

In both the U.S. and India samples, participants followed a web link to access the study. A welcome screen informed them that the study concerned their experiences in the workplace. Participants then completed a ten-minute survey that included questions about bias in the workplace, workplace processes such as performance evaluations and compensation, and outcomes such as belonging and intent to stay.

Confirmatory factor analysis was conducted on each dataset to ensure that the data was a good fit to the theoretical model we built on. During the analysis stage, items were combined into scales as appropriate. For items that did not fit together into scales, we analyzed them separately. To determine whether group differences were significant, t-tests and one-way ANOVAs were conducted on the Likert scale data. For ease of understanding, the data was converted into a dichotomous percentage agreement for presentation in reports; however, all comparisons were conducted on the raw data.

Results

The results of our surveys in the U.S. and in India indicated that workplace bias is a widespread issue. In general, the results showed that women in both India and the U.S., and men in India, reported higher levels of bias than U.S. white men. In the U.S., bias was reported primarily based on gender and race. In India, bias was reported based on both gender and region of origin. Tables 2 and 3 outline the major cross-cultural findings detailed in this section of the report. Multiple regression analyses were conducted on the data from India to examine the impacts of the four patterns of workplace bias, and are detailed in Table 4.

Prove-It-Again

Prove-It-Again bias was reported by 76% of women and men engineers in India, a level on par with women in the U.S. and higher than white men in the U.S. Prove-It-Again bias can impact any groups that are different from the majority in the workplace; this means that in a male-dominated workplace, women may experience bias, and in a workplace dominated by people from a certain region, people from another region may experience bias.

Regression analyses were conducted to examine which of the four patterns were associated with outcomes and workplace processes. An increase in Prove-It-Again bias was

linked to a decrease in feelings of belonging, satisfaction, and enjoyment at work, as well as an increase in thinking about looking for a new job elsewhere. Prove-It-Again bias was also linked to a decrease in perceptions that workplace processes in one's company are fair, including networking opportunities, performance evaluations, and compensation.

Tightrope

Tightrope bias was reported by 77% of the men and women engineers in India who took our survey, a level similar to that of U.S. women. This indicates that engineers were feeling like there is a narrow range of acceptable behaviors that they have to conform to in the workplace. There were some gender differences as well: in India, more women (45%) than men (30%) felt pressure to take on traditionally feminine roles in the workplace, like party planning or taking notes at a meeting. Women tend to get pushback for refusing to take on this office housework, but if they do play these roles, it takes time away from their engineering work (Williams & Dempsey, 2014).

Our regression analyses showed that Tightrope bias had the strongest impact of the four bias patterns. This was not surprising: Tightrope bias was reported by the highest number of participants, and Tightrope bias includes problems that engineers face due to being both "too feminine" and "too masculine." An increase in Tightrope bias was linked to a decrease in career satisfaction and enjoyment, intent to stay, and happiness about one's career continuing as it has been. Tightrope bias was also associated with negative perceptions of the fairness of workplace processes including assignments, performance evaluations, sponsorship, compensation, and the way the organization values diversity.

Maternal Wall

In India, 40% of men and women engineers agreed that their workplaces think that women should be at home, caring for their children. Furthermore, 27% of both men and women engineers in India thought that fathers should be working more after having children. These findings highlight traditional gender roles, which indicate that mothers should work less and fathers work more after having children. There was also a stigma against caregiving: 70% of engineers in India agreed that people with caregiving responsibilities face negative competence and commitment assumptions in their workplaces. Finally, engineers also have trouble obtaining flexible work arrangements for family care: 60% of women and 51% of men in India reported this issue, numbers slightly lower than women (74%) and men (63%) in the U.S.

Engineers without children also faced issues in the workplace. In India, 50% of men engineers and 39% of women engineers reported having to work longer hours because they don't have children. This was in contrast with the data from the U.S., where more women report having to work more to compensate for the schedules of colleagues with children. Using our qualitative data, we understand that in India, women have family care responsibilities that extend to other family members including parents and in-laws, so there isn't the same attitude that women without children have "no life" and are responsibility-free outside of work.

Regression analyses revealed that Maternal Wall bias was linked to feeling more excluded at work, and negatively linked to feeling like their company values diversity in the workplace.

Tug of War

Women engineers in India reported experiencing Tug of War bias as well. They reported having to compete for the "woman's slot" on the team at a higher rate than women in the U.S. (45% compared to 38%). Women in India (63%) reported that their women colleagues have

"turned into men" and taken on the way men to things in the workplace. 74% of women engineers in India, compared to 48% in the U.S., agreed that the younger women engineers in their workplaces do not understand what it takes to succeed as an engineer. These generational differences are likely due to gender bias in the environment being passed through from woman to woman.

Regression analyses revealed that Tug of War bias was linked to decreased feelings of belonging, perceptions of compensation fairness, and feeling like one's company supports diversity. Tug of War bias was also linked to feeling excluded at work and intending to leave one's current organization.

Workplace Processes

Engineers also reported high levels of bias when asked about specific business systems in their workplaces. In India, 54% of men and 45% of women engineers reported bias in their companies' hiring processes, a number comparable to U.S. women and higher than U.S. white men. This may reflect the issue of the "meritocracy": engineers tend to consider their field to be meritocratic, where people are rewarded for the hard work they put in. This attitude ignores the impacts of bias, and leads people to believe that hiring a more diverse group of employees is lowering the bar. Men in India may report more bias in hiring because they feel like women are being favored, although employment levels of engineers in India suggest that women are not actually being favored over men in the workplace.

Three-quarters of men and women engineers in India reported bias in their companies' promotion systems, a level higher than U.S. white men (54%) and women (64%). Women in our qualitative data sample from India spoke specifically about the difficulties women face when trying to get promoted, and how they see men being promoted over qualified women.

In India, 67% of men and women engineers reported bias in their companies' performance evaluations systems, compared to 63% of U.S. women and 55% of white men.

We asked about sponsorship and networking, and found a different pattern. In India, 76% of engineers reported bias in their companies' sponsorship systems, a number lower than that reported by U.S. white men. It seems that formal policies surrounding sponsorship and mentorship should be revised in both the U.S. and in India. Survey participants in India reported that more mentorship opportunities at their companies could help them excel in the workplace.

When asked about compensation fairness, 78% of men and women engineers in India reported bias in the compensation processes their companies use, a number higher than U.S. women (65%) and U.S. white men (53%). Compensation fairness is a major issue in retaining employees, and is a problem for most engineers both in India and in the U.S.

Lastly, we asked about belonging and exclusion in the workplace. In India, 61% of women and 53% of men engineers reported feeling excluded in the workplace, compared with 49% of U.S. women and 44% of U.S. white men. When individuals are excluded at work, it is a problem for the company as well as the individual: the company misses out on the opportunity to get a diverse point of view and take advantage of the full range of their talent.

Discussion

A clear pattern emerged in both of the populations we surveyed: people who do not fit the mold of what an engineer is supposed to look like experience more bias in the workplace, and tend to experience worse outcomes. This is a problem on an individual level, but it is also a problem for the organizations they work at because companies are losing out on some of their top talent.

In order to support employees and make sure they can produce their best work, it is important to ensure that everyone knows what the workplace policies are and that they are enforced in the way the organization intends. If an individual is seeking a promotion, they should be able to understand the steps they must take to get that promotion, and they should achieve the promotion if they take those steps. Transparency and respect for employees is key. There are a number of things a company can do to make sure their employees know, respect, and have a say in workplace policies: the company can organize focus groups, launch climate surveys, or simply ask employees for feedback (and make room to receive it). In many situations, employees already have the answers, they just need to be asked.

Participants in our survey of engineers in India reported a perception that supporting diversity is a poor career move. Similarly, in the U.S. we found that discussing gender bias in engineering is seen as controversial. This is a place where we can act to improve the workplace for the next generation. It is important to tackle the myth that engineering is a meritocracy – that the hardest workers will get ahead, and that hard work is rewarded fairly. Our surveys show that this is not always the case: sometimes bias gets in the way, and people who work hard may fail to get ahead if they don't match the majority demographics. This is something we can address in the education system, while people are still in training for STEM fields.

Engineering students take a variety of courses to learn how to be successful engineers. Training varies across disciplines, but we expect engineers coming out of school to understand math, physics, and computer science. Adding targeted training on bias in the workplace or incorporating bias lessons into the curriculum could be an effective way to prevent bias from infiltrating workplace processes. Teachers could share data on the prevalence and effects of bias in engineering workplaces with their students so they are aware of the impact that bias can have

before they encounter workplace bias firsthand. If we can train new engineers on how to address bias when encountered and mitigate bias in workplace decisions, we may see substantial changes in the engineering workforce going forward.

This study was a step forward in understanding the way bias impacts engineers in two countries: the U.S. and India. The two populations faced many of the same problems, but also saw some differences. This type of cross-cultural work needs to continue so that educators are provided with the strongest evidence to train their students on how to get ahead in a workplace that isn't always focused on merit. More evidence will allow us to advocate for policy changes at companies and training programs at universities, in order to get the most prepared engineers out there in the field.

Across both populations, we found high levels of workplace bias against engineers. Typically, white men engineers experience bias at significantly lower levels than women in the U.S. and India and men in India. When individuals face bias in the workplace, they are less engaged, less satisfied, and more likely to leave their companies. By using this knowledge to educate new engineers, we can inoculate them against the negative effects of bias and work toward equality in the engineering workplace.

Table 1: Sample Demographics

	Number (India)	Percentage (India)	Number (U.S.)	Percentage (U.S.)
Gender				
Women	423	61%	2,587	85%
Men	270	39%	506	15%
Age				
18-24 (18-25 U.S.)	80	12%	143	6%
25-34 (26-34 U.S.)	397	57%	898	35%
35-44	176	25%	590	23%
45+	40	6%	922	36%
Highest Level of Education				
Bachelor's degree or below	238	34%	1,185	46%
Professional/master's degree/doctorate	438	63%	1396	54%
Years of Employment Experience as an Engineer				
2-5	228	34%	338	13%
6-10	197	30%	756	30%
11-20	200	30%	544	21%
20+	22	3%	801	31%
Other Demographics				
Have dependent children	298	43%	1,136	37%

Table 2: Cross-Cultural Comparison of Four Patterns Bias

	India Men (%)	India Women (%)	U.S. White Men (%)	U.S. Women (%)
Prove-It-Again!	78.9	74.3		
Prove myself over and over			60.8	78.0
Held to higher standards			64.9	76.1
Ideas respected			37.4	56.8
Stolen idea			57.9	68.2
Tightrope	77.8	76.0		
Interruptions			41.7	66.4
Pushback for assertiveness			68.2	75.9
Leadership pressure			41.0	59.9
Self-promotion			74.5	73.5
Expressing anger			77.4	77.4
Worker bee			62.8	69.3
Leadership			45.5	50.4
Office housework			52.2	72.0
High-profile tasks and teams			68.8	76.9
Access to assignments			42.1	59.7
Feminine role	30.0	45.0		
Women can’t argue	28.0	45.0		
Maternal Wall				
Bias against mothers	40.4	40.3		
Bias against fathers	26.8	27.1		
Caregiver bias	69.3	70.9		
Work long hours			53.2	60.3
Flexibility stigma	51.2	59.6		
Flex arrangements			63.3	73.9
Personal bias	59.7	65.6		
Compensate for people with kids	50.6	38.9	42.3	46.2
Tug of War				
Women don’t know what it takes	59.1	74.5	29.8	46.7
Trouble getting admin support	54.6	40.8	32.7	37.2
Lot in common with my gender	51.0	54.5	52.9	53.6
Compete for woman's slot		45.4		37.9
Female colleagues support each other	38.6	43.7		
Women turned into men	54.9	63.3		
Supporting diversity is a bad move	50.8	48.6		

Table 3: Cross-Cultural Comparison of Workplace Processes

	India Men (%)	**India Women (%)**	**U.S. White Men (%)**	**U.S. Women (%)**
Hiring	54.2	44.7	26.8	46.6
Promotions	76.9	77.8	54.3	64.1
Performance evaluations	67.4	65.9		
Performance evaluations are fair			37.8	45.5
Performance evaluations are honest			44.3	55.6
Sponsorship	75	76.8		
Good mentors			59.9	60.2
Have Sponsor			77.7	74.8
Access to networking			40.0	54.5
Compensation	76.3	78.1		
Paid the same			52.4	65.3
Paid less			57.3	66.8
Belonging	53.3	56.2		
Exclusion	52.8	61.0	43.5	49.1
Region & Language	44.2	30.1		

Table 4: Multiple Regression Analysis Betas and P-Values

	Prove-It-Again	**Tightrope**	**Maternal Wall**	**Tug of War**	**Gender**
Belonging	.12*	.40***	.06	.12*	.02
Performance evaluations	.37***	.32***	.06	.03	.00
Assignments	-.04	.44***	.00	-.04	-.03
Support for diversity	.01	.21***	.22***	.24***	-.14***
Sponsorship	.14*	.34***	.04	-.11	-.03
Exclusion	.07	.31***	.14**	.23***	.02
Compensation	.21***	.24***	.01	.11*	.00
Others invested in my career	-.09	-.36***	-.05	.03	.05
Clear path for advancement	-.10	-.35***	.02	.00	.04
Career satisfaction	-.15**	-.46***	.08	-.04	-.03
Career enjoyment	-.12*	-.39***	.02	-.06	-.05
Happy for career to continue	-.05	-.40***	-.02	.00	.04
Looking for new job	.17**	.28***	.02	.14*	-.03
Long-term future	-.05	-.49***	.08	-.07	.00
Recommend my company	-.04	-.30***	-.04	-.10	-.01

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

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