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Experiences of Women Department Chairs in Engineering: A Narrative Study

Kayla Person
University of Nebraska-Lincoln, kayla.person@hotmail.com

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by

Kayla Person

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Kayla Person, Ph.D.

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Advisor: Christina Yao

Within higher education, STEM based disciplines need strong and balanced leadership. Leadership which demonstrates equity and diversity because all perspectives are needed to solve complex issues that face our world today. In 2016, women earned 23.2% of engineering Ph.D.'s awarded, which contributes to the low number of women faculty in engineering (Yoder, 2016). Those women who enter the professoriate increasingly need to navigate the labyrinth within their faculty positions and leadership roles within higher education. A key leadership role, department chair, has numerous responsibilities as both a faculty member and an administrator. Little research has been conducted to showcase the unique experiences of women department chairs of traditionally male dominated disciplines such as engineering.

The purpose of this qualitative study is to explore the experiences of women department chairs in engineering departments to understand how these women successfully navigated the pipeline and identified success strategies which led them to persist in a traditionally male dominated discipline. Additionally, this study sought to understand strategies for success, previous leadership experiences or professional training which helped to prepare them, and challenges they may have encountered or had to overcome. This narrative inquiry is guided by self-efficacy theory, feminist theory, and

previous literature on women STEM faculty experiences, women in education administration, and the role of the department chair. A purposeful sampling technique (n=6) is utilized to include women department chairs of engineering departments who had two or more years of experience as a department chair.

The findings show that participants relied on a strong support system for continued success in their field and the development of their self-efficacy. Participants also engaged in a variety of professional development opportunities for skill development. Unfortunately, all participates noted incidences of gender discrimination or unconscious bias they received at varying degrees of severity. While this finding is not unique to this study, this study has demonstrated that these situations are still occurring within engineering academic departments. Studying women's experiences and challenges within engineering academia is very valuable to promote successes and remove barriers in an effort to advance more women into the role of department chair.

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Chapter 1: Introduction

Background and Problem Statement

Women make up half of today's workforce, but are still exceedingly underrepresented in science, technology, engineering, and mathematics (STEM) occupations. According to the U.S. Department of Commerce (2011), women hold less than 25 percent of STEM jobs, which is a direct result of women earning a disproportionately low share of STEM undergraduate degrees. Increasingly, our future leaders will continue to be challenged to solve complex social, cultural, economic, and environmental STEM based issues which will continue to plague our planet. Within higher education, where our future leaders are educated, STEM based disciplines need to have strong, balanced leadership which demonstrates equity and diversity because all perspectives are needed to solve these complex issues.

Contributing to women holding less than 25 percent of STEM jobs in industry (U.S. Department of Commerce, 2011), women are underrepresented in undergraduate STEM disciplines, graduate STEM disciplines, faculty roles, and leadership roles in academia, particularly in engineering. According to the American Society of Engineering Education Earning, women earned 20.8% of engineering bachelor's degrees, 25.4% of master's degrees and 23.2% of engineering doctoral degrees in 2016 (Yoder, 2016). Contributing to their underrepresentation in administration in higher education, women are often underrepresented at the full professor rank. Across disciplines, Carroll and Wolverton (2004) found female chairs are less likely to be full professors or to have held the rank for very long, which may lead to authority issues over the

faculty in the department. Having so few women in the role of department chair can further complicate challenges by exacerbating feelings of isolation or loneliness for those women who are in the position (Vaidya, 2006). Tokenism can be an additional challenge for women in situations where one may be considered the 'other.' Women who experience tokenism may end up representing their whole gender whether they want to or not. According to Kanter (1977), "They can never be just another member while their category is so rare; they will always be a hyphenated member, as in 'woman-engineer' or 'male nurse' or 'black-physician'" (p. 968). In an effort to avoid tokenism, some women may not fight stereotypes or limit the amount they correct mistaken impressions to avoid the awkwardness or the possibility of having to explain oneself (Kanter, 1977).

A key leadership role within higher education is the role of department chair because this role is both a faculty member and an administrator. While very few researchers have studied the personal and professional experiences of women who have advanced to the role of department chair and led these male dominated STEM disciplines, several researchers have studied the role, responsibilities, and challenges associated with being a department chair (Bowman, 2002; Burns & Gmelch, 1992; Carroll & Gmelch, 1992; Carroll & Wolverton, 2004; Gmelch, 1991; 2004; Gmelch & Burns, 1990; 1991; Gonaim, 2016; Niemeier & Gonzalez, 2004). One of the challenges associated with being a department chair include acting as a "gatekeeper" between administration and faculty, often referred to as role conflict (Burns & Gmelch, 1992). In addition, department chairs have many individuals competing for their attention and resources. For example, in any particular day a department chair could meet with the dean about needing

additional funding for a project, meet with a faculty member regarding promotion and tenure, meet with an upset student, teach a graduate level course, work in his or her lab, and work on his or her own research, all of which are competing for attention and may cause role conflict. An additional challenge includes balancing his or her new faculty and administrative roles (Gmelch & Burns, 1991; Burns & Gmelch, 1992; Gmelch, 2004). Balancing roles can be particularly challenging because chairs are still considered faculty and try to stay current in their field by contributing to research, publications, or teaching, while also providing leadership to the department. Role ambiguity is a noted challenge because chairs often have little training when starting their positions and are initially uncertain about what tasks to prioritize or how best to complete certain tasks (Gmelch & Burns, 1991; Burns & Gmelch, 1992; Gonaim, 2016).

Niemeier and Gonzalez (2004) reported, using survey data collected by the Association of American Universities (AAU), departments such as engineering, mathematics, and physical sciences are almost exclusively chaired by white men. Most chairs in the study identified as white (56.7%) and fewer than 10% of chairs surveyed identified as a racial or ethnic minoritized individual; however, 34% of chairs surveyed chose not to report their racial or ethnic identity (Niemeier & Gonzalez, 2004). When broken down for engineering exclusively, most chairs still identified as white (63.7%) and 21.1% of chairs identified as a racial or ethnic minoritized individual, with 15.2% not reporting (Niemeier & Gonzalez, 2004). Within STEM fields and engineering specifically, most department chairs tend to be white men. In a speech on diversity in the engineering workforce, as cited by Burack and Franks (2006), William A. Wulf,

former president of the National Academy of Engineering, suggested, "organizations diversified by race, ethnicity, religion, class, and gender are the best hope for problem solving and creativity" (p. 94).

Historically, women have struggled to break into and successfully navigate career fields that are male centric. A 1986 article, published in the Wall Street Journal, stated even though women were rising in the ranks of corporate America, women would eventually hit an invisible barrier or a glass ceiling (Hymowitz & Schellhardt, 1986). However, this metaphor can be misleading and suggests that women could only rise to a certain level of success within an organization. According to Eagly and Carli (2007) "central to these beliefs was the conviction that it would be risky to invest in women because they might well quit their jobs to raise a family. Such an assumption about a division of labor continued to disqualify women" (p. 4). As a result, Eagly and Carli (2007), suggested the alternative metaphor of the labyrinth, which "captures the varied challenges confronting women as they travel, often on indirect paths, sometimes through alien territory, on their way to leadership" (p. 1).

Previous research focuses on the shortage of women in leadership roles within both the faculty and university senior administration roles, but does not adequately address the experiences of current women in mid-level leadership roles who have navigated the labyrinth, particularly the unique position of department chair (Glazer-Raymo, 1999; Longman & Madsen, 2014). This is concerning because most individuals do not immediately jump from their faculty role to a Dean or Vice President/Chancellor role. Similar to the business world, there are typically in-between steps, a mid-level leadership role, such as

department chair, management of a large lab, or an interim leadership position, where an individual is drawn from a faculty position and provided the opportunity to sharpen their leadership skills and learn a different side of the institution (Hachet, Higgerson, Gmelch, & Tucker, 1999).

There is little agreement within the research community as to how or if women lead differently than men. Differences are mostly discussed in the form of leadership styles or patterns of behavior exhibited by a leader. However, leadership styles are typically viewed through a male lens since men have historically been the individuals who hold leadership roles. As stated by Eagly and Johannesen-Schmidt (2001), "Differences in styles can be consequential, because they are one factor that may affect people's views about whether women should become leaders and advance to higher positions in organizational hierarchies" (p. 781). The two most common leadership styles associated with gender norms include a task-oriented style associated with male gender norms and an interpersonal oriented style associated with female gender norms (Northouse, 2013). However, a meta-analysis conducted by Eagly and Johnson (1990) found that in comparison to men, women did not lead more interpersonally or less task oriented in organizational settings; rather differences were only found in experimental settings tended to be gender-stereotypic.

Colleges of engineering and higher education institutions must better understand the experiences of women who are department chairs to identify how to attract and retain women in this leadership level. Representation and having a role model can have a significant impact on a woman scientist's career. A career path is often clear for men because they have witnessed others before them be

successful in various pursuits such as academia, industry, or governmental research positions (Bonetta, 2012). However, according to Geraldine Richmond, a professor of chemistry at the University of Oregon, for women the path is not always as clear. A woman may not know of any or many other women who have taken the same career path, “so they cannot visualize where they are going to go. If you plan to have children, but don't see any women who have gone that path, you may not be sure it's possible" (Bonetta, 2012).

Glazer-Raymo (1999) stated, “feminist often say that we have to start with women’s own experience if we are to understand how profoundly it influences our perspectives, values, attitudes, and role in society” (p. 1). If the personal and professional experiences of women in engineering who have advanced to the position of department chair are not studied, the role risks status quo, lack of representation, and lack of understanding of how to better prepare women faculty who wish to advance within their discipline and higher education in general.

Purpose of Study

The purpose of this qualitative study was to explore the experiences of women department chairs in engineering departments to understand how these women successfully navigated the pipeline and identify success strategies which led them to persist in a traditionally male dominated discipline. The role of department chair is one of the most unique roles in the academy because a chair is called upon to play both roles, faculty member and administrator, simultaneously. As both a faculty member and a mid-level university administrator, a department chair makes important decisions about the direction of their department. As more women take on leadership roles within higher education, more knowledge must be

gathered to understand how these women developed the necessary skills to navigate the complexities of being both a faculty member and an academic leader in a traditionally gendered academic discipline.

Research questions

Within this study, I address the following central question: What have been the experiences of women department chair in engineering academic departments as they have navigated the pipeline to their current position? My sub-questions are:

1. What are strategies for success that women department chairs believe have been helpful in reaching this position?
2. What previous leadership experiences or professional training helped prepare women department chairs of engineering departments for their role as department chair?
3. What challenges have women department chairs within engineering encountered and had to overcome?

Definition of Terms

To effectively examine the experiences of women who have successfully navigated the pipeline to their current position, department chairs in engineering departments, a few definitions of key terms should be noted. These terms include *STEM,* department chair, self-efficacy, feminism, and woman.

- *STEM* is an acronym used to describe the academic disciplines of science, technology, engineering, and mathematics.
- *Department Chair* is a faculty position within an academic unit designated to manage the academic unit. Seagren, Creswell, and

Wheeler (1993) described this position as "midlevel leaders in the academy, academic chairs hold academic or programmatic positions in units called college "divisions," "colloquia," or more frequently, "departments"' (p. 2). Chu (2012) noted most chairs continue to teach and advise graduate students on their theses and dissertations.

- *Self-efficacy* is the concept of one's belief in themselves and their ability to endure obstacles and achieve. According to Bandura (1982), "perceived self-efficacy is concerned with judgment of how well one can execute courses of action required to deal with prospective situations" (p. 122).
- *Feminism* is both a movement and a theoretical perspective. According to hooks (2015a) feminism occurs when "any female or male resists sexism, sexist exploitation, and oppression" (p. xii).
- *Woman* is an adult who identifies as a human female (Merriam-Webster, 2018).

Methodology

For the purpose of this study, this research question was addressed using a qualitative approach, specifically with a narrative inquiry methodology. Qualitative approaches seek to understand and give meaning to certain problems or experiences (Creswell, 2013). There are many characteristics of qualitative research. These characteristics include: but are not limited to; the use of multiple methods which are interactive and humanistic, the studied phenomena typically occurs in the natural world, the phenomena focuses on context, the phenomena is emergent, the phenomena is evolving, and the phenomena is interpretative

(Marshall & Rossman, 2016). Narrative inquiry allowed me to develop a deeper understanding of the lived experiences of women department chairs within engineering disciplines because this research method is the study of stories and lived experiences (Connelly & Clandinin, 1990). Through their stories and oral histories, participants were able to share their experiences of being women faculty and department chairs in engineering. While discussing narrative approach, Webster and Mertova (2007) stated, "it provides researchers with a rich framework through which they can investigate the ways humans experience the world depicted through their stories" (p. 3). This method provided a platform for the stories of participants.

Narrative inquiry can take on many forms including narrating in oral and written form, visual communication (signage or photography), memoirs, diaries, public records, health records, music, news reports, and historical accounts. There are also several approaches to narrative inquiry, including biography, auto-ethnography, life history, and oral history (Creswell, 2013). According to Daiute (2014), "a common rationale for using narrative in research projects is to gather information about personal experiences, memories, feelings, and knowledge" (p. 10). When considering narrative inquiry, one needs to consider one's relationship with time, those around the participant, and the environment around the participant to gain the full context of their experience (Clandinin, 2013).

One common goal of narrative inquiry is to give voice to those who have been otherwise silenced. Researchers play an important role in bringing previously excluded voices to the foreground of public attention. According to Daiute (2014), "with those voices increasingly in the foreground rather than the

background of public life, researchers can take them increasingly seriously by focusing on the nuances, diversities, and powerful uses of narrating within as well as across social groups" (p. 10). A second common goal of narrative inquiry is to motivate others to act either for political change or as part of a social movement. For this research, I studied the lived experiences of women department chairs in engineering who shared their personal experiences both as a woman who is an engineer, but also as a woman in a leadership role within higher education.

Delimitations

Several delimitations were made in order to bind this study. The research design is a narrative approach, which required participants fit specific criteria to be included in the study. This study focused specifically on women who are department chairs in engineering departments. Engineering is the focus discipline of this study because, along with other science, technology, and math disciplines, engineering is routinely cited in the literature as having low numbers of women earning Ph.D.'s and progressing to leadership positions, compared to their male counterparts (Glayzer-Raymo, 1999; Niemeier & Gonzalez, 2004). Department chairs were the focus of this study because of their unique position of being both faculty member and leader within their department and mid-level leader within the college/university (Chu, 2012). Participants came strictly from engineering departments. Potential participants were identified as current engineering department chairs through their university website and available organizational charts at doctoral granting universities. Institutions were identified using the top 100 Best Undergraduate Engineering Programs as ranked in 2018 U.S. News and World Report Rankings (Doctorate). Of the top 100 institutions, 58 women

engineering department chairs were identified at 28 institutions. Of the 58 women, using information from their university's website, personal websites, or LinkedIn pages, the possible participant list was further narrowed to women who have been in the department chair/head role for at least two years. This resulted in 29 possible participants. The selection was limited to women who have been in the role for two or more years to allow for women to have gained experience and introspection about the position. The study included participants who self-identified as a woman. Sex and gender are not often clearly separated in the literature; however, for the purposes of this study, sex will refer to the anatomy of an individual and gender will refer to environmental or cultural expectations or influences on an individual (Lips, 2007). Throughout the study, the terms, "female" and "woman" will be used based on how the researcher(s) refer to their populations in their studies.

Limitations

All research will have limitations, no matter how well planned. For this study, I used an interview based approach, which relied heavily on individual interviews with participants, to gain a deeper understanding of their lived experiences as women department chairs in engineering academic departments. Asking individuals to recall experiences, feelings, and reflect on the past can be problematic, especially if some of these experiences happened years ago. However, these are questions are important to learn the participants' experiences as they know them to be true.

The nature of narrative inquiry required establishing close relationships with participants, some of whom were more open to sharing about their

experiences than others. Each participant came to the study with a wide range of experiences, from different institutions and with varying backgrounds. This study used purposeful sampling to ensure women who are department chairs of engineering disciplines were invited to participate in the study. The number of participants were limited due to the number of women who hold this position. However, in general, narrative studies are meant to focus on the stories and experiences of a smaller number of participants (Creswell, 2013).

Significance of the Study

In 2015, women earned approximately 52% of Ph.D.'s. in the United States; however, they made up only around 44% of faculty at research institutions overall (NCES 2015a; 2015b). According to a survey conducted by Niemeier and Gonzalez (2004) of Association of American University (AAU) members, men chaired 74.4% of departments and women chaired 17.5% of departments. Of the 17.5% of women who chaired departments at AAU member institutions, only 5.7% came from mathematical, physical sciences, and engineering departments (Niemeier & Gonzalez, 2004). If isolated for only engineering, women made up 2.7% of department chairs.

The lopsided statistics need to change because the demographics of the faculty and the administration are not representative of the student body in which they serve. In the near future, current senior administrators at institutions of higher education will start to age out and as a result, there will be a large number of opportunities for women to take on leadership roles within institutions of higher education at every level (Madsen, Longman, & Daniels, 2012). It is necessary for women at all levels in higher education to be given opportunities to

develop and be equipped with skills to advance. Through better understanding of the experiences of women who hold the pivotal role of department chair, there will be a better overall understanding of how individuals can use skills learned within this position as they continue in their careers in academia.

Not only will this research help fill the large gap in the literature which exists for women department chairs, but this research will also help fill the large gap in the literature for women department chairs of STEM disciplines. This study will give the microphone to women in these positions instead of only hearing from the male perspective or lumping their experiences in with male experiences. Women's experiences are unique and deserve attention because they are vastly underrepresented in engineering and engineering education, earning 20.8% of engineering Bachelor's degrees, 25.4% of Master's degrees and 23.2% of engineering doctoral degrees in 2016 according to the American Society of Engineering Education (Yoder, 2016). Lessons learned from the experiences of women department chairs will provide an overall better understanding of expectations and skills needed to be a department chair; in addition to identifying ways the traditional masculine culture of engineering needs to change in order to make these fields more welcoming for faculty and students. Through their experiences, these women may be able to identify ways to attract and retain more women faculty and students into the field of engineering by sharing their stories. Additionally, through learning about women department chair's experiences, we will better understand their leadership trajectory and can help current and future women faculty members who aspire to be on similar trajectories themselves, to be on these paths sooner.

Chapter Summary

This chapter was an overview of the rationale for this study. In summary, women are earning Ph.D.'s at record rates, however, are still underrepresented in tenured track faculty positions and continue to be progressively underrepresented as women advance into higher administration roles within higher education. While the literature reports on statistics and focuses on systemic reasons for women's underrepresentation, the research rarely focuses on these issues from a qualitative, participant's point of view. This study focuses on the lived experiences of female department chairs in engineering academic departments to better understand the experiences of women who embody this important role, both as a faculty member and an administrator.

In chapter two, I will provide a background of the study by reviewing the literature which has previously examined women faculty members in STEM disciplines, women in senior administrative positions in higher education, the department chair role and women in relationship to the department chair role, both in general and in STEM departments. Additionally, I will outline the theoretical framework which will provide insight into how different factors motivate participants to persist in their chosen profession and how their environment hinders or promotes inclusion. Finally, in chapter three, I will outline the methodology, including the study's design, data collection, and analysis method, which I used to execute my study.

Chapter 2: Literature Review

Introduction

In chapter one, I outlined how women in engineering disciplines are vastly underrepresented in academia and academic leadership, especially the higher one rises in leadership roles. In order to solve complex problems which will continue to plague campus leaders as we move into the future, there needs to be an influx of women into campus leadership positions to diversify leadership composition. Women with STEM academic backgrounds are uniquely poised to help solve complex problems because of their academic background in problem solving. Additionally, teams composed of individuals with diverse backgrounds, cultures, and interests help develop results and a better holistic application of those results (National Research Foundation, 2010). However, in order to understand why so few women go from graduate degree to faculty role to leadership role, it is important to understand the multitude of challenges women face, both at work and home.

Six broad themes were explored for my literature review. First, I reviewed the literature on women faculty members within the STEM fields in higher education, within which I also discussed promotion, tenure, and mentorship. Second, I discussed women in senior administrative roles in higher education, which included a review of literature related to leadership development for women in higher education. Third, I highlighted the role of department chair and the primary challenges associated with this position along with specific leadership development opportunities for this position. Fourth, I focused specifically on women department chairs and their unique challenges. Fifth, I narrowed further,

and included a discussion on the underrepresentation of women as department chairs in STEM based academic disciplines. Sixth, I include my theoretical framework, which included Bandura's (1977) self-efficacy theory and feminist theory (hooks, 2015b). A summary of the chapter is included at the conclusion.

STEM Women Faculty in Higher Education

Few researchers have studied the personal and professional experiences of women who have advanced to the role of department chair in the STEM disciplines at a four-year research intensive institution. However, several researchers have studied the roles, responsibilities, and challenges associated with being a department chair (Bowman, 2002; Burns & Gmelch, 1992; Carroll & Gmelch, 1992; Carroll & Wolverton, 2004; Gmelch, 1991; 2004; 2016; Gmelch & Burns, 1990; 1991). In order to better understand why women are underrepresented at the department chair level, and particularly within engineering, it is necessary to understand women's underrepresentation in other positions within academia and how academia is supporting and promoting women to advancement.

For the purposes of this study, STEM departments include areas within the science, technology, engineering, or math fields. While women are underrepresented in STEM tenure track faculty positions, this phenomenon does not occur solely within STEM fields as women's underrepresentation in tenure track faculty positions is systemic across all fields of study. Women currently earn approximately 52% of Ph.D.'s in the United States; however, they make up only around 44% of faculty at research extensive institutions (National Center for Education Statistics [NCES], 2015a, 2015b). The popular pipeline theory explains

that as more women earn college degrees and advanced degrees, more women will enter the academy and rise in ranks in both the faculty and higher education administration. While more women have been earning undergraduate and graduate degrees, as highlighted by Kellerman and Rhode (2014), the pipeline theory fails after that point. Women's rise within faculty ranks has been slow moving. While women are obtaining doctoral degrees at record rates, they are not joining the academy or raising in the faculty ranks at the same rate. According to a study commissioned by the American Association of University Professors and conducted by West and Curtis (2006) "the barriers for women in higher education not only raise questions of basic fairness, but place serious limitations on the success of educational institutions themselves" (p. 4).

Due to Title IX and other advancements, many formal barriers have been removed for women in the workplace; however, invisible barriers remain and may get more challenging as women advance through their careers (Jackson Teague, 2015). Many researchers have studied the experiences of female faculty members to try to better understand challenges that may prevent women from continuing in academia. Several challenges which are presented within the literature include the wage gap (Kelly & Grant, 2012), balancing career and family (Blackwell, Anderson Snyder, & Mavriplis, 2009; Bonawitz & Andel, 2009; Gunter & Stambach, 2003; Kelly & Grant, 2012; Marschke, Laursen, Nielsen, & Rankin, 2007), low numbers of women in STEM (Blackwell, et al., 2009), perceived lack of support (Bonawitz & Andel, 2009), department culture (Maranto & Griffin, 2010), stereotyping (Jade Xu, 2008; Kellerman & Rhode, 2014) overt discrimination/harassment (Bonawitz & Andel, 2009; Blackwell, et al., 2009;

Jade Xu, 2008; Marschke, et al., 2007; Rosser, 2004), micro aggressions (Maranto & Griffin, 2010), and decreased funding opportunities (Rosser, 2004).

Women faculty members often cite balancing career and family as the most significant challenge to career advancement (Rosser, 2004). While women believe gender discrimination to be an issue in the workplace, they believe the larger issue is workplace flexibility. According to Eagly and Carli (2007), "because many women adjust their employment to meet family responsibilities, they may seek jobs having different demands than those men seek, or women may be less psychologically committed to their jobs" (pp. 59-60). In a survey of nearly 400 Professional Opportunities for Women in Research and Education (POWRE) awardees from fiscal year 1997, 1998, 1999, and 2000 on their experiences in academic STEM fields, participants felt balancing career and family was the most significant challenge facing women scientists and engineering, however, other issues included the low numbers of women in STEM, the stereotyping which occurs, overt discrimination/harassment, and decreased funding opportunities (Rosser, 2004).

Workplace climate is also directly cited as a challenge for faculty from marginalized groups including women and ethnic or racial minorities. Blackwell, Anderson Snyder, and Mavriplis (2009) conducted a survey in an effort to improve work climate, policies, and procedures at a large public university as part of a National Science Foundation (NSF) ADVANCE program grant initiative. A total of 219 faculty completed the survey and results showed women reported significantly lower equality of treatment than men in the sample and women in STEM disciplines reporting the most extreme difference. Of those surveyed, 59%

of STEM women in the sample cited “negative climate” (Blackwell et al., p. 199) as the primary reason they would leave their institution This was an important finding for this institution and for institutions around the country to evaluate their workplace climate as an employee retention measure.

Another challenge for women, particularly for minoritized women, is the feeling that colleagues or supervisors are less tolerant of mistakes or unpopular decisions (Kellerman & Rhode, 2014). The feeling of always having to be perfect or not feeing supported when a difficult decision needs to be made can create a hostile work environment for an individual. As a result this could affect a woman’s self-confidence and may discourage a woman from taking on risks or tasks which would require her to take on more responsibility or a leadership role that may come with risk (Kellerman & Rhode, 2014).

Pedersen and Minnotte (2017) also studied workplace climate and the affects climate can have on burn out for women faculty in STEM. Common themes related to burn out the researchers specifically studied included: lack of access to information, lack of faculty influence in decision-making, scholarly isolation, lack of coworker social support, and interpersonal conflict. The researchers studied STEM departments at a midsized Midwestern university and had 117 participants. The researchers found gender was significantly associated with job burnout, with women faculty reporting higher rates of job burn out. Marital status was also significantly associated with burnout, single STEM faculty reported higher levels of burn out.

Finally, even though men have increasing taken on more responsibilities within the home in this modern time, family and household responsibilities

disproportionately burden women. An academic career survey on dual-career couples was administered to thirteen top research institutions by Stanford University (Schiebinger & Gilmartin, 2010). Women scientists with partners reported doing 54 percent of household tasks such as cooking, cleaning, and laundry, while men scientists with partners reported doing just 28 percent. Women are also taking on more of the responsibilities in dual career couples in the work of the family, which includes child care (Yavorsk, Kamp Dush, & Schoppe-Sullivan, 2015). Beyond children, women are also providing more than twice as much time on elder care assistance than their husbands or brothers (Dwyer & Seccombe, 1991). These obligations take time away from their work life and may delay their promotions or may cause their promotion and tenure portfolios to be not as diverse as their male counterparts.

The promotion and tenure process is often a rigorous and time consuming process. The length of the process, work/life balance issues, or the possibility of an unsupportive department can derail women from continuing on the tenure track. As a result, this leads to fewer women at the rank of full professor, which leads to fewer women available for upper level leadership positions within colleges and universities.

Promotion and tenure

Some of the most documented challenges for women faculty members are associated with the promotion and tenure process. Regardless of discipline, women faculty members note similar struggles. As noted earlier, women who earn a terminal degree in their discipline are entering and advancing to top faculty ranks at low percentages regardless of discipline (NCES, 2015a, 2015b). This is

particularly true for engineering disciplines. In 2001, a National Research Foundation (2010) study found that women only made up 6.2 percent of the tenured faculty in engineering.

While dependent on the institution, the typical length of time from hiring to earning the position of associate professor is seven years, but there is no clear mark for length of time from hire until full professor. According to a 2007 National Science Foundation study, as cited in National Research Foundation (2010), women scientists and engineers hold fewer high-ranked faculty positions compared to their male counterparts and were less likely to be full professors, but more likely than men to be assistant professors. This could indicate there is about to be a surge of women advancing into the full professor rank; however, staying stagnant within a rank has important pipeline, scholarly, and wage implications.

In their qualitative study, White Berheide, Christenson, Linden, and Bray (2013) analyzed the length of time women faculty members took to progress from associate professor to full professor at two private, liberal arts institutions. Their findings concluded women were less likely to hold the rank of full professor and STEM female faculty spent on average a year longer at the rank of an associate professor than their male counterparts (White Berheide et al., 2013). Additionally, women reported not getting regular feedback and senior colleagues were not providing guidance for navigating the system, which decreased the likelihood that female faculty members would apply for promotion or tenure. An analysis of salaries also revealed a significant gender gap in salaries (White Berheide et al., 2013).

How men and women faculty members view the challenges associated with the promotion and tenure process varies. In conjunction with a larger NSF-ADVANCE institutional study, which is a National Science Foundation initiative to increase the participation and advancement of women in academic science and engineering careers (National Science Foundation, n.d.), Gunter and Stambach (2003) conducted a qualitative study on how female and male science faculty discuss their work and non-work experiences. Findings from the study showed women tend to bring attention to gender role specific issues, but men did not explicitly mention gender. Specifically, 91% of women interviewed talked about the challenge to balance their work and personal life obligations. But, males did not discuss the challenges of balancing fatherhood with work obligations (Gunter & Stambach, 2003). Both men and women described different experiences with the promotion and tenure process. When discussing promotion and tenure, women tended to talk more about balancing challenges and men talked more about the difficulty involved with meeting expectations.

As faculty move through their ranks, challenges continue to present themselves. The popular glass ceiling preventing women from advancing in the workplace has been referred to as the concrete ceiling in academia because glass gets brittle and breaks after a while, but women in academia have only been able to chip away at the ceiling with little improvements (Bonawitz & Andel, 2009). Women often find themselves contending with identity issues, which can make women's ability to chip away at the concrete ceiling more difficult. Mid-career faculty faced contradictions between being an ideal scientist and an ideal woman (Hart, 2016). Hart (2016) conducted a case study of 25 mid-career faculty in

STEM disciplines at a Midwestern university. The themes that emerged from the findings included: networks, departmental division of labor, and promotion and leadership experiences. All participants had had major successes within their disciplines, but the researcher found that the ideal scientist and the ideal woman are often a contradiction of one another. How can women, "act like women" and "act like men"? If women are not successful at fulfilling both characterizations there could be major career implications, work overload, or social isolation within their department.

While the literature does present some solutions to minimize challenges such as mentorship, negotiating resources, not taking on extra course work unless mandated, not allowing over enrollment in courses, requesting time away, establishing clear boundaries, and re-evaluating and changing the timeline for promotion and tenure (Bonawitz & Andel, 2009; Gibson, 2006; Gorman, Durmowicz, Roskes, & Slattery, 2010), many of these solutions are institutionalized, would require major cultural shifts, and are not easily implemented.

Mentorship

Due to the challenges presented with promotion and tenure, a lack of female role models remains a challenge in academia, particularly within the STEM fields. One way female faculty members have tried to combat retention issues and attract more women to the faculty ranks has been to implement mentorship programs and peer support networks. In a phenomenological study on the mentoring experiences of nine women faculty members from multiple institutions, Gibson (2006), found the climate of the organization is a critical

component of the faculty member's experience. The overall findings of the study suggest a need for human resources within organizations to develop initiatives that support women's career advancement (Gibson, 2006). Other suggestions from the findings include selecting committed department chairs who will promote mentoring, developing mentoring committees, cross institutional mentoring, and recognizing mentoring in faculty promotion and tenure evaluations (Gibson, 2006).

Institutions are commonly taking individualized approaches, such as the Women in Science and Engineering Future Professionals Program (WiSE-FPP) at Syracuse University (Bhatia & Priest Amati, 2010). The program is a structured professional development program with a peer mentoring component. Participants in WiSE-FPP receive a yearly stipend, can participate for up to two years, develop academic and professional goals, attend formal and informal activities, meet regularly with peer mentors, develop a career plan, and are expected to produce a professional portfolio at the end of their participation (Bhatia & Priest Amati, 2010). The researchers found the program had been valuable for women to start developing their support networks early in their careers, which can lead to academic and career success in the future.

Unlike a formal mentee/mentor relationship, some faculty rely heavily on their peer network for support. In a case study of the School of Sciences (SOS) at Stevenson University in Pikesville, Maryland, where 71% of the full-time faculty are women and 100% of the STEM academic leadership are women, Gorman et al. (2010) discussed what works when developing female leaders. The backbone of the existing model at SOS is the web of mentoring at all levels which include

formal and informal structure and customized plans to each position and participant (Gorman et al., 2010). The mentoring web contributes to a sense of community and sense of value. Since their leadership structure is comprised solely of females, SOS is uniquely situated to have a big impact on females in the STEM leadership pipeline as faculty move into leadership positions at different institutions.

In this section, I have provided a brief overview of the experiences and challenges presented to women in tenured track faculty positions in STEM fields. According to the literature, advancing in tenure track positions can be difficult due to the wage gap, balancing career and family, lack of mentors or perceived lack of support, departmental culture, and overt discrimination or harassment. I have also highlighted, mentorship programs and strategies, because mentorship is the most commonly suggested strategy to promote recruitment and combat retention issues within faculty ranks. In the following section, I will more broadly address the challenges presented to women in senior administrative roles within higher education and leadership opportunities focused on developing women faculty and non-faculty administrators in preparation for senior level positions.

Women Senior Administrators in Higher Education

Underrepresentation of women in the faculty ranks contributes to the lack of women academic administrators in higher education. Similar to tenure track faculty, many challenges exist for women who change trajectories and/or advance into administrative roles. Women can often experience challenges related to their character moving into leadership roles both in their departments and at the university level. According to Eagly and Carli (2007):

> Women who are too assertive, competitive, or even competent can at times threaten others, who then resist female influence and leadership. This resistance to their leadership can lower evaluations of women's personalities and skills, obscure women's contributions to group tasks, undermine their performance, and even subject them to sexual harassment. At the same time, women can be criticized for being too nice (p. 117).

Many researchers have studied the experiences of female administrators to try to better understand challenges for women in these roles (Dean, Bracken, & Allen, 2009; Dominici, Fried, & Zeger, 2009; Gerdes, 2003; Hurtado & DeAngelo, 2009; Jackson, & O'Callaghan, 2009; McDaniel, 2002; White, 2011). Several of the same challenges that exist for female faculty members also exists for female administrators in higher education. Researchers have identified separate challenges, slower and often blocked pathways to leadership roles, exclusion from informal networks, the "good old boy network," gender inequities, imposter syndrome, less recognition or inequitable rewards, and affirmative action (Ballenger, 2010; Dean et al., 2009; Dominici et al., 2009).

Since Hanna Gray became the first woman to hold a university presidency position at the University of Chicago in 1978, the number of women has been increasing in academia's top leadership role, but the pipeline is slow (Glazer-Raymo, 1999). According to a 2017 report by the American Council on Education, women now lead eight percent of doctoral granting institutions (American Council on Education, 2018). In a qualitative study conducted by Bucklin (2014), current and previous women university presidents reported never being viewed simply as president, but feeling as though everything they did was viewed through the lens of their gender. They felt their gender colored their ability to do the job, explaining, "the whole group known as women would be

judged as incompetent if this individual woman was not successful" (p. 174). This brings an enormous amount of pressure to be perfect, which may lead to increased scrutiny and fewer women in leadership positions or fewer women who choose to seek out leadership roles. While not fair, many women feel they need to be exceptionally good to compete with "less competent men" (Eagly & Carli, 2007, p. 164). For these reasons there needs to be additional institutional support for individuals as they take on these influential leadership roles.

Leadership development for women in higher education

In an effort to overcome the presented challenges, develop, and advance more women into leadership and senior leadership roles, several institutions and professional organizations have organized leadership development opportunities for women in both the faculty ranks and managerial professional roles (Baltodano, Carlson, Jackson, & Mitchell, 2012; Bonebright, Cottledge, & Lonnquist, 2011; Ely, Ibarra, & Kolb, 2011; Hornsby, Morrow-Jones, & Ballam, 2012; Longman, & Lafreniere, 2011). A number of formal professional development programs have been developed or expanded at both the institutional level and within professional organizations to include mid-level professionals or faculty (Cejda & Jolley, 2013). The current senior academic administrators at institutions of higher education will soon start to age out and as a result, there has been a special focus on leadership development programs for women in higher education. Along with leadership development, institutions are increasingly developing succession plans, which can sometimes be seen as a negative. However, through leadership development programs, institutions can create larger pools of qualified candidates, especially as current administrators retire (Hornsby et al., 2012).

Institutions need to recognize there is a gender issue within leadership and hold administrators accountable to diversifying leadership composition. According to Kellerman and Rhode (2014), "A wide array of research finds that the most important factor in ensuring equal access to leadership opportunities is a commitment to that objective, which is reflected in workplace priorities, policies, and rewards structures" (p. 32). However, actions need to be driven by need and have measureable outcomes. Decision and policy makers need to be held responsible for initiatives to ensure accommodations are producing results and meeting the needs of the employee (Kellerman & Rhode, 2014)

Another way leadership can remain accountable and prioritize diversity and inclusion is to incorporate these ideals into their curriculum and research priorities. At the undergraduate level, institutions could integrate these issues into core course requirements. At the graduate level, "professional and MBA programs could also increase research support for scholars and continuing education for practitioners on gender equity issues" (Kellerman & Rhode, 2014, pp. 33-34). By making action items with measurable outcomes to increase diversity and inclusion at every level an institution demonstrates their commitment to increase the flow of the pipeline.

In addition to support from institutional administration, human resource departments can influence and impact leadership development programs on campus for both academic and non-academic purposes (Baltodano et al., 2012; Bonebright, et al., 2011). More broad-based opportunities are facilitated through The American Council on Education (ACE) and its Office of Women in Higher Education (OWHE). These organizations provide leadership development training

opportunities to thousands of women in higher education through a variety of different methods, including the ACE Fellows program, the Higher Education Resource Services (HERS), and the Council for Christian Colleges & Universities' (CCCU) Women's Leadership Development initiative (Baltodano et al., 2012; McDaniel, 2002; Longman & Lafreniere, 2011). Executive Leadership in Academic Technology, Engineering and Science (ELATES), which is a "national leadership development program designed to advance senior women faculty in academic engineering, computer science, and other STEM fields into effective institutional leadership roles within their schools and universities" (ELATES at Drexel, n.d.) with the purpose of providing tools and training to senior women faculty members to help them move into leadership roles is another popular leadership development program for women.

In this section, I have provided a brief overview of the challenges, experiences, and examples of leadership development opportunities that exist for women who aspire to senior administrator roles in higher education. Current senior administrators in higher education will soon start to retire and it is important to have women and those from minoritized populations prepared to step into senior leadership positions. While the department chair role is not considered a senior leadership position, a department chair is a critical position within a department and college. In the following section, I will discuss the general responsibilities associated with the department chair position, challenges, and professional development opportunities for department chairs.

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Department Chairs

The department chair role is one of the most important positions at an institution because this position is influential in making some of the most important decisions and acts as a spokesperson for the department faculty, staff, and students (Hecht et al., 1999). Leadership responsibilities of a department chair include, leadership of the department, influencing curriculum offered, departmental vision and goal setting, recommending faculty hires and promotions, faculty mentoring and annual evaluations, all departmental personnel issues, developing and managing the department budget, fundraising, interacting with students, developing relationships within the institution and with industry partners, and cultivating the overall department culture (Carroll & Wolverton, 2004; Hecht et al., 1999; Nichols Mitchell, 2004; Seagren et al., 1993). Chairs represent their department to administration and represent administration to their departments. Chairs are the “essential link" connecting administration and the department (Hecht, et al., 1999).

For the purposes of this literature review, a department chair is defined as a faculty position within an academic unit designated to manage the academic unit. Seagren, Creswell, and Wheeler (1993) described this position as “midlevel leaders in the academy, academic chairs hold academic or programmatic positions in units called college “divisions,” “colloquia,” or more frequently, “departments”’ (p. 2). A department chair typically plays dual roles, administrator and faculty member.

When seeking candidates for a chair positions, Hecht et al., (1999) noted that faculty and deans look for similar yet different qualities. Faculty want a

candidate who is “a strong advocate, a consensus builder, a budget wizard, and superb manager” while a dean may want a candidate who possess qualities such as “superb managerial and communication skills, and are able to implement university policies and directives” (Hecht et al., 1999, p. 22). Faculty oriented hiring systems and administratively oriented systems can factor into how long a chair stays within his or her position. A faculty oriented system is one in which the faculty elects a chair, whereas an administratively oriented system is one in which the dean appoints a faculty member without the input of the faculty (Carroll & Wolverton, 2004). Faculty members are motivated by different reasons to become chairs. Some have intrinsic reasons and an aspiration for leadership, while others take more convincing by the Dean or their colleagues (Carroll & Wolverton, 2004). Within the interviewing process, some departments are starting to give candidates situational questions to help identify fit with their department and the position (Williams June, 2018). According to a survey conducted by Gmelch and Miskin (1993), as cited by Gmelch and Miskin (2004), the top three reasons an individual becomes a department chair is for personal development, drafted by the dean or colleagues, and out of necessity (no other options). Terms of service differ by university and by department. Terms can be fixed, such as three or five year terms, or can be indefinite terms (Hecht et al., 1999).

A major responsibility of a department chair is hiring, training, and mentoring new faculty members in their department. Chairs must recruit quality candidates to apply for open faculty positions, and head the search and selection process of new faculty hires into the department (Gmelch & Miskin, 2004). After a new faculty member is hired, a chair is responsible for both supporting and

motivating the new faculty member in their development through mentoring, connecting, evaluating, and rewarding (Gmelch & Miskin, 2004).

After conducting a survey of over 800 department chairs, Gmelch and Miskin (2004) identified four comprehensive roles of a department chair, faculty developer, manager, leader, and scholar. These roles often intersect causing challenges and role conflict. However, the chair needs to create balance and understand his or her "support of the students and faculty can have an immediate impact on department spirit, faculty satisfaction, and the student experience" (Chu, 2012, p. 11).

Challenges for department chairs

The department chair role is situated between upper academic administration and the faculty which can result in many challenges. Many times, department chairs are hired into their positions without prior administrative training, lack of clear understanding of their new role, and lack of leadership training (Gmelch, 1991; 2004; Hecht, et al, 1999). Challenges presented within the literature include stress from faculty, perceived expectations, time pressures, confrontation with colleagues, administrative tasks, role ambiguity, and administrative leadership (Burns & Gmelch, 1992; Gmelch & Burns, 1990; Gmelch & Burns, 1991; Foster, 2006; Gonaim, 2016, Hecht et al., 1999).

The department chair position can be particularly challenging because the chair needs to balance serving their faculty and their discipline, but also needs to satisfy the institution's upper administration (Gmelch & Burns, 1990; Thomas & Schuh, 2004). Hecht, et al. (1999) described the stress of two potentially competing interests as walking a "tightrope" and are quick to point out this stress

is apparent in nearly all of a chair's roles and responsibilities. General responsibilities of a department chair include creating structure, enforcing policies, influencing curriculum, creating a vision, executing the mission, and creating unity and engagement (Bowman, 2002). According to Bowman (2002), "the real work of academic chairs as a leader is to make colleagues' strengths effective and their weaknesses irrelevant" (p. 161).

As a noted challenge, many department chairs begin their roles with a lack of formal leadership experience or administrative training (Hecht, et al, 1999). Most of their training is done on the job. Typically, department chairs see themselves as scholars and researchers first and then as a department chair. Many department chairs express frustration about not having enough time to devote to their research because too much of their time is devoted to administrative tasks (Gmelch, 2004). Balancing the administrative tasks with scholarship can be a major challenge to the position.

Administratively, new chairs are most surprised by are the amount of meetings and paper work that are now required of them. According to Chu, (2012), "the process takes time. Documentation carefully done take hours and energy. Listening – on top of teaching and lecturing – takes time" (p. 26). Unexpectedly, taking on the chair position can alter relationships with colleagues, as individuals who were once close friends are now one's subordinates (Chu, 2012). The change in demands and the change in social support structure can cause stress for many department chairs.

Using data from a 1990 study conducted by The Center for the Study of Academic Leadership for the Study of the Department Chair at Washington State

University, 808 department chairs from 101 universities were surveyed to better understand how department chairs view themselves and the tradeoffs they had to make when moving from professor to department chair. According to Gmelch (1991), the biggest tradeoff identified was balancing time and stress. Suggestions for the position going forward include cohort groups, mentors or support networks, restructuring the position, eliminating unnecessary administrative tasks, reversing the hierarchy, protecting research interests, and continuous professional development (Gmelch, 1991; 2004).

Due to these challenges, the department chair position is often viewed as a temporary position or a position one is only willing to commit a certain number of years (Gonaim, 2016). As a result, not much leadership development training is devoted to this position to prepare faculty or to develop the individual while in the position. However, the department chair role is critical to the university and the university must do more to prepare individuals for the position and continue to develop their leadership skills while in the position. After their time in the department chair role has ended, many individuals are promoted or advance to senior leadership roles within the university or return to faculty (Gonaim, 2016).

Leadership development for department chairs

An important leadership component is the cultivations of relationships with all university constituents and knowing one's own institutional resources and procedures (Hecht, 2004). Since the department chair role is so critical to the university, institutions and professional organizations have developed opportunities for leadership development specifically for department chairs and those showing interest in one day becoming a department chair (Quinn, Yen,

Riskin, & Edwards Lange, 2007; Su, Johnson, & Bozeman, 2015; Stockard, Greene, Lewis, & Richmond, 2008; Wolverton, Ackerman, & Holt, 2005). For those in the department chair role currently, continuous professional development provides the opportunity to learn and sharpen their skills and prepare for upper administrative roles. Organizations such as the Council of Independent Colleges and the American Council of Education and a conference held for academic chair persons at the Kansas State University, have provided on the job training opportunities (William June, 2013).

A case study conducted by Quinn et al., (2007) studied UW-Madison's STEM department chairs workshop on leadership development and the workshop's role in the cultural transformation of the departments of the attending department chairs. The workshops were half-day events, which centered on different topics. Twenty-one UW department chairs within the STEM fields participated. Participants worked with peers to analyze case studies, develop relationships, and work to strategically address current issues at the institution. These workshops allowed department chairs at UW-Madison to collectively address issues and collaborate on creative solutions.

Within this section, I discussed the general responsibilities of the department chair role in higher education, challenges presented within this role, and leadership and professional development opportunities. While many challenges exist for department chairs, department chairs are in the unique position to make noticeable and lasting changes in their department. In the following section, I will narrow in on the unique challenges presented to women in the department chair position.

Women Department Chairs

Women are underrepresented in academic leadership roles and less represented among department chairs and deans. When considering the low representation of women in department chairs roles, one must consider the low number of women in tenure and tenure track positions. According to a study conducted by Tierney and Bensimon (2000), most senior administrators or department chairs, a majority of who are white males, have suggested that senior faculty "are unaware of the gendered and racial connections of the conduct, language, mode of interaction, gestures, etc." (p. 310). These individuals may mistakenly assume they are race or gender blind and that women and minoritized individuals are given equal consideration based on merit, however, many individuals are unaware of their own implicit biases.

According to a survey conducted by Niemeier and Gonzalez (2004) of Association of American University (AAU) members, men chaired 74.4% of departments and women chaired 17.5% of departments. While there is a good amount of literature on the position of the department chair and the responsibilities and challenges associated with the role, there is very little research on the unique experiences or challenges associated with women who are department chairs. There are some auto-ethnographic accounts of women's experiences as department chairs along with advice (Dalbey, 1988; Danielson & Schulte, 2007; Palm, 2006), however, very little research exists on this population overall.

An exploratory study by Vaidya (2006) surveyed seven female department chairs in the discipline of psychiatry at medical schools throughout the United

States. Findings from the study indicated that nearly all of the chairs were internal hires to their position. In addition, almost none of them planned to have an administrative type career, and because most had no prior business training, most participants attended short term seminars on leadership development after they took the position. Many participants expressed a sense of loneliness within their position because even though they still had friendships with colleagues, the colleagues could no longer relate to the same struggles the individual as chair was now facing.

Women are often generalized within other research on the department chair position and have not been studied as a unique population with unique experiences. Within this section, I focused on women who are department chairs and the need to better understand their unique experiences and challenges within the position. In the following section, I will narrow my focus further on women department chairs in STEM disciplines.

STEM Women Department Chairs

Successful women scientists make for top candidates for administrative and senior level administrative positions at universities. According to Rosser (2012), "their experience in obtaining funding and managing large budgets, major projects, and teams of personnel in their scientific laboratories translates well into the expectations and skills needed by deans, vice presidents of research, provost and presidents" (para 4). While it is true women's representation in administrative level positions is growing, the growth does not appear to be happening quickly. Of the 17.5% of women who chair departments at AAU member institutions, only 5.7 percent came from mathematical, physical sciences, and engineering

departments (Niemeier & Gonzalez, 2004, p. 160). If isolated for only engineering, women make up only 2.7 percent of department chair positions (p. 161). While there are some research studies on women department chairs, there are hardly any on women department chairs of STEM disciplines. According to Niemeier and Gonzalez (2004), the number of women as STEM department chairs, "is lower than the representation of women in the pool of senior faculty who, at least based on the criterion of academic rank, should be eligible for departmental chair positions" (p. 162). The shortage of women in senior faculty roles goes back to the shortage of women in tenure track faculty positions.

Since women department chairs in STEM disciplines make up such a small population very little literature exists on their experiences. Within this section, I narrowed my focus on women department chairs in STEM disciplines. In the next section, I will discuss the theory that will provide the framework for my future research.

Theoretical Framework

This section provides an overview of the theoretical framework used to bind the experiences of women department chairs in engineering. The theories used within the framework include Bandura's (1977) social cognitive theory, with an emphasis on self-efficacy theory, and feminist theory (hooks, 2015a). The literature describes challenges women as faculty and within the department chair role face. Self-efficacy theory and feminist theory will provide a better understanding of what drives these women to succeed in their chosen profession and their experiences they have had throughout their careers.

Self-Efficacy Theory

The main theoretical framework that guides this study is Bandura's (1977) self-efficacy theory, which is a type of social cognitive theory. Self-efficacy is one's belief about their own ability to perform a task or behavior. According to Bandura (1977), "efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and averse experiences. The stronger the perceived self-efficacy, the more active the efforts" (p. 194). Desire alone will not produce performance outcomes. There are many things people will not do because there is no incentive to do that task or job. Bandura (1977) argues "give appropriate skill and adequate incentives, however, efficacy expectations are a major determinant of people's choice of activities, how much effort they will expend and how long they will sustain effort in dealing with stressful situations" (p. 194). Conversely, individuals who doubt their abilities lighten up on their efforts or give up all together; however, those who have a great sense of efficacy exert a greater amount of effort. This can help explain why men and women initially select fields or college majors they feel they can excel at or "master" and have a high task value for them (Eccles, 2007). Additionally, levels of high self-efficacy can help explain why women stay in fields, particularly a highly competitive, highly stressful academic profession despite challenges throughout the promotion and tenure process, competition for grant monies, or sexism/racism in the workplace. An individual with high levels of perseverance typically attains high levels of success (Bandura, 1982).

Sources of self-efficacy include performance accomplishments, vicarious learning (modeling), emotional arousal, and social persuasion (Bandura, 1977).

See Figure 2.1, which demonstrates Bandura's (1977) four sources of self-efficacy. The first source of self-efficacy comes from one's past performance accomplishments. These serve to reinforce one's confidence that they are capable of the task at hand. Succeeding at easy tasks allows one to believe that they can continue to succeed at more challenging tasks. According to Betz (2000), "succeeding only on easy tasks is unlikely to teach the perseverance necessary in most worthwhile real-world endeavors" (p. 208). However, successfully succeeding at progressively more challenging tasks builds one's self confidence and allows them to believe they can continue to succeed.

Second, according to Bandura (1977), most human behavior is learned through modeling others behavior and responses to new information. Temporary experiences can leave lasting effects on an individual. Individuals can self-correct based on observations or informal feedback (Bandura, 1977). Being able to observe others failures is just as important as observing their successes. Modeling behavior can also be an effective way to build on one's ability to believe they can complete a task.

Third, emotional arousal can refer to any emotional or physical response to a situation such as sweating, anxiety, and rapid heartbeat. According to Betz (2000), "self-efficacy can be enhanced by reducing the extent to which the individual experiences these indicators for example, by managing stress and anxiety responses and by increasing physical fitness levels" (p. 208).

Finally, evaluations or other's judgement also effect thought patterns and emotional responses. According to Bandura (1982), "those who judge themselves inefficacious in coping with environmental demands dwell on their personal

deficiencies and imagine potential difficulties as more formidable than they really are" (p. 123). Social persuasion from others can be effective, but only if the outcome is realistic. Encouragement should be focused on realistic outcomes, failure to achieve unrealistic outcomes can be detrimental to one's self-efficacy (Betz, 2000). When considering how one learns new information, new skills, or a new job, they are drawing from experiences in their past, executing previously modeled behavior, drawing from emotional responses, and drawing on evaluative feedback to perform corrective action (Bandura, 1977).

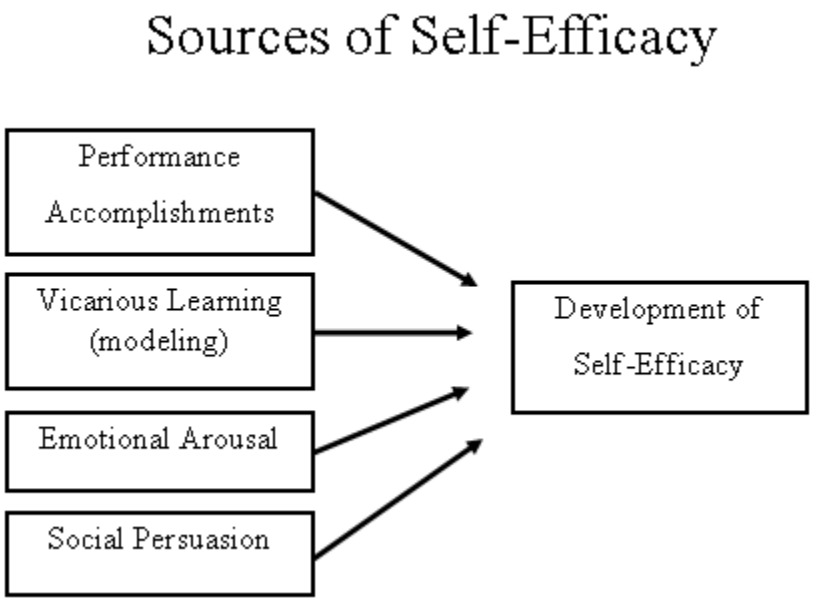

Figure 2.1. Sources of Self-Efficacy. Adapted from "Self-efficacy: Toward a unifying theory of behavioral change," by A.Bandura, 1977, *Psychological Review.* 84(2) 191-215.

Career self-efficacy. Betz and Hackett (1986) first began applying Bandura's (1977) theory of self-efficacy to career development. While career self-efficacy often gets mistaken as a theory in itself, the term is actually a general term used to describe research pertaining to a wide range of self-efficacy application in career choice and career development research (Betz & Hackett, 1986). Career self-efficacy is not a theory, but the application of self-efficacy to career choice and career development.

In a review of the literature, Hackett and Betz (1981) identified women who were typically constrained to low paying, low status jobs compared to men, with additional barriers, seen and unseen. Betz and Hackett (1986) collaborated to

use self-efficacy theory to help explain two problems with regards to women's career development, women's underrepresentation in traditionally male dominated fields such as STEM fields and what they perceived to be the underutilization in their career pursuits. See Figure 2.2, which models the effects of traditional female socialization on career related self-efficacy. Betz and Hackett (1981) found gender had no significant role in self-efficacy across all occupations tested, but when isolated for traditional and non-traditional occupations, significance did emerge. They found college-aged women's self-efficacy was significantly lower for traditionally male occupations and significantly higher for traditionally female occupations such as social worker, hygienist, and secretary. One has to believe they are capable of doing the work in that field, if they are ever going to attempt a career in that field.

Sources of Efficacy information	Examples of Socialization	Effects on Career-Related Self-Efficacy
Performance Accomplishments	Greater involvement in domestic and nurturance activities, but less involvement in sports, mechanical activities, and other traditionally "masculine" domains.	Higher self-efficacy with regard to domestic activities; lower self-efficacy in most other behavioral domains.
Vicarious Learning	Lack of exposure to female role models representing the full range of career options. Female models largely represent traditional roles and occupations.	Higher self-efficacy with regard to traditionally female roles and occupations; lower self-efficacy in nontraditional occupations
Emotional Arousal	Higher levels of anxiety are reported by feminine sex-typed individuals.	Further decreases in both generalized and specific self-efficacy.
Verbal Persuasion	Lack of encouragement toward and/or active discouragement from nontraditional pursuits and activities, e.g. math, science.	Lowered self-efficacy expectations in relationship to a variety of career options.

Figure 2.2. A model depicting the postulated effects of traditional female socialization on career-related self-efficacy expectations. Adapted from "A self-efficacy approach to the career development of women," by Hackett, G. & Betz, N. E., 1981, *Journal of Vocational Behavior, 18, p. 333.*

When applying self-efficacy to career choice and career development, Betz (2000) suggests three major concepts need to be considered: approach versus

avoidance behavior, expectations of performance, and effects on persistence. Betz (2000) explains "approach vs avoidance" behavior as what one is willing to try versus what one is not willing to try. This effects an individual's career choice and educational choices. The expectations of performance can be anything from how one expects to perform on an exam, a course, a degree program, or in their chosen profession. Finally, the self-efficacy's effects on persistence describes what challenges one is willing to face and for how long one will persist in the pursuit of their long term goals.

Many studies have been conducted on how self-efficacy has impacted career assessment and practice over the last 25 years (Bets & Hackett, 2006; Gainor, 2006). Career self-efficacy research has led to the development of several assessment tools for career coaching/counseling including the Career Decision Making Self-Efficacy Scale, the Career Search Efficacy Scale, and the Skills Confidence Inventory. However, it is also important to consider environmental impact on one's self-efficacy, such as discrimination, economic, academic, and vocational barriers.

Feminist Theory

The second framework that guides this study is feminist theoretical framework. For the purposes of this research, I applied a feminist lens to examine gender, gender equity, and discrimination in the workplace within STEM disciplines, specifically engineering. Characteristics of feminism and research considered to be feminist in nature have been debated since women's movements have started since different movements have occurred during different time periods, in different countries, in different languages, and for various purposes

(Ramazanoglu & Holland, 2002). A feminist approach to research, according to Allen (2011), "describes research that seeks social change while also emphasizing women and gender as key analytic categories" (p. 18). Men and women have different lived experiences and feminist theory "asserts that women have something valuable to contribute to every aspect of our world" (Ropers-Huilman & Winters, 2011, p. 670). The focus is largely on women and their experiences, but also on how men's experiences influence those experiences of women and how "gender norms are maintained or disrupted by current institutional practices" (Ropers-Huilman & Winters, 2011, p. 671).

Feminist theory puts gender as the main organizing characteristic (Ropers-Huilman & Winters, 2011). Feminist theory also provides a framework to better understand challenges or barriers which have occurred or are occurring external to the individual. These challenges could include uneven division of labor at home with a spouse or partner, lack of support within the participant's organization, or examples of discrimination, harassment, or sexism experienced within the workplace. These barriers or challenges do not allow women to reach their full potential.

bell hooks (2015b), explains feminism as "a movement to end sexism, sexist exploitation and oppression" (p. viii). Oppression, or simply the absences of choice, comes in many forms and in many degrees including class, race, and religion for example (hooks, 2015b). Additionally, over the last several decades feminist theories have evolved to include the intersectionality of women's identities to be inclusive of this oppression including their race, social class, sexual identities, and nationalities.

bell hooks's (2015a) feminist theory focuses on voices who have been marginalized. She explains, "to be in the margin is to be part of the whole, but outside the main body" (p. xvi). The participants in this study have experienced being a part of a department or a college, but did not always feel included or as if their voice or opinion was as valuable as their male colleagues. hooks (2015a; 2015b) encompasses marginalized voices such as women in low socio-economic statuses and non-white woman. Prior to conducting this study, I did not presume to know who participants may be, or their backgrounds. hooks (2015a; 2015b) allowed for and encouraged inclusivity of women who may come from a variety of backgrounds and experiences. Additionally, her theory promotes women mentoring, supporting, and advocating for each other.

There are several strains of feminist theory. Traditionally, within liberal feminism, women seek no special treatment and want everything to simply be equal and for everyone to receive equal consideration. hooks (2015b) argued that women should not fight to be equal to men because not all men are equal. However, fighting for equal access against oppression is central to theory. According to Hart (2006), "liberal feminists believe that equal treatment in the workplace is the ultimate goal. Unlike some of the other strands of contemporary feminism, liberal feminism is primarily concerned with women's roles outside of the home" (p. 46). Liberal feminist theory focuses on wanting to remove barriers that prevent equal access for all genders (Rosser, 2005). Nicholson and Pasque (2011) argue today's patriarchal society promotes only those careers traditionally feminine, "as such society pressures women into jobs such as teaching and childcare and subsequently steers women away from jobs in business, technology,

engineering and mathematics" (pp. 5-6). Much of the research included within this review has aligned with liberal feminist theory.

Feminist and feminist scholars within this area want to remove barriers that prevent equal access (Rosser, 2005). Often the principles of liberal feminism theory, intentionally or unintentionally, guide programming initiatives which seek to increase participation and retention of women in STEM fields by promoting the removal of barriers and inclusion. Rosser (1987, 1998, 2005), a leading researcher in applying feminist theory to science and technology, has done several studies connecting feminist theory to science fields. In one such study, Rosser (1998) analyzed projects funded by the National Science Foundation (NSF), which aimed to promote science to women and girls, through a feminist lens. Rosser (1998) categorized the studies by different feminist theories including, liberal feminism, socialist feminism, racial/ethnic feminism, essentialist feminism, existentialist feminism, psychoanalytic feminism, radical feminism, and post-modernism. Nearly all of the 80 projects analyzed had a purpose most closely associated with liberal feminism or making the playing field more even and equal for all participants (p. 194). Little research has been done connecting feminist theory to higher education or to science fields, however, as institutions seek to promote STEM education to women, feminist theory can help to provide a framework.

Theories combined

Self-efficacy theory and feminist theory provide a better understanding of what drives these women to succeed in their chosen profession and the experiences they have had throughout their careers (Bandura, 1977; Hackett & Betz, 1981; hooks, 2015a). Self-efficacy theory provides a framework to better

understand why participants believed they could be successful in their chosen profession and persevered up to this point despite the many known challenges (Bandura, 1977). Within self-efficacy theory, the application of career self-efficacy guides a deeper understanding of their career choice and adjustment (Hackett & Betz, 1981). Additionally, this theory provides a guide for better understanding of what the participants wished they would have known when they started their position and what leadership positions prepared them for the department chair role. Self-efficacy theory focuses on the individual level. Self-efficacy theory focuses on intrinsic factors, such as performance accomplishments, modeling, emotional arousal, and social persuasion, which motivate the participant to continue on a given task or chosen career field (Bandura, 1977).

Feminist theory provides a guide to better understand challenges and barriers which have or are occurring outside of the individual (hooks, 2015a). This theory also allows for a better understanding of any challenges or barriers the participants may or may not have encountered externally in an otherwise male-dominated profession. Recognition that one's gender identification may affect men and women differently, suggest an understanding that gender is a social construct with varying phenomena (Roppers-Huilman & Winters, 2011). From an organizational perspective, Feminist theory provides the framework to examine the structure and environment of the participant's organization and the participant's previous organizations as she knows them to be true. For the participant, the environment could be anything external to themselves such as their lab, their department, their college, or their university. Examples of

challenges, or perceived challenges, or barriers a participant may have encountered could include how the typical promotion and tenure years align with the typical child rearing years, hostile work environments, overt discrimination/harassment, lack of support, stereotyping, exclusion from informal networks, gender inequities, and pay inequities.

These combined theoretical frameworks guide this study to better understand the lived experiences of women department chairs in engineering academic departments. Additionally, the chosen methodological approach, narrative, allows for "the ability to explore and communicate internal and external experiences" (Webster & Mertova, 2007, p. 10). The internal and intrinsic factors being explored through self-efficacy theory (Bandura, 1977) and the external and extrinsic factors being explored through feminist theory (hooks, 2015a).

Critique of the Literature

The topic of department chair responsibilities and challenges have been researched for over thirty years. Due to the small percentage of women in the department chair role, women are often generalized with other research on the position and not given the proper attention their unique population with unique experiences deserves. Additionally, the literature generalizes the experiences of minoritized peoples. Within engineering academic disciplines 21.1 percent of chairs identified as a racial or ethnic minoritized individual, with 15.2 percent not reporting (Niemeier & Gonzalez, 2004), this is a significant population, who should not be ignored.

The studies which examine the experiences of women as department chair are often auto ethnographic (Dalbey, 1988; Danielson & Schulte, 2007; Palm,

2006) and lack a breadth of experience. Women need to be broken out and made the focus of the research to learn more about their experiences, challenges, and future goals in an effort to prepare and hire more women to the department chair position.

Much of the original research on the role of the department chair was done over twenty years ago and while most findings are still relevant, I believe with technological advancements and the changing demographic of students, new responsibilities and challenges have emerged which deserve attention in the research.

Summary

It is important to learn about women's experiences and challenges to promote successes and remove barriers in an effort to advance more women into the role of department chair in engineering because the role of department chair is a key position in shaping curriculum, hiring and promoting faculty, and cultivating the culture of their department for their faculty, staff, and students (Carroll & Wolverton, 2004). While not considered a senior level position, the department chair role is arguably one of the most important positions at an institution. Women are underrepresented in academic leadership roles and less represented among department chairs and deans. While there is a good amount of literature on the position of the department chair and the responsibilities and challenges associated with the role, there is very little research focused specifically on the experiences of women who are department chairs. Women have chipped away at or broken the glass ceiling in my different ways, however, "impediments still exist, producing the sometimes confusing and often indirect

paths that women travel. Astute pathfinders maneuver through this labyrinth" (Eagly & Carli, 2007, p. 183). The goal of this study is to contribute to the deeper understanding of the unique experiences or challenges associated with women who are department chairs in engineering.

Chapter 3: Methodology

Sharing one's experiences through story in a variety of formats has been around since the beginning of humankind, starting first as pictures in caves, then as oral presentations, and has since evolved to include written narratives in many forms. Narrative inquiry is a method which keeps evolving as technology allows, as stated by Daiute (2014), "with current technologies, human mobility, and the resulting intercultural connections, narrating has become a tool people use to engage with diverse others, to develop personally, and to contribute to the development of society" (p. 2). Within the development of society, narratives often take the form of political or social justice work and movements by telling the stories of those who have otherwise been unheard or in the background. I used narrative inquiry to highlight the experiences of women who are engineering department chairs at institutions of higher education because this is a small population and this approach will allow for an in-depth understanding of their experiences from their perspective.

This chapter outlines the methodological approach and research design I used to conduct my study. I will expand on my sample selection procedures, data collection method, and data analysis method. Additionally, I discuss my own positionality as a researcher and a woman in higher education to this topic.

Research Questions

Within this study, I address the following central question: What have been the experiences of women department chair in engineering academic departments as they have navigated the pipeline to their current position? My sub-questions are:

1. What are strategies for success that women department chairs believe have been helpful in reaching this position?
2. What previous leadership experiences or professional training helped prepare women department chairs of engineering departments for their role as department chair?
3. What challenges have women department chairs within engineering encountered and had to overcome?

Methodology

Within the literature, findings report that women are underrepresented in both top faculty and administrative roles in higher education and there are mostly male narratives describing experiences as department chairs. As a researcher, I wanted to gain a deeper understanding of the experiences of women leaders within engineering departments. A qualitative research approach is well suited for questions which seek to understand or give meaning to a certain problem (Creswell, 2013). By utilizing a qualitative design, and more specifically, a narrative approach, I was able to understand the phenomena of the lived experience of women department chairs in engineering from their perspective and learn their stories. This qualitative inquiry allowed for participants to describe their experiences as they understood them to be true. This approach also allowed for the research to go beyond the surface and "delve beneath outward show of behavior to explore thoughts, feelings, and intentions" (Webster & Mertova, 2007, p. 16). A narrative is defined as "a spoken or written text giving an account of an event/action or series of events/actions, chronologically connected" (Czarniawska, 2004, p. 17). As technology diversifies so do the available

platforms for sharing one's experiences. Narration is a way individuals communicate the stories they tell to teach and to entertain.

Narratives are a sense making process, which are driven by stories, these "stories are how we make sense of our experiences, how we communicate with others, and through which we understand the world around us" (Merriam & Tisdell, 2016, p. 33-34). The story telling process helps the researcher to better understand the participant through their stories and through the process of narrating one's experiences (Daiute, 2014). As a researcher utilizing narrative inquiry, one must practice excellent active listening skills because within this method the researcher and the participant work together to reconstruct the narrative as lived by the participant. Feminist scholars do not go into research believing they already know the answer, instead "they recognize that because they live and work in a society that tends to privilege men's viewpoints, they may not necessarily hear and see the realities of women's lives unless they are specifically looking for them" (Ropers-Huilman & Winters, 2011, p. 671). In addition to the interview, stories are gathered through a variety of forms of data including historical documents, photographs, newspaper articles, observations, and other sources.

Creswell (2013) outlines the four common narratives approaches: biographical study, auto-ethnography, life history, and oral history. Within a biographical study, the researcher documents specific experiences of the participant. In an auto-ethnography study, the researcher documents their own life experiences. While similar to biographical study, in a life history study, the research documents the participant's entire life instead of focusing on specific

experiences. An oral history is a personal reflection of past events by the participant and the possible causes of the event. The approach that best fits with this study is an oral history because an oral history narrative which allowed for recollections, participant perspective on causes of past events, and their personal reflection drove their narrative. An oral history allows for story telling by the participant of personal critical life events, with potential moments of realization, awareness, and empowerment (Portelli, 2009). According to Portelli (2009), oral history is "predominately a feminist method," because "oral history allows us to get at the valuable knowledge and rich life experience of marginalized persons and groups that would otherwise remain untapped, and specifically, offers a way of accessing subjugated voices" (p. 151).

Individuals and groups collect stories and by nature want to share their experiences. Narrative has been gaining in popularity as a research method within education research because "people by nature lead storied lives and tell stories of those lives, whereas narrative researchers describe such lives collect and tell stories of them, and write narratives of experience" (Connelly & Clandinin, 1990, p. 2). As a qualitative methodology, narrative allowed me to research the experiences of the participants and the contexts which surrounds their experiences.

Sample Selection Procedures

As noted in the review of the literature, the percentage of women who hold the position of department chairs in engineering is low. As a result, sampling was purposeful to ensure that I spoke with women who met the criteria of my study. According to Patton (2002), "the logic and power of purposeful sampling

lies in selecting information-rich cases to study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry" (p. 273). Participants came strictly from engineering departments. Potential participants were identified as current engineering department chairs through their university website and available organizational charts at doctoral granting universities. Institutions were identified using the top 100 Best Undergraduate Engineering Programs as ranked in 2018 U.S. News and World Report Rankings (Doctorate). Of the top 100 institutions, 58 women were identified at 28 institutions. Of the 58 women, using information from their university's website, personal websites, or LinkedIn pages, I further narrowed the list to women who have been in the department chair/head role for at least two years. This resulted in 29 possible participants. I chose to limit the selection to women who have been in the role for two or more years to allow for women to have gained experience and introspection about the position.

Of the 29 possible participants, department chairs were recruited through an initial solicitation email requesting their participation in the study, with one subsequent follow up email. This allowed possible participants to self-identify as a woman for purposes of this study. Six women engineering department chairs agreed to participate in the study. The nature of narrative inquiry is to focus on a few participants to go deep within their stories. Participants were located all over the United States, in three different time zones.

Once the participant agreed to participate, we sat up a meeting time and I sent her the open-ended interview questions ahead of our meeting so she had time to think about her responses prior to the meeting. The meetings took place at the

location of the participants choosing including, phone or virtual meetings, to accommodate busy schedules. To ensure confidentiality, participants were assigned a pseudonym of their choosing within the study. Pseudonyms include Lauren, Msehead, Professor, Ashley, Denna, and June. While there are no immediate benefits to participating in this study, participants are adding to knowledge about their position and their overall discipline.

Data Collection Method

Within narrative, the most commonly used data collection method is interviews. However, these interviews tend to be conversational and storytelling for the participant and less of a question and answer period. According to Riessman (2008), "the goal in narrative interviewing is to generate detailed accounts rather than brief answers or general statements" (p. 23). As a researcher, it is important to allow the participant opportunities for extended narration by asking open-ended questions and allowing participants to construct their answers. In alignment with narrative inquiry, a central tenet to feminist research is to allow for open exploration of a woman's experience, "since only from that vantage point is it possible to see how their world is organized and the extent to which it differs from that of men" (Maynard, 2000, p. 90). In addition to interviewing, other field text could include artifacts, such as photographs, curriculum vitas, or newspaper articles.

For this study, as participants agreed to participate, prospective participants filled out a Qualtrics survey with general non-identifying demographic information, identified a pseudonym of their choosing, and signed the consent from electronically or sent an email to the researcher confirming their

consent. Since the primary mode of data collection was interviews, participants were contacted to take part in up to two semi-structured, open-ended interviews, which were conducted, via phone or virtually and lasted approximately 60 minutes each. The interviews were semi-structured with open-ended interview questions to allow participants to tell their experiences about being a department chair and challenges they may have encountered while in the position or while working toward the position. Semi-structured, open-ended questions establish a guideline, but allowed the participant to answer how she felt appropriate (Seidman, 2006). During the first interview with participants, questions focused on the topic of self-efficacy with regards to how one becomes a department chair, copes with the challenges of the positions, and what strategies for success participants have used to navigate the position and other leadership opportunities. During the second interview with participants, questions focused on feminist theory and how one overcomes/overcame challenges associated with their gender and being department chair in a male dominated discipline. The two interviews occurred within one month of each other to accommodate participants' schedules. With the permission of the participant, the interviews were audio taped and the interview transcribed. The digital recordings of the interviews are saved in a password protected location, such as UNL's Box. Three years after the completion of this research project, I will delete the recordings from these locations.

After each interview, I memoed about the interview, which included my thoughts, reflections, and observations. Each researcher develops their own technique for taking memos and the technique may vary in degree of length and

content. However, additional functions of memos include storing concepts rather than raw data and reflecting analytical thought, which can be sorted and coded (Corbin & Strauss, 2008). Secondary data was collected through public documents such as published photos, published curriculum vitas, university websites, university news articles specific to the participant's current and previous institutions, and books and journal articles which synthesize the topic. Interviews were conducted during most institution's summer term, when department chairs typically have fewer faculty and administrative commitments.

After completing our interviews, each participant was sent the transcripts from the interview and allowed to make corrections. After constructing each participant's narrative, the narrative was sent the participant for member checking. Each participant was given six weeks to review their narrative and send back revisions or comments. Participants were notified that if revisions or comments were not returned by a specified date, an assumption was inferred that no updates were desired. Only one participant returned their narrative with corrections.

Data Analysis Methods

Within narrative inquiry, narratives are partial and told from the point of view of the participant. Quantitative and qualitative data collection have different validity strategies. According to Webster and Mertova (2007), "in quantitative research 'reliability' refers to the consistency and stability of the measuring instruments, whereas in narrative research attention is directed to the 'trustworthiness' of field notes and transcripts of the interviews" (p. 5). After each interview, participants were sent a transcript of the interview to review for

accuracy. Member checking allowed participants to give feedback on the researcher's interpretation of their experience, omit certain information, and/or have the opportunity to withdraw from the study. While phrasing may be different, participants should be able to recognize their experience and be able to provide suggestions to further capture the essence of their experience (Merriam & Tisdell, 2016). Secondary data was collected through public documents found online such as published photos, university websites, university news articles, curriculum vitas, and books which provided additional information on the participant. Other validity strategies included lengthy quotations within the narratives to allow for vivid descriptions and interpretation while adding an additional level of accuracy for the reader. To minimize bias, the same core open-ended interview questions and only one interviewer were used to enhance the standardization of the data collection.

While all narrative inquiry is concerned with content, thematic analysis is more concerned about the topic as opposed to details, such as what was said, how it was said, or visually observed (Riessman, 2008). Thematic narrative analysis is one of the most common forms of analysis in an applied setting; however, there is not an agreed upon set of rules for thematic narrative analysis (Braun & Clarke, 2006; Riessman, 2008). Thematic analysis focuses on identifying themes or patterns within the data (Aronson, 1995; Braun & Clarke, 2006). As Braun and Clarke (2006), explained it is important for researchers to explain their strategy so others can understand the analysis and decisions that informed the analysis of data. I executed a thematic analysis for this study in the following way:

familiarized myself with the data, generated initial codes, searched for themes, reviewed themes, and defined and refined the themes (Braun & Clarke, 2006).

First, to begin the thematic analysis process, after participants reviewed the transcripts of their interviews for accuracy, I used the interview transcripts to outline and compose chronological narratives about each participant's experiences leading up to and as department chair. Participant narratives were written as stories, in which the story is the "casual" (p. 18) narrative of life or the "expected arrangement" (p. 18) of one's biography and the plot emerges as the unexpected events which differentiate participants' experiences (Riessman, 2008). While each participant shared commonalities among their stories, each had experiences which differentiated them. After composing the personal narratives, I sent the personal narratives to each participant for review. An important part of the validation process is getting feedback from participants, which gives them an opportunity to co-construct the narrative (Riessman, 1993).

While interviewing participants, transcribing interviews, and composing participant narratives, I familiarized myself with the data (Riessman, 1993) and initially noticed some reoccurring topics such as being the first woman of something in their academic career (ex: being the first woman faculty hired in their department, being the first woman faculty to earn tenure in their department, or being the first woman department chair in their College), the importance of mentorship, and subtle or overt examples of gender discrimination. I kept these topics in mind as I continued to work with the data. Riessman (1993) stressed the importance of this step of analysis to begin to interpret the data.

Second, I reorganized the narrative outline for each participant by interview question responses and built a table to easily cross-reference data or plot lines between participants. The table (see an example in Appendix E) was organized into three columns as follows: interview question, participant pseudonym and interview question response, and summary of participant interview question responses. Using the summaries for each participant's interview responses allowed me to easily analyze responses across participants and begin the thematic analysis in an effort to better understand how these women understood their lives, behaviors, and emotions. Riessman (2008) described this stage of thematic analysis as

> The investigator works with a single interview at a time, isolating and ordering relevant episodes into a chronological biographical account. After the process has been completed for all interviews, the research zooms in, identifying the underlying assumption in each account and naming (coding) them. Particular cases are then selected to illustrate general patterns – range and variation- and the underlying assumptions of different cases are compared (p. 57).

Each row in the table included a different interview question. While building the table, I also reviewed and included notes and memos taken while interviewing the participants. In the third column of the table, a summary of each participant's responses allowed for an initial round of identification codes and summation of responses to each interview question for each participant and then for all participants. Due on the semi-structured format of the interviews, not all participants were asked all of the same questions due to time or the way our discussion flowed. However, in general, participants were asked a majority of the same questions.

After an initial analysis of the interview questions and responses, during the second round of coding, I paired each interview question with one of the three research sub-questions outlined previously in the study. The research sub-questions guided the development of the original interview questions. The first interview conducted with participants included mostly questions related to research sub-questions one and two which focused on strategies for success that women department chairs believe have been helpful in reaching their position and previous leadership experiences or professional training which helped prepare women for their role as department chair. The second interview conducted with participants included mostly questions related to research sub-question three which centered around challenges women department chairs within engineering have encountered and had to overcome. Both interviews included questions related to self-efficacy theory and feminist theory. While Braun and Clarke (2006) advised against using the interview questions to guide data analysis in fear the questions themselves would become the themes, I developed a modified version to help digest a large data set, which I feel avoided interview questions becoming themes. Organizing the data based on research sub-questions and interview questions which were related to those sub-questions allowed me to best organize the large swath of data and analyze the data or narrative plot lines. Examples of the initial identification codes based on those questions included: being the first woman of something in their academic career, mentorship, support, gender discrimination, promotion, participation in ELATES, previously held leadership positions, challenges related to prioritizing tasks, general responsibilities,

department gender breakdown, department climate, and leadership aspirations. These initial codes were areas of interest and identified on a basic level.

In the third round of coding, I was able to identify patterns of commonalities. These commonalities or similarly experienced deviations became themes of categories for thematic analysis (Fereday & Muir-Cochrane, 2006). The data was again evaluated using initial identification codes based on the sub-questions. Initial codes from the first and second round remained, but examples of additional initial codes included: moving institutions, personnel issues, difficult conversations, supportive spouse, knowing what tasks to prioritize, gender's effect on their position, balancing responsibilities, splitting responsibilities with partner, advice for women faculty, and experiences with unconscious bias. During the third round of coding, I was able to cohesively look at responses based on research sub-questions to identify and combine related patterns into themes.

Prevalence of a theme was determined in two different ways. Prevalence was determined both as themes occurred across participants and the amount of times each participant spoke on a certain topic (Braun & Clarke, 2006). For example, Professor and Ashley both talked about their experiences with gender discrimination for an extended portion of their interviews, Lauren and Msehead talked for a few minutes on the topic, and Denna and June touched briefly on the topic. Major themes which were identified in this third round of coding include: support structure, mentoring, climate, professional development, challenges, and creating opportunities. After the third round of coding, I went back and reviewed data, codes, themes for accuracy. Finally, I wrote the discussion and findings

section and discussed the themes in detail as they relate to the data and previously conducted research.

Within narrative inquiry, thematic narrative analysis is a way to compare narratives across a series of participants and their first-person accounts of their experience (Riessman, 1993). This analysis "examines casual sequences to locate the turning points that signal a break between ideal and real, the cultural script and the counter narrative" (Riessman, 1993, p. 30). The use of extensive quotes from the participants allows for keeping their "stories" intact and allows for "evidence for the investigator's interpretation of the plot twists, deviations from the conventional story" for each participant to come through in their narrative (Riessman, 1993, p. 30).

L**imitations of Framework and Study Design**

While conducting this study, limitations became clear. First, all participants identified as the same race, which excluded the voices of Women of Color. All but one participant self-identified as Caucasian and one self-identified as mixed race. Personal narratives from more women with varying racial backgrounds and nationalities would have provided an additional perspective to the data collected. However, engineering disciplines lack diversity in gender, race, and ethnicity. By learning the experiences of current women engineering department chairs who have successfully navigated the labyrinth to leadership roles, Colleges Engineering and higher education institutions can start to understand how to provide conditions that will better serve women engineering faculty who aspire to leadership positions in the future. Having diverse leadership creates conditions for equitable work environments, an increase in diverse

mentors, a variety of perspectives to problem solving, and improved financial performance (Jackson Teague, 2015).

Second, data collected was primarily through two virtual or phone interviews with each participant, which lasted between 30 – 60 minutes. Additional data was collected through curriculum vitas, resumes, and news articles; however, building a holistic picture of participant's professional journey was difficult in such a short time frame. While a substantial amount of data was collected, perhaps if more time was spent with each participant and more data collected, a deeper understanding of specific participant experiences could have been gathered. Despite limitations, the study's framework and design allowed for insight into six women's successes, professional preparations, and challenges on their professional journey to becoming a department chair of an engineering discipline.

Researcher Positionality

It is important for the researcher to position themselves within the context of their study and disclose any issues of bias which may be present prior to the study. During the period of reflexivity "the inquirer reflects about how their role in the study and their personal background, culture, and experiences hold potential for shaping their interpretations, such as the themes they advance and the meaning they ascribe to the data" (Creswell, 2014, p. 186). This exercise is about how the researcher's personal background may influence the study.

Although I have never been a faculty member, a senior administrator, or a department chair, as defined earlier in this study, I do strive to one day hold a position of leadership in university administration. I am employed within a

College of Engineering at a university whose College of Engineering is included within the US News and World Reports top 100 engineering programs. However, my College of Engineering has no department chairs who identify as women. As a researcher and for this research study, this meant all of my participants were new relationships which needed to be cultivated. As a result, some possible participants may have been hesitant to work with me initially because I am not faculty and/or I do not have a STEM background in either my undergraduate or graduate coursework. However, in my position within the College, I work closely with students and faculty every day and am witness to their challenges and accomplishments. I have witnessed the few numbers of women in top faculty and top administrative positions at the universities where I have been a student and where I have been employed throughout my career up to this point.

I am aware of my own experiences, both personally and professionally, and have done my best to not impose these experiences on the participants or have them influence the study in any way. Overcoming bias, or perceived bias, was critical to convey each participant's stories in the most authentic way possible. Throughout my doctoral program, courses which have helped shape my study and helped me critically reflect on this topic include: Women in Educational Leadership, Human Resource Management in Higher Education, and Feminist Theory. Women in Educational Leadership helped me better understand the historical perspective behind women in education and leadership roles within higher education. For the purposes of this study, Human Resource Management in Higher Education taught be about the promotion and tenure process. Finally,

Feminist Theory taught me feminist theory from a historical and literary perspective, and allowed for discussion on the intersectionality of identities.

The lessons I learned from the course Feminist Theory stayed with me as I continued learning about feminism, the history of the feminist movement, and the intersectionality of identities. Due to the lessons I learned in Feminist Theory, I define feminism as the social, political, economic, and sexual equality of the sexes. Feminism seeks to bring attention to race, class, and economic oppression, just as much as it seeks to bring attention to sexism. Women's contributions, either paid or unpaid, should be valued as valid contributions to society. All women should be educated and if a woman chooses to work outside of the home, I believe she should have the freedom, and should be encouraged to work in the profession of her choosing without fear of discrimination, harassment, or micro-aggressions. Additionally, within that chosen profession, women's work should be valued just as much as their male counterparts.

Marshall and Rossman (2016) stated that it is important for the researcher to position themselves by "establishing how she discovered the importance of the research questions, how she has experienced them personally or professionally, and how even her very appearance could affect the research" (p. 118). As previously stated, within my own university there are currently no women department chair who serve in the College of Engineering, which originally sparked my questions into the topic. As I have learned more about this topic, I have grown inquisitive about how one becomes a department chair, the general job responsibilities of a department chair, and presented challenges. Looking deeper into the College of Engineering at the University of Nebraska – Lincoln,

while there have been women who have served as interim chair, I have learned there has not been a woman in a permanent department chair role. For these reasons, learning about department chair experiences and issues pertaining to women's advancement in higher education have become topics of interests for me.

I have taken social constructivist viewpoint, which seeks to understand and apply meaning to how individuals engage with the world. Social constructivists understand that how an individual interacts with their world is largely based on their background and social perspective (Creswell, 2014). Applying this paradigm throughout the study has allowed for a deeper discussion on challenges associated with being a woman in a leadership position in male dominated discipline and how one's background and surroundings contribute to their self-efficacy.

Summary

In this chapter, I have outlined the methodological approach and research design I will use to conduct my study. I have explained the sample selection procedures, data collection method, data analysis method, and my own positionality as a researcher and women in higher education. Next, I will report the results of the study.

Chapter 4: Participant Narratives

Participants

The participants in this study were from across the United States and from a variety of different institutions; small and large, public and private, large and small departments, with a variety of different personal and professional experiences within engineering. Participants also represent five different engineering fields. Regardless of the basic characteristics of their institution or their engineering discipline, all six chairs have been in their positions for at least two years and their departments are listed as a top 100 engineering college as ranked by the 2018 US News & World Report rankings.

Each participant agreed to meet for two semi-structured interviews lasting roughly one hour. The first interview focused on her experience leading up to and while chair of her current department and the second interview focused on her experiences as a women in a traditionally gendered discipline. After completing our interviews, each participant was sent the transcripts of interview and allowed to make corrections. After constructing each participant's narrative, the narrative was sent to the participant for member checking. Each participant was given six weeks to review their narrative and send back revisions or comments. Participants were notified that if revisions or comments were not returned by a specified date, they approved the narratives. Only one participant returned their narrative with corrections.

Each participant had a unique experiences which shaped their academic career and leadership journey. The narration of their lived experience allowed me to research the experiences of the participants and the contexts which surrounds

their experiences. In this section, the experiences of women department chairs in engineering are told through the narratives of Lauren, Msehead, Professor, Ashley, Denna, and June.

Lauren

The first participant, Lauren, is a department chair of a medium sized engineering department in a large college of engineering at a large institution. I met with Lauren in May and June of 2018 via Skype, just as the school year was winding down and summer activities were ramping up. Lauren self describes as "stubbornly tenacious" and after our conversations, I cannot help but agree. Throughout her career, Lauren has been the "first" many times, she was the first woman faculty member hired in her department, the first associate dean for research at her previous college of engineering, and the first woman department chair of her current department. Her persistence, drive for continuous learning, and support of those around her has helped her achieve in her field.

Lauren and I started by discussing how she developed her interest in engineering. Although she noted that numerous individuals saw her love for math, physics, and chemistry and encouraged her to pursue engineering, her advanced placement (AP) physics and chemistry teacher had the most memorable impact. He encouraged her to consider engineering as a major and took her and another woman classmate to tour the chemistry department at a local College to further spark their interest. When discussing the challenge of how to get more girls and women interested in STEM Lauren hypothesized, "I think part of it is due to what girls are encouraged to be interested in as you know when they are really young" and also "I think there are just some stereotypes around math being hard for girls

or things like that." Women continue to become more underrepresented as they rise in educational attainment. Within academia, Lauren has noticed "women are definitely underrepresented at the full professor level across academia, but especially in STEM for sure."

While an undergraduate, Lauren attended a selective, top ranked institution. She notes most of her classes were gender balanced, and she said the environment and community the department made were encouraging and supportive to students. Lauren recalled her experience stating, "It was really important to have a good community there to kind of support you through that process as you're learning to navigate really difficult courses and subject matter." As an undergraduate, Lauren participated in many activities. She participated on the crew team, conducted undergraduate research, interned at a packing plant, and was an undergraduate teaching assistant (TA). Lauren remembers being "petrified of public speaking" and working as a TA helped her overcome her fears. As a TA Lauren had the opportunity to get a glimpse of what it might be like to work in academia full-time. In addition to scholastic experiences, Lauren's experience rowing crew gave her additional experience working in a team and being challenged in a way she had not been challenged previously. Lauren recalled never having participated in team sports before joining the crew team and never having had lifted weights. Of her time rowing crew she recalled, "I think trying something hard and new and learning how to do it and working together and I think the people I met I think it's really a valuable experience."

Immediately following undergrad, Lauren went on to earn her Masters and Ph.D. in her engineering discipline, both degrees at a different institution than her

undergraduate institution. As we discussed her experiences she recalled not feeling as though her gender impacted her educational experience or noticing much biases saying rather, “I think probably I saw more sort of in internships a little bit and a little bit more in graduate school. I think there sort of pipeline starts to shrink as you get into graduate school.” After earning her Ph.D., Lauren took a faculty position at a mid-sized institution in a young department. At the time of hire, and for the next 11 years, she was the only woman faculty member in the department. Lauren recalled, “I definitely experienced it (discrimination) more as a faculty member.” During her early years, she spent most of her time teaching, building up her research, and recruiting graduate students. A benefit of being a part of a young department is one gets to participate in the building, development, and direction of the department, which Lauren enjoyed.

In a small department, where one is the only woman faculty member in the department, Lauren cautioned, one needs to decide if they are going to act as the “mom” figure or have a harder image. Not that she did not care or was not supportive of all students, but “if you’re the sole woman faculty member, you can’t be the sole advocate for all of these students when they have problems.” She also shared an observation she has made throughout her time in academia, that men often get more leeway when expressing emotions, saying “I think that can be a real challenge for women to navigate that it’s very easy to be labeled a bitch.” However, she recognized as she has risen in the ranks of faculty and administrators she felt a shift stating, “I’d say as I get more senior it tends to happen less to me. Um…but I don’t, I don’t think that it’s not out there I think that I don’t experience it as much.”

During her promotion and tenure process, Lauren had two children. As the only women in the department, Lauren remembers her pregnancies as the times she felt most like the other. Remembering how her pregnancy highlighted the differences, “I had one kid pre-tenure and one post tenure. So one assistant and one associate. And I think for me it was like that was definitely a stressful period being a professor and being the only woman and being pregnant.” Not that the other faculty members were not supportive, but it was an experience they could not empathize with, saying, “I mean many of them had wives who had kids recently, but that is not the same and it just made me feel like that was an experience that made me feel like I really was cognizant of being different.”

A few years after earning tenure, Lauren took on a new role within her former department, as the Director of Graduate Studies, Lauren was able to develop valuable skills, which have helped her in her current role. As Director of Graduate Studies in her department, Lauren had to develop and enforce structure in graduate education for the department and have her colleagues buy into the structure she was developing, such as enforceable timelines. She was able to collaborate and build relationships with other graduate programs across campus and pool resources. She also notes getting early practice at having difficult conversations, counseling students who were dealing with a mental health crisis, meeting with students who did not pass their qualifying exams, and coaching students through issues with their faculty advisors. Reflecting on how this experience helped prepare her for being a department chair, she learned some issues can be complicated and there are always two sides to every story, saying, “I

just got used to handling those kinds of situations and conflict between students and faculty, which you deal with a fair amount of faculty conflicts as a chair."

Toward the end of her term as Director of Graduate Studies for her department, Lauren took on an additional role as a co-director of a joint research center with a faculty member from another discipline. As a co-director, Lauren gained valuable experience in management and obtaining resources, stating

> Being involved with that helping to develop programs, go around to a bunch of chairs and get buy in and financial support for a programs and then get those up and running so that was really useful to sort of think about what is valuable to you know the people above you in the food chain and how can you motivate them to support your program.

These successful experiences and accomplishments further encouraged Lauren to consider leadership roles.

After earning tenure, Lauren continued to look for professional development opportunities. She had known several women who had participated in ELATES, Executive Leadership in Academic Technology, Engineering and Science, which is a "national leadership development program designed to advance senior women faculty in academic engineering, computer science, and other STEM fields into effective institutional leadership roles within their schools and universities" with the purpose of providing tools and training to senior women faculty members to help them move into leadership roles (ELATES at Drexel, n.d.); however, the program was a large time commitment and up to that point Lauren had not previously felt she could make the program work with her schedule. After participating in ELATES at Drexel University, she referred to her participation as the "most impactful" and "probably the most intense" professional development experience she had had. Two of her biggest takeaways

from ELATES were being mindful of the perspective of others you are working with and articulating what you want and negotiate in a way that the situation is a win-win for everyone.

Participation in ELATES enabled Lauren to continue to look for opportunities to grow, both outside and within her institution. She started to think about an associate dean role. When a new dean moved into the College, Lauren scheduled an appointment with him and said "I'm interested in having this type of role, are you interested in having a dean who handles these types of things?" Shortly thereafter, Lauren assumed the role of Associate Dean for Research. While in the role, Lauren helped the new Dean learn his new environment, while she had more exposure to different financial models and different leadership approaches. Lauren noted, "Thinking about sort of okay how you could build a model that would drive, you know these behaviors that we want, like more research or more tuition revenue things like that."

As a faculty member, Lauren participated in specific professional development opportunities geared toward women faculty members and women in leadership, which were offered at her institution**.** When I asked if she felt her gender affected the number of opportunities for development available to her, Lauren felt that **"**there were more opportunities because there were women who were kind of on the lookout for other women." One opportunity that was presented to Lauren was to serve on the search committee after their long time chair decided to step down. The department decided the new chair should be external to the College. During a challenging first search, peers in her department suggested, "well if we don't hire anybody we should think about who the internal

people might be and some people were like will you think about it if it ends up being internal." Her peer's encouragement and persuasion started her thinking about the department chair role and if she would be interested in pursuing the position. Her home department ultimately ended up choosing an external candidate as planned; however, Lauren started to get intentional about the role, stating "okay what's my vision and how do you teach this kind of, how do you evaluate you own program or other programs in terms of strengths and weakness, and where you would want to go with a program." Having her peers and mentors encourage her to continue into leadership helped motivate her to think about why she would want to be a department chair. When reflecting on her experiences Lauren explained,

> I really enjoy building things so kind of having that experience of being in an early department and helping build the programs there I really enjoyed that and I enjoy interacting with people from across campus and seeing how the different departments, different research groups can work together to build new programs so I think that's the that's the exciting piece that I can see you know a the chair playing an important role in the right setting.

Related to search committees, for those women who want to move into an administrative role, Lauren advised to seek out opportunities to participate in and lead search committees. These were valuable experiences for her saying "faculty hiring is such a big piece of what I do and it's certainly one of the most emotional things that we all navigate because it's such a big decision."

Holding positions as a faculty member in a young department, director of graduate studies within her pervious department, co-directing a research center, and as associate dean for research at her previous institution provided Lauren with a myriad of opportunities to prepare for her current role as department chair. Reflecting on her experiences, Lauren noted one of the most important things for

women to do who think they may want to be in a leadership role is to tell others they are thinking about moving their career in that direction and tell people who have the ability to position you well for those roles. Lauren said, **"**I think the first thing you have to do is be willing to say yeah I want this and tell people, tell the people who make the decisions you know that you're interested in that role." Recognizing that can be hard for some, Lauren goes on to say, **"**I think that's the hardest part for women a lot of times is putting themselves out there and saying I'm interested in that role."

Lauren did just that, getting advice and encouragement from those in her professional network. After deciding she was interested in a department chair position, Lauren interviewed within and outside of her current institution, but was passed over the first few interviews. Her professional network's words of encouragement helped her persevere through the job search period and channeling her energy adding, "Finding other ways to challenge that like taking that associate dean role for example that was one way I channeled that." She also credited the relationships she had formed in her personal and professional network for helping her stay positive, "I think kind of you know having people who were 'no, like you'd be good in this role just be patient and keep trying and look for the right fit.'"

In 2016, her hard work and persistence paid off and she found the right fit for her and her family at a new institution. Lauren moved from her small department at a mid-sized private institution and accepted a chair position at a mid-sized engineering department in a large College of Engineering at a large public institution. Moving to a new institution has been a big shift, noting the

research foci and the culture are different. Lauren had trouble determining if the differences she perceived were because of the public institution or size of the department.

At her current institution, chairs are termed to four years with the option of renewing. Due to the number of departments, Lauren reported there is general turn over at the department chair level, with one or two departments having a new chair each year. However, due to regular change, the College has adapted and developed a structure to help on board new chairs. This was helpful as Lauren stated "Even if you're internal you might know certain things you might not, you might know the department better, but you don't necessarily know you know a lot of the financial pieces or whatever." An additional on boarding resource her current institution offered to her as she transitioned into her new role was executive leadership coaching. During the first six months on the job, Lauren met three to four times with a coach and at one of the final meetings they did a 360 degree review of her performance thus far.

Lauren is only the third permanent chair of her current department and succeeds two senior men. She recognizes she is a shift from the department's previous normal, stating, "I think one of the things I've tried to be conscious of is just you know walking in the door and sitting in the seat was a big radical departure from the past" and she has tried not to rock the boat too much. Lauren's current department is fairly gender balanced, coming out nearly even. However, she is the first women chair in the department and is currently the only woman department chair in the College. While the Dean of the College is also a woman, Lauren said the gender imbalance is noticeable at chair meetings. She recalled a

scenario with a colleague who took her place at a meeting and her colleague's reaction was "kind of funny because I'm kind of used to it now and when one of my colleagues who is also a woman who went one time when I was out of town and she's like "it's like you and the Dean and a lot of dudes.'"

Reflecting on how the move affected her leadership, Lauren said, "I think for me moving was actually helpful because it was easier to be seen as a leader coming from the outside. I was just my only role there was this leadership role. Right, and at my other institution there were plenty of people who only saw the 25 year old assistant professor who started." When considering if her gender has played a role in her overall experience as chair, Lauren feels being a woman is almost easier in a leadership role, if she is leading a meeting "people are more likely to listen to what I have to say, instead of you know when you're just average faculty member in a meeting sometimes you say something and you may or may not hear what you have to say."

As noted earlier, a department chair has many demands on their time and competing interests he or she must juggle. When Lauren and I talked about how she juggles the demands, she said, "I think it's definitely challenging to navigate." Lauren has a reduced teaching load, which has helped with the amount of time spent on administrative tasks, but she is also actively doing research. Although Lauren has held several previous leadership roles and participated in several professional development opportunities prior to assuming her role as chair, she noted that having more experience with budgeting or finance models, would have been helpful, noting, "one of the things that is kind of a challenge to wrap your

head around those budgets and how they work and sort of what money you actually you know can do something you know have control over."

While a department chair has many competing interests, there are many rewards that come with the position. The three areas that Lauren is most proud of since she became chair are hiring great people; faculty development, but specifically defining a support structure for junior faculty; and her work with undergraduate programs. Conversely, the challenges that come with being a department chair are well documented within the literature. Since becoming chair, Lauren felt the challenges have actually decreased, stating, "I feel like I had a lot more challenges in sort of getting to this role and fewer challenges now that I'm actually in it." However, even though she had experience from a previous position, Lauren said having difficult conversations has been a challenge she has had to overcome. As someone new coming into a department, she noted, "it's not necessarily the expectations have changed but that but that you're actually more honest you know taking off the rose colored glasses about a situation. So that's one thing I've had to learn to navigate." Along with challenging conversations about follow through of expectations, Lauren noted another challenge has been learning the existing office culture. She stated, "I've worked really hard to do is understand what was the existing department culture and how to navigate the different personalities and get things done and try to build consensus for you know for different things…"

When talking about how she perseveres through these ongoing challenges, Lauren acknowledged that it is hard, and she was not chosen for the first couple of chair positions she interviewed for, but that is part of the reason she likes her role,

"I think that's important you know just like in research you don't usually succeed the first time you have to fail a couple of times and figure out how it works." She also recognizes she is not going to be good at everything right away and is sure to give herself room for trial and error to improve in different areas. She said she feels it is important for individuals to know "that you're not necessarily going to be great at all of the pieces at once and figuring out what pieces you're going to have to work on and how to get better at those."

Lauren's participation in ELATES helped her understand office climate and identify what her ideal office climate would be if she could cultivate her own. One element of office climate can be the diversity breakdown of an office. Unlike her current institution, at her previous institution Lauren was the only woman in her department for 11 years and for eight years she was the most senior woman faculty member in the College, despite having recently earned tenure. The disparity in numbers, "made me definitely more aware of the differences" and the culture of her previous institution fueled the heightened awareness. Due to the glaring disparity, Lauren served on a lot of committees. During her committee work, "I started to see sort more of the things that were happening and where we were looking at selecting leaders for different roles I definitely saw more more issues in terms of gender imbalance and in some of the ways women were perceived."

Our talk turned to office climate and how climate can affect one's experience with their department. Lauren's ideal climate is "one where everyone feels like their able to meet their full potential um and that they have the resources that they need to be successful." When comparing this ideal office climate to the

climate of her current department, Lauren noted one distinct difference from her previous institution, **"**one of the things that is nice here is that I feel like I'm not always the one that has to speak up for diversity." There are others in the department who will speak up "when they feel like a situation is potentially disadvantaging or disadvantages to a group of people so I think that's really great."

As the literature repeatedly notes, having a strong support structure is important to any faculty member to be successful, but particularly this is true for women faculty members as they juggle their personal and professional demands. The literature stresses the importance of mentors for young students and young faculty members who will help push and guide them to their next level of opportunities. Lauren recalled one of her mentors routinely challenged her to think about the future and next steps, saying "you know what do you need to get there okay now work on those pieces and you know and things to be thinking about as you're going into different parts of the process." Having a mentor as a graduate student or a young faculty member can be essential to navigating the tenure ladder and office politics. Lauren noted, "I think sometimes people don't understand the process and they don't understand the timelines and they don't understand how it all works and this can be a main, it can be both women and men." But beyond mentors, Lauren praises her network of supportive colleagues who have helped encourage, challenge, and support her throughout her career, who are her "trusted people." Even though her participation in ELATES ended, she and her cohort still check in regularly. Going beyond mentors and a supportive personal and professional network, Lauren notes how important it is

for women to see other women in leadership roles, saying, **"**I think it is really critical and just for women to see role models and to kind of envision themselves in those roles I think is also really important." Role models provide a critical modeling piece for women to be able to see a woman who has had success and believe in themselves that they too can rise to that models same level or beyond. Lauren also feels the lack of role models continues to contribute to why there are so few women in STEM fields saying, "they just don't know you know what types of jobs or roles there are in those fields so I think if they don't see it they just tend to go towards things that they see more." Feminist scholars in STEM fields have also recognized this as an issue and want to remove barriers that prevent equal access and promote more equitable recruitment of career types (Rosser, 2005).

Lauren was open about how the move to a new position at a new institution has shifted her family dynamics at home, going from a fairly equal household and parenting work distribution to her husband being the primary caregiver due to the additional commitments in the evenings, saying "I think having a supportive partner and kind of working through what it is at different time points in the career" is needed for balance. Beyond career, Lauren recognized that having a supportive partner in general is a key to balancing responsibilities. Also, part of having a support network is letting your support network support you and "realizing you can't do it all, you can't be everywhere at the same time." Lauren explained, she has learned to negotiate her time and lean on her children to let her know when certain events are important to them. She will ask them if they care if she attends a certain event or not and sometimes they

will say "'no I don't care' then I'm like I'm not going to cancel these three meetings to be there," but sometimes, they will say, "'you really need to come to this thing' then I'm like okay, I'll make it work." A solid support network allows for a healthy management of stress, which can increase an individual's emotional response and lead to their ability to successfully perform tasks.

For those women faculty members who are interested in being a department chair someday, Lauren encouraged them to first focus on earning tenure, their research, and being promoted to full professor. She reported seeing men and women get side tracked with administrative roles and their long term career options can be limited. She advised women to work on developing a strong, well-rounded portfolio, which would include "one thing that is in education, like graduate or undergrad, having something more focused on research like a center or you know like some type of leadership role in a research community." When strategically rounding out a portfolio, also consider when might be the best time in your trajectory to make certain moves. Ultimately, Lauren encouraged women to have more confidence in their skills, their portfolios, and start envisioning themselves in leadership roles. To help other women to envision themselves in leadership roles, she encouraged other women in engineering if they know a woman who would be great in a leadership role, or if one is mentoring a young woman, be sure to say something. Lauren said,

> I think it really takes someone to kind of say I can see you in this leadership role, maybe not necessarily today, but I can see you in this role in 5 years or I can see you in this role in 10 years, here are the things that you can do in between to make yourself a stronger candidate…

As we winded down our conversation, Lauren and I turned our attention to the future. While Lauren enjoys her current position, she acknowledges there can be good days and bad days, but

> I feel like you know I feel like I can make a difference for my faculty and for my students and you know I think that's I think that's really the goal is to build a good climate for people to really live up to their potential.

However**,** Lauren confided that she is interested in continuing in administrative leadership, possibly a Dean position, however, "a very wise advisor said don't even start thinking about it until you're three years in because you kind of got to get in there and do the job and show that you can get something done…."

As we concluded our discussion, Lauren stressed the importance of women having confidence in themselves and their work to be able to envision themselves in an academic leadership role. As women rise through the faculty ranks, academia needs to do a better job at identifying and encouraging future women leaders, especially within engineering disciplines.

Msehead

The second participant, Msehead, is a department chair within the College of Engineering at a large private institution. She and I met for our interviews via phone during June of 2018. Our first interview was plagued with technology issues and we ended up conducting our first interview by phone instead of video conference. Due to time constraints we ended our first meeting short, but for good reason: Msehead was heading to a graduation celebration for the students in her college. To avoid the possibility of technology issues for our second interview, we scheduled a phone interview. Initially starting in industry after college, Msehead returned to earn her PhD after significant life events caused her

to reevaluate how she was utilizing her engineering skills. Since returning and joining academia as a faculty member, she has held multiple leadership roles including associate vice provost for research and is currently, department chair, at her current institution. Similar to Lauren, Msehead has also been a first many times including the first woman faculty member hired in her department and the first woman department chair at her university. Her passion for helping others shined through as she discussed why she returned to earn her PhD, how she supports her department's graduate and undergraduate students be successful, and how she has worked to support other women in engineering.

We started our conversations by discussing how she first became interested in engineering and how to get more young women interested in engineering. As a middle and high school student, Msehead first developed her interest in engineering, wanting to better understand how things worked. In high school, her favorite class was physics which directed her toward studying engineering during college. As an undergraduate, Msehead studied at a medium sized institution. She had a great experience as an undergraduate, saying, "…I had good colleagues in my class, the guys were really nice, we had a good group of friends, and some of the girls that were in my class are still my best friends today." As an undergraduate, Msehead balanced her engineering course work while playing lacrosse, participating in student organizations, and conducting undergraduate research. During her time as an undergraduate, Msehead recalled her class composition as about 12-15% women, so her and her female classmates certainly stood out saying, "you definitely felt it was still unusual at that time to have women in engineering." Having so few women classmates, Msehead

hypothesized that one could struggle with identity issues and question if this is the right field for them.

As Msehead reflected on her own experiences and how to get more women interested in STEM fields, she recognized there is a pipeline issue into STEM fields, some areas of engineering have fewer or more women than others, and engineering needs to do a better job of promoting itself as a helping profession. She argued that the data does not support the claim that women or girls do not like math or science. However, she acknowledged, commonly, women or girls would like to be in a profession that helps other people. While not commonly thought of as a helping profession, engineers help people every day.

For those women who earned a degree in engineering or another STEM field, Msehead hypothesized the reason they may leave those careers could be because they are traditionally not as flexible with work hours as business or medical professions. When discussing engineering within academia, Msehead went further in discussing the challenges and said, “fewer women go and get their Ph.D.’s and they have to get fight for faculty positions, and they have to fight for tenure, and all of these things are really meant to weed out people from the system and they do.” This leads to fewer women to start from at the assistant professor rank. Of the women who start at the assistant professor rank, some will get through the tenure process, but as Msehead explained, “the big stumbling block is getting from having tenure which is called an associate professor to becoming a full professors which is like the last step of the whole process, a lot of women don’t make it to full professor.” This issue directly leads to why there are few women in STEM leadership roles. If women are not able to achieve the rank of

full professor, few leadership opportunities are available to them, such as department chair, Dean, or Provost.

After graduating with her undergraduate degree, Msehead worked in industry for four years at a company and participated in their training program. This training program allowed for her to rotate jobs through three different eight month assignments, which then allowed her to pick a position at the end of the rotations. During this time, Msehead's company also supported her financially in getting her Master's degree in her engineering discipline. After a couple of years, Msehead's company offered her a management position, which would have had her managing about 15 other engineers. However, during this time, life events, particularly her mother's passing away from breast cancer, caused her to rethink how she was utilizing her engineering skills. She turned down the management position at her company and went to graduate school to earn her PhD.

Her PhD experience was different than her Master's program experience. During her Master's program, Msehead rarely had other women in her classes, which felt isolating at times. However, when she returned for her PhD, she explained, "there were more women in the class again at least I would have 1 or 2 more classes with me."

At the time of her faculty interview, Msehead was pregnant and two years later, she had her second child. While raising two children, Msehead worked toward tenure, without much guidance from her department. With the demand of a faculty schedule and now as a department head, a strong support system is important. Of her family, Msehead is clear: her kids are her first priority. Msehead explained her children are older now and independent; however, when they were

young, her balance looked different, saying “I still managed to cut out a lot of time for my kids and when they got in school…I would be home by 3 to get them off the bus …I would work at night after they went to bed.” Of those years and her choices, she said, “you know you make your choices, I don’t have like a thousand publications but I have enough.” Msehead reflected on her promotion and tenure process saying, “I had some success in securing research funding and graduating students and having publications so when it was all said and done at the end of those five years, I didn’t sleep much, but I ended up with tenure [laughing].” She was the first woman to be awarded tenure in her department.

When Msehead joined the faculty at her institution, she was the only woman faculty member in her department. Msehead joked that there were no department profiles of faculty on the internet because there was no internet when she was first interviewing for faculty jobs so she was naïve to the composition of the department saying, “I didn’t really notice that I was the only woman at that time that much or worry about it. I just I was kind of used to it and whatever, I wanted the job.” As she interviewed for the position, she vividly recalled meeting with an older woman faculty member, as part of the interview, who was a faculty member in another engineering department. This woman said to her,

> Look, when you come and do this you’re going to have to be twice as good as every man here, you’re going to have to be twice as hard working, twice as this’ like everything just to get to where they are.

Although in a different department, this woman became a good mentor and role model to Msehead and made her feel more supported and less alone.

There was no formal professional development provided by Msehead’s department or College when she first started as an assistant professor. She

described her early years as “a sink or swim kind of things.” However, Msehead does not necessarily feel that was to the fault of her department or College, but rather the result of there being fewer opportunities in higher education in general. Looking back on her experience, Msehead felt having a senior faculty member to offer guidance on grant writing or networking would have been helpful. She said, “all of those things I just kind of, kind of learned more of less on my own you know.” As she advanced in her career and took on leadership roles, Msehead participated in a yearlong leadership development program targeted at women in a related discipline. This experience had such a positive effect on her, she helped to develop a similar program targeted at women in STEM called, ELATES, which stands for Executive Leadership in Academic Technology, Engineering and Science. The program is a “national leadership development program designed to advance senior women faculty in academic engineering, computer science, and other STEM fields into effective institutional leadership roles within their schools and universities” (ELATES at Drexel, n.d.) with the purpose of providing tools and training to senior women faculty members to help them move into leadership roles. Many department heads have gone through the ELATES program and the typical participant is an associate or full professor, or a current department head.

Through her participation in ELATES and a similar program, Msehead identified her vision and ideal office culture saying, “I was able to set my mission very clearly and set the culture and use, learn how to use that to help drive decision making and rationalize how I was making decisions so that it wasn’t random you know.” Having identified her mission, she was able to use her mission to guide how she prioritized resources, saying “…to be a leader that

maybe everyone doesn't always agree with all of the time, but at least they respect because I can stay to a pedagogy or a method that they understand." As department chair, Msehead changed this to allow for more mentoring and formal opportunities for professional growth for her faculty, especially newly hired faculty.

While her home department was not big on mentoring when she first started as a junior faculty member, Msehead found support in other areas of the university. One such person in a different area was the Vice Provost for Research who recruited her to work for him as an Associate Vice Provost for Research. Of that time Msehead recalled his persistence and willingness to accommodate her work and home life. She recalled how great mentors both the Provost and Vice Provost became to her saying, "once I agreed to go work with them, they gave me lots of opportunity and that really made the whole thing worthwhile." Her experience working at the university level helped Msehead realize, "I kind of like being part of a team and I like being part of bigger things happening then you can be when you're a professor in your lab."

Ultimately, Msehead's previous experiences helped her to understand both sides, faculty and administrator. Having been a professor, she can relate to the requirements and demands of the position and having worked in administration previously, she understands the different facets of the university. During her time in the Office of Research, Msehead learned how a university operates, she served on the Provost's advisory board, and networked with Deans throughout the University and other upper level administrators such as the Vice Provosts, Provosts, and President. That experience and her accomplishments within her

role, helped her in her current position saying, “when I came here I already knew how all of that stuff worked so if I needed to get anything done, I knew exactly how and who to go to.”

When it came time for her home department to transition into new leadership, Msehead thought the position would be a good opportunity to continue to develop as a leader and learn more about managing at the department level. At the department level, she would be able to gain more experience with personnel, have more student interactions, gain experience in hiring and retaining faculty, and helping faculty through the promotion and tenure process. Colleagues encouraged her to consider the position, she applied, interviewed, and was hired. With her hire, she became the first woman department head of any department, in her University and College of Engineering’s, 125 year history. While she may have been naive about being the first woman faculty member in her department, Msehead’s reaction was different to being the first woman department chair: “I realized there were no female department heads when I started looking around at that then I found out that they are were never any ever and then I was just sort of shocked at that and just figured well we have to stop this nonsense so [laughing].”

Msehead is unique in comparison to the other participants in that she has been at her home institution from assistant professor through becoming her department’s chair. Since becoming chair, Msehead described her experience as “fantastic” and elaborated, “we have a great department and I’ve been able to initiate a lot of research initiatives.” She hosted a retreat for her department when she first started and at that retreat the department identified focused research areas, which has helped them to write grants, grow their department, and get

closer to having a research center. Msehead explained, “we’ve gone from not having any research focus to having a very tight research focus and being able to compete nationally for some of these things….” One challenge that comes with getting national attention, is faculty retention. Msehead explained, “…we have really strong faculty and they get recruited to other places so we fight retention battles with that and but we’ve been able to hold a lot of them here, which has been nice.” Along with faculty retention, Msehead has had to learn how to motivate faculty without having much incentives, saying, “you know you’re taking their time away from their research mission and teaching and teaching mission. You have to be kind of clever about that. So that’s also a bit of a challenge.”

Msehead has also prioritized student retention in her department. During discussions about her department, it is evident that she is a department chair who is hands on with her students and understands the growing number of mental health issues college campuses face. She explained, “I spend a lot of time doing wellness checks on students who are troubled and mentoring them and also helping them manage through their illness and their behavior health challenges.” Msehead is student success driven and is most proud of her student’s success. She beamed as she told me about how her department works to “nominate them for a ton of awards, we nominate them for fellowships when they go to graduate school.” Her department also helps students identify co-operative education (co-ops) opportunities and full-time job opportunities. Msehead said with a smile, “I’m most proud of their performance, both the undergraduate and graduate students.”

As the first women department chair, Msehead felt the issues that have come up have less to do with her gender and more to do with her having been new to her role. “I think people try when you have a new manager to challenge them a little bit either push them to see how much money they can get from them or how much you know reduction in teaching they can get…” Despite some faculty members trying to challenge her to see how many more resources they can get, she feels very supported by her department and colleagues saying, “I’ve had the utmost respect for my colleagues they’ve appreciated the job I’m doing, they tell everyone else that I’m doing a great job, which has been really nice in that’s not often common….” While every leader will bring his or her own style to leadership, Msehead self-described her style as more helping and less challenging, saying,

> When I hire somebody or have someone who has recently been hired, we made a big investment in those people, there are almost a million dollar start up packages that we give to hire a faculty member I don’t want them to have to sink or swim to figure it out, I’d rather show them how to do it and mentor them a little more so that they can be successful.

She also gets her new faculty coaches to help with grant writing and whatever they need to be successful “because they’re all smart people you know walking in the door so why not make it a little bit better and go faster.” Msehead felt her support approach has helped her department become one of the most successful departments in the College. Msehead sees herself as a people person and her self-described leadership style, supportive or servant leadership, is reflected in her drive to see others succeed. As she talked about leadership, she described herself as a servant leader saying, she acts supportive “rather than penalize in many times, in many cases I’ve been able use that kind of servant leadership style rather

than a dictatorial leadership style and for me that works very effectively so I purposely approach management that way."

As was discussed in the literature, the department chair role can be hard to juggle. Of her experience, Msehead explained the position keeps her very busy. She maintains her research lab, continues to write grants, and continues to advise PhD and Masters students, and she also mentors undergraduate students who work in her lab. While maintaining the management side of the position, saying "If I were just doing research 100% of the time, you know it would be more productive in the research area you know then I am now because I take time for the other things, but that's the role." Msehead still teaches, but not as much as before. She has decreased her teaching and research areas of her mission in order to pick up more service. As we discussed time management and her ability to fit everything into her schedule, Msehead explained balance was less about time management and more knowing what and how to prioritize. She continued, balancing not just the department chair day-to-day responsibilities, but all the other stuff you must prioritize, "Like the student life, the undergraduate education, you know placement of those undergrads, recruiting those undergrads, all the grad stuff, all of your staffing, the reporting you have to do, the research, you know management, and finance."

Most surprising to Msehead about the department chair role, is that the same few individuals regularly ask for departmental resources. Of her time as a faculty member, Msehead said, "I never knew that people went to the department head and asked for resources. I never did that. I was one of the ones that never did that. But some people come in all of the time." The two biggest issues Msehead

has run up against are financial challenges, motivating faculty with no financial incentive, and properly prioritizing her time. Like many universities, Msehead's is not immune to financial uncertainty. Msehead has had to lead through difficult financial cut backs and layoffs within her College saying, "I didn't have to lay anybody off from my department, but it took me six months of battling to do that and it was hugely distracting from every other good thing we were trying to do."

Through her professional development, she used her professional mission to inform the type of office climate she wanted to project. Within her professional mission, she focuses on three main areas: undergraduate education, providing faculty members with the resources they need to be successful, and respect. With regards to respect, she aims to "provide a culture that is respectful and that there is respect among the faculty, staff, and students." If she sees any one abusing their power in a situation she tries to address the issue as soon as possible.

While Msehead participated and developed professional development opportunities, there are still areas she wished she would have had more practice in or knew more about prior to assuming the department chair role, including conflict management and negotiation. Msehead said, "there is conflicts whenever you put people together" and she has regularly dealt with conflict resolution whether that is with a faculty member and a student, a student with another student, or a faculty member with another faculty member. With negotiation, Msehead felt this piece is important because negotiation is a part of almost everything. But negotiations in academia have to be different than when someone buys a car or a home, because faculty positions are lifetime appointments and you have to be able to continue to work with these individuals. She explained, when

negotiating, the results have to be such that "…everybody wins a little bit or you can give up something they can give up something and you can get something and they can get something and it's all in the end you're happy with it and you're still maintaining relationships…."

Creating a positive and respectful office climate is important, especially in a male centric discipline. Msehead openly talked about her experiences with gender discrimination, admitting that while she believed both subtle and overt discrimination exists, she has felt fortunate at her institution. However, a few years ago, Msehead experienced overt gender discrimination in the hiring process when she applied and interviewed for a Dean position at another institution. As a finalist in the candidate pool, she beat out hundreds of candidates to be considered for one of four on campus interviews. However, nobody was offered the position and the institution failed the search. In an effort to learn from her experience, Msehead contacted the recruiter and asked for feedback. The recruiter told her the chairman for that institution's board of trustees had stepped in, who had not been involved up to that point and said, "'why did you give me diverse candidates, I'm not hiring a woman for this position." Reflecting on the experience, Msehead said

> I think that there is still some more obvious biases and some more subtle biases about when you get higher and higher up the ladder because the positions become, first of all they pay more, they're more prestigious, there are fewer of them and well it's okay, I think, for men to hire assistant professors as women, the same men making decision to have their Dean or their Provost a woman it's just a lot a lot less, it starts at the department head right?

After learning about Msehead's experience with the Dean position, I asked how she bounced back and continued to seek other leadership positions. Her previous experiences helped build up Msehead's perceived self-efficacy, but she

admitted it took a while to recover from that particular experience saying, “I had to take about a year to recover from that to tell you the truth. That was sort of, I couldn’t believe that happened, but I’ll try some more.” However, change is slow, Msehead has struggled with gender equality within engineering academia and admits that it is a process. She points to how she did not have a female instructor until her junior year of college and how now, there are four women faculty members in her department, and her as the department head, but that took almost 30 years. About herself, Msehead said, “I think I’ve always been a little bit of a fighter.”

Diversity in leadership allows for different perspectives to be considered. At her College’s leadership meetings, Msehead is the only woman at the table and brings a different perspective, saying, “…I know I bring up things that they’re like ‘wow I never thought of that in that way’ [laughs] it’s always good to have different perspective in the room so I think we’ve all benefited from that in a way.” In addition to Msehead, as a department chair, starting fall semester, there will be a new female dean for Msehead’s College, which, according to Msehead will “shake everything up.” The new Dean will also contribute to the diversity in leadership and role models available to young women at her College. Msehead reflects, “I don’t really think we would have went from having no woman department heads to a female dean you know. I don’t think we would have made that jump necessarily. So in away all of these little things paved the way for more things to happen.” Msehead understands these changes in upper administration take time and she believes changes have been made faster at the lower levels of the university than they have happened in administration. She talked about her

institution's future, saying, "maybe someday we'll have a president who is a woman at our university which we've never had, but or provost who is female which we've never had." she recognized leadership position are few, saying, "It's very difficult to compete anyway for an executive position, but I think that the gender bias is still a bit too much a bit too dominating at the higher levels…"

As a leader, Msehead knows how important it is for her students to see role models both in the classroom and in industry. Msehead described her own experience and how she sees young women engineers in her college and department look to her for guidance, whether verbally or nonverbally. She explained,

> They're watching what I wear and I think that's because there not as many of us and they're looking for a model how to model themselves and so I'm always, these are the little things that are always, I guess you're always doing subtle messaging to try and make it inclusive, you know, you can wear a nice dress and still be in a board meeting with all of these men and doing your thing, like you know what I mean? You don't have to give up on yourself to be like them so that's what diversity is about bringing your own perspective to an issue or to an organization. Where if you have a total narrow way of thinking you're going to miss a lot and, but how to do it and be yourself and still be professional and still be respected…it's breaking a barrier I mean in a way you know it's breaking a barrier and because of that I'm always very conscious of how I conduct myself um how I advise people how I interact with people even with what I wear you know because when, we haven't gotten to meet in person, but when I was in school, engineering women had this very like image of an engineer women was really like not attractive [laughing] not like a great image, so we I don't know, I just always I dress professional, but I always wear dresses, I always, I try to, I always look put together, I try to like that's not really my thing, but I made it my thing because I don't want girls to see that as the stereotype and to see that they can be however they are and be an engineer.

As an act to minimize oppression of women in her field, Msehead has tried to break the stereotype of how a woman engineer should dress, act, and conduct herself.

For those women faculty members who think they may want to be a department chair/head or another university leadership position, Msehead recommended for women to be active and to start acting as a department chair, she explained, “help the department head when you can, offer, you know, your services when people are writing a bigger grant or trying to do a new initiative, hosting visitors, running seminars.” She also encouraged women to “maintain good advocacy outside of the department in the university, the college and then the university so that the dean knows who you are. Because the dean will ultimately be hiring the department head.”

In addition, she encouraged women to support and nominate other women for awards or to committees. From her own experience in her chair role, she explained, women tend not to nominate themselves for departmental or university awards, but men nominate themselves all of the time, saying “I see this because I’m in charge of pairing these awards packages for my staff and the women hardly ever nominate themselves and the men nominate themselves all of the time or others so we have to nominate each other.” She continued, “I’m always trying to nominate people…and others need to do that too to get more visibility and more prestige and that helps you get more leadership positions and it all kind of builds up so…” In addition to volunteering to work on department specific projects, networking, and nominating women in engineering for awards, Msehead also stressed that women need to identify various ways to create their own opportunities. Of her own experience, Msehead said, “I’m basically way more qualified to be a department head than any of the other department heads,” due to her many years of service at the University level. As the first woman department

chair, Msehead said, "…maybe that's what it took to get this first position?" She continued, "It's still a little bit like really super-duper prove yourself to get the same opportunity."

As we ended our conversation, Msehead smiled and talked about how happy she was in her role, but spoke honestly about her future in leadership and exploring other leadership positions, saying, "I've been trying at that and come close a couple of times so we'll see how that goes or some other upper administrative position. Maybe a vice provost for research, which is an area that I like so yeah so continuing in academic administration." Msehead is a fighter, fighting to be a woman in a man's field, she will continue to be role model for young women in engineering regardless of the position she holds.

Professor

After our meetings in in July 2018, I found Professor to be warm, personable, and someone others are drawn to. As a first-generation college student, Professor followed her passion for math and science into a career in engineering academia. As the first woman hired into her department as a junior faculty member, Professor had many positive experiences at the beginning of her career, but as she advanced up the tenure line her work life became toxic. Through professional development opportunities and her mutual mentoring support team, Professor took on a leadership role at her institution's Graduate College. However, when a colleague called and shared a department chair opening at her alma mater, Professor applied and was offered the position. As Professor shared, this has been a pivotal move for her and her family. Throughout our conversation, Professor included pieces of advice for future women in STEM.

She has a clear passion for faculty development and mentorship which shined through in our conversations.

Professor was raised in a blue collar family, the daughter of a taxi and bus driver and an office assistant. When she was in high school, Professor first developed her interest in engineering through her love of math and science. When she left for college, she was interested in both engineering and medicine, and actually started college on a pre-med track. However, through taking the required math and science courses for pre-med, she discovered her passion for engineering, saying, “I originally had thought that I would go on to medical school but then I got more excited about teaching and research and that’s why I decided to go for the PhD instead of the MD.”

Professor described her undergraduate class make up as maybe 20% women and while she knew she was a part of an underrepresented group she never felt as though she was and preferred to put a positive spin on the situation saying, “You know when there is only 20% women at a university you kind of stand out if you’re doing well.” Professor was an active student, who participated in undergraduate research, was president of the student chapter of her discipline’s professional society, participated in her institutions honors program, and was active in Greek life. Through her involvement as an undergraduate she discovered her interest in teaching. Being a first generation college student, Professor admitted, “I didn’t really have an idea of what professors actually did, I just saw that they got to teach and do cool research [laughs] which is why I wanted to do it.”

With the goal of becoming a faculty member, Professor entered graduate school where she acknowledged she viewed the gender difference more sharply and described the macroaggressions she heard from some of her male classmates saying, “I think a lot of the men students even thought that women were there because of quotas and diversity quotas they needed to reach and so I definitely heard some comments and felt that more as a as a graduate student.” With the exception of some summers, Professor has been in academia her entire career.

When considering how to get more girls and women interested in STEM disciplines, Professor pointed to creating more inclusive environments that girls and women feel welcomed and supported in. She continued,

> Women are inherently interested in STEM. I’ve seen this in my own children and friends of my children. You know in elementary school, the boys and the girls like STEM the same and they get to middle school I’ve seen the girls are now saying, “I can’t do math” “I don’t like math” and I hadn’t seen that before so I think they need people to tell them they can and they need to have an environment that shows them that that they’re supported, be it teachers in middle school or be it faculty once they get to college or their teachers in high school. They have to feel like they belong and I think in a lot of cases they don’t.

At the age of 27, Professor accepted her first faculty position. Along with being the youngest by far in her department, she was also the first woman hired in her department and the first person hired in the department who did research in her interest area. When she was hired for her position as an assistant professor, she was hired along with another woman candidate; however, that woman turned down the offer and cited having a baby as the reason. Other faculty members were fearful Professor would also quit if she started a family and discouraged her from doing so saying, “I think it kind of gave the men in the department kind of an idea that woman when they have babies and then they quit [laughing].”

Professor described those early years as a faculty member as “really good.” She felt supported and mentored by her older colleagues, and even “felt a little special.” Being the first woman faculty member in the department also allowed Professor many opportunities, particularly for leadership positions, such as serving on committees or head planning of different events “I think I had a lot of opportunities open to me because I was a woman but on the reverse side of that I think that I was definitely taken advantage of a lot of times….” One example of being taken advantage of, Professor recalled, was with her teaching load. She agreed to teach a quarter of a class, which was a part of an interdisciplinary life science group of classes, which resulted in an overload of her teaching schedule. She said, “I didn’t know that at the time and no one told me otherwise to advocate for myself so I ended up having a higher teaching load for several years without even knowing it as a young faculty member.” Being the only women in her department and not having a solid mentor in her early years caused Professor to rarely ask questions and let her “gut guide” her because she was afraid of others would think she did not know what was going on or that she was a weak person because she did not know procedures or policies.

Aside from her lack of mentorship in her early years, Professor described her tenure process as going “pretty easily” and going through “just fine.” But shortly thereafter, the department’s composition began to change as faculty retired and newer faculty were brought in to fill their places. Some of the new hires, Professor described as “misogynistic” and when she went up for promotion, she had her first discrimination experience. About five or six years after she earned tenure, a couple of the more senior faculty in the department suggested she go up

for promotion. Professor agreed that that was an appropriate time for her and submitted her package to the department chair for promotion. She recalled he approached her a couple of weeks later and said, “you know I’ve ran this by a majority of the senior faculty and they just don’t think you’re ready you know you really need to publish little bit more of your recent work, you need to graduate a couple of more students.” She agreed and refocused for the next year. By the next year, she had 10 additional research publications and had graduated three PhD students. She felt she was ready after that year and resubmitted her promotion package.

For Professor, this is where the discrimination started, saying, “I think he either mishandled it (the promotion package) intentionally or unintentionally, but subconsciously he didn’t send out for external letters until maybe three weeks before they were due.” A while later, the promotion committee, five men, gathered in Professor’s office and said they were not recommending her for promotion because they had asked 12 individuals to write letters of support and only six returned letters, likely due to the short notice they were given. While Professor’s request for promotion was denied, two of her male colleagues, who were up for early promotion early were granted their promotions. There was one other woman who went up for promotion at that same time and both she and Professor were denied. As a result, “the woman and I, we put together a spreadsheet like as a grid for publications you know teaching, everything and we out shined the men five folds in most cases.”

Professor elevated her case, which started a long process of appealing to her university’s union and Provost for Academic Affairs. Eventually, Professor’s

College promotion and tenure committee heard her appeal and unanimously approved her promotion. During this same time, her department was encouraging her to wait a couple of more years, but she knew if she waited it would become increasingly more difficult to obtain leadership roles. Professor described that time by saying,

> I fought that and won but it was really, really, really grueling time for me and it ended up being a really bad time moving forward in that department because the senior male faculty viewed me as a threat or as a someone who is going to fight and I was very much bullied for the next couple of years before I ended up leaving.

The office climate during this period was not welcoming for Professor, she described, “And there were multiple men that I felt harassed by and bullied by in those situations…Those few years that was really experiencing the harassment from those men during my promotion.”

There were other effects from this grueling time in her career, including negative effects to her marriage and health, including weight gain and stress. She started to see a therapist and taking medication. Professor explained, “My entire personality changed, I became very skeptical I was very, just you know, walking into the building and having to see some of these people would make my stomach cringe, avoided work, became depressed.” The effects of this experience stayed with Professor as she transitioned to her new position. She took awhile to adjust saying, “it took me a little while to get to my old self, which I feel like I finally am but I always always try to look for people ulterior motives because these people were so manipulative.” As Professor reflected on this incredibly challenging experience, she remarked, “For me that was my, I guess that was my ceiling that I needed to break through.”

While talking with guest lecturer from another institution, Professor discovered she and her shared a similar experience. This chance meeting helped her not feel alone in her struggles with her department. Professor confided that the experience was “kind of embarrassing to me at the time” but she started to hear similar stories from other women who were full professors in engineering about their promotion experiences, she said “It’s like a full professor circle that men didn’t want women to get into.” Based on her experience, Professor became an advocate for women faculty in engineering and was recently awarded a NSF ADVANCE grant to examine the transition from associate to full professor in women faculty.

During her challenging promotion experience, Professor leaned on her support system including her family. Her love for her children carried through in her voice while we talked about them however, Professor admitted that having kids during her tenure and promotion process was challenging. She said she and her husband had recently had a similar conversation, saying she,

> Pretty much spent all of my 30s either pregnant or trying to get pregnant or having miscarriages for 10 solid years, which is when I became an associate professor and until I became a full professor. I was I was hormonally driven. I was tired, I was focusing on trying to balance my reproductive focus alongside my job focus and everything else. So I think it was absolutely challenging. And it’s a challenge men just don’t have to face, not that they don’t have children, but they don’t go through all of the changes physically and hormonally.

Older male colleagues discouraged her from having children prior to earning tenure, saying, “I had a couple of faculty members older male faculty tell me that I better not have children during my pre-tenure years because that would derail me and I wouldn’t get tenure and that was hurtful.” Despite their words of

caution, Professor went ahead and had her first son prior to earning tenure, but she admits being a career mom has come with challenges, saying, “I also felt for many years like I wasn’t doing enough both in my job and in raising my children and so that was a struggle that I always had. I also found for me that I absolutely needed a village.” Elaborating on her support system, Professor gave her husband a lot of credit, saying, “I had a very supportive husband who took on a lot of the child care responsibilities and also while we were having children was very supportive while I was pregnant and having children.” During their early years, Professor and her husband moved closer to family so her parents and her husband’s parents were able to help with the children. She reflected on the challenges of her promotion process, while having children, Professor laughed, “I’m pretty impressed with myself [laughing] it is hard.”

Along with having a strong support system, Professor credits three programs as her major professional development; participating in HERS Institute: Higher Education Leadership Development Program, her mutual mentoring group made of women in sciences at her previous institution, and leading an IGERT grant. Her participation in the HERS Institute, a holistic leadership development program targeting women in mid- to senior level positions either as faculty or staff (H.E.R.S., n.d.), helped her to proactively think about future positions she may be interested in and what skill sets she needed to develop.

At her previous institution, Professor was a founding member of a mutual mentoring group for female faculty in the STEM fields. The group consisted of about 10 women faculty from all stages in their academic career who met bi-weekly over several years. Of the group, Professor describes the experience as,

"tremendously helpful" because, "there were a couple of senior women faculty members in that group that could kind of give advice but also you know tell us when we were like tell us how great we were when we weren't noticing it ourselves." This group provided a needed social and professional support and encouragement for Professor. One example Professor provided was of how a member of this group encouraged her to apply for an exceptional merit raise. Professor did not feel worthy of such a bonus, but a more senior faculty member in the group encouraged her to apply and pointed out all of the fantastic accomplishments Professor could write about herself and her research. With her encouragement, Professor applied and won one of the 50 merit raises awarded that year. She recalled, "I would have never had got that had that woman not been there to encourage me."

While considering the ways her gender has affected her career, Professor reflected that her gender positively affected her professional development opportunities. For example, the HERS Institute is a professional development program specifically for women, her the mutual mentoring group were composed of women, and she felt the gender composition of the faculty co-PIs on her grant application was a big reason she was awarded an IGERT Grant. When Professor went to the first meeting of awardees, one of the reviewers of the grant applications came up to her and said, "oh my god, I'm so happy to meet you you're the first IGERT I've ever read with an all-female leadership team. I so wanted you to get this."

Professor's professional development opportunities provided her with the tools, experience, and the confidence to pursue academic leadership positions.

Prior to becoming a department chair, Professor served as Associate Dean for Graduate Student Development at her previous institution. Through an exercise she did at the HERS Institute, Professor started to identify positions within the university she may be interested in pursuing. Her institution did not have an Associate Dean for Graduate Student Development at that time and when the opportunity presented itself, she approached the Dean of the Graduate College to ask if he had ever considered such a position. He asked if she would be interested in such a role and within weeks, she was the new Associate Dean for Graduate Student Development and Professional Development. Professor was in this role for her last three years at her previous institution and recalled the experience fondly saying, "I got to see the entire university because I was no longer in just engineering, I was looking at people in you know fine arts and history and totally different fields and so it was a really great period of professional growth for me." As we spoke of women in academic leadership positions and the struggle to get more women into leadership roles in academia, Professor said, "I think the women in academic leadership really need to step it up and each give of their time and energy to women that are coming up." Professor is a strong supporter of mentoring and the variety of different mentoring methods available.

Professor spoke highly of her mutual mentoring groups she was a part of at her previous institution and the group she participates in at her current institution. She credited these groups for their support both in friendship and professional support. Of mutual mentoring, Professor said, "I think it's such a great model when you involve people and women who are you know in these types of roles all the way down to the newest assistant professor hire…" and these

groups can help the participants navigate the faculty or university system**.** Professor feels so strongly about mutual mentoring groups that her department applied for and received an NSF ADVANCE grant to study the transition between associate and full professor of women in STEM disciplines and how to best support those women and help them identify purposeful career goals.

Professor's path to her current role as a department chair seemed serendipitous as she told her story. Professor recalled putting her name in for the chair position at her previous institution. She made it to the final round, but the search ultimately ended due to the department reconfiguring. As fate would have it, Professor's friend, who was a professor at Professor's undergraduate institution, called and notified her of an opening for a department chair role in Professor's engineering discipline and strongly encouraged her to apply. At first, Professor was apprehensive about being the chair of her undergraduate department, but she applied, did a phone interview, progressed to the next round, and had an on campus interview, which as Professor recalled, "I thought it might be awkward because some of the same faculty are here that taught me in undergrad, but it really felt like very natural almost as if I was coming home so it happened very quickly." Professors said she ultimately decided to take on this role at her undergraduate institution because she was ready to test out some of her leadership skills and she knew she would not be able to stay at her previous institution and continue down a leadership path, "I knew I would have to go somewhere else and so [inaudible] so I was about ready to leave there because I couldn't tolerate the environment any more…."

Her mutual mentors were a big influence when she was trying to decide if she should accept or decline the position. The morning of the day she was to give her decision, she had planned on declining the offer because her previous institution came back with a strong counteroffer, but that afternoon, she met with colleagues from her mentoring group, explained her situation, and by 5 pm, she accepted the role. As Professor reflected on her own mentoring experiences, she recalled, “I think you know not having mentors, being the first woman everything is good and bad good because you get opportunities, but bad because you can get taken advantage of.”

Within this role, Professor is the first women department chair of her department and the first full-appointment women department chair in the college of engineering at her institution. Being the first woman chair has been an amazing experience for Professor up to this point, saying, “I don’t know if it’s the people here or the fact that I just found enough confidence to sort of say what I need and advocate for myself and advocate for my department, but it has been really good so far.” Professor has broken down barriers within her department and College. Professor recalled, when she first started, in an effort to help with her transition, faculty members volunteered to teach extra classes or sit on different committees, which for Professor, was a significant, positive difference in office climate. In addition to the support of her faculty, Professor has had strong support from her university and college administration saying, “I feel like I have the support of upper administration we’re all on the same page of wanting to move the university forward and I also have the support of the faculty here.”

While Professor may be the only woman at the table during Chairs meetings with the Dean, others have taken notice. She recalled an advisory board meeting when their new female University President attended. The meeting consisted of about 20 men and Professor. When the new female President arrived, she introduced herself, noticed the gender disparity, and pointedly asked the Dean, "where are the women" in front of everyone. The Dean answered, "we have Professor" and then everyone looked at her. The President acknowledged Professor and asked the Dean where the rest of the women were, of which, he had no answer. Professor said, "I loved how she called everyone out on that and so I think her leadership has changed a lot at this university…." The President and Professor have a shared goal of breaking down barriers and being more inclusive to those with diverse backgrounds.

Within her own department, women make up about 35% of the faculty. This is a number Professor is happy with, saying, "to me incredible that is so unbelievably high so yeah there is still gender imbalance but it's much better and possibly one of the most gender balanced [engineering discipline] departments in the country." Professor described her ideal office climate as one that is akin to extended family, "where people have each other's back, they work together toward common goals they know that you know if that their colleague is doing well and happy and productive then their life is going to be better and more productive and more happy." Diversity in backgrounds and perspectives in office make up is also very important to Professor. Within her department, Professor believes she and her faculty and staff have achieved some of these things, but knows there is still work to be done. She believes a critical component in

increasing the number women in STEM is to create a supportive environment where they feel valued saying, “I think that the climate is absolutely critical in bringing more women into the field of STEM and into you know the types of positions that I’m in now. I think people have to feel like they’re valued.”

While the transition to her new role at a different institution has been met with open arms, there are many job responsibilities that come with being department chair and Professor admits being both an administrator and a faculty member has been tough to manage. She explained,

> The administrative part often requires your immediate attention so if something happens like a student dies or a student or you have an ethical issue to deal with or you have a faculty member that something happens to or there is a space issue or you’re hiring someone and you need to get something cleaned out there is so much so many different fires you have to put out on the administration side.

She also noted the amount of meetings she is included in now has significantly increased, but that may be in part due to how many committees she participates on. Due to the many administrative demands, Professor feels her research has taken a backseat, explaining, “I’m definitely behind on publishing so a lot of backlog of papers I need to get out.”

In addition to balancing her job responsibilities, Professor has a family, which includes three children at home, who also need her attention. Professor explained, “I think you know the balancing of everything is just really hard and knowing where to place your priority at what time and learning to say ‘no’ those are things I struggle with for a long time.” While the job is demanding, there are many rewarding aspects to the position. For Professor, her most rewarding aspect are the faculty and working on faculty development. Professor explained her

favorite part is, “hiring the faculty working with the faculty, watching them, really challenging them about where their careers are going and what they can do.” She also loves negotiating, saying, “I really love advocating and negotiating it’s my favorite thing to do. Every time I sit down with my dean he’ll laugh he’s like what are you going to ask me for? I’m not going to be able to say no.”

With the rewarding parts of the position, come the challenges. Professor eluded to this earlier, but she noted her biggest challenges have been balancing her research and balancing the overall time different tasks take. When she switched institutions, she also moved her research program and there were some issues with students coming or leaving, and her research lab is physically in another building, which can cause some logistical challenges. In her current role, she has been able to hire six new faculty members to the department, however, with hiring comes interviewing, negotiating, identifying office space, and providing support, all of which take time. In general, other challenges Professor has had to overcome include time management and staff management.

I asked Professor if she felt being a woman has affected her experience as department chair and she admitted that sometimes she felt out of place. For example, male colleagues might go after work to play basketball and then out for beers, but she is not included. She believes this happens less and less as she has become more senior. Professor explained that she does not feel much discrimination in her role now and is unsure if that is because she is older or more confident now. However, she does feel her being a woman plays a role in her being a department chair, especially being the first woman department chair, saying, “I think I feel more like a role model here. I know that the women faculty

and in my hiring, the women students definitely look to me." Professor continued women faculty and women students look to her for advice and just her presence has had an impact, saying, "I think it has helped break down barriers for them and that makes me feel really proud." When considering her role, Professor felt the biggest thing she brings to the table as a woman chair, based on her gender alone, is the perspective of equality, explaining,

> To be able to have an influence on faculty hiring to be able to direct merit raises to that faculty of similar stature and effort and success have equitable salaries. I've seen definite difference amongst the faculty and amongst the people that I'm responsible for and so having an influence on hiring and being able to adjust resources accordingly with the female perspective I think has been fantastic so I really have embraced that part of my job.

The reason for so few women department chairs in engineering or STEM, Professor explained, "There's not a lot of full professor women to draw from number one." She has witnessed firsthand women getting stuck at the associate professor rank or leave academia all together. Professor hypothesized that the reason so few women advance to the level of full professor in engineering included issues related to gender such as sexism as a women advances, sexism as she becomes more competitive with her male colleagues, and logistically the positions does not provide a lot of leeway or balance to women with children or aging parents. Professor cautioned, "you're also limiting your opportunities for the future by not becoming full as early as you can."

Having young children at home, a husband, and aging parents, Professor explained how she balanced her work life commitments with her home life commitments. She explained her time management strategy as efficient, she talks fast, writes fast, and she does not schedule meetings for longer than what they

should take. When it comes to her home life, Professor was clear, her three young kids come first saying, “they have a concert at 3 in the afternoon at the elementary school, I am there.” She rarely works in the evenings and instead she cooks dinner and spends time with her kids, along with being their chauffer, saying, “They’re in a billion activities so I’m usually driving someone around every single night.”

Since moving to a new city she has worked hard to develop and maintain friendships, saying, “I have found that having friends is extremely critical….” Throughout her struggles at her previous institution, Professor spoke candidly about how her marriage suffered through that time and how she and her husband are still working to get back on course,

> I did neglect my marriage for sure so like I did say we’re struggling right now and we’re trying to find our way so I would definitely if any woman is married I would make sure she’s spending time on her husband and her marriage as well. I think that’s something that dropped for me that I’m really trying to refocus and reprioritize.

Her own personal health and well-being is another area Professor is working on improving. She has started to regularly go to the gym and has hired a personal trainer. She encouraged women to set aside time to do things they like doing and to protect that time.

As a department chair there are many people and interests vying for your attention and it is important to have a strong support system for when responsibilities get challenging. Since her transition to her current institution, Professor admits that building a new support system at her new institution has been challenging, saying, “when you’re coming in as a department head you don’t have a lot of people that you know at the institution right? And a lot of the people you know are the faculty and you can’t be friends with them….” Personally,

Professor considers herself very lucky and has a circle of five or six friends who are her confidants. She also talked about her sister and her parents who have been very supportive of her career and willing to help when times get hectic. As she reflected on her support system, she said,

> I am extremely, extremely fortunate. Like really I realize more as I'm getting older you need to cultivate and make sure these relationships are kept strong, you know in your marriage, in your friendships, in your family, they are just absolutely critical whoever you have in your life you need to make sure of that you can keep that going because you know having kids and working this job and trying to balance everything is just a lot.

As for the future, Professor is not quite sure of her next move, but knows she is not finished with academic leadership roles. Currently, she is unsure if she would like to have a Dean role or a provost for research, but she knows she wants to stay in academia and in leadership. Professor really enjoys her current department and institution, saying, "I have a really, like the students are fantastic, my staff is great, I mean I've had some blimps but for the most part, like I'm really working with really great people and so it's made the job a lot of fun."

As we closed out our time together, I asked Professor what advice she had for women faculty members in engineering disciplines who think they might want to hold an academic leadership role, specifically department chair, in the future. Professor was full of words of wisdom starting with, "Really think about their careers and what they want. Don't let things happen to them. Make sure you network and you create opportunities where you see potential." On more than one occasion throughout the course of our interviews, Professor stressed that women should focus on their research. If a woman wants to be a department chair at a

research institution, she needs to show she can do research and knows how to manage grants and personnel.

In addition to research, Professor advised women to be strategic in what courses they teach, what committees they serve on, and network. She also encouraged women to be open to moving to another institution, saying, “I notice this a lot and I don’t know if you’ve seen this in your conversations, but for a lot of female engineering department heads they don’t necessarily become department heads at their own the institution they started at.” When considering another institution, Professor advised that one should research the institution and choose an institution that fits with your own values, saying, “I would advise any women looking for a chair position or a leadership position to think about the university that she’s going to and to pick a place that kind of has values that has the same values”

Professor endured many challenges on her way to becoming a department chair and she is a great example of why mentoring and creating your own opportunities are so important. Her passion for mentoring and helping to identify strategies to help women faculty members advance from associate to full professor are evident and propelled by her own experience. The contrast between her former institution and her current institution clearly demonstrates that environment has a big impact on physical and mental health and wellbeing. While she will continue to seek leadership positions within academia, Professor said, “I’m in the right place for me.”

Ashley

In early July and August of 2018, Ashley and I met via phone. Throughout our discussions, I appreciated how open Ashley was about her experiences as a faculty member and was fascinated by her journey with mindfulness and purpose, which are outside of the engineering realm. Initially, Ashley was not convinced on becoming an engineer or joining engineering academia, but she said she is happy with how everything has worked out. Currently a chair in a small department at a small private institution, Ashley is appreciative of the shared vision for growth she has with her faculty and university administration. While she may not want to continue is academia leadership, she has ideas of how she might want to spend her time after being chair.

To better understand Ashley, one needs to learn about how she was introduced to engineering. As a young student, Ashley was initially turned off by the idea of becoming an engineer. She liked math, but was not excited by science. Even though her dad and her brothers were engineers, she did not think engineering was for her. One day, her dad brought home a book that sparked her interests. As a high school student, she recalled attending an outreach event hosted by the Society of Women Engineers (SWE) at her local college, afterward they contacted her about getting involved, and she responded, "why?' I'm just you know I'm studying to be an engineer the fact that I'm a woman has nothing to do with it."

She decided to attend the one university she applied to which offered her discipline of interest as a degree path. She laughed, "So I wound up being in engineering anyway. [Laughing]. Which turned out to be a good thing." Ashley

spoke fondly of her time as an undergraduate, but recalled as she became an upperclassman she experienced occasional difficulty when she worked in groups with her male classmates. She said, “It was difficult to be heard and I felt like whatever I said wasn’t being heard and respected as much and that the men in the group tend to kind of railroad their opinions.” As an undergraduate, Ashley was involved with undergraduate research and described a memorable summer research experience. She approached her professor about a summer research, as Ashley recalled, “he said ‘oh yeah I got this you know we have some programming that we need done and you could do that.’ And I said ‘I can’t program’ and he said ‘of course you can, I’ll help you.’” During her summer research experience, she went on to build an educational program to teach students about manufacturing. This experience helped build her confidence with computer programming and helped her believe in her capabilities.

As she neared graduation in her junior year, Ashley started interviewing for summer internships and looking for full-time positions in industry. When she was interviewing for positions she did not find one that excited her. For the next semester, she combed through the course catalog to see if her institution offered courses which applied operations research to environmental programs. She explained, “I found this course on environmental systems analysis and took it, fell in love with it, and wound up getting a job with the one company that would hire people in operations research that did environmental work….”

After graduation, Ashley worked as a consultant for a governmental agency, but eventually grew bored of doing the same analysis over and over. She decided to go to graduate school to study environmental engineering. Her plan

was to go to graduate school, earn her master's degree, and return to industry; however, her advisor convinced her to stay and earn a Ph.D. She later found out, she was only the third female Ph.D. to go through her degree program at that institution, and all three women were in the degree program at the same time, under the same advisor, who was also a woman. A year before finishing graduate school and while working on her Ph.D., Ashley had her first son. While her advisor was supportive of her choice, others on her committee were skeptical she would finish her dissertation and degree. Ashley received a tremendous amount of support and encouragement from her faculty advisor, who wanted her to stay in academia, saying, "I just didn't even know how unusual that was so she was working pretty hard on all of us and all three of us actually went into academia."

In the same way she was unsure about engineering as an academic discipline, Ashley was unsure about becoming a faculty member. While the job itself looked pretty "nutty," Ashley decided, "I'll give it a try and see how I like it and I'll put what I'm willing to put into getting tenure and if I don't make it, I don't make it, but you know why not?" Ashley had her second child two years into her faculty position as an assistant professor. Ashley recalled, "They just really didn't know what to do with me. They never had you know a faculty member have a baby not to mention being on the tenure track…" She requested and received a semester off from teaching and a roll back on her tenure clock. The roll back on tenure would prove to be a contentious issue moving forward. When Ashley returned after having had her second son, she found balancing her responsibilities and the demands of being up multiple times a night with an infant to be difficult. She submitted a request to decrease her service load, "I had a

pretty heavy service load and he looked at me and said ‘well you know [Ashley] we’ve all had children and we’ve all managed. So you need to just cope.’”

After their second son was born, Ashley and her husband decided her husband would be a stay at home dad. He does a majority of the cooking, cleaning, and when the kids were younger, laundry. Her husband has a large role in her support system saying, “So that meant I could be working full time in a very demanding job, but when I got home I could just spend time with my kids.” This arrangement has been incredibly helpful to Ashley and her family to “make it all work.”

As it became time for Ashley to move up on her original tenure clock, Ashley decided she did not need an extra year and asked to go up for review. Unfortunately, her department’s tenure committee pushed back and said she had taken a roll back and so her case would be considered an early tenure case and the criteria would be much higher and she was not a good candidate. In response, Ashley appealed to her department chair and said, “look you’re penalizing me for taking this roll back” of which, the department chair agreed, he consulted the Provost, and requested the tenure committee apply regular criteria for tenure to her case. However, this left Ashley with a very short timeline to prepare her materials. Later, a close colleague who participated on the department’s promotion and tenure committee, told Ashley there was still disagreement between committee members and they were still stuck on whether to apply regular or early tenure criteria to her case, her colleague finally, “slammed his fist down on the table and said ‘I don’t give an f what that number says she’s ready’

[laughing].” Even though her case eventually went through, Ashley recalled this as a very stressful period for her.

Ashley recalled other instances of gender discrimination while a faculty member at her first institution. One example occurred during a department chair search, where one of the final candidates was a woman. During an open meeting with faculty from the department, a younger male professor asked, “Which was more important diversity or excellence?” Ashley responded to his question with surprise saying, “as if we had to make a choice.” During this same department chair search, another faculty member asked, “Why she (the candidate) didn’t have any children?” She also overheard senior male faculty members saying, “It will be a cold day in hell before we have a female department head.”

Another instance occurred after Ashley won a National Science Foundation (NSF) Career Award, which is a prestigious award for young scientists. After she won, her department chair asked to circulate her proposal so other assistant professors could use her proposal as an example of a winning proposal. Her colleague told her he had been advised by a senior faculty member to not use Ashley’s proposal as an example because her proposal might not be very good and Ashley might have won because she is a woman. Of this exchange, Ashley said, “I was really upset by this, when I brought this up to one of my mentors.” Her mentor replied, “Well haven’t you noticed that there is a higher percentage of women who earn those awards?” Ashley was stunned by her mentors response and afterward thought, “well did you ever think that maybe only the really excellent women make it this far?”

Post tenure, there was another faculty member who accused her of stealing his ideas when he asked her to collaborate on research. Of this instance, Ashley recalled, “There were people all over the country trying to do similar things, but he said I was stealing his ideas, even though these were things hundreds of people were trying to do and we were in completely different areas.” Ashley said, this male colleague went as far to say, “Either I was going to leave the university or he was.” He went on to talk poorly about Ashley to other faculty members within the College and across the university. Eventually, Ashley heard his comments and felt the comments likely led to lost opportunities. This happened with another male faculty member, of which Ashley recalled, “He wound up trashing my proposal to them (the research sponsor) so that it (her project) wasn’t funded.”

After earning tenure, Ashley started looking for leadership opportunities across the university. After not advancing in a job search, she asked the chair of the committee why she did not advance. During the conversation, Ashley suggested there may have been some unconscious bias, which was not well received, explaining “He started claiming that he didn’t have any bias and told me about how much he cared about his mother [laughing] he cared so much about women because of his mother.” With all of these examples, Ashley explained, she is not the only one who has experienced harassment or unconscious bias at in her previous department. The department chair perpetuated the issues by not attempting to change the culture. Ashley said, “his philosophy was basically that these people, that this kind of behavior, was a byproduct of being a top department because these were all top scholars and that there was nothing that could be done about it…”

The more senior Ashley became, the more she started to recognize instances of bias and started to realize she was getting passed over for leadership opportunities and awards. She asked individuals why certain decisions were made to get a better understanding of what was going on and said, “People couldn’t give me a good answer. And I started learning more about unconscious bias, which nobody seemed to be familiar with.” A specific example was when four endowed professorships were awarded, all to men, and one went to an individual in the same line of research as Ashley, but seven years her junior. Prior to this point, all endowed professorships had gone to individuals senior to Ashley. Ashley inquired why she was passed over, but nobody could give her an answer. As a result, she filed an internal grievance, first informal and then formal to try to get an answer, but wound up with contradicting answers. She then filed a complaint with the Equal Employment Opportunity Commission (EEOC). The EEOC reviewed the evidence and agreed to open an investigation. At this point, the university asked Ashley if she would be open to mediation. Ashley recalled, “After spending 10 hours in two conference rooms with a mediator shuttling back and forth between me and my department chair we came to a settlement, but at that point I was persona non grata.” After this situation, for Ashley, it was clear opportunities were not going to be available to her at any longer and the time had come to move on.

After learning about Ashley’s horrible experiences of discrimination and harassment at her former institution, I could not help but wonder what helped her persist through these experiences. She explained,

> Well a lot of what kept me going was we had a lot of young female faculty and I really wanted to try and get some of the decision processes changed to be more protective against unconscious bias. So I really felt like I was doing it for them and I knew it was too late for me. I was able to and raise some awareness so you know I had to do it just so my own pride you know too.

Unfortunately, she is not the only woman from her previous department who had sought legal action against the institution for gender discrimination.

Despite the toxic environment around her during her time as a faculty member, Ashley attended workshops on faculty development, mutual mentoring lunches, and was the principle investigator of a $3 million NSF grant. The NSF grant allowed her to step into a leadership role and manage a network of 100 individuals across the country, many of whom were more senior than Ashley in academic rank. As principle investigator on a large grant, Ashley struggled and the Provost, who was also a woman and an engineering faculty member, promised if Ashley found a leadership course she was interested in, the Provost would find a way to fund the development opportunity. Ashley took advantage of this opportunity and participated in the Center for Authentic Leadership. She explained, “it’s not really for academics per say, but it was all about sort of communication and emotional intelligence skills basically which was what I wanted to focus on.” The program was a two and a half year long program and Ashley described the program saying, “It was incredible. Transformed my whole life, both personally and professionally. So I will always be grateful to her for paying for that.” In addition to the Center for Authentic Leadership opportunity, the Provost also encouraged Ashley to participate as a Provost fellow. As a participant of this program, Ashley worked in the Provost’s office for two years

and went through an institutional academic leadership program. While a Provost Fellow, Ashley created and implemented a sustainability vision for her campus. Of this experience she said, “those experiences of how to work with faculty, how to motivate them to do something, how to address all of these conflicting interests, and conflict when it comes up…” helped her prepare for her role as a department chair.

While these were incredible experiences, one area Ashley thought would have been helpful to gain more experience in was interviewing for academic leadership positions. Interviewing for any position within academia can be strenuous, but interviewing for leadership roles can be particularly grueling with multiple day interviews, presentations, and campus tours. Another area Ashley recalled not learning much about was how to create the ideal office climate or inclusivity within one’s department. She participated in the Big Ten Academic Leadership Program, where they focused on the variations of university finances, budgets, problem solving, and performance evaluations, but lacked training on creating an inclusive office climate. While gender may not have played a role in the number of professional development opportunities presented to Ashley, she does feel her gender correlated with her being passed over for leadership positions at her former institution.

Since the situation at her previous department had turned toxic, Ashley knew if she wanted to continue to take on leadership positions she would need to move institutions. She had a great support system of mentors and other colleagues who encouraged her to start interviewing for other positions, including department chair positions. Ashley explained, “I had applied for a couple of jobs

and had gotten turned down so, but this time I went to [university name] and just really struck me that it was an opportunity to build something new from the ground up almost…" At this institution, Ashley was reassured by the Provost and the Dean they would support her vision for growth, which is what appealed most to her, growing a small department and helping to make them nationally known. She recalled a conversation with a former colleague who left to do something similar saying, "He's like 'oh my gosh that's a fabulous opportunity and you should do it' and then he's been very supportive about giving me advice as I've been settling in…." Her current role has also allowed her to create and teach leadership courses, which she is passionate about.

Since becoming chair, Ashley is most proud of the vision she and the department have created together, the implementation of their shared vision, and the hiring she has been able to do. She credited the hiring she has been able to do to the vision she and the department created saying,

> I feel like it was that vision and that got these folks really excited. I mean these are people who could have gone anywhere in the country. And we're a small, not that well known program, with a big vision and big dreams and they believed in it and have joined us and that has helped strengthen us and helped move us along. One of them got his PhD at Stanford, the other one got her PhD at Georgia Tech and then the we just closed on a senior hire who was a full professor at Berkley before he went off and did other things. So they're really, really strong folks coming in and I feel like you know, it was my leadership that helped create that vision and I met with each of them over breakfast and we talked about the vision and that it that you know that I played a significant part in communicating the excitement of that vision to them that helped make them come so that's what I'm most proud of.

The most rewarding part of being department chair has been watching the department grow and seeing her faculty excited about things to come. Ashley admitted, the most challenging part for her as chair, is finding the time to do

everything, saying, “there just aren’t enough hours in the day.” Ashley said she was most surprised by all of the “administrainia.” She moved from a large public to a small private and, incorrectly, expected there to be less bureaucracy. She explained, “at [university name] they’re small enough that they put their finger in the pot a whole lot more. So things just have to, you know, have multiple signature on everything.”

There are dual aspects to the role of department chair, an individual balances between being a faculty member and administrator. Of her own situation, Ashley felt the most difficult role for her to balance is being a mentor and evaluator, saying, “I was actually thinking the most difficult roles to juggle are between being sort of as department chair we’re simultaneously mentors and evaluators. And that’s to my mind the most difficult role to juggle because how can you both mentor other faculty and be in the role of having to evaluate them. It’s not easy.” For Ashley, juggling the role between administrator and faculty member is less of a challenge because she felt she had been balancing those roles for a while now. She explained her strategies for those times when she has to do, what she described as “deep work,”

> I set a side certain times like I’ll work at home so that I can work on my papers write proposals, things that take sort of deep work that if I’m in the office and people are always wondering in and interrupting me it’s very difficult to do it there. I try to schedule meetings in the afternoon so that I have the mornings free to do deep work. And um and work at home during those times.

In an effort to build more efficiency into her day, Ashley also delegates whenever possible and when working with her graduate students she said she does not micromanage them, but instead expects them to become independent researchers.

While there are many responsibilities to juggle, Ashley recalled situations where she has witnessed unconscious bias play out in front of her as a woman department chair. An example of such a situation is when students or visitors to the department mistake her for the department office assistant, saying, "sometimes they might be looking around looking for the department chair and so they'll look right past me and they'll talk to my assistant and she'll say 'oh have you met our department chair' [laughing]." Her assistant has recognized this happening and immediately will introduce Ashley as the department chair to students or department visitors, "then the person will look really surprised like 'oh, you're the chair' [laughing] and then they'll start paying attention to me and this has happened so many times. So I mean it's just little stuff, but it is definitely annoying." She has also worked with her department to curb the commonly used noun, "guys" to refer to a group of mixed gender individuals or use the pronoun, "he" when referring to an engineer in a generic way. Ashley explained,

> At our last retreat, I organized a dialogue on climate and brought in a facilitator and we went around the room and each person, there were several questions, and one of them was you know think of a time when you didn't feel included or respected and what could someone have done to so that you would have felt more included and respected and so it gave me a chance to bring this issue up in kind of a generic way and I think it opened some eyes because everybody had their own stories about times they didn't feel included or respected.

As chair, Ashley strived to create a supportive and welcoming environment for her faculty, staff, and students. The most important piece of building a welcoming environment, for Ashley, is to build a place where, "everyone is respected and certainly among the faculty and the staff that everyone's contributions are respected and valued." At the department retreat

where they created the vision for the department moving forward, many of the faculty members said they did not want their collegiality to change. Another piece of her current department's climate is improving the gender breakdown within the department. Ashley admitted the gender breakdown within her department is not where she wants the breakdown to be, at two out of nine faculty members being women, but hopes to hire more in the future.

Along with hiring more women, Ashley speculated the current lack of women in STEM fields and lack of role models has led to two issues. The first issue is that there is not enough diversity in thought to solve big problems, Ashley explained, "So for example in engineering, a big part of engineering is not just math and science, it's about applying math and science to solve societal problems and that social dimension." And the second issue, Ashley added is, "the culture that is created so you have a culture that tends to be more male oriented where men just feel more comfortable." As she and I discussed different ways to curb these issues and help young men and women get excited about STEM, Ashley explained, "so we just need to be intentional about it. Like we need to figure out what we're doing right and share it with other departments."

Within academia, currently, Ashley sees too many women get stuck in a non-tenure track position or not get fully promoted to professor, which limits one's abilities to advance within the institution to leadership roles. From her own experience, Ashley felt women's contributions can easily be discounted and felt this plays out in interviewing processes and when women are in leadership positions, saying "We haven't done a good job of educating people about

unconscious bias and how to be protective as much as possible, but you can never be completely protected against it."

Understanding there are a lot of demands on one's time as a department chair, balancing work and life commitments can be challenging. When her children were younger, Ashley tried to always leave the office by 5 pm so she could enjoy dinner with her family and spend time with all of them before the kids went to bed. She would occasionally work from home, but preferred to spend her time with her husband. She also said, when the kids were younger, she had a flexible schedule as a faculty member so she would often rearrange her schedule to attend programs or special events at the kids' schools. Now her children are grown and living on their own, arranging her schedule around them is not as much of a concern.

Currently, Ashley and her husband are living apart while her husband finishes a multi-year volunteer commitment he made in their previous city. He will move to her when he is finished, but in the meantime, Ashley has been commuting between states. Living apart has been an adjustment, but the couple video chat every evening, she explained, "I skype with him every night and so he's a huge support in terms of talking about whatever is going on with me." Aside from her husband, Ashley talked about friends, both professional and personal friends, who are scattered across the country, who have been supportive. But her current split life has left her unsettled in her new city. She has not had enough time to work on building new friendships, but when her husband joins her in another year she hopes to settle in more.

Within her life, Ashley is very organized, strategic, and utilized multiple to-do lists. She also discussed her soulful values, which is something she learned at her authentic leadership course. Her soulful values include "learning and adventure, and making a difference and contributing, and workability and feasibility." Since learning this, she has focused on activities to fulfil those areas such as, back packing, rock climbing, scuba diving, saying, "I find these sort of fun adventures to do to challenge myself that way."

In addition to her soulful values, ten years ago, Ashley took up mediation and does so almost every day. She tries to live a healthy lifestyle saying,

> I exercise regularly. I try to eat well. I try to get enough sleep, I try to never ever set an alarm clock if I can possibly avoid it, which is partly why I schedule all of my meetings in the afternoon [laughing] so taking care so I know really well what does it take to take care of myself and my family and that is kind of my sacred time and then everything else sort of fills in around it so it's a very integrated approach to life. You know it's not work/life balance, it's work/life integration.

Through mindfulness and meditation, Ashley has worked on her own personal development, which has helped her stay calm, she said, "some of that was development work, the leadership development work, involved a lot of personal development as well to deal with old baggage and be able to stay more grounded and not get caught up in other peoples' issues."

Looking to the future, Ashley replied honestly and said she knows she is making a difference within her department, which is important to her and she enjoyed her work, but "it just can be a little overwhelming sometimes, in terms of the quantity of work. And I'm doing my best to delegate as much as I can, but there is a limit to what I can do." Ashley is heavily involved with leadership training, which would provide a natural next step for her to continue in a

leadership role in academia or focus on leadership coaching independently. Previously, she would have wanted to go into upper administration, but now does not find the work her Dean does as appealing. She has experienced a resurgence in her research and has enjoyed her research more and more. When considering retirement, her plans could include her leadership and mindfulness training. She recently took a trip to Colorado and participated in a wilderness mediation retreat. She explained excitedly, “So if I got that training then maybe I could start doing more of leading wilderness trips and taking people out into the wilderness and teaching them mindfulness.”

For those women who think they may want to be a department chair, Ashley advised they make **“**sure that your faculty are really supportive and interested in doing whatever it is you’re interested in doing and that your Dean is also supportive of your vision.” Ashley has had many challenges related to gender discrimination and unconscious bias throughout her career, but she has taken those challenges and made them opportunities for herself by learning more about authentic leadership, helping others to develop their leadership skills, and helping others understand unconscious bias in the workplace. While she may not want to continue in academic leadership, she is a role model for healthy work life integration and for standing up to work place injustices.

Denna

The fifth participant, Denna has a more winding road to becoming an engineer compared to other participants. Transferring undergraduate institutions and participating in a dual-degree program, Denna earned two bachelor’s degrees, one in engineering and another in a science related major. She continued on to

graduate school and into academia as a professor. She credits strong mentorship for helping her get connected with development opportunities and for helping to connect her with leadership opportunities. Denna and I met via Zoom video conference in August and September of 2018. As the academic year began, classes were getting started and the excitement of a new semester was in the air.

Reflecting on when she was a new student and first considering universities and majors, engineering was not in the equation. However, she credits her high school guidance counselor, who knew she was an academically strong student, and suggested she explore engineering as an option. She liked math and science and thought, "I'd give it a try and that's what I did." Denna had an atypical undergraduate experience compared to other students. Through the encouragement of upperclassmen, Denna found her interest in a particular engineering discipline; however, that discipline was relatively new and there were not a lot of opportunities to study at that time. As a result, Denna transferred to different institution, which happened to be an all-girls university, who offered the discipline as a degree program in collaboration with a neighboring institution.

At this second institution, she studied an engineering adjacent discipline. She participated in a dual program between two institutions and earned a degree from both as a result of the structured program. Denna was one of the first students to go through the partnered program and said, "I had faculty who went out of their way to make the program work." Speaking about her experience in the classroom as a student at a women's college, Denna felt that "the women were much more comfortable in the classroom in terms of speaking out and that kind of thing, which was an interesting experience." However, at the neighboring

institution, Denna was one of three women in a classroom full of men. With that being said, Denna did not recall thinking that was odd or, "that the faculty treating any of us any differently or my fellow students treating us any differently. It just was." If any gender bias occurred, Denna was not aware. Of her fellow classmates, Denna said, "I think really really strong women go into engineering…Typically, so most of them are pretty comfortable in the classroom anyway and in speaking their minds." Since Denna was one of the first students to go through her institutions dual degree program, she found herself taking a lot of independent studies and spending more time with faculty than a typical student might. Through her time with faculty she was able to make strong connections and her faculty knew her well. Her undergraduate faculty encouraged her to continue on to graduate school as Denna recalled, "they essentially said you can't go to industry you have to go to grad school. You will be miserable if you go to industry so that was helpful."

Denna followed the advice of her faculty and continued onto graduate school. She had been accepted to a graduate program, but deferred her enrollment until the following fall term. In that year, the professor she had planned to work with left, and she ended up transferring to a different institution to earn her Ph.D. Denna spoke highly of her Ph.D. advisor and his advocacy for women in academia. She shared "When he was recruited elsewhere, for his retention package what he asked for was a guarantee the university would pursue female faculty position. Try to fill open positions with females because he felt it was important to the students coming in."

Denna has passed on opportunities in industry to focus on her research and has spent her entire career in academia. As a new faculty member, Denna spent the first six-and-half years in a department where she was the first woman faculty member. The department chair and undergraduate chair, both men, in her first department both had wives who had professional careers. As a result, Denna thought they felt that a women who had a professional career was very normal. Denna said, "they were completely supportive of me and I don't think they thought of it as odd or I was just one of their colleagues and they were both very supportive just of a junior colleague as well." Denna views herself as very fortunate, saying, "I've been in these great situations where the leadership around me has been hugely supportive." For example, the department chair took Denna under his wing, helped her write her first grant, and taught her the importance of graphs and charts in a grant proposal. For her first few classes, the undergraduate chair team taught with her. As the first woman faculty member in the department, Denna noted, "that all of the female graduate students were in my office a lot so there was that added service if you well, because of the mentoring and things, but that's okay."

After a guest lecture appearance, she was offered a faculty position at her second institution. Initially, Denna was not convinced that this was the right move for her because things were seemingly going well at her institution. She had good collaborators, was a part of a design institute, and had good funding. She returned home and talked it over with her family, her colleagues, and her mentors. Her support system convinced her to give the institution another look and possibly consider other institutions as well, but there were no other institutions she was

interested in. Around this same time, at her first institution, the President was implementing, what Denna referred to as “radical ideas” and felt those ideas were negatively affecting engineering. Ultimately, Denna chose to accept the offer at her second institution and refers to it as, “I think it’s the best thing I could have done.” Denna went on to spend ten years as a faculty member at her second institution.

As a faculty member, Denna experienced a lot of support in terms of professional development. At her first institution, she attended effective teaching workshops for engineering faculty, where she learned, “a little bit about active learning and breaking up your classrooms so you’re not just lecturing people and asking the right questions to help break things up to hold people’s attention so that was great.” She also attended a leadership development program that was focused on department chairs. From this experience, Denna, “Learned a little bit about strategic planning and management and different learning styles and difficult conversations which was great.” At her second institution, her department had a large number of women faculty members, in addition, the Dean of the College of Engineering was a women and the associate dean, white, male, was active with NSF ADVANCE and was an advocate for trying to increase the number of women in STEM faculty. The Dean and the Associate Dean encouraged Denna to participate in Executive Leadership for Academic, Technology, Engineering and Science (ELATES) which Denna described as, “a great experience.” In addition to ELATES, Denna also participated in another executive leadership experience in the form of a “a three or four day workshop where you just interact with a bunch of high level leaders, presidents, provosts, of universities.”

Through her experience with ELATES, Denna envisioned she would go the research route and take on a leadership role such as a vice president of research or be the director of a research center. However, during one of her conversations with her Dean, her Dean pointed out how Denna was particularly passionate about mentorship, whether that be with graduate students or younger faculty members, and she suggested Denna consider faculty affairs. A few months later, the position for Vice Provost for Faculty Affairs position opened on her campus and she applied. She was selected and was in the role for a little under two years. Denna admitted, she struggled at the beginning because the move meant giving up her research and she felt she was too young to do that, but she enjoyed the position so much she could see herself going back someday.

While in the vice provost position, Denna started getting calls about provost and dean positions at other institutions, but as she discussed these opportunities with her support network in academia, Denna realized she was missing direct faculty oversite and would benefit from taking a step back and taking on a department chair position. This would also allow her to continue her research. While Denna was looking for opportunities, a chair position opened at an institution near where a start-up company she had helped found was located. She moved her family, including two teenagers in high school to a different region of the United States. She joked, “My son was a sophomore when we came here and he hated me for about six months [laughing]” but now he tells her, “I wish we’d lived here my whole life.”

As she considered leaving the vice provost’s office and taking on a department chair role, Denna said her ELATES support team was very

encouraging of the switch and helped her see the benefits for the future. Denna explained why she decided to step down from her position as vice provost and pursue a department chair role, saying

> It's the provost and then me right? And he's just under the president and so a lot of responsibility without ever having that faculty experience and even when you think about the Dean's office if I wanted to be a dean I knew what the Deans came to me and asked, I didn't know what a chair went to a dean and asked, and missing a big piece of information about how a university works and that experience of overseeing faculty and trying to build or improve a department.

At her current institution, Denna is the only woman department chair. Overall, she described her experience as, "interesting." When she first started, the department had had a two year interim chair, who Denna described as, "just keeping the department going." This individual had not rocked the boat, but did enough to where the department operated and performed their day to day functions. She also started under a different Dean than who she interviewed with the year prior and this Dean operated very differently. Admittedly, the transition was tough for Denna because there were so many things she wanted to do right way, saying "you're getting a little antsy about cleaning up a bunch of stuff to make sure there was equity in work and there weren't secrets in the department and everything was above board." The individual who held the permanent chair role prior to Denna had a different leadership style, Denna explained her predecessor as a, "Mediterranean male and this is just how it's going to be very polished and smooth," but she is the opposite, describing herself as, "more consensus building, meet with people constantly, trying to figure out where we want to go next by censuses rather than just trying to decide so it's an interesting transition."

As she reflected on her experience up to this point, Denna is proud of a few things, two of which reflect on the changing culture of her department. She is proud of how open, honest, and respectful her department has become since her arrival. Denna said, “It’s really everyone has a voice and we’ve collectively decided the directions we want to go in and everybody is working toward those goals and we created in strategic planning.” Additionally, the budgeting model was a mystery to most faculty and Denna has changed that saying, “Everyone understands what is going on and there is no behind the scenes deals anymore.” Along with the openness that her leadership has created, Denna is very excited about the new hires she has made, saying, “The thing that I’m most proud of is that I’m very excited about the new faculty that we’ve hired since I got here.” She expanded by saying the most rewarding part of being chair comes back to her initial passion of mentoring and helping young faculty get started, saying, “I think the mentoring I’ve had more opportunity to mentor faculty and talk with them about what their next career steps might be and what leadership roles they might be interested in and that kind of thing….”

With points of pride come challenges. In an economy where most institutions of higher education are facing budget cuts, Denna’s biggest challenge has been working with the Dean to justify needed resources within her department’s budget as soon as she arrived. Due to the funding source for the building Denna’s department is housed in, the budgeting model for Denna’s department is different from the other departments in the College. This different funding model has caused some friction between her department and the other departments and her department and the Dean.

One of the more challenging situations Denna has had to work through since she first started has been realigning faculty expectations of staff members and providing staff members with a more healthy work load. She explained by saying the previous chief of staff, who was conflict adverse, had somehow convinced the staff that they needed to do whatever the faculty asked of them, no matter if those tasks made them work 80-90 hours per week. Unfortunately, this chief of staff was also "the only person that really knew how the department worked. I really think she was the department chair for the last 7 years." At the same time, the chief of staff was planning to retire, so Denna kept her on until her retirement date and soaked in as much knowledge as possible and hired a new chief of staff, who quickly realized status quo was not sustainable. Through this process Denna tried to "reset faculty expectations, some of them reset beautifully and some of them not so much well." In an effort to offset the change in expectations, Denna reduced everyone's teaching load so they had more time to devote to administrative tasks and did not need to solely rely on the staff for grant support.

When Denna transitioned into her role as department chair from her position as vice provost at her previous institution, she was most surprised by how much time it takes to actually be chair. She acknowledged she made a commitment to being department chair and a leader, so that role comes first, which can be challenging "when I think I really need to be getting this paper out or I really need to be writing this grant and then ugh I got to go take care of this mess, right? The mess comes first."

As a department chair there are many responsibilities one must manage including teaching, research, and administrative work. Each chair decides how he or she will balance responsibilities differently. Denna switched responsibilities up from how the last chair divided his responsibilities, by adding teaching to her schedule. Denna explained, “I don’t teach quite as much as everyone else. I teach probably about 50% of what the other faculty teach.” At her previous institutions, a department chair was appointed by the Dean and the chair served at the pleasure of the Dean until he or she wanted to return to faculty or move on to something else. At Denna’s current institution, the chair is a rotating position, appointed to 5 year terms with the opportunity to extend. With regards to her research, Denna does not think she could have as big of a lab as she once did because, “it’s hard to have the time to devote” when considering grant writing and mentoring master’s and Ph.D. students. Of her current situation, Denna said, “I have 5 people in the lab now, but it’s great I can do both, I can still do the research that I love, not as much of it as I love to do, but then do the administrative things as well.”

Denna credits the ELATES program for helping to prepare her for her role as a department chair. The program helped to teach her to handle difficult conversations and has provided a wide network of individuals from across the country who can provide honest feedback. She credits her Dean and her Associate Dean at her second institution for identifying her as a potential leader and for helping to give her opportunities she might not otherwise have had. Although she had a great experience participating in ELATES, prior to becoming chair, Denna would have liked more training on human resources. She explained, “I’m very good at okay let’s make sure this doesn’t get out of control type of thing. But

having more of that ability to talk to people and empower them to help them with the situation I think would be really useful."

Office culture was a challenge for Denna when she first started and has since become a point of pride. Denna's ideal office climate centers on mutual respect for one another, saying, "Respect for people's time, space, feelings and other things. If you have a comfortable work environment, people are more effective at their jobs, a lot more gets done." Denna felt the staff are in a much better place in terms of work capacity and comfortable working environment today than when she first arrived. While some of the faculty are still adjusting to the changes, Denna said in a "couple of more months we should be in a good place and have some best practices and things." With regards to the gender balance of her department, Denna admitted that things could be better. In addition to adding more women to the faculty, Denna would also like to focus on adding more faculty members from underrepresented minorities.

Within her college, her department is physically located in a building that is a distance away, about a 15 minute walk, from the main engineering building, which can cause isolation. While there are some frustrations shared by faculty members about the direction the College is going and the lack of funding available, regarding the climate within the College, Denna said, "some other departments there is probably much more tension among the faculty and staff than ours and others are probably much better." At her second institution as a faculty member, training on institutional and departmental culture was provided. Unfortunately, Denna was otherwise engaged and was never able to attend. However, she recalled an incidence from when she was a young professor, where

an issue came up and the issue was addressed by providing training for the entire department. This has been a technique Denna has admired saying, “if there is an issue maybe rather than singling that issue out and the few people who have experienced it, because that can put a stigma on you… you know finding a way to train everyone, the whole community.”

While there may be many reasons there are so few women in STEM leadership roles, there are a few reasons Denna felt there are so few women in department chair positions, starting with the lack of women at the full professor rank in engineering. Second, the role itself can be very challenging and many women self-select out. She elaborated on why some women may choose to self-select out,

> You give up a lot of things when you become chair just because if you have a big department that is active you will always have things coming at you from all sides that take away from your ability to do other things if you really want to be an effective chair. So being a chair can kind of stymie your research career, which isn’t good either because in academia, especially in STEM, research is king, right?

Third, with engineering being a traditionally male dominated and globally practiced, Denna discussed cultural differences with faculty members, saying,

> There are lots of cultural differences in this world and academia is one of those beautiful environments where you really have that blend of cultures, right? It really makes the environment quite rich and I think it increases innovation and it makes us more aware of our different learning styles and different approaches to things. I think it’s a wonderful thing. But there are also some downsides to that. So there some cultures that truly don’t believe that women should be in any professional role, right? That is not there place. And it becomes particularly challenging when you have a female in a leadership role and you have some of these faculty members in your department. So that I think plays into it to some extent.

Even before women choose STEM disciplines to study in college, there needs to be ways to get girls interested about STEM fields earlier, which for

Denna, comes down to the family and not imposing gender stereotypes onto children, such as Legos for boys and Barbies for girls. In an effort to improve the pipeline, Denna suggested exposing children to many different toy options while they are young, saying, "I do think that exposing children in elementary school to STEM in a way that they understand how exciting how it can be and the impact it can have in our lives." For those areas who do STEM outreach to children in K-12 classrooms, Denna cautioned one must inspire the age by doing activities or experiments that are age and knowledge based appropriate.

As the only woman chair in her current College, Denna acknowledged there may be some challenges that are unique to her, such as balancing family and work, and she acknowledged she has felt a desire to carry out the stereotypical female role such as, making dinner every night and going to all of her kids' events. Denna's mother was a stay at home mom and Denna wants to be there for her children in the same way her mom was there for her. However, she was quick to say, she had "not experienced any of the sort of unintended bias or implicit bias that I think you often see everybody seems to be pretty good. I feel very fortunate."

Due to the many duties a chair is responsible for, getting caught up and struggle with balance can be an issue. Denna admitted struggling with time management in her department chair tasks, but she described her priority driven work life balance strategy, which revolved around her husband and children explaining,

> I can work anywhere. Since you've been able to use a smart phone to be able to turn it into a modem I have done that. So I would drive the hour to get my daughter to crazy practice when she was going to play division one

> and I could sit in the car and work and I had my modem right there and my computer right there and was totally connected. I can work on the side of a soccer field before the game starts. I can write it's just the ability to learn to use your time very effectively but then be there and be present for the kids when it's something they need you for and so I've always made sure I could do that.

With her children as her main priority, Denna tries to be there for their activities or banquets the best she can. She described another strategy for balancing her work life and home life by working on email or other work, while her children work on their homework in the same room, saying "I'm there with them doing homework and available to them with questions. And same if they're watching a movie. They don't care if typing and answering questions to the less important emails I'm there with them and witnessing their experience…."

In addition to her children, while not always easy, Denna's husband has been a big support pillar in her career,

> Early on it was definitely a struggle, I think that he had you know well I'm working my job is more important type attitude you know my job is less flexible and so if the kids get sick you should take them and it took a few years to get past that it was pretty frustrating and difficult but once we got past that it swung completely in the other direction to at one point he said when we moved to [state] he said I can't get a job that makes enough money where it makes sense for me to work I'm just going to stay home and take care of the kids and the house and I was like okay so that was really nice it freed up a lot of things for me.

Her support structure has changed a little bit since moving to her current institution because she came in as a leader and not necessarily a colleague, saying, "I think it's hard because you're coming in a leadership position even though it's a rotating position, you're coming in in leadership position…." She has also had to rebuild her structure since moving, but her children are older now and don't need to be supervised. When they were younger, Denna said she had a group of

mom friends who had kids around the same age as her own and they would take turns taking care of the kids, “where the kids don’t realize it’s because mom’s working because they’re with their friends having fun and so I’ve had a great support structure there.” Her youngest child in a senior in high school and admitted that has played a role in some of the things she has declined so she can be available for all of the ‘lasts’ and big moments of high school. Throughout her career, Denna said, “I’ve always had great mentors and just tried to make sure and I knew who the 7 or 8 people that if I walked down the hall if their door was opened I could walk into their office and talk to them.” In addition, her parents have been a big part of her success and Denna said that they are really supportive of her career and have always made her feel as though she could do anything she wanted and be successful.

Denna explained how she had heard colleagues at other institutions talk about the harassment they have experienced or know others who have shared instances of unconscious bias, but has never felt victim to those things herself. When she hears her colleagues talk about such situations she said, “You want to reach out and help and give as much support as you possibly can, right? And it makes you want to help effect change.” While she may not have experienced instances of harassment, she recalled a training she participated in, not too long ago, about how to improve the climate for women and underrepresented minorities in academia. After the training, she was talking with a male colleague about a potential collaboration, when a third male colleague came from behind and grabbed her around her waist. Without hesitation, the original male colleague, who she was talking to said, “what did we do yesterday afternoon’ and just stood

there and stared at him and the person went [dropping motion] and walked away and it was just great, but it was my male colleague standing saying ‘oh no no no this is not happening?”

To those women who have experienced harassment or have encountered unconscious bias in their career, Denna recommended to them to establish and find their network of individuals they feel comfortable expressing their feelings to, possibly even outside of their institution. As a leader who may be addressing these issues, Denna suggested, providing learning opportunities for those at both the college and the department level, saying, “Just to bring a little bit more attention, not to your particular situation, but the situation as a whole to really improve the climate at the institution. I think the first step is to make sure you have that comfortable network.”

Denna’s advice for those women faculty members who are considering leadership positions is to involve oneself on committees which allow one to get to know individuals in administration. She advises, “If you can bring some visibility to yourself and sort of start to understand how the university operates, by serving on these different committees it will definitely put you in a better position.” For when one becomes chair, Denna advised one be open, listen, and be transparent about decision making. She also stressed to be aware of when you are too emotionally invested in a situation or a decision, and suggested “to get some advice and help from colleagues to make sure you make a good decision other than an emotional decision and it’s okay to back off for a little while, right to give yourself a chance to calm down….”

As Denna shared earlier in our conversation, she was interested in becoming a Dean or Vice Provost, but wanted to gain experience at the departmental level to get direct faculty oversite experience. Of the experience up to this point, Denna said, “I have learned a lot and am excited about some of the things that I have accomplished. Would I want to do it again? [shaking head no]. [laughing] yeah no, it definitely has been a challenge on the culture side more so than I had anticipated.” With that being said, next semester Denna will step down from her current position as department chair and move into a new role within the Dean’s Office as an Associate Dean for Faculty Affairs. She laughed as she talked about the news saying, “so the dean talked to me about it because of my experience in the provost office so I agreed I would go do it and you’re laughing because you’re saying ‘oh Denna you just said personalities and stuff were killing you.’” The decision to move into a new role was a hard decision Denna contemplated for several months. She explained she would have happily stayed on as chair and finished out her contract and only agreed to move if and when the Dean found a strong replacement who could take the department to the next level, which Denna believed the Dean had found a good candidate.

This new position in the Dean’s Office will allow for Denna to act as Dean while the actual Dean is travelling or on leave, Denna said, “it will give me a really good opportunity to better understand how the Dean’s office works and what that position is really like, which I’m really excited about.” As she considered next steps past an associate dean role, Denna weighed the different responsibilities that she liked about each position for the next step, Provost or Dean. She has decided she preferred work that is internal facing within a

university, but wants to learn more about the Dean role saying, “Obviously I need to think about it and decide if I would really like to do that, but I think I’d like to go to the Provost office again.” Regardless of the direction Denna decides to take her career, she’ll continue to be a role model for young women in engineering.

June

June and I met during early fall semester 2018 via Skype. She is currently the department head of a small department at a small, private institution. Having previously been at a large public institution, the move has been a transition, but a welcomed transition. June has studied all around the world and admittedly did not strategically plan to be in a leadership role. However, she has had a strong support system of family and mentors, who encouraged her to pursue degrees in engineering and for her to consider leadership roles within her department.

Growing up internationally, in a country which strongly encouraged women and young girls to attend college and attain advanced degrees, her family valued education and encouraged June to not only attend college, but to obtain an advanced degree. June said, “the political situation in [country] was that if you sought a degree in engineering or in medical sciences as a girl your chances of finding employment in general were higher so I had been encouraged” by family to follow a career path such as engineering. While in high school, June recalled, “I didn’t know anything about scientific writing, but I loved to write. I always loved presenting and I have always been good with debates and things like that I figured all of this out in my senior year in college.” She said she had strong scores in math and sciences, but originally thought she would study something in the social sciences such as international relations; however, she chose engineering.

Living in a country which encouraged young women to pursue professional careers in business, engineering, or law, and a having a family who valued education resulted in a "very positive experience" for June as an undergraduate. June recalled her class gender distribution being about even and within her major having slightly more women in her classes. Of her classmates and that time in her life, June said, "We all came from families that valued education of women, which valued economic independence of women. They believed in this kind of change and there were a lot of pressure for this kind of change to happen. Politically, economically, culturally."

Even though June had so many family members in her ear who encouraged her to pursue engineering, she did not like engineering for the first couple of years saying, "I didn't like the basic course work, I couldn't see where it was going and we were required to do internships, I really did not like the internships in the factory environment." By her third and fourth year, June was in discipline specific courses, which she enjoyed much more. Her specific engineering discipline allowed for some flexibility in what she studied and allowed for her to blend some of her humanities interests. As she neared the end of her program, her older sister was considering graduate school, which made June think, "I can go to graduate school and I don't have to be a traditional engineer, I can become a faculty member, I can be on the research side of this, I can teach and that is what I did."

As an undergraduate, she presented a paper, which was based on her senior thesis research, at the international conference for her engineering discipline. Also at this conference were top faculty from across the world in

June's chosen engineering discipline. Through this conference, June connected with faculty and potential Ph.D. advisors. She decided to stay in her home country and pursue a master's degree, but she ended up pursuing a Ph.D. in a different country, under an advisor she met at the conference as an undergraduate, after having been offered an assistantship. The conference June attended as an undergraduate was pivotal to her graduate experience. June felt as though the decision process to attend graduate school was fairly straightforward, especially with a fully funded Ph.D. opportunity. June enjoyed the academic lifestyle and at the institution where she earned her master's degree, there was on campus housing for graduate students and faculty members. June explained,

> I knew about the lifestyle, I knew about the independence, I knew about the empowerment that comes with working on a research topic once you decide to study more and more and obtain a Ph.D. you already know that this is something you love and the lifestyle that aligns with it best is the faculty life.

After earning her Ph.D., June applied for faculty positions at several universities, but ultimately chose a large, top engineering school in the United States to start her faculty career.

In her years as a faculty member, June referred to herself as having been, "very, very fortunate" because she did not experience harassment or bias. She enjoyed her time at her previous institution as she worked hard toward tenure. She acknowledged the tenure track is "not for everybody, but for somebody who really enjoys what they are doing and can adopt this as a lifestyle it is rewarding, after all it's a big deal. I mean who has job security for life…." Part of what helped make the tenure and promotion experience more enjoyable were the good mentors June surrounded herself with in her early years who helped support her.

Admittedly, June felt as though her generation of faculty members had it a little easier than those who are one generation above her, but acknowledged issues still exist and underrepresentation is a wide spread issue, saying, “We still are facing some significant issues and challenges we need to grow our numbers and we need to keep pushing because we still do not have a sufficient number of full professors, even at the university level.”

As a faculty member, June took every opportunity available to grow, such as attending teaching workshops, workshops hosted by her disciplines professional organization, participating in the National Academy of Engineering Scholars program, National Science Foundation (NSF) sponsored leadership workshops, an NSF sponsored women engineering leadership workshop, ADVANCE workshops, serving on university and departmental committees, networking with others in her field, and serving as a mentor. June felt these opportunities and having started her career at a large university helped her when the time for her to serve as a department chair.

When June was at her first institution as a faculty, she had plenty of faculty peers and mentors who suggested she look for additional leadership roles within the department, college, or university, but June was not ready. She recalled, “When I was an associate professor. There were several department searches, there were 3 or 4 people who wanted to nominate me or wanted me to take on that role. I wasn’t really interested in it until up until I moved here.” June appreciated the three pillars of academic life, teaching, research, and service and explained she sees her department chair role as an “opportunity for service.”

When June went on maternity leave she continued to write and worked with her Ph.D. students. Shortly thereafter she and her husband-realized something they already knew, their current town lacked options for daycare, family centered events, and entertainment options for small children. Around this same time they were wanting a more family friendly environment, she was approached by the dean at another engineering school. This institution was located near a metropolitan area and would provide a lot more options for her family. Shortly after joining the faculty at the new institution, the Dean asked June if she would be willing to become chair of her department. June explained, "He was new dean and was trying to bring new leadership. He was trying to hire new faculty and new chairs with experience elsewhere other institutions." June had previously served in administrative roles in her previous department and had a lot of committee experience so she decided to accept the appointment. She explained, "… there comes a point you need to you need to provide this kind of service to your department and I also knew that I could help. You know I could help him realize his vision."

After two years, June has had an overall good experience as department chair, but admitted, there was a "learning curve." She explained,

> When you have an administrative position, your priories have to change, just like when you have kids. Email, for example, is a priority and a lot of people take care of business via email and you need to keep up with it. Student needs, you know from all programs they take priority, they reach out to me, when they have a problem, they have a solution. I don't necessarily work on the problem, but I assign somebody to the problem or sometimes I have to make a decision. I have to say something, we have to put one extra student in this class type of thing.

June is leading a small department in a small college, which has allowed her to become very close with her faculty. She explained, “it’s not an isolated chair role, my door is always open. I just came from coffee with my assistant professors. So I’m still very much a faculty member.” While she can empathize and sympathize with her faculty, she is their evaluator and must provide formal feedback.

Since arriving to the department, June has streamlined course offerings and changed teaching assignments. She has made some changes she said others did not expect her to make, but explained,

> Those changes are not the easiest and I’m not in a rush. I start a conversation and it takes some time. And really value these collegial relationships over efficacy because we are here for the long haul so I try to give at least one year heads up if somebody’s teaching assignment is going to change.

Of her colleagues, June said she tried to be as “generous as possible” with her judgement and hoped they reciprocate the effort. After all, they work in a small college and as June explained, “we are smaller and we have a lot of face time. You know I cannot just send you an email and then hide, for sure when I go to the Starbucks in the [location on campus] I will run into you.”

Due to her college’s size, June does not yield much decision making power. She explained, “I have a very small operating budget that I can host a student picnic and send some students or faculty to some conferences, but it’s not large amounts, so there’s no accounts to look over it.”

Through her position, June has grown both the undergraduate and graduate enrollment in her department. Her and her faculty work hard to recruit top students at both levels and at the graduate level they work to ensure each

student is fully funded. June is particularly proud of the number of new faculty she has been able to hire. While at a retreat with the dean, June boasted, "the dean was asking everybody are you excited about something share that with us and I said we have a new assistant professor who just graduated from [university name] and she's onboard and I'm looking forward to working with her."

Since becoming chair, there have been a few surprises, such as how many emails a chair receives, June said, "There are some days that I'm just lost. Sometimes I count and tell my coordinator that I just received 78 emails today." She asked her students to give her 24 hours to respond before they start complaining about her not being responsive saying, "if I don't respond in 24 hours start complaining, push me, bug me its okay [Laughing]." She admitted, when she first started, she did not know all of the day-to-day demands that are on a chair or how to prioritize them. She also has learned to negotiate more and to slow down when making decisions.

There have been some challenges, one of which is time and the struggle to balance the tasks one has to do with the things one wants to do. Another challenge has been negotiating, June explained,

> …When you're just a faculty member you are pretty much an entrepreneurial running your own business. You are very independent and now you have to work more collaboratively with people who are under you, above you, and you have to negotiate. You know you have to, with that said, that is a skill that requires a different part of your brain.

June has felt her gender has become more of an issue because as she has become more senior in academia, she felt "As you get more and more senior you have more and more experiences you are more aware, you've heard more things even if

you have not experienced them yourself personally and also you are more powerful because of your position."

As she reflected on her gender's effect on her own professional career, June did not feel her gender influenced her career or current position. According to June, "having a positive environment having a supportive environment in general is very valuable." Her overall office climate is positive. However, June's ideal office climate is "all people are present and they are um willing to serve in multiple ways, faculty members, they have similar ideals in terms of academic ideals in terms of educational and research goals." She also explained she is okay with conflict, as long as the conflict can be talked through and all are able to move past the conflict because "when there is zero conflict sometimes there is no progress." Admittedly, her home department could use some work saying, "it would be ideal for example if more of the tenured faculty members were more present so that they set examples for junior faculty that would be ideal, but we are also sometimes challenged by our size, and peoples preferences as well." Since she started, she has felt the new hires have influenced the office culture, but there have not been sweeping changes to the culture, but said, "…one of my senior colleagues told me when I first started as an assistant professor, the only real change happens through hiring. You hire new people, they rise through the ranks and that is how real change happens."

When she first arrived, she was the only woman in a full professor position. While there were other women in the department in lower ranks, the data made the department look balanced; however, the dynamics of influence were different. Through hiring, June and her fellow department chairs have been able to

add new faculty to the College and June said, “the numbers are different right now and other departments are also have been hiring very well qualified women so numbers need to change.”

June felt the lack of women in STEM disciplines is a systemic issue, she explained, “in engineering we really have very few very few domestic students. So it’s systemic, it’s cultural reasons, historical reasons, and there are other reasons, economic reasons.” She continued, “Retention rates are not very good.” The retention issue leads to fewer women at the full professor level to pick from for leadership positions. Some of those women at the full professor rank may not aspire to be in leadership, similar to June, who said,

> I never aspired to be in administration, but I always aspired to have an endowed position. And stay active in research and keep going but I’ve realized that as you rise through the ranks, you need to serve and their comes a point where your leadership is needed and we need to step up to the plate and do the service.

However, June acknowledged there can be bias against women leaders, which she has heard about from her colleagues, saying “There are still biases. I spoke with many female professors who interviewed for chair positions and they talk about these biases. Some people are more aware of these biases. People even talk about bias against women leaders by women.” As someone who has not personally experienced workplace harassment, June knew harassment and bias still exist and feels terrible when a colleague has shared such an experience. To support those women who have experienced workplace harassment or prevent instances from happening in the future, June said she has gone, “out of my way to try to help or offer help” and she became a mentor to young women faculty. While she provides support to others, she also leans on others for her own support. In her new city,

she explained she and her husband have a larger circle of friends then before. Her and her husband's parents frequently visit to provide support with her children, cooking, and the house.

When grandparents are not visiting, June has specific strategies for maintaining work/life balance. She enjoys being able to participate in her children's carpool and does not schedule any meetings around pick up or drop off times. When the children were younger, June and her husband used to hire a babysitter for smaller holiday breaks, such as Labor Day, Memorial Day, and Veteran's Day, so she and her husband could work on those days, but now their kids are older the family cherishes those shorter holidays as important family time. In addition, June and her husband try to divide the household chores evenly. He does the laundry and takes care of the cars and she does the cooking and takes care of the household shopping.

For those women faculty members who think they want to hold leadership positions in academia, June advised to women to actively participate, saying, "be present, and I guess placing an emphasis on first building your academic career, making sure that you move through the ranks and you make some meaningful contributions by being an active player at all levels, teaching, research, and service." She also felt her advice would be different to women at different stages of their career, saying "if early in the career at assistant professor year or associate professor year, I would encourage her to focus on promotion." There may be several opportunities, but June encouraged women to exercise saying 'no' otherwise the work can feel overwhelming. She specifically encouraged women to get involved in their department's graduate committee saying, "If they have the

opportunity and interest in administration I encourage them to participate on the graduate committee to participate in the college level graduate invitational." She also encouraged participation in search committees, both at the department level and the college level, especially if there is a department chair position open in the college. This is a good opportunity to learn about the hiring process from the hiring perspective in the college, according to June, "you learn a lot about the culture how other people's reactions and you have experiences that you normally wouldn't have sitting in your office if you participate in that kind of work." With regards to work place harassment or bias, June empathized and said, "Sometimes you have to ignore, just ignore, move on and ignore. And share your experiences with others because there will always be people who would hear you and understand you."

With regards to the future, June replied, "I really did not think about this strategically I'm in the middle of my first term so I know that I'm going to finish this term. There is a good chance there will be an opportunity to serve as a second term…." While she would like to see her new hires earn tenure, she is a believer in sometimes a department needs to hire an external candidate to bring new life and energy into a department. If her department chose to go in that direction at the end of her appointment, she would support the faculty's decision. While June did not aspire to be in a leadership role, others saw her leadership capabilities and encouraged and pushed her to consider such a role. June and her career are evidence a strong support system, who value education and learning, equally for both genders, can make a significant difference in a young girl's life.

This chapter included the narratives of Lauren, Msehead, Professor, Ashley, Denna, and June. Within their personal narratives they discussed how they first became interested in engineering, their collegiate experiences, their experiences as they worked toward tenure and promotion, their leadership development experiences, and the experiences as department chair. Next, I will discuss my findings, implications for practice and theory, and recommendations for future research.

Chapter 5: Findings and Discussion

Overview

The purpose of this qualitative study was to explore the experiences of women department chairs in engineering departments to understand how these women successfully navigated the pipeline and identify success strategies which led them to persist in a traditionally male dominated discipline. The theories used to frame this study include Bandura's (1977) social cognitive theory, focusing on self-efficacy theory, and feminist theory (hooks, 2015a). Self-efficacy theory and feminist theory provide a better understanding of what contributed to participants' belief that they could be successful in a traditionally masculine profession and the effects of the environment and those around them had on their success. Historically, women have been chronically underrepresented in STEM disciplines, holding less than 25 percent of STEM jobs in industry (U.S. Department of Commerce, 2011). Despite women earning Ph.D.'s at record rates within higher education, they are still underrepresented in tenure track faculty positions, which contributes to their underrepresentation in upper level administrative positions. The participants in this study were able to overcome barriers and break through the proverbial "glass ceiling" to achieve leadership positions within their institutions and academic departments.

With breaking the "glass ceiling" comes a lot of firsts. For example, Lauren, Msehead, Professor, and Denna were the first woman faculty hires in their departments when they started as assistant professors. Lauren, Msehead, Professor, Denna, and June were also the first women department chairs of their departments and are currently the only woman chairs in their Colleges.

I studied the lived experiences of women department chairs in engineering who shared their personal experiences both as a woman who is an engineer and as a woman who is in a leadership role within higher education. The following research question guided this study: What have been the experiences of women department chair in engineering academic departments as they have navigated the pipeline to their current position? The guiding sub-questions were:

1. What are strategies for success that women department chairs believe have been helpful in reaching this position?
2. What previous leadership experiences or professional training helped prepare women department chairs of engineering departments for their role as department chair?
3. What challenges have women department chairs within engineering encountered and have had to overcome?

This study utilized a qualitative method, specifically a narrative approach, to understand the lived experience of women department chairs in engineering from their perspective. This qualitative inquiry allowed for participants to describe their experiences as they understood them to be true and to develop a deeper understanding of women department chairs within engineering disciplines through their told stories (Connelly & Clandinin, 1990).

This final chapter provides a discussion of the research findings. The findings and discussion are organized by research sub-questions. I also address limitations of the study and implications for practice. Finally, I provide recommendations for future research and concluding remarks.

Research Question #1: What are strategies for success that women department chairs believe have been helpful in reaching this position?

This research sub-question sought to understand the strategies that helped participants attain and be prepared for their role as an engineering department chair. Participants cited their support structures, mentoring, department climate, and healthy work/life balance strategies as having a major influences on their ability to continue to achieve in their field. These areas of support allowed for women to believe in their own abilities to achieve at home and in the workplace.

Personal support structure. Their support structures were broad and included both professional and personal lattices of support. Participants cited their spouse, family members (parents and siblings), friends (personal and professional), colleagues, and mentors (both having mentors and being a mentor) as being the most influential within their support structure. Previous literature on women in higher education leadership did not discuss the influence of a strong nuclear or extended family support system on women's success in academia. Nearly all participants cited their spouse as having one of the most significant impacts on their success, both as someone who acts as their cheerleader and as someone who helps divide domestic responsibilities. Small tasks or responsibilities that may seem insignificant, participants noted, can add up and their spouses provided needed support. As Lauren said, "you know even before we had kids we had dogs who took care of the dog, who took the dogs to the vet and taking care of the house and all of that kinds of things."

Having husbands and children to balance household responsibilities and who provide support outside of the workplace has allowed them to be more

engaged and productive at work. Having a nuclear family who are supportive of participants' career goals and understanding of time demands, which come with their job responsibilities, were also cited as having a significant impact on their career success. Two participants, Ashley and Denna, have spouses who transitioned to stay-at-home dads because the switch made the most financial sense for them and their families. Having husbands who are secure in their masculinity and their relationships to challenge traditional gender norms has allowed both Ashley and Denna to focus on spending quality time with their husbands and children when they are not working. Modeling different familial norms for their children and not following traditional gender norms has allowed Ashley's and Denna's families to demonstrate liberal feminism' equal opportunity and access for both sexes to different career options (Donovan, 2012). A supportive spouse and family provide opportunities for them to navigate between family and work, all of which may have positively influence job retention (Petersen & Minnotte, 2017). Previous literature on women in higher education leadership did not discuss the influence of a strong nuclear or extended family support system on women's success in academia.

In addition to participants' nuclear families, parents and siblings were also cited as having a significant impact on participants' support structure. For example, June talked about how supportive and encouraging her parents and siblings were when she decided to pursue engineering and then advanced degrees. Her parents and her in-laws also regularly visit for a month at a time and help with child care and household responsibilities. Their assistance with household responsibilities alleviates stress for June, which allows for her to spend more

quality time with her family. Denna cited feeling supported very early by her family no matter what she did, saying,

> Growing up with a family that really supportive career and made sure you felt like you could do whatever you wanted and you could be successful at whatever you choose to do and you could choose what you wanted to do and be successful and that it didn't have to be A, B, or C right that didn't matter it was just go be successful.

Professor referred to her support structure as her "extended village." Her village, which is made up of her husband, mentors, both professional and personal friends, her parents, and her sister, provide both professional and personal support. Professor said she relies on her parents a lot saying, "I rely on them a lot, my mom and my dad come every single week to visit the kids and they make us dinner," which allows for extra family time.

All participants relied on either extended family or family friends in helping to juggle their work and family responsibilities as their faculty and research workloads increased. Without the support of extended family and family friends, participants would have a significantly more challenging time balancing work and family commitments. Overwhelmingly, women still take on the larger share of housework, child care, and elder care (Bonawitz & Andel, 2009). Had participants not had support in these areas, they may not have been eligible or may have forewent leadership opportunities. Additionally, without the support of their spouses or if the participants were single, participants would have had to take on more domestic responsibilities or be the sole individual responsible for the upkeep of their home. This would have taken time away from their labs or classrooms which may have added to their time to earn tenure or get promoted. Not having a partner to balance responsibilities may be one of the reason women

and single STEM faculty, both men and women, report higher levels of faculty burn out (Pedersen & Minnotte, 2017).

Participants valued colleagues who provided professional encouragement and words of wisdom when they were stuck on a research issue, needed professional advice, or looked out for their professional best interests. Msehead recalled a woman faculty member in another department, who she met during her interview, who sat her down and bluntly told her, "look, when you come and do this you're going to have to be twice as good as every man here, you're going to have to be twice as hard working, twice as this like everything just to get to where they are." Part of navigating the labyrinth is establishing competence in a male dominated structure. Women in academia can be penalized for being "too competent" if they are thought to not be acting how a "woman should behave" (Williams, Alon, & Bornstein, 2006, p. 81). Women tend to receive more polarized evaluations from both students and peers, be judged on their accomplishments instead of their potential and thought to be "lucky" instead of the merit of their skills (Williams et al., 2006). These are examples of how women have to work harder to be seen as equals to men in their same field.

When considering different roles, both Ashley and Professor had former colleagues who were pivotal to both of them making their move. Ashley's former colleague tried to recruit her to work at his institution and when Ashley told him about a different offer, he was understanding and encouraging of her to take the opposing offer. According to Ashley, "He's like 'oh my gosh that's a fabulous opportunity and you should do it' and then he's been very supportive about giving me advice as I've been settling in…." Professor's colleague, who does similar

research as her, at the institution she became a chair at, called her to let her know about the position and strongly encouraged her to apply. Having colleagues encourage and acknowledge their potential for being effective department chairs contributed to Ashley's and Professor's self-efficacy in their ability to be a department chair through social persuasion.

Mentoring. Literature often cited lack of mentoring as a key barrier to women's ability to identify or gain access to leadership positions within academia (Ballenger, 2010; Bhatia & Priest Amati, 2010; Dean, 2009; Gibson, 2006; Jackson Teague, 2015). As a testament to the positive impact and necessity of mentorships, throughout their narratives, participants credited good mentorship, provided by both men and women from a range of university positions and age range through both formal and informal networks, to their success in navigating their faculty positions and then navigating the transition into a leadership role. Participants also cited acting as a mentor to others as a way to both help younger faculty and as a way to build their skill sets. A major responsibility as a department chair is to hire, train, and mentor new faculty members in the department and participants take this responsibility very seriously. All participants included the hiring and development of new faculty members to their departments as points of pride within their positions.

Lauren, June, and Denna all credited having strong mentors and guidance as one of the reasons they feel they have not experienced significant harassment or unconscious bias in their career. According to Bandura (1982) models "teach observers effective strategies for dealing with challenging or threatening situations" (p. 127). In having a strong bond with their mentors, mentors who

advocated for women in engineering, Lauren, June, and Denna grew in their perceived self-efficacy as an observer to how their mentors handled or approached different situations.

All participants took part in some form of professional development which helped build their networks. Having strong mentors who one can model behavior and responses helps contribute to a mentees ability to grow confidence in their own abilities when faced with similar situations. Lauren described one of her mentors by saying they were always, "encouraging me to think about the next step you know what do you need to get there okay now work on those pieces um and you know and things to be thinking about as you're going into different parts of the process."

While Msehead's department did not offer any formal support in the realm of mentoring or support during her early career years, outside of her department, one of Msehead's mentors outside of her department, the Vice Provost for Research at her institution, recruited her to be his Associate Vice Provost for Research. This position was pivotal to her leadership trajectory and made her want to take the next step in leadership, she said, "I kind of like being part of a team and I like being part of bigger things happening then you can be when you're a professor in your lab." The Provost for Research and the Vice Provost for Research became strong mentors to Msehead, she recalled, "So the Vice Provost for Research and the Provost for Research were fantastic mentors for me and once I agreed to go work with them they gave me lots of opportunity and that really made the whole thing worthwhile." Similarly, Ashley found strong support outside of her department. The Provost at Ashly's institution, a woman faculty in

engineering, championed Ashley's leadership development. She offered to financially support whatever leadership development experience Ashley felt would be of most value to her. The experience Ashley chose was a transformative experience for her, both personally and professionally. Personally, Ashley's leadership development experience helped contribute to her learning to better manage her stress levels and her response to stress, which she has continued to utilize in her career. Ashley went on to work in the Provost's Office as an Associate Provost Fellow for two years. In both Msehead and Ashley's situation, having someone outside of their home department encourage, help open doors to new opportunities, and recognize their potential transformed their careers.

Professor highlighted how the lack of good mentorship, early in her career, caused her to unknowingly do extra work and not fully understand the details of the promotion and tenure ladder. Since her early years, Professor has grown her mentorship network and is a strong advocate for mutual mentoring groups. Similar to the WiSE Future Professional Program (WiSE-FPP) at Syracuse University (Bhatia & Priest Amati, 2010) and the School of Sciences (SOS) mentoring program at Stevenson University (Gorman et al., 2010), Professor participated in two different mutual mentoring groups, both involving women in science and women in engineering, and has helped to develop a similar group at her current institution. Of the mutual mentoring model, Professor said,

> I think it's such a great model when you involve people and women who are you know in these types of roles all the way down to the newest assistant professor hire and so getting to know other women and other they navigated the system and really to have women serve as advocates for you I think is tremendous that certainly helped me when I was at [university name] and I'm really happy to be able to play that role here at [university name].

In a phenomenological study on the mentoring experiences, Gibson's (2006) key findings recommended the selection of committed department chairs who will promote mentoring, develop mentoring committees, promote cross institutional mentoring, and recognize mentoring in faculty promotion and tenure evaluations. Denna's experience with her first department chair and curriculum chair supports this finding. Both men provided guidance during her early years on effective classroom teaching and how to write successful grant proposals. This allowed Denna to model positive teaching practices and writing strategies, which helped her gain confidence and knowledge in those areas. Both chairs tried to remove barriers to allow for Denna to be a successful teacher and researcher. Having department chairs who promote mentoring and who provide a positive example of mentoring themselves also creates a model for faculty to follow in their own mentor/mentee relationships. Promoting mentorship within a department can minimize or help to avoid the lack of guidance Professor or Msehead experienced early in their careers. Mentorship can take on many forms and can be both formal and informal, but at the core of mentorship for women, is helping women navigate situations, identify possible barriers, provide guidance on how to remove barriers, and provide support.

Climate. Gibson's (2006) study on mentoring also found the climate of the organization is a critical component of women faculty member's experience. Participants expressed the desire to create and work in a climate in which everyone felt supported, individuals were present and willing to serve, everyone worked toward common goals, and everyone felt respected. Not every participant

felt as though they have been successful at creating their ideal office climate, but felt as though they were on the correct path in doing so. Creating an inclusive climate where women feel valued and supported is important because poor department or college climate can lead to large levels of burn out, which was found to disproportionally affect women faculty in STEM more often (Pedersen & Minnotte, 2017). Gender was found to have a significant impact on rates of reported STEM women faculty burn out, with women faculty reporting higher rates of job burnout resulting from lack of access to information, lack of faculty influence in decision-making, scholarly isolation, lack of coworker social support and interpersonal conflict (Pedersen & Minnotte, 2017). Gender's impact on job burnout is another example of the labyrinth women must navigate in the work place. In addition to lack of access or support, "women often confront an inhospitable masculine organizational culture and male executives who prefer to work with other men rather than with someone less similar to themselves (Eagly & Carli, 2007, pp.187-188).

Changing an office's climate can take years, but participants have made changes to create better work balance for faculty and staff by adjusting workloads, adjusting teaching schedules, being transparent on budgeting issues, and hiring additional faculty, all of which have helped create a better working environment. A study on "chilly climates" by Maranto and Griffin (2010) found a strong correlation of one's gender and racial minority status to the perception of exclusion resulting in a chilly climate among faculty in higher education. Maranto and Griffin (2010) also found the perception of procedural fairness in decision making within a department can increase perceived inclusiveness. While

participants may not have cultivated their ideal office climate yet, even small changes participants have made to create an inclusive and equitable environment for all faculty can have a significant positive impact on department climate. Participants said creating an inclusive, supportive, and collegial climate was necessary and as Professor felt, “the climate is absolutely critical in bringing more women into the field.” Additionally, to create an inclusive and equitable environment within academia “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.” (Tierney & Bensimon, 2000, p. 310). Ashley provided the example from her own experience of patronizing or indifferent language using male gender pronouns when describing an engineer. Critical examination of office climate is needed in order to evaluate work place inclusivity and to make adjustments to support all employees. On an individual level, Bandura’s (1977) theory of self-efficacy fails to take into consideration the influence of the environment or the culture around an individual on one’s ability to believe or perceive that they can be successful in that environment.

Work/life balance strategies. According to Rosser (2004), women faculty members often cite balancing career and family as the most significant challenge to career advancement. While participants of this study noted challenges related to work life balance, they cited their personal strategies to balance both their work life and their home life as a key to their success. Identifying ways to balance their work life with their home life allowed for participants to maximize their time and blend the two important spheres of their life together. Ashley referred to her

work/life balance strategies as work/life integration as a way to better explain how work and her home life molded together. She described work/life integration as not getting hung up on when work was happening, such as no work after 5 pm, but fitting work into her life when needed or appropriate. For example, working on her work while her children worked on their homework, or while they watched a movie, or after they went to bed. Similarly, Denna uses her down time between her children's sport games to answer emails using her cellphone as a hot spot. Denna and her children would also do homework together in the evening.

While Professor and Denna have both identified strategies to balance work/life obligations that fit their situations, both admitted there are times when they feel guilty about not being the one who cooked all of the meals at night or if they miss an event. Denna spoke of wanting to portray and model the same behavior her mother, who was a stay-at-home mom, did when she was a child. She feels guilty at times for not modeling that same behavior to her children. Professor said, "I also felt for many years like I wasn't doing enough both in my job and in raising my children and so that was a struggle that I always had. I also found for me that I absolutely needed a village." Both Denna and Professor have worked with their husbands and their support system to find a balance. Even though Denna and Professor have identified strategies for balance they still feels the pressures of a patriarchal society to be all things to her children. In a society that places the highest value on a two parent patriarch family despite evidence that proves the best situation for children is in a loving environment regardless of which sex heads the household, the marital status of parents or caregivers, and family income levels (hooks, 2015b).

Participants all cited dividing certain duties with their husbands. While two of the participants have stay at home husbands who shoulder much of the traditional household and childcare responsibilities, the other participants have partners who also work in academia and had to identify a balance between career and home life. All participants have children of varying ages, and had children at varying stages of their academic careers. Participants resoundingly prioritized their children and worked to integrate their children's schedule into their professional schedules. Lauren, Msehead, and June cited the flexibility of a professor's schedule which has allowed them to pick up their children after school or attend their school events. Professor ends her work day at a reasonable time so she can spend the evenings with her kids, either cooking dinner or shuttling them to their many activities. Ashley and Denna discussed the importance of spending time with their children, whether that was working alongside them as they did their homework, spending quality in the car as they drove to different activities, or doing activities together they both enjoyed.

Researchers found work/family balance to be the biggest disadvantage for women in the workplace, ahead of salary disparities (Kelly & Grant, 2012) and found work/life balance to be the most significant challenge facing women scientist and engineering today (Rosser, 2004). By identifying work/life balance strategies that work for their personal situations, participates have been able to juggle traditional home life gender norms while challenging gender norms in their chosen profession. According to hooks (2015b), "Visionary feminist activists have never denied the importance and value of male parental caregivers even as we continually work to create great cultural appreciation of motherhood and the

work done by women who mother." Feminist need to equally value work done inside and outside of the home by both parents. Participants have either established boundaries to guard their time with their children or learned to integrate their home life with their work life, which has allowed them to be successful in their field, while also maintaining a healthy home life.

Research Question #2: What previous leadership experiences or professional training helped prepare women department chairs of engineering departments for their role as department chair?

Prior leadership and training experience. Prior to becoming chair, all participants held leadership positions either on a major research project, at the college level, or at the institution level. Lauren was Associate Dean for Research in her previous College and was the co-director of a research center on her campus. Within these roles, Lauren learned to negotiate for resources, learned about different budgeting models, and managed student crises. Prior to assuming her role, Msehead was an Associate Vice Provost for Research and spun out start-up companies based on her research. These experiences allowed Msehead to better understand the university at a higher level and build relationships with individuals across campus. Professor was Associate Dean for Graduate Student Development and Professional Development at her previous institution and was the lead PI on an IGRERT grant. These opportunities allowed for Professor to exercise her passion for graduate student development, work with departments from across campus, and manage a large research project. At her previous institution, Ashley was an Associate Provost Fellow in her previous institutions Provost's Office and was the lead PI on a large National Science Foundation

(NSF) grant. The NSF grant provided Ashley the opportunity to oversee researchers from across the country and direct work toward a common purpose. As a Provost Fellow, she was able to work at the university level and identify sustainability solutions that would effect change across her campus. As the Associate Vice Provost for Faculty Affairs, Denna was able to work with faculty from across the university while also managing four large research grants. Initially, June was reluctant to take on leadership roles within her previous department, despite her colleagues' encouragement. At her previous department June was an associate vice chair within her department. This position allowed her to work closely with the chair and gain a better understanding of what the responsibilities may be as chair, if she decided to take on the role herself someday.

These experiences allowed participants to view the university from a variety of angles, view issues or problems from a variety of perspectives, and allowed them the opportunity to work with a variety of individuals from across their discipline, college, and/or institution. These positions allowed participants to build their perceived self-efficacy based on the four principal sources of information. These sources of information included performance accomplishments within their positions, shadowing or modeling behavior of academic administrators around them, the ability to balance the stress or emotional arousal of multiple projects, and the verbal persuasion from those around them to continue to seek out other leadership roles (Bandura, 1977; 1982). Additionally, when viewed through the lens of career self-efficacy, participants were will try different roles that may have taken them outside of their comfort

zone, participants expected to succeed in their roles, and were persistent in their success.

In a 2013 study, researchers studied the American Association of Community Colleges (AACC) essential competencies for effective leadership in community colleges and found "accepting additional responsibilities and serving the institution provides practice experience that contributes to the development of competences for future positions" (Cejda & Jolley, 2013, p. 165). Practice allows for one to build their self-efficacy to take on and accomplish larger tasks. Even though participants in this study are from the top 100 engineering universities and not community colleges, similarly all participants accepted additional responsibilities and service, which led to leadership skill development that helped prepare them for future leadership positions.

In addition to senior leadership roles within their departments, colleges, or institutions, participants cited many examples of professional training and development, which helped prepare them for their role as department chair. Participants attended and participated in several leadership development programs or professional development workshops. These opportunities ranged from teaching workshops and seminars hosted by their university or professional organization, serving on search committees or tenure and promotion committees, serving as a mentor to young faculty, participating in Executive Leadership in Academic Technology, Engineering, and Science (ELATES), HERS: Women Leaders in Higher Education, authentic leadership training, and executive leadership seminars.

While not a formal professional development workshop or seminar, all participants cited participating on search committees or promotion and tenure committees as valuable professional experience for their current positions. During this committee work, they were able to learn the hiring process, see what successful candidates curriculum vitae looked like, and participate in interviewing. As a department chair, these are critical skills when hiring new faculty. However, due to lack of women in engineering departments, women may also be asked to serve on many committees to achieve a balanced gender ratio within the committee. While committee work is a valuable experience, women faculty should be aware of becoming the token woman on committees, where they end up representing their entire gender whether they want to or not. Professor warned, an individual should limit their commitments and not be afraid to say 'no,' otherwise an individual can overcommit and risks burn out.

Professional training opportunities. Three of the six participants, Lauren, Msehead, and Denna, participated in Executive Leadership in Academic Technology, Engineering, and Science (ELATES). The program was modeled after the Effective Leadership in Academic Medicine (ELAM) at Drexel University, which is also where ELATES is based. ELATES is a national leadership development program focused on advancing senior women in technology, engineering, and sciences into leadership positions within their institutions (ELATES at Drexel, n.d.). ELATES is a year-long, part-time commitment with three on-campus sessions ranging from four-six days each (ELATES at Drexel, n.d.). Lauren referred to ELATES as "probably the most

impactful and I think that was probably the most intense program," which helped to her to "strategically thinking about the bigger picture."

Overall, participants felt their gender did affect the number of or types of professional development or training opportunities were presented to them, both in good and bad ways. Gender affected the number and type of opportunities in a positive way because others notified them or nominated them for opportunities. Some of the professional development opportunities participants took part in were only open to women, such as ELATES and HERS. Budworth and Mann (2010) argued targeted leadership development based on gender, such as ELATES and HERS, and development level could yield more women in top leadership roles. However, some participants felt gender was a barrier to the number and type of opportunities in a negative way because they felt they had been passed over or not considered for some opportunities due to the gendered characteristics associated with being a leader, especially a leader within their traditionally male disciplines. The hierarchical structure within higher education and within engineering, which has historically valued the patriarchy, typically do not consider the unique needs of women. As a result, women have had to create their own opportunities.

Participants advised future women leaders in engineering academia to focus on their research and obtain the rank of full professor before taking on too many leadership roles. They also advised future women leaders to participate in committees as they are appropriate at the department, college, and institutional level. Committees such as search committees, promotion and tenure committees, departmental graduate committees, or curriculum committees all allowed for participants to actively participate in shaping their careers, while gaining valuable

experience in decision making processes that would be expected of them as leaders. Committee work was cited as a valuable professional development opportunity.

Creating opportunities. In a field that is small and leadership opportunities are few, participants cited their ability to create their own professional opportunities as a strategy for their success. Participants' perception of their own self-efficacy to create their own opportunities was increased by having consistent accomplishments, modeling behavior as demonstrated by their mentors, being able to manage the stress of multiple responsibilities, and having mentors and colleagues encouraging them to pursue leadership roles (Bandura, 1982). One's perceived self-efficacy increases as they begin to master tasks or when their experience "disconfirm misbeliefs about what they fear and when they gain new skills to manage threatening activities" (Bandura, 1982, p. 124). While all participants were accomplished researchers and held leadership roles prior to becoming department chairs, participants talked about creating their own opportunities for growth and advancement.

Working within the patriarchal structures of higher education and engineering, participants such as Lauren and Professor were successful in their ability to see an opportunity, envision themselves in such a position, and secure the opportunity for themselves. As Msehead pointed out, leadership positions are limited in higher education and become more competitive as one moves up the leadership ladder. In Msehead's experience, one needs to be "really super-duper prove yourself to get the same opportunity" as her male colleagues. Msehead self describes as "a bit of a fighter," but as evident by many of the participants'

extensive leadership backgrounds and previously held positions, there are times when women need to be more qualified than the job description to be considered for the role. According to Eagly and Carli (2017), "Contemporary women still face many challenges, especially in relation to male-dominated leadership roles. They must be brave, resourceful, creative, and smart to be successful, because they can face the most elaborate of labyrinths on their path to leadership" (p. 199). Lauren and Professor were both creative and resourceful. They not only saw a need within their leadership structure, but suggested themselves for the position. Lauren advised the first step in seeking a leadership role, and maybe hardest step, is being brave enough to put yourself out there and tell others you are interested in a role. Lauren said, "I think the first thing you have to do is be willing to say yeah I want this and tell people, tell the people who make the decisions you know that you're interested in that role." Lauren self-described as being "stubbornly tenacious," but all of the participants advocated for themselves during their career. Bandura (1977; 1982) found individuals with higher levels of perceived self-efficacy, are more likely to persist in their efforts until they succeed. Lauren and the other participants have higher levels of perceived self-efficacy as demonstrated by their "stubbornness" or "being a fighter," which allowed them to persist in a traditionally male-dominated discipline.

Missing development. Participants came to their positions with a large variety of previous leadership positions and professional development training. However, participants cited many areas within their position they would have liked to have more training or development on prior to becoming a department chair. Areas participants would have liked to know more about include: human

resource related information, grant writing, networking, negotiating, budgeting, varying financial models, conflict resolution, and interviewing for academic leadership positions. Additional leadership development training could have included how to create an inclusive and supportive working climate or how to assess the climate of an office or department when first starting one's position. Previous literature on the role of department chair did not discuss the development or the importance of office climate as a responsibility of a chair. However, participants all expressed the importance office climate is to faculty and student success, but little training was provided on how to achieve such a climate. Having additional training or exposure to the topic of creating inclusive climates could have assisted in building additional self-efficacy with regards to taking on leadership responsibilities.

Research question #3: What challenges have women department chairs within engineering encountered and had to overcome?

While successful in their fields, participants described challenges, both on the path to becoming a department chair and as a department chair. Participants chronicled challenges such as learning their positions, discrimination experiences either they experienced or heard second hand, poor job interviewing experiences in which their gender was a factor, feelings of isolation, cultural conflicts with men whose culture does not support women in the workplace or in a leadership role, becoming a perceived threat to their male colleagues and their male colleagues' opportunities, and examples of subtle or unconscious bias.

Job responsibilities and challenges. Since becoming chair, participants described challenges related to knowing what tasks to prioritize, dealing with

personnel issues, having difficult conversations with both faculty and students, and being both a mentor and an evaluator to faculty in their department. In an effort to minimize some of the challenges and allow more time for administrative tasks, all participants had a reduced teaching load, but all participants perform a balancing act of teaching, advising Ph.D. students, maintaining research labs with varying degrees of activity, publishing their research, and performing their administrative duties. Denna provided an example of the dueling commitments, "when I think I really need to be getting this paper out or I really need to be writing this grant and then ugh I got to go take care of this mess, right? The mess comes first."

Gmelch and Burns (1990; 1991; Gmelch, 1991; Burns & Gmelch, 1992) discussed similar challenges reported by participants of this study within their research, such as faculty role stress, perceived expectations stress, administrative task stress, role ambiguity stress, and administrative leadership stress. However, the challenge of simultaneously being a mentor and evaluator was not discussed in previous literature on department chair responsibilities. Ashley reported one of her biggest challenges to navigate in performing her position has been finding a balance in nurturing and building up young faculty, but then also critiquing them. Women can often be pressured to perform stereotypical roles, such as being nurturing and supportive, to be accepted by the group, whereas others who push back on stereotypical gender roles are not accepted by the group (Williams et al., 2006). Women can be pushed to perform stereotypical gender roles such as the '"mother" who is non-threatening and nurturing; the "princess" who aligns with a stronger man; or the "pet" who is perky and deferential'" (Williams et al., 2006,

p. 82). Within this structure, women are not allowed to reach their full potential as faculty or leaders and performance is measured relative to male colleagues instead of relative to performance expectations. Additionally, women are never viewed as equals to their male faculty colleagues within this structure.

Gender. Overall, since becoming department chair, participants felt as though their gender has not largely affected their position, but they have experienced gender's influence in different ways. Within Ashley's office, when new visitors come to the department, if the office assistant is not at her desk and Ashley helps the guests, the guests think she is the office assistant or use male gendered pronouns to refer to the department chair. Individuals stereotype leadership positions or positions of power and assume the person in charge is a man. Gender stereotypes are socially constructed assumptions of how men and women should act, occupations men and women should hold, and behaviorally how men and women should act, which perpetuates inequalities between genders. According to Ridgeway (2001), "Beliefs about men's greater status, worthiness, and competence are an especially insidious component of the gender system, because they embed an essential hierarchical element into our fundamental cultural conceptions about who women and women are" (p. 651).

Gender stereotypes and hierarchical elements continue to play out in other aspects of participant's role, such as in leadership meetings. For those participants who are the only woman department chair in their college, they noted at leadership meetings with the dean, while they may be use to being the only, the contrast is noticeable. As Lauren recalled when a colleague attended a leadership meeting in her place she came and said, "it's like you and the Dean and a lot of

dudes." Lauren felt being a woman chair is almost easier than being a woman faculty member "because if I'm leading the meeting, people are more likely to listen to what I have to say, instead of you know when you're just average faculty member in a meeting sometimes you say something and you may or may not hear what you have to say."

The leadership structure of the environment has allowed for small changes to be made with regard to gender composition of the leadership, however, there are still barriers in place which prevent more women from joining the leadership ranks. Lauren recalled from her experience on committees as a faculty member, "I started to see more of the things that were happening and where we were looking at selecting leaders for different roles I definitely saw more issues in terms of gender imbalance and in some of the ways women were perceived." Barriers which prevent equal access to opportunities for women faculty include how typical promotion and tenure years align with the typical child rearing years (Bonawitz & Andel, 2009; Gunter & Stambach, 2003; Jade Xu, 2008; Kelly & Grant, 2012), overt discrimination/harassment (Rosser, 2004), lack of support and mentoring (Ballenger, 2010), stereotyping (Rosser, 2004), exclusion from informal networks (Ballenger, 2010; Dominici et al., 2009; Maranto & Griffin, 2010), gender inequities (Ballenger, 2010; Dean et al., 2009), and pay inequities (Ballenger, 2010; Kelly & Grant, 2012).

Gender discrimination. All participants described either having experienced or know of other women in their field who have experienced examples of discrimination or unconscious bias. Both Ashley and Professor experienced significant examples of gender discrimination. These instances of

gender discrimination impacted their promotions and soured their relationships with their departments to the point where both left their institutions, in part, due to the toxic environment that had been created. The traditional masculine culture of engineering does not support the needs of women and has not allowed women engineers to reach their full potential. This culture needs to change in order to make engineering more welcoming and equitable for faculty and students by removing barriers that prevent equal access (Powell, Bagilhole, & Dainty, 2009; Rosser, 2004; Rosser, 2005). In contrast to Ashley's and Professor's experience, Denna and June noted positive experiences of male colleagues who acted as advocates to help them advance. Men's experience influence the experiences of women and can both positively and negatively affect womens' careers (Ropers-Huilman & Winters, 2011).

Msehead recalled an experience where she applied for a Dean position and was invited to do an on-campus interview. She visited campus, met with all of the respective parties, and in the end, the search failed. Since this was Msehead's first interview for a Dean position, she asked the recruiter for constructive feedback so she could improve for the future. The recruiter told her the chairmen of the board of trustees stepped in during last minute, "who wasn't involved in the interview process, stepped in in the last minute and said 'why did you give me diverse candidates, I'm not hiring a woman for this position.'" Msehead recalled this experience as her first where she "really and truly and fully slapped with a sort of gender discrimination very close to home in a position that I really knew I could do well in without any problem." Subtle and overt examples of sexism still exist and Msehead said her experience caused her to pause at looking at other

leadership positions for while after the incident. Many women feel they need to be exceptionally good to compete with "less competent men" (Eagly & Carli, 2007, p. 164). Subtle or overt examples of discrimination and harassment create barriers or challenges that do not allow women to reach their full potential (Rosser, 2004; Monroe, Ozyurt, Wrigley, & Alexander, 2008). Previous literature failed to include discussion on specific examples of subtle or overt gender discrimination and their effect on women backing away from seeking out leadership opportunities.

This section included a discussion on the findings as related to each of the three research questions, which included what are strategies for success that women department chairs believe have been helpful in reaching this position, what previous leadership experiences or professional training helped prepare women department chairs of engineering departments for their roles as department chair, and what challenges have women department chairs within engineering uncounted and had to overcome? Next, I will discuss implications for practice and implications for theory.

Implications for practice

Findings from this study resulted in several implications for practice. Based on their lived experiences, participants had several implications for practice, which included: K-12 STEM education, advice for women within engineering who are considering leadership roles, and suggestions for colleges of engineering and higher education. Participants' paths to leadership within engineering higher education can help outline the various paths to leadership roles for women faculty members who are considering leadership positions.

Additionally, participants' perspectives are valuable because their "…activities and behaviors are crucial to understanding and taking action on improving social situations (Ropers-Huilman & Winters, 2011, p. 673).

K-12 STEM education. Participants in the study felt encouraging young girls to be interested in STEM based disciplines early is a key component to getting more women into STEM based degree programs in higher education and employment fields after they graduate. Participants had many experiences either participating in K-12 outreach programs or through their own child's experience. Local school districts, Colleges of Engineering, industries who depend on engineers, and engineering professional organizations all have made efforts to try to increase the number of young girls and women interested in STEM fields. While Msehead does not feel the effort as made a sizeable impact, she and the other participants have additional suggestions on how to more effectively encourage girls to consider STEM disciplines. From a young age, both Denna and Lauren suggested gender neutral toys and needing to do better about not creating gender biases with children through their toys, such as Legos are for boys and Barbies are for girls. Next, when doing outreach to students in K-12, Denna suggested outreach efforts match students' level of understanding and match experiments to popular topics to continuously keep students engaged. In addition to developmentally appropriate science, engineering, and math topics, K-12 can support developmentally appropriate leadership topics to encourage students to build these valuable skills early. Discussing and building leadership skills early in a student's education will contribute to a culture change on what skills are deemed valuable.

Additionally, Msehead and Ashley stressed when doing outreach or building recruitment materials, colleges and industry need to point out how engineering helps society and how engineering is a helping profession at its core. Engineering uses math and science to solve societal and other large scale problems, which effects individuals' everyday life. Disciplines such a biomedical engineering, civil engineering, and chemical engineering can more easily be seen as helping people, which has typically resulted in those disciplines having a higher ratio of women students. On their surfaces, disciplines such as mechanical engineering and electrical engineering can be more challenging to connect as directly helping people. As a result, Colleges may see fewer women in those departments by comparison. Men and women in these disciplines need to do a better job of communicating simply how they connect to other disciplines and how they contribute to solving societal problems.

Encouragement and support from parents, teachers and guidance counselors to consider STEM career fields can be pivotal to a young girl expressing interest in engineering. Referring back to their own decision process in choosing engineering as a major during their undergraduate experience, participants all received encouragement and support from their parents and high school counselors or teachers to pursue engineering, a traditionally male dominated discipline. Arguably, without that encouragement, participants may not have picked engineering as a degree and may have chosen a different career path.

In an effort to expose more students from a variety of backgrounds and identities, engineering education advocates and university administrators need to work with local school districts to incorporate strong engineering education into

their K-12 curriculum. Currently, there is a lack of consensus on what K-12 engineering curriculum should include; however, stakeholders, K-12 educators, university administrators, and industry partners, should identify learning outcomes and progression metrics to evaluate their customized curricula (National Research Council, 2009). Echoing Denna's suggestion, K-12 engineering education needs to include developmentally and skill level appropriate topics (National Research Council, 2009). Additionally, K-12 engineering education should include discussion on how engineering connects with different disciplines, such as history or music, to help solve societal problems. Going to the beginning of the pipeline, K-12 STEM education is important because participants stressed that starting early and exposing young children to STEM education will get them interested in STEM at an early age and help increase the number of women at the beginning of the pipeline. With more women at the beginning of the pipeline, there is a higher likelihood that more women will choose STEM based careers, some of which may be in higher education. If there are more women a professoriate role in STEM higher education, the possibility exists for more women to hold leadership roles.

Future women academic leaders. Participants in the study provided a multitude of suggestions for other women faculty members to implement for themselves who may be interested in administrative roles in the future. While it may sound counterintuitive, participants strongly encouraged women faculty in engineering who are interested in leadership roles to focus on their research and on being promoted to full professor before taking on large leadership responsibilities. Participants warn that if a faculty member takes on too much

leadership that takes him or her away from their research, they may stall and never be fully promoted.

Second, participants suggested building one's career portfolio to include noteworthy scholarly achievements in education, research, and service. One can do this by being active in their department and being strategic with the committees they are members. Choosing committees who do noticeable work within the department or college, such as serving on a curriculum committee or graduate committee, allows one to gain valuable experience and helps one network across the department or College's. Participants also encouraged activities or collaborative research that allows one to network or collaborate outside of one's home department and to maintain good advocacy.

Third, participants felt mentors and mentorship played large parts in their strategies for success. Women faculty members need to find mentors they can look to as guides and provide critical feedback. Mentors act as a critical role model for young women. As participants noted, mentors can be from other departments, can be of the opposite gender, and can act as mentors either formally or informally. Participants encouraged women to also be mentors to young faculty members.

Fourth, participants stressed the importance of being an advocate for one's self and other women. If there are teaching, service, or research awards in the department or college and a woman feels they are deserving or know a deserving woman faculty member, nominate oneself or colleague for the award. By nominating and recognizing women faculty, nominators and awarding individuals are helping to elevate the presence of women in engineering which allows

colleagues and outsiders to see women achieving in their field. From Msehead's experience,

> We tend not to nominate ourselves for awards and a lot of men will put themselves up for awards all of the time. I see this because I'm in charge of pairing these awards packages for my staff and the women hardly ever nominate themselves and the men nominate themselves all of the time.

If one knows a woman faculty member who would make a good leader or would make a good leaders someday, Lauren encourages women to share that information and encourage her to seek out opportunities to grow in different capacities. Women need to have more confidence in themselves and believe they have the qualities reviewers are looking for in award nominations.

Lastly, women should not be afraid to move. Unlike Vaidya's (2006) study, which found nearly all women chairs within departments of psychiatry were internal hires, all but one participant in this study remained at her original institution. Of the six participants in this study, five moved institutions when assuming their role as department chair. Of the five who moved institutions, four specifically moved to take on the chair role, while June was asked to take on the role after first being recruited as a faculty member. When considering leadership roles, participants encouraged future faculty leaders to consider looking at other institutions for position openings and be open to moving. Professor encouraged women to find a university that shares the same values and goals as themselves. Lauren felt coming from the outside has been an advantage to her saying, "I'm just the chair and that's the role I've always been in and it's not, I don't have to sort of put this sort of tough exterior and fight for the recognition." Bandura's (1977) self-efficacy theory centers on one's own ability to perform a task or

behavior and how they persist through obstacles and adverse experiences. Four out of the six participants wanted to be in leadership positions and identified the department chair role as a leadership position they were interested in for their next move. When that opportunity was not available to them at their present institution, they persisted by seeking out the role at different institutions.

Colleges of Engineering. As previously stated, the study identified several implications for K-12 education and for future women engineering leaders in higher education; however, the study also identified implications for Colleges of Engineering with regards to their women students and their women faculty members. The study identified the importance of exposing women undergraduates to research opportunities, providing layers of support for women faculty members, and fostering women faculty members' leadership skills.

One of the most important implications for this study is the value and influence of undergraduate research. All participants took part in undergraduate research. While not every female undergraduate student who is interested in engineering will also be interested in engineering research, creating opportunities for more women undergraduate students to participate in undergraduate research is one of the first steps in sparking their interest in research long term, exposing them to the benefits of graduate school, and showcasing what a career in academia may look like. Colleges of Engineering need to work with faculty to increase the number undergraduate research opportunities available to students. Russell, Hancock, and McCullough (2007) found undergraduates who participated in undergraduate research had a better understanding of how to conduct research, had an increased awareness of graduate school, and were more

likely to go on and earn a Ph.D. The more undergraduate women who participate in undergraduate research, the more women who will attend graduate school for engineering. In addition, College's academic advising and career staff need to make students aware of undergraduate research opportunities and the benefits of those opportunities in the same way they promote industry internships and co-ops.

In addition to creating opportunities for more undergraduates to conduct research, participants stressed the importance of mentors. As noted by all participants, and emphasized by Professor, the influence of mentors and mentorship can have a significant impact on a woman's career. While there are implications for the individuals who identify and build mentorship bonds, there are also implications for colleges of engineering, which can provide programming and connect women across departments. Professor had such a positive experience with her mutual mentoring group that she has developed a similar program at her current institution. There are several different successful programs colleges can model, which center on a peer mentoring component (Bhatia & Priest Amati, 2010; Gorman et al., 2010). Helping connect women with other women faculty members in engineering or STEM can provide a network of support, which can improve retention in the field, reduce rates of burn out, and create a greater sense of community.

Third, colleges of engineering can do more to provide additional support to women faculty members, specifically during the associate to full professor timeframe. Participants highlighted one of the reasons women are underrepresented in leadership roles within engineering is because there are few women at the full professor rank. Participants described seeing colleagues get side

tracked after earning tenure, seeing colleagues slow down their research endeavors after earning tenure, or seeing colleagues get stuck in non-tenure track positions, which limited their ability to take on leadership roles. Supported within the literature, White Berheide et al.'s (2013) study found women were less likely to hold the rank of full professor and STEM female faculty spent on average a year longer at the rank of an associate professor than their male counterparts. Within the tenure and promotion process, men and women describe different challenges as they relate to the promotion and tenure process (Gunter & Stambach, 2003). Women note more challenges related to balance, whereas men report challenges related to expectations (Gunter & Stambach, 2003). Colleges of engineering can do more to provide support to women in the associate professor rank to assist in their promotion to full professor by being cognizant of the number of service oriented tasks women faculty are asked to participate in or place more emphasis on service as part of the tenure and promotion decisions. Women faculty in STEM disciplines reported higher levels of service than their male colleagues (Blackwell, et al., 2009; LaPointe Terosky, Phifer, & Neumann, 2008; Monroe, et al., 2008; Parker & Welch, 2013), this is likely due to the additional hours spent mentoring female undergraduate and graduate students and the number of committees they are asked to participate on in an effort to include female representation. This behavior can create tokenism and inequitable structures of oppression for women faculty by creating more work for women faculty as opposed to their male colleagues.

Fourth, since becoming chair, participants cited minimal professional development opportunities. Lauren received executive coaching for the first six

months of her positions, Ashley regularly attends her professional organization's annual chairs meeting, and Denna cited diversity training offered by her institution. However, chairs did not cite ongoing leadership development training since becoming chair or professional development was not as robust as prior to becoming chair. Colleges of engineering can better serve their current department chairs by offering targeted continued leadership training or encouraging chair's attendance at ongoing professional development workshops or seminars. Ongoing training offered by the College should be targeted to accommodate chair's experience level and specific leadership training needs. This would continue to serve the chair on their individual leadership path, but also the College and their department's faculty as college student make-up continues to evolve and education on current issues within higher education change.

Considering additional support for both faculty and current department chairs, colleges of engineering need to consider the financial investment, particularly in times of financial constraint. ELATES, which several participants stated was helpful in their leadership development, can be expensive and may not be viable for every institution. Thus, college leadership may need to be creative in finding leadership development opportunities and support, specifically for women engineers. Colleges could look to regional opportunities, opportunities within different professional organizations, or develop their own model.

Institutions. Institutions need to make diversifying leadership at all levels of the institution a priority. As Msehead observed, based on her own experience, change has happened at the lower levels much faster than change has occurred at the upper levels. Institutions need to recognize there is an issue and hold

administrators accountable to diversifying leadership and faculty make-up. According to Kellerman and Rhode (2014), "A wide array of research finds that the most important factor in ensuring equal access to leadership opportunities is a commitment to that objective, which is reflected in workplace priorities, policies, and rewards structures" (p. 32). However, actions need to be driven by need and have measureable outcomes. By making action items with measurable outcomes to increase diversity and inclusion at every level an institution demonstrates their commitment to increase the flow of the pipeline. Many institutions, including the University of Nebraska – Lincoln, have started faculty leadership development programs in which faculty who are interested in leadership roles participate in workshops and learn about leadership as it relates to the campus's mission to teaching, research and service (Nebraska Today, 2018). Programs such as this can help prepare a diverse group of future leaders if the program makes diversity a part of its overall mission.

Findings indicated a strong support system was crucial to participants exploring engineering as a major and then as participants went through graduate school and the faculty promotion and tenure process. All participants have children and credited their spouses and extended family for helping them to care for the children and balance household responsibilities while they worked. However, if participants were single parents or lived a far distance from their families, these responsibilities would be more daunting and may cause for early faculty burn out or cause a delay in earning tenure or promotion (Pedersen & Minnotte, 2017). Women are disproportionally burdened with child and elder care responsibilities compared to men (Bonawitz & Andel, 2009). To help women

faculty members, regardless of marital status, institutions can provide flexible and affordable child care options, flexible family leave options, flexible scheduling, and adjustments to the tenure and promotion clock to accommodate maternity. In addition to providing these benefits institutions need to ensure faculty are not penalized for taking advantage of the benefits. As reported by Williams et al. (2006), even institutions with progressive work/family policies have low rates of participation in the benefits because of the stigma and discrimination that occurs from others within their department and College.

The findings within this study also showed how an inclusive and collegial department and college climate create a positive work environment in which women can grow and thrive. Leaders must consider all factors when considering the low number of women within engineering, both as faculty and as students. Often the issue is presented as too few women interested in engineering; thus, by increasing the number of women in a field, representation may improve. While improving the number of women in faculty and leadership roles within engineering academia will undoubtedly make a difference, creating and providing training on maintaining inclusive and collegial climates will improve retention of women. Within their professional development and training, participants reported their professional development did not cover how to assess current department climate, identifying problem areas, and providing teachable solutions on how to fix the problem areas. Additionally, institutions should include training on identifying and correcting implicit bias for all faculty and staff. Everyone needs to be trained because addressing and correcting implicit bias is everyone's work, and not just those marginalized. Institutions of higher education and professional

organizations should incorporate how to assess a department or college climate and how to address findings to build an inclusive climate into their professional development or leadership training.

Implications for theory

Bandura's (1977) theory of self-efficacy is at the center of his social cognitive theory. Social cognitive theory describes how individuals' actions and reactions are influenced by what an individual has previously witnessed. However, this social cognitive theory was developed, in part, through a study on toddlers at Stanford's nursery school (Hock, 2009). The development of self-efficacy theory does not take into consideration the unique experiences of women leaders and neglects to include the impact of external support or the environment around them on their ability to believe they can be successful. The theory may need to be updated to include expanded sources on individuals' reasons for high or low self-efficacy.

Currently, within Bandura's (1977) theory of self-efficacy "judgements of self-efficacy, whether accurate or faulty, are based on four principle sources of information" (Bandura, 1982, p. 126). These four principles include performance accomplishments, vicarious learning, emotional arousal, and verbal persuasion (Bandura, 1977). In addition to these four principles, the theory may need to be revised to include other sources of self-efficacy, such as support systems and environments. This study has shown there could be additional influences on self-efficacy than just the four principles initially outlines by Bandura (1977). Additionally, since the theory was not an exact fit, findings may indicate a need

for a grounded theory study to develop a model that is more appropriate to this population.

Feminist theory is an evolving theory that has historical relevance and includes multiple interpretations and includes varied intersections of women's identities. Two of those identities being woman and engineering. According to hooks (2015b), "In its earlies inception, feminist theory had as its primary goal explaining to women and men how sexist thinking worked and how we could challenge and change it" (p. 19). More studies focused on how to get more women and girls interested in STEM or advance through faculty promotion and tenure need to consider their research through a feminist lens to fully understand the physical and socially constructed environment around the participant.

Most individuals today do not have an understanding of the many ways in which feminism and feminist actions, as early as the eighteenth century, have positively influenced their lives (hooks, 2015a; hooks, 2015b; Donovan, 2012). The beauty of feminist theory has been the theory's ability to evolve to address the changing levels of oppression women face. As women have gained access to the higher education and the workplace, the oppression they face and the extent of the oppression has changed. There are critics who believe feminism is no longer necessary or relevant "since women now have equality. They do not even know that on average most women still do not get equal pay for equal work, that we are more likely to make seventy-three cents for every dollar a male makes" (hooks, 2015a, p. 49). Based on their own experiences and the experiences of their female colleagues, the participants in this study would argue women do not have equality, particularly in STEM based disciplines. As our world continues to

evolve, as the challenges that face our planet becomes imminent, and our civilization becomes more reliant on technology, diversity in representation and ideas will be necessary to solve global problems. Feminist theory will need to continue to evolve and examine equality and levels of oppression in science and technology, how that oppression impacts future decisions, and how to best achieve equality among the sexes.

Recommendations for future research

The purpose of this study was to understand the experiences of women department chairs in engineering academic departments as they have navigated the pipeline to their current position. After completing this study, there are several recommendations for future research. As described in the limitations, a more comprehensive study with more participants, specifically women department chairs within engineering from diverse racial and ethnic backgrounds, could provide a more nuanced view of the position, position responsibilities, and identify multiple career paths women have taken to the department chair position. Additionally, including feedback from the chairs' previous colleagues could provide insight on their skill development, leadership preparedness, and collegiality from a longitudinal perspective.

Second, additional research is warranted to explore women faculty's promotion and tenure process, specifically the transition from associate to full professor. Participants described this as a critical transition and provided antidotes of women getting "stuck" or "comfortable" in the associate professor rank. Participants also provided anecdotes of women taking on too many leadership responsibilities at the associate professor rank and getting side tracked from their

research and never reaching the full professor rank. Staying at the associate professor rank and not being promoted to full can limit women faculty's academic leadership opportunities within the institution. For Professor, who experienced gender discrimination during this period, providing additional support and studying this period of a women faculty member's career is personal. Professor has made studying this transition period a research priority so she can help future women faculty attain the rank of full professor.

A third area that deserves further research is the retention of women engineers both in industry and in academia. As noted by both Msehead and June, retaining women in the field is just as big of an issue as getting women interested in engineering. As chair, Msehead has fought to retain her faculty, who get offers from other institutions and industry regularly. In higher education, when budgets are continuously shrinking and resources are minimal, additional research is needed on why faculty choose to leave an institution or what makes faculty decide to stay. Within the field of engineering, participants hypothesized women leave due to long hours or their position is not what they thought the position would entail. June stressed the importance of retention strategies for women in the field, however, more needs to be known about what retention strategies for women in engineering industry exist and what are best practices.

Fourth, a challenge Ashley highlighted as part of her role as department chair is being both a mentor and evaluator to young faculty in the department. The literature cites many challenges associated with being a department chair (Bowman, 2002; Burns & Gmelch, 1992; Carroll & Gmelch, 1992; Carroll & Wolverton, 2004; Gmelch, 1991; 2004; Gmelch & Burns, 1990; 1991; Gonaim,

2016; Niemeier & Gonzalez, 2004; Vaidya, 2006), but did not note the challenge between both being a mentor to young faculty member while simultaneously professionally evaluating the same individual. Since much of the literature is from the male perspective, and more than a decade old, additional research should be conducted on this department chair challenge to learn more about how gender plays into this challenge and to learn best practices.

Lastly, further research is needed on the influence of women department chairs on the diversification and equity of the faculty within their department and the makeup of their department's undergraduate and graduate student enrollment while they are chair. Contrary to findings suggested by Su, Johnson, and Bozeman (2015), participants were more likely than their male predecessors to promote gender diversity and equity strategies within their departments and their hiring practices. All participants noted their impact on hiring processes, especially new hires, which include both men and women, as a piece of their tenure they are most proud. Professor discussed her contribution in ensuring salary compensations were equitable between male and female faculty of similar rank and length of service. Msehead explained how being herself and dressing how she wants to dress has allowed women within her department to "see that they can be however they are and be an engineer." Being a woman department chair undoubtedly influences the culture of the department and the students within the department. The extent of their influence deserves further attention.

Concluding remarks

Researchers play an important role in bringing previously excluded voices to the foreground of public attention. This study sought to understand the

experiences of women department chairs in engineering academic departments as they have navigated the pipeline to their current position. Specifically, this study aimed to understand strategies for success of current women department chairs, what professional development opportunities were of particular value, and what challenges they came up against, and how they overcame those challenges on their path to becoming a department chair. Unlike previous studies, this study wanted to understand the experience of women department chairs in engineering departments through their personal narratives. Several studies on the role of department chair were singular autobiographical accounts or used a different qualitative method, such as phenomenology or case study. While most of the previous literature on department chairs did not use narrative inquiry from women's perspectives and no literature existed from the perspective of a woman chair in an engineering discipline, existing literature was useful in determining department chair position responsibilities and what may be potential challenges for those who hold the role.

After analysis, findings from this study conclude women who are engineering department chairs have a strong support system, which consists of family, friends, and mentors, and have identified work/life balance strategies for their personal situations. A strong foundation of support was critical to participants' continued success within their fields. For those individuals who may feel as though they do not have a strong support system, participants suggested working on building one's network through their professional organizations or through on-campus faculty networking opportunities.

The participants took advantage of a myriad of professional development opportunities, and in some cases, created their own opportunities for leadership or to gain skills that would better serve them professionally. There are a limited number of leadership opportunities within higher education, as pointed out by Msehead; however, Lauren and Professor demonstrated seeing a need within the leadership structure and successfully pitching themselves to fill that need. When considering leadership positions, women need to be confident in voicing their intent and in their ability to perform the responsibilities of the position.

Unfortunately, the participants in this study have experienced or know other women colleagues who have experienced gender discrimination through overt or subtle instances. While this finding is not unique to this study, this study has demonstrated that these situations are still occurring within engineering academic departments. Additionally, participants in this study provided advice and guidance to women faculty who may find themselves in a similar situation. The more women and men talk about and work to end situations of gender discrimination or unconscious bias, colleges of engineering will be more welcoming environments. Colleges of engineering can work to end gender discrimination and unconscious bias through the hiring of additional women and minoritized individuals, providing training on diversity and inclusion, and making diversity and inclusion a top priority within the college's strategic plan, which will result in an institutional cultural shift.

Much remains to be studied on the experiences of women leaders within engineering fields. Such as the transition from associate to full professor, retention of women in the engineering field, and women engineering chair's

impact on the culture and make-up of their department. However, studying women's experiences and challenges, within engineering, is valuable to promote successes and remove barriers in an effort to advance more women into the role of department chair.

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Appendix A

Semi-Structured Interview Protocol

Central research question: What have been the experiences of women department chair in engineering academic departments as they have navigated the pipeline to their current position? My sub-questions are:

1. What are strategies for success that women department chairs believe have been helpful in reaching this position?
2. What previous leadership experiences or professional training helped prepare women department chairs of engineering departments for their role as department chair?
3. What challenges have women department chairs within engineering encountered and had to overcome?

First interview:

- Describe when you first developed your interest in engineering.
- Describe what made you want to pursue a PhD in engineering
- Why did you decide to pursue a career within academia or return to academia?
- Describe your promotion and tenure process.
- Tell me about what motivated you to want this position. [Social persuasion & Performance accomplishments]
- Describe your experience as a woman department chair in an engineering academic department.

- What previous experiences do you feel helped prepare you for this position? [Performance accomplishments & Vicarious learning]
- Did you have faculty peers within your department, your field, or a mentor who encouraged you to pursue leadership roles? How so? [Social persuasion]
    - Probe: Did you ever have the opportunity to learn from or observe others in a way that influenced you to purse the department chair role? In what ways? [vicarious learning]
- What professional development opportunities did you participated prior to assuming this role? [Performance accomplishments & Vicarious learning]
    - Probe: What opportunities were the most impactful?
    - Follow up: What professional development opportunities have you participated in since assuming this role? [Performance accomplishments & Vicarious learning]
        - Probe: What opportunities were the most impactful?
- Describe your work/life balance strategies?
    - Probe: If partnered, how has your partner, helped or hindered the success of these strategies?
- How do you manage stress? [Emotional arousal]
- Describe your support structure both professionally and personally. [Emotional arousal]
    - Probe: How has this support structure contributed or not contributed to your success as a department chair? [Emotional arousal]

- What do you believe has contributed to your overall success?
- Describe any challenges you have encountered or had to overcome prior to becoming chair
    - Follow up: Describe any challenges you have encountered or had to overcome since becoming department chair.

Closing questions:

- Is there anything else you would like to share with me about what we have discussed today?
- Do you have any questions for me?

Second interview:

- What role do you feel gender played while you were a student or postdoc?
    - Follow up: What role do you feel gender played while you were a faculty member?
    - Follow up: What role do you feel gender has played since becoming chair?
- Are there challenges within your position as a department chair, that you feel have been exasperated by your gender? How have you overcome those challenges?
- How would you describe your department office climate?
    - Follow up: How would you describe your College's workplace climate?
    - Probe: how do you feel the department or College climate has changed, if any, since you became department chair?

- Describe any biases, stereotypes, or harassment you have encountered either in your career or in this position.
    - Probe: What enabled you to persist through these challenges?
- Why do you feel there are so few women department chairs in STEM fields broadly and, more specifically in engineering?
- What strategies or actions do you think should be taken to reduce the gender gap and significantly affect the pipeline in engineering academic leadership in higher education?
- What additional leadership experiences or professional training do you feel could help prepare women department chairs of engineering departments for their role as department chair?
    - Follow up: What support or additional support do you feel could help women in current faculty roles and prepare women for the department chair or other leadership roles?
- What do you feel is the role of gender on the leadership development process?
    - Probe: Do you feel gender has impacted the number of leadership experiences or professional training opportunities made available to you, positively or negatively? How so?
- What steps or strategies do you think women faculty members in engineering should take if they think they might want to one day be a department chair?

Closing questions:

- Is there anything else you would like to share with me about what we have discussed today?
- Do you have any questions for me?

Appendix B

Participant Consent Form

University of Nebraska Lincoln

COLLEGE OF EDUCATION AND HUMAN SCIENCES
Department of Educational Administration

Participant Informed Consent Form
IRB# XXXXXXXXXX

Title: Experiences of women department chairs in engineering

Purpose:
This research project is intended to study the experiences of women department chairs in engineering departments to understand how these women successfully navigated the pipeline and identify success strategies which led them to persist in a traditionally male dominated discipline. Your participation in this study will assist me to better understand women engineering department chair's experiences as an authority figure in their discipline, and provide a better understanding of what one can do to better prepare themselves to become a department chair or university administrator. You must currently be a department chair in an engineering discipline and identify as a woman to participate. You are invited to participate in this study because you currently serve as a department chair in an engineering discipline.

Procedures:
This is an invitation to participate in at least two 60 minute interviews. You may be asked to do a follow-up third interview that will be scheduled for no more than 60 minutes which would be conducted on Skype, Zoom, or through email. These interviews will take place in person or via Skype or Zoom, to accommodate your schedule. You will be asked a series of questions, and all interviews will be digitally recorded. Data analysis will follow standard qualitative procedures. You will choose a pseudonym prior to analysis and all identifying information will be removed from transcripts prior to analysis. These interviews will be audio recorded on a digital recorder with your consent. To indicate consent, please check the following:

☐ I agree to be audio recorded.

Benefits:
There are no direct benefits to you as a research participant.

Risks and/or Discomforts:
There are no known risks or discomforts associated with this research.

Confidentiality:
Any information obtained during this study which could identify you will be kept strictly confidential. The data will be stored in a locked cabinet in the investigator's office and will only be seen by the investigator and her faculty advisor during the study and for three years after the study is complete. The information obtained in this study may be published in academic journals or presented at academic meetings but the data will be reported as aggregated data. Your identity will be confidential and you will be referred to only by a chosen pseudonym throughout the interview, analysis, and any reporting processes.

Opportunity to Ask Questions:
You may ask any questions concerning this research and have those questions answered before agreeing to participate in or during the study. Or you may contact the investigator at the phone number or email address below. Please contact the University of Nebraska-Lincoln Institutional Review Board at (402) 472-6965 to voice concerns about the research or if you have any questions about your rights as a research participant.

Freedom to Withdraw:
Participation in this study is voluntary. You can refuse to participate or withdraw at any time without harming your relationship with the researchers or the University of Nebraska-Lincoln, or in any other way receive a penalty or loss of

141 Teachers College Hall / P.O. Box 880360 / Lincoln, NE 68588-0360 / (402) 472-3726 / FAX (402) 472-4300

benefits to which you are otherwise entitled.

Consent, Right to Receive a Copy:
You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have decided to participate having read and understood the information presented. Please print or save a copy of this page for your records.

Signature of Participant:

_____ _____
Signature of Research Participant Date

Name and Phone number of investigator:
Kayla Person, Secondary Investigator Office: (402) 472-7079 Email: kperson4@unl.edu
Christina W. Yao, Ph.D., Principal Investigator Office: (402) 472-3758 Email: cyao@unl.edu

Appendix C

Solicitation Email

Hello,

My name is Kayla Person, and I am currently a doctoral student in the Education Administration department at the University of Nebraska – Lincoln. I am reaching out to you to invite you to participate in a study on the experiences of women department chairs in engineering departments. Women make up a small percentage of those who hold a department chair role in engineering disciplines. This study is important because it will give the microphone to women in these positions and will provide information on expectations and skills needed to be a department chair, as well as provide information on career and leadership trajectories of women faculty members in engineering.

Your participation will help me better understand women engineering chair's experiences as an authority figure in their discipline, and provide a better understanding of what one can do to better prepare themselves to become a department chair or university administrator.
The information from the interviews will be used to inform this research project and contribute to scholarly research on the experiences of women faculty and department chairs within engineering and STEM departments.

Participation will include two interviews, lasting approximately 60 minutes, which will take place either in person or virtually, at the location of your choosing and will accommodate your schedule. Any identifying information will be removed from final documents and analysis.

If you are willing to participate, please complete this demographic survey: Insert Link

I will be in touch as soon as possible to schedule an interview with you.

I appreciate your willingness to consider participating in this study. Also, please feel free to forward this email to any colleagues that would fit the needs of this study. Participants need to be current women department chairs of engineering departments.

Thank you,
Kayla Person
Doctoral Student
402.472.7079
kperson4@unl.edu

Christina W. Yao, Ph.D.
Assistant Professor
Department of Educational Administration
College of Education and Human Sciences
University of Nebraska–Lincoln
134 Teachers College Hall
Lincoln NE 68588-0360
402.472.3758
cyao@unl.edu

Appendix D

Qualtrics Demographic Survey

Qualtrics Demographic Survey

(embedded in recruitment email)

1. First Name
2. Last Name
3. Age
4. Gender
5. Nationality
6. Race/ethnic background
7. University name
8. Department name
9. Academic Discipline
10. Position title
11. How long have you been chair/head?
12. What is your apportionment? (% administration, % teaching, % research, etc.)
    a. How much time do you actually spend on those responsibilities
13. Email Address
14. Chosen pseudonym/fake name

Appendix E

Coding Table Example

Introduction to STEM/Engineering	LAUREN "so um in high school, I was really interested in math and physics and chemistry and so it was really through enjoying those subjects and being encouraged by a number of people but especially I would say my high school AP physics and chemistry teacher really encouraged me to consider engineering as a career path. Um…and was really supportive in helping me um you know do well in those courses and prepare prepare for the APs. He took another another female student and I on a tour of a local college to see their chemistry department and their MRI um their [in audible] equipment. Um and that was really how having someone who saw that potential and encouraged me to pursue that as an eventual career option." MSEHEAD "um yeah um I think I was in middle to high school just sort of liking to learn how things work better and really fell in love with physics in high school and that kind of propelled me into mechanical engineering." PROFESSOR "I first developed my interest in engineering um while I was in high school. I really um loved math, um and I loved science, and so I was thinking about engineering and I was also thinking about pre-med, so I came to [University name], which is an engineering known school um in [State], which is close to where I grew up and when I came here I was originally pre-med, but then I started taking more math classes and science classes and decided to get my degree in [engineering discipline]. And I originally had thought that I would go on to medical school um but then I got um more excited about teaching and research and that's why I decided to go for the PhD instead of the MD." ASHLEY "well my dad and my brothers were electrical engineers and I actually swore I was not going to be an engineer [laughing] because I was not interested in that. I really liked math, but I wasn't too keen on science as much, but my dad brought me home a book on operations research and I was really	OVERALL Participants developed an interest in high school and were influenced by either high school teachers, high school guidance counselors, or family members. LAURN Developed interest in high school. AP physics and chemistry teachers were influential MSEHEAD Developed interest in high school Really enjoyed physics PROFESSOR Developed interest in high school ASHLEY Dad and brother were engineers Wasn't particularly interested Liked math Dad introduced her to an engineering discipline she was interested in DENNA Had an influential guidance counselor JUNE Many adults in her family encouraged her to pursue engineering. Country was very encouraging of women and girls in science fields.

	intrigued by that and so I started looking at colleges and applied to 5 different schools. Only one of them had operations research in the engineering school and that was the one that I decided to go to. So I wound up being in engineering anyway. [Laughing]. Which turned out to be a good thing." DENNA "I hadn't really thought about engineering, but I had a great guidance counselor in high school. So when I started to think about where I wanted to go to college looked at my grades and what I was good at and said you know you should really consider chemical engineering. And I thought 'oh oh okay' because I like math and I like I like the sciences so I thought I'd give it a try and that's what I did. Um and I actually stuck with engineering. So um I really just I had a good guidance counselor because I didn't know much about engineering when I was in high school." JUNE "I come um from a family um in which education has been very very important um I I had um you know many adults in my life um including my parents and immediate family who encouraged both myself, my sisters, and my cousin all girls um to study, seek high high level degrees and um when I applied for college it was back in the [decade] and the political situation in [country] was that if you sought a degree in engineering or in medical sciences um as a girl your chances of finding employment um in general were higher so I had been encouraged by my mom, dad, and everybody including my sisters um to I have a sister who is one year older than me and she was going to law school in [country] you can go to law school as an undergraduate and then on to graduate school she also encouraged me to seek a engineering. That is how I ended up in engineering. Actually, I did not necessarily want to study engineering, I could, I had the scores and all of that. I was good at math, my passion was um something more in social sciences something like international studies or international relations, but what I was told made sense to me so I decided to study engineering."	