

# Gendered Facets of Faculty Careers and Challenges to Engineering Education as an Inclusive Profession

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## BACKGROUND

Women faculty remain underrepresented in many science, technology, engineering, and mathematics (STEM) fields in both Australia and the United States. Given the current interest in developing engineering education as a profession in its own right, it is necessary for engineering educators to examine and understand the experiences and working conditions of engineering faculty members. Otherwise, professionalization efforts risk ignoring and perpetuating gendered facets of faculty careers. Furthermore, those gendered facets of faculty careers stand as potential barriers to the successful promotion of engineering educator identities. Better understandings of the experiences of female faculty are necessary because gender biases of faculty careers often go unnoticed or unvoiced and therefore remain unproblematized as neutral features of academia.

## PURPOSE

The purpose of this study was to identify factors contributing to the low numbers of female faculty members in engineering (and related) fields, identify gendered facets of faculty careers, and highlight bodies of literature that are pertinent (based on our data) to engineering education.

## DESIGN/METHOD

Forty-four semi-structured interviews averaging 90 minutes in length were conducted with female and male faculty members in science, technology, engineering, and mathematics (STEM) departments at a large public research university in the United States. Participants were asked about many different facets of their experiences as STEM faculty members. Transcript data were analysed using a grounded theory approach to identify gender-related themes that shape faculty careers.

## RESULTS

Three themes emerged as gendered influences on faculty careers. They were: socialization, gender roles and unconscious bias, and work-family balance. Each theme reveals ways in which academic institutional (and broader social) norms generally work to the advantage of male faculty and the disadvantage of female faculty.

## CONCLUSIONS

There are a variety of ways in which engineering faculty careers are gendered, and literature from relevant fields such as higher education and social psychology should be brought to bear on our understandings of those gendered facets. Gender inequalities, such as those we identify, should be understood as challenges for the engineering education community to address as it aspires to become a more equitable profession, and we also offer these themes as important research horizons for engineering education researchers.

## KEYWORDS

Gender, faculty members, institutional culture

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## Introduction

Despite decades of effort, time, and money invested to recruit and retain women faculty, they remain underrepresented in many science, technology, engineering, and mathematics (STEM) fields in both Australia and the United States (Mills, 2011; National Science Foundation, 2011). They are denied tenure at higher rates than men, and they leave faculty positions more often than men (AFT Higher Education, 2011; Ceci, Williams, & Barnett, 2009; Committee on Maximizing the Potential of Women in Academic Science and Engineering, 2006; Hill, Corbett, & St. Rose, 2010). In the field of Higher Education, this phenomenon has been studied through various lenses, including human capital, culture and privilege, and institutional organization (Marschke, Laursen, Nielsen, & Dunn-Rankin, 2007). However, most engineering education scholarship on women and gender tends to focus on female students or engineering professionals in non-academic contexts, while faculty are overlooked. Nonetheless, there are important reasons for examining gendered facets of faculty careers, particularly as engineering education focuses on professionalization efforts. As Tierney & Bensimon (1996) assert, gender-blindness does not in fact lead to equality, and further analyses of gender in the academy are needed: “The eradication of overt and covert discrimination against women requires critical and gender-based appraisals of academic structures, practices, and policies as well as the elimination of language and interactions that create overtly hostile, patronizing, or indifferent workplaces for women” (p. 76).

The purpose of this paper is to highlight bodies of literature that, as seen in our data, are pertinent to engineering education as a professionalizing field. Specifically, we address the following questions: (1) What gendered facets of faculty careers have STEM faculty experienced? (2) What are the implications of these gendered facets for engineering education as a profession? Based on in-depth interviews with 44 faculty members, we identified three leading themes as gendered facets of faculty careers. The themes were: (1) socialization and informal social networks; (2) gender roles and unconscious bias; and (3) work-family balance. Together, these facets contribute to the “cumulative disadvantage” faced by female faculty members. Our analysis points to several themes as important research horizons for engineering education researchers interested in advancing engineering education as an inclusive profession.

## Literature Review: Gender in Faculty Careers

### Socialization and informal social networks

Socialization, “the process through which individuals learn the necessary behaviours and skills to fulfil new roles,” (Sallee, 2011, p. 188) is a common theoretical lens used in higher education literature. Formal and informal social networks play key parts in the socialization of new faculty (Bagilhole & Goode, 2001; Tierney & Bensimon, 1996). Informal socialization consists of after-work activities, lunches, and water cooler gatherings, for instance, and female faculty in male-dominated departments are often not included in these activities (Rose, 1989; Tierney & Bensimon, 1996). More than just leading to feelings of isolation and loneliness, as that exclusion does for female science and engineering faculty, it also has serious implications for career success (Bagilhole & Goode, 2001; Tierney & Bensimon, 1996). Male informal social networks contribute to the success of men’s careers in multiple ways that typically go unseen, or are treated as unproblematic facets of academia. Women’s exclusion means they have less access to information, collaboration and professional opportunities, and support (Bagilhole & Goode, 2001). However, the advantages men accrue through gendered socialization dynamics most often are interpreted as happenstance, or being in the right place at the right time, rather than being seen as a systematic gender advantage: “For men who more usually find themselves in influential company, the process of networking, mentoring and sponsorship need not necessarily be a conscious activity. The enhancement of academic reputation becomes a by-product of an informal culture”

(Bagilhole & Goode, 2001, p. 173). In other words, "Success is not achieved by publishing more, or even doing better research, but through personal contacts, friendships and cooperative work with key players in the field" (Bagilhole & Goode, 2001, p. 166).

## **Gender roles and unconscious bias**

Gender roles, or gender stereotypes, are "consensual beliefs about the attributes of women and men" that inform collective "expectations associated with women and men" (Eagly & Karau, 2002, p. 574). Gender role research shows that certain traits and behaviours are generally associated with women and others with men. Studies from social and organizational psychology fields, among others, reveal that women are expected to be nice, communal, and non-self-interested, while men are expected and perceived to be competent, agentic, dominant, and influential (Babcock & Laschever, 2003; Biernat & Fuegen, 2001; Carli, 2001; Heilman, 2001). Moreover, these associations are descriptive (relating to how men and women actually do behave), prescriptive (influencing how we believe men and women *should* behave), and injunctive (carrying social sanctions for those who transgress them) (Eagly & Karau, 2002; Heilman, 2001). Gender roles prescribing that men are more competent and that women need to be nice mean that women and their work products are evaluated less favourably, particularly when they do not conform to roles, e.g., if they are too assertive. Contrary to popular myth, academia is not immune from gender-biased evaluations and assumptions about incompetency based on race or gender (Bagilhole & Goode, 2001; Moody, 2004; Shields, Zawadzki, & Johnson, 2011). However, gender biases of this sort are difficult to detect and prove because they are subtle, indirect, and implicit. Often people are not aware of how their judgments are shaped by gender roles and consider themselves unbiased (Dovidio, 2001; Heilman, 2001; Shields, et al., 2011). Therefore, "Although women may suspect that they've been the victims of negative attitudes toward women, they can rarely prove it and often have no recourse" (Babcock & Laschever, 2003, p. 94). The current systems and processes for evaluating faculty, including for tenure and promotion, are set up in ways that promote the operation of unconscious biases (Beddoes & Pawley, In review; Moody, 2004; Shields, et al., 2011).

## **Work-family balance**

As we elaborate upon in greater detail elsewhere (Beddoes & Pawley, In review), the challenge of balancing work and family is a common theme in research on faculty. While many faculty, men and women alike, struggle with this balance, research has shown that women struggle more and sacrifice more in the struggle than men do (Fox, Fonseca, & Bao, 2011; Morrison, Rudd, & Nerad, 2011; Philipsen, 2008; Primack & O'Leary, 1993; Sorcinelli & Near, 1989; Thompson & Dey, 1998; Wilson, 2003; Wolfinger, Mason, & Goulden, 2008). It is well documented that women spend more time on housework and childcare activities than their male partners, even when holding full-time jobs (Baker, 2008; Coltrane, 2004; Leonard, 2003). Moreover, male scientists and faculty members tend to have more supportive home environments, which help advance their careers (Hochschild, 1975; Morrison, et al., 2011; Thompson & Dey, 1998; Traweek, 1992), and the careers of male faculty benefit from family and children in ways women's do not (Mason & Goulden, 2004). Not only do men benefit in ways women do not, but having children carries a stigma for female faculty that it does not for men (Tierney & Bensimon, 1996).

## **Methods**

### **Participants and recruitment**

Participants included 44 faculty members (17 men and 27 women) in science, technology, engineering, and agricultural fields at a large, public research university in the Mid-western region of the United States. Participants represented several different racial and ethnic groups; however, because not all participants chose to identify their ethnicity, we cannot

report any numbers in that regard. In this paper, participants are identified as P1 through P44.

Potential participants were identified through: 1) publicly available data (e.g. departmental websites and newsletters); 2) college-level Deans' offices; 3) faculty hire date; and 4) modified snowball sampling. Recruitment focused on tenured and tenure-track faculty progressing through certain career path points, including initial hiring, third-year review, tenure, and subsequent promotion. An email was sent to eligible faculty inviting them to participate in an interview. If they were interested in participating, they then contacted us. Additionally, at the end of each interview, participants were asked for names of other faculty that might be eligible for the study and willing to participate. Although participants were not involved in education research themselves, their experiences and beliefs are germane to engineering education because they provide insights on cultures and policies of engineering departments and the majority of faculty involved in the emerging field of engineering education are located in engineering departments.

### **Data collection and analysis**

Semi-structured (Fetterman, 2010), in-person interviews were conducted between 2009 and 2011. They lasted approximately 90 minutes in length. Interviews were recorded and transcribed by a professional transcriptionist. Transcripts were pseudonymized to remove actual names and any other identifying information. This paper emerged from two larger, and ongoing, studies on the limitations of pipeline and chilly climate metaphors and promotion and tenure policies. Participants were asked how they felt about: the pipeline metaphor and the way it explained women's underrepresentation among STEM faculty; aspects of women's career pathways not covered by the pipeline and chilly climate models that should be given further attention; how the pipeline metaphor fit their own career pathway; and their experiences with promotion and tenure policies. Data were analysed using a grounded theory approach (Strauss & Corbin, 1998) to identify leading themes that emerged from the interviews. Other findings from the on-going research projects have been published elsewhere (Banerjee & Pawley, 2011; Pawley & Hoegh, 2011; Schimpf, et al., 2012).

## **Findings and Discussion**

### **Socialization and informal social networks**

Female participants discussed being excluded from male social networks and a lack of freedom to engage in those networks, even if they wanted to. P16 stated that the university was female-friendly; however, her explanation belied that statement. She elaborated that she liked the Women in Engineering lunches, but women had had to create their own lunches because they were being excluded from the men's lunches:

*I do find [this university] female-friendly. I like the women in engineering lunches that we have. I think those are interesting and good...I have noticed that when men were hired I would see them going out for lunch. No one ever asked me out for lunch. So, you know, the times that I have had lunch with male colleagues it's been me that's gone and said, "Let's have lunch." I've never been invited for lunch...with anyone. So I always have to have lunch at my desk.*

She compared the situation to her former institution, and noted a bind women face:

*The faculty [at the other university] also tend to have a lot of lunch meetings. So, you know, you get together with a colleague and you have some stuff to sort out and you eat together as well and have kind of that social interaction as well. And it's just very different here. And I feel kind of weird always being the one going to my colleagues and going, "Let's have lunch." You know, especially since I'm the woman. [It] doesn't matter what happens, you do have to be careful. I have to make sure, with male colleagues, I'm always asking about their wives, I'm always asking about their children. I'm letting them*

*know I'm not hitting on you!...And I think if I get married that will be less of a problem, but, I think there are some things in which a single female woman is seen as threatening.*

Others believed that women tend to be more isolated, which is detrimental to their careers because they do not have access to or knowledge of the same resources as men who are included in social networks. A lack of mentoring was also cited as a challenge more often faced by women than men. These experiences of exclusion and isolation from social and professional networks can have serious negative consequences for women's careers, as prior literature, discussed above, demonstrates.

### **Gender roles and unconscious bias**

Although we did not specifically ask any questions related to unconscious biases, several participants recognized that the tenure and promotion system left room for biases and the "likeability factor." For instance, P34 said:

*It takes a while to build up a picture of what to do. You have to talk with a number of people, because everybody's perspectives on these things are different. There's one senior professor who states, basically if he wants you to be a colleague, he'll vote [yes]. He doesn't care what you put down on the form. While there's others that...try to dismiss anything they know about you personally, and they just look strictly at the objective criteria. Everybody sort of has a different idea of what they want. So from that perspective, it's sort of a little bit inscrutable as to what exactly you need to do.*

P6 worried about the role of external letters, saying, "I don't know that I have any enemies in the field but perhaps there are people out there who don't like me or like my work and I was really scared that some of those people could write bad letters." P6 also said that the secrecy is "really frustrating...Especially from the perspective of a woman I think you worry about there being some kind of an old boys club. I had no evidence to say that was going to be the case but I think that's where I felt particularly vulnerable." Similarly, P11, now an administrator, recognized that the process is susceptible to "double standards" and is "all kind of relative in many ways" because "we're all people that have biases and we look at things all in different ways." P39 also recognized that "there is the possibility for abuse," elaborating on the ability of vocal or influential committee members to sway the vote and the role of human biases:

*I may take the same case and decide I really like this and I can present all the positives and give excuses for all the things that weren't done quite right, or I can take exactly that same case and absolutely destroy it. The system relies on a few key individuals fairly and objectively presenting the case. I would say I've seen a few cases where that hasn't been the case. Where I've seen a presentation and I think, you know, that wasn't done in the best interest of the faculty member. So, I think probably each year there's a very small number of cases that you look at and you think, wow, if a different person had been presenting that, that may have been a different outcome. And that's where unintended biases could be coming into play...You're never going to remove the fact that people are involved in the process...but I think we have to have many checks and balances in place to make sure that the committees of people making these decisions are not letting elements of their subjectivity that are probably not appropriate come into play.*

Furthermore, P39 emphasized that, in discussions, people do not always express their true opinions, because votes do not always match the discussion: "People vote and it's a confidential vote and so people put things down on a piece of paper and sometimes it's surprising, you know, you had this discussion and you think, wow, everyone said they're of the same opinion and you look at the vote and it's like, where did these three numbers come from?" Thus, participants voiced concern over the ways in which individual biases enter into evaluation processes.

## Work-family balance

As reported in greater detail elsewhere (Beddoes & Pawley, In review), the most common theme that emerged was work-family balance. Most participants expressed a belief that there are conflicts between being a female faculty member and having children and a partner. They believed that faculty careers are too “demanding” and the work is not “family-friendly” because it entails too great an investment of time for women who also want to have children. As P19 said, explaining why she believed women are underrepresented among STEM faculty, “I think that the reason it happens is because women think that if they have this job...they can’t have kids and they can’t have a family and that they’re gonna be working like 100 hours a week and that won’t leave time for anything.” Reflecting back on her own experience and expressing a similar sentiment, P16 said, “By the time I went into a faculty position I pretty much abandoned the idea of having children...And so, I guess that did make it easier for me to conceive of being successful, because I knew I would have so much more time.”

The work-family balance challenges were directly linked to the fact that women have greater family and housework responsibilities. P42 explained:

*The conflict for [women] is [to] balance work and life. I have to say women’s requirements are much higher than men. And what I may say may be not politically correct, but...unfortunately, our society is such that I think women’s load is higher than men. I think women tend to be more nurturing of the men. And men are much less nurturing of the woman, in a husband/wife relationship. That makes [a woman’s] job much, much tougher.*

Many participants commented on the unequal domestic and emotional labour energies for wives, the expectations that women should put more energy into the marriage and how those expectations conflicted with demanding nature of faculty careers. Jokes about needing a “wife” also revealed unequal gendered expectations. For example, as P14 said, “Just every once in a while, it’s like, ‘Oh, I wish I had a housewife to help me out, too.’ You know?” It should be noted that both male and female participants made such jokes about needing “wives.”

In addition to general discussions of family-related responsibilities, participants also discussed stigma and negative perceptions of female faculty who have children, including negative treatment during pregnancy. Legitimately, then, P19 worried that having children would negatively affect colleagues’ perceptions of her:

*The other thing to...think about is how having kids...affects others’ opinions of you...I’m afraid that...if I have kids before tenure, people will think that maybe I’m not so serious or maybe, like, the job isn’t my highest priority or if they would use it as an excuse to look down on me, which I’m not saying people in this department would necessarily. But I don’t know. I don’t know everybody really well...When you go up for tenure, they’re the ones that are gonna be deciding whether or not you get to stay. And so, if people think that you’re good and you take your work seriously and you’re productive, then you’re good to go. And if people think that you’re just off having a bunch of kids all the time and you’re not doing your work...that reflects negatively on you. But at the same time...there’s...all these guys in the department...who have kids, right? And I don’t think it’s ever reflected negatively on them that they’ve had kids.*

Similarly, P16 believed there was “stigma” associated with having children if women take advantage of parental leave policies. Therefore, along with socialization and unconscious biases, gendered-family roles contribute to the “cumulative disadvantage” of female engineering faculty.

## Discussion and Conclusion

In contrast to scholarship that examines the challenges of conducting education research within engineering departments, this analysis has focused on the challenges of being a female faculty member in an engineering department, where engineering education initiatives for, the most part, currently reside. Leading gendered facets of STEM faculty careers were found to be: (1) socialization and informal social networks, (2) societal gender roles and unconscious biases, and (3) work-family balance. The findings reveal that there are multiple and complex gendered facets to academic careers, and increasing the number of female STEM faculty will therefore require multiple and synergistic strategies. Participants felt strongly that it was important to discuss and publicize the struggles female faculty face because the struggles often go unseen and unaddressed, even by women themselves, until they are given an opportunity to talk about it. For instance, P16 reflected upon how articulating her experiences in the interview made her more aware of problems that she usually tends to dismiss as “nothing.”

We suggest that, as engineering education emerges as a research field, our findings, and the three themes identified in this analysis, serve as promising research horizons for engineering education researchers. Extending research done in other fields and in other contexts (e.g., business) to engineering education contexts would be valuable. For example, data-driven studies of unconscious biases operating among engineering faculty specifically would likely go some way toward convincing engineering faculty that they exist and shape careers. Another way in which the research could be extended would be through similar analyses of other national contexts. While the literature in which our analysis is grounded is international in origin, our data came only from one university in the United States, and engineering education researchers and administrators should understand the challenges faced by female faculty members in their own countries. Additionally, comparative international studies of work-family balance in different countries could be useful to identify best practices that could be adopted in other countries. The ways in which faculty socialization differs across national contexts would also be important to understand, as would strategies that have successfully been used by female faculty to overcome those challenges.

Our findings resonate with much prior research on higher education generally, and STEM fields specifically, and we contend that they are worth highlighting in the current engineering education context. Female faculty face multifaceted, and intersecting, gender biases that put them at a disadvantage compared to their male colleagues. P16 described what others have labelled “cumulative disadvantage”, the notion that there are many, often small, barriers that add up to female faculty being at a disadvantage: “It’s more like, a drip, drip, drip. So ... there’s always like, this little drop of water falling on your head. So it’s little small things. And that’s what wears you down.” Indeed, our findings reveal that cumulative disadvantage involves complex and intersecting facets, three of which we discuss in this paper. Despite prior documentation of these issues, since the 1970s and 80s, faculty are still experiencing the same problems. This suggests not only that the findings bear repeating but that given the lack of change, new strategies are needed to address them. There is an opportunity at the moment for the engineering education community to take these gender biases seriously as part of their efforts to create an inclusive profession. If gendered facets of engineering faculty careers are not recognized or addressed, then all professionalization efforts will serve to maintain the status quo of unequal treatment and opportunities for female faculty.

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