DIVERSITY AND INCLUSION OF WOMEN IN THE CONSTRUCTION INDUSTRY

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Abstract: The construction industry has been growing for many years and is expected to continue expanding over the next decade. However, it has experienced a concurrent "widespread and significant shortage" in workers over the past two decades, specifically among project management and skilled positions. One of the most glaring disparities in the construction workforce is the industry's failure to recruit and retain women. Construction has long been considered a "masculine" profession and is still classified as a non-traditional occupation for women by the U.S. Department of Labor, which is reflected in historical employment statistics. Although increasingly more women have found employment in the construction industry since the 1980s, this growth is not substantial and the proportion of women in the industry has not meaningfully changed. The consequences of a construction labor shortage at a national level are a significant risk to economic growth. Thus, further exploration of how to effectively enhance women's inclusion in the construction industry is warranted. The primary objective of this dissertation research is to identify critical intervention points and opportunities for fostering the inclusion of women in the construction industry. This dissertation used three quantitative surveys as the primary data source and utilized a number of statistical techniques to achieve its objective. The first study describes the personal attributes of women in construction and organizational factors of their workplaces that encourage retention, or persistence, in the industry. The second study determines the extent to which different types of implicit gender bias occur within the construction workplace, while the third study examines gender bias within construction-related academic programs and its relationship to students' self-concept. This dissertation contributes to the overall body of knowledge by providing the first quantitative evidence of women's experiences of gender bias and persistence in the construction industry. The results of this dissertation can be used by academic programs and industry leaders to increase the number and proportion of women working in construction to meet current and projected workforce demands.

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CHAPTER I

INTRODUCTION AND BACKGROUND

PROBLEM STATEMENT

The construction industry has been growing for many years and is expected to continue expanding over the next decade (Center for Construction Research and Training 2007). The U.S. Bureau of Labor Statistics (Bureau of Labor Statistics 2019e) projects that construction and extraction occupations will grow by almost 10% between 2018 and 2028, a rate twice that of the overall projected job growth rate (5.2%). Additionally, the anticipated median annual wage among construction and extraction workers is expected to increase at a rate of 11.2% compared to 8.7% for the general worker population (Bureau of Labor Statistics 2015, 2019f). The outlook for construction managers is particularly promising, as the need for personnel with management skills and experience will increase with the advance in building materials and construction methods, and with the rise in the number and scope of laws related to building construction, worker safety, and the environment (Center for Construction Research and Training 2007; Moir et al. 2011). With a projected increase of more than 46,000 jobs in construction management, candidates with a bachelor's degree in a relevant field (i.e., construction science, construction management, or civil engineering) are expected to have the best job prospects (Bureau of Labor Statistics 2019d).

However, the construction industry has experienced a concurrent "widespread and significant shortage" (Associated General Contractors of America 2018b) in workers over the past two decades, specifically among project management and skilled positions (Education and Training Administration 2004; Grossman 2005; Stockbridge 2018). Between 2001 and 2006, more than 100,000 construction positions were vacant each month (Center for Construction Research and Training 2007). A 2016 survey among Georgia-based contractors found that the vast majority (87%) struggled to retain and attract quality workers at all levels (Stockbridge 2018). A nationwide industry survey from 2018 yielded similar results, with 80% of contractors reporting that it was difficult to find quality craft workers (Associated General Contractors of America 2018a). Almost half (48%) believed that meeting overall workforce demands would become even more difficult in the next 12 months (Associated General Contractors of America 2018a). Atwater and Jones (2004) proposed that this may be part of a systemic worker shortage in the United States, which is primarily the result of changing demographic trends as baby boomers continue to retire faster than the workforce can replace them (Atwater and Jones 2004; Moir et al. 2011). In 2012, 19% of skilled construction workers were 55 years or older, and 53% were 45 years or older (Wright 2013). Among other causes of the shortage of skilled construction workers are an insufficient number of new graduates from construction and engineering degree programs, difficult immigration processes, and a departure of workers from the workforce due to family responsibilities, early retirement, or disabilities (Atwater and Jones 2004; Grossman 2005; Menches and Abraham 2007).

One of the most glaring disparities in the construction workforce is the industry's failure to recruit and retain women. Construction has long been considered a "masculine" profession (Banchefsky and Park 2018; Menches and Abraham 2007) and is still classified as a non-traditional occupation for women by the U.S. Department of Labor (Women's Bureau 2012), which is reflected in historical employment statistics. Although increasingly more women have found employment in the construction industry since the 1980s, this growth is not substantial and the proportion of women

in the industry has not meaningfully changed (Arcand 2016; Bureau of Labor Statistics 2016, 2019a; Center for Construction Research and Training 2007; Goss-Graves et al. 2014). Even though women accounted for almost half (43.1%) of the total workforce in 2018, the U.S. Bureau of Labor Statistics reported that only 9.9% of construction workers were women (Bureau of Labor Statistics 2019a, 2019c). Construction management, in particular, boasts one of the lowest proportions of female employment among any occupation recorded and tracked by the U.S. Department of Labor, wherein women hold only 7.9% of construction management positions, despite records showing that women occupy 39.2% of management positions across all industries (Bureau of Labor Statistics 2016, 2019b; Women's Bureau 2018). In fact, most professional construction occupations (i.e., architects, construction managers, engineers) employed less than 10% women and most construction trades (i.e., painters, electricians, plumbers) fared even worse with an employment rate of less than 5% women (Menches and Abraham 2007). In analysis of employment records of a large-scale, multi-year project in Boston, Massachusetts, Arcand (2016) revealed that women accounted for only 8.2% of hours in apprenticeship positions and less than 1% of hours in management or foreperson positions. Furthermore, over half (52%) of the women employed in construction serve in administrative or support positions, roles that are expected to decline due to increased automation (Center for Construction Research and Training 2007; Goss-Graves et al. 2014).

Despite being widely recognized as an "untapped resource" (Menches and Abraham 2007), the federal policies and industry strategies designed to increase female representation in the construction workforce have been ineffective. In 1965, Executive Order (EO) 11246 provided affirmative action for minorities, including women, in federally funded construction projects (Office of Federal Contract Compliance Programs 2002), and amendments in 1978 set a goal of women's participation at 6.9%, although little to no enforcement of this executive order has ever been codified (Eisenberg 1998; Goss-Graves et al. 2014; Moir et al. 2011). Instead, achievement is determined through "good faith efforts" and evidence shows that companies often circumvent the intention of the

policy by hiring women in the initial years of a project only to terminate their employment in later years once the minimum thresholds of diversity have been established for the project, a process known as checkerboarding, or fail to meet the requirement altogether (Arcand 2016; Eisenberg 1998; Moir and Azaroff 2008; Moir et al. 2011). Ultimately, federal policies such as the Workforce Investment Act of 1998 and the Workforce Innovation and Opportunity Act of 2014 have shown meager impact on the inclusion of women working in construction (Arcand 2016; Goss-Graves et al. 2014; Hegewisch et al. 2014). Moir and colleagues (2011) speculated that this shallow commitment has, in fact, done more harm than good in perpetuating the culture of sexism and discrimination in the industry by reinforcing the minimum level of acceptance of female workers and, as other researchers describe, fueling stereotypes that women are not qualified for skilled positions (Seron et al. 2018; Williams et al. 2016).

Likewise, the construction industry itself has identified the need to increase the number of women working in construction in order to achieve a sufficient workforce (Menches and Abraham 2007; Morello et al. 2018) but few of the current or proposed strategies for addressing the worker shortage specifically consider how to increase the recruitment and retention of women (Moir et al. 2011). Commonly proposed strategies include adopting technological advances to reduce the labor demand, increasing compensation and benefits, introducing or improving flexible working practices, improving the quality of education and training and the availability of apprenticeship programs, and developing innovative recruitment techniques to garner more interest among those entering or preparing to enter the workforce, including partnerships with the construction industry (Associated General Contractors of America 2018b; Goss-Graves et al. 2014; Grossman 2005; Menches and Abraham 2007; Sewalk and Nietfield 2013). In their most recent workforce development plan, the Association of General Contractors of America (2018) proposed a number of new recruitment strategies, all of which seem to adhere to the masculine culture of the construction industry. For example, one of the proposed strategies was to create a "sports-like ceremony" during which

employers will "announce which of the students they have 'signed' to join their team" (Associated General Contractors of America 2018b). Moreover, Whyte and colleagues (2013) described 14 programs or policies that exhibited innovation or best practices in recruiting workers to construction, none of which mentioned targeting or appealing to women.

Researchers have recently made an evidence-based appeal for promoting diversity in the workforce (Grossman 2005; Menches and Abraham 2007). Studies have shown that gender diversity and inclusion in the workplace can increase profitability as much as 15% by enhancing the ability to attract top talent, increasing employee satisfaction, promoting creativity, alleviating hostility among coworkers as well as business-customer relationships, improving customer orientation, and enhancing long-term business opportunities (Arditi and Balci 2009; Hunt et al. 2015; Lee et al. 2018; Menches and Abraham 2007; Stockbridge 2018). Yet female participation in the construction trades has long been resisted, "vigorously [and] sometimes violently" (Schleifer 2002; Sewalk and Nietfield 2013). Williams and colleagues (2016) found that nearly one-fifth (17%) of male engineers believed that diversity efforts were threatening the quality of the profession and that women had unfair advantages in obtaining positions. Men may be reluctant to accept evidence of gender bias (Williams et al. 2016) or may simply prefer not to disrupt the status quo (Kaiser and Spalding 2015). Moir et al (2011) posited that this hesitancy to embrace diversity may be present in construction due to the inherent danger of the job. In an effort to establish and maintain trust among co-workers, and therefore feelings of safety, men draw on their common norms and values which are centered on masculinity and, by definition, exclude women (Moir et al. 2011).

The consequences of a construction labor shortage at a national level are a significant risk to economic growth and has already resulted in higher project costs and completion delays, competition for the best workers among companies, and hiring of underqualified workers (Associated General Contractors of America 2018b; Menches and Abraham 2007). Taken in conjunction with other industries as part of a systemic shortage, this may contribute to a reduction in the growth in standard

of living, higher wage-push inflation, decreased international competitiveness, and erosion of future domestic production capacity (Atwater and Jones 2004). At a time when viability and growth for the industry are high, it is essential to increase and emphasize workforce diversity in construction. As Atwater and Jones (2004) stated, "A silver bullet to solve significant shortages… is not realistic. Tactical combinations of programs and new paradigms will become the standard."

Thus, further exploration of how to effectively enhance women's inclusion in the construction industry is warranted. Most of the available research on gender diversity in male-dominated industries focus on the STEM (science, technology, engineering, and mathematics) fields; little attention has been paid to construction. This dissertation aims to address this gap in the literature by examining the experiences of women in construction in both professional and academic environments in order to better understand the personal and organizational factors that influence women's decisions to remain in the industry, including their perceptions of gender bias. Ultimately, this research provides recommendations to academic programs and industry leaders regarding opportunities for increasing the number and proportion of women working in construction to meet current and projected workforce demands.

DISSERTATION PROPOSAL STRUCTURE

This dissertation consists of five chapters. Chapter 1 introduces the problem statement, structure of the dissertation, and the research scope and objectives. Chapters 2, 3, and 4 describe different facets of the problem and present research findings from this dissertation. Each chapter includes an abstract, introduction, background and literature review, research methodology, and references. Chapters 2 and 4 also include results from completed studies as well as conclusions and recommendations. These chapters are written in the format of extended journal papers. Upon completion of the dissertation, they will be condensed and submitted for publication to peer-reviewed academic journals, namely the *Journal of Construction Engineering and Management*, the *International Journal of Construction*

Education and Research, and the *Journal of Management in Engineering*. While each chapter answers a particular research question and is intended to be a standalone paper, some overlap in ideas and findings may occur. Appendices include additional resources, including tables, figures, and the survey instruments used to capture data and associated statements of consent.

RESEARCH SCOPE

This doctoral research draws from previous research conducted in the male-dominated fields of science, technology, engineering, and mathematics (STEM). Workplace demographics and published research agendas are similar for STEM and construction fields, and many engineering fields work within construction and are a component of construction degree programs. This study, however, represents the first of its kind in the construction industry. It is divided into three major parts, each structured using a separate STEM-focused study as a guide. The first study focused on the personal and organizational factors that contribute to the retention of women in construction, whereas the second and third studies explored the perceptions of gender bias that women report in the professional and academic contexts.

Primary data were electronically collected for each study using quantitative surveys adapted from the model studies (Fouad et al. 2016; Robnett 2016; Williams et al. 2016). While women were the primary study population of interest, male participants were also recruited for the second study to allow for a comparison of the experiences of gender bias between male and female construction workers. Statistical analyses, including multivariate analysis of variance (MANOVA), covariance (MANCOVA), and regression models, were conducted to answer the research questions.

The methodology chosen for a study always presents some limitations. In this study, one of the primary limitations was selection bias. All participation was voluntary; therefore, respondents self-selected and those who were recruited but did not participate may be different than those who

did. Furthermore, participants were asked to report their perceptions of gender bias in two of the three studies, which may not accurately estimate the actual occurrence of bias.

RESEARCH OBJECTIVE

The primary objective of this research was to identify critical intervention points and opportunities for fostering the inclusion of women in the construction industry. This main objective can be divided into three secondary objectives, each aligned with one of the studies detailed in this dissertation:

1. To identify personal attributes of women in construction and organizational factors of their workplaces that encourage retention, or persistence, in the industry;
2. To determine the extent to which different types of implicit gender bias occur within the construction workplace; and
3. To determine the extent to which gender bias occurs within construction-related academic programs and its relationship to students' self-concept.

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CHAPTER II

EXPLORING THE EFFECT OF PERSONAL AND ORGANIZATIONAL FACTORS ON THE PERSISTENCE OF WOMEN IN THE CONSTRUCTION INDUSTRY

ABSTRACT

Male-dominated occupations, such as construction and engineering, experience a greater turnover among women than other, more traditionally feminine occupations. Graduation and job placement rates suggest that women should be increasing their representation in the construction industry, as each new class of graduates adds more women to the workforce, but employment statistics do not support this theory. Rather, they indicate that women are leaving the construction industry early. This study examined the personal attributes of women in construction and organizational factors of their workplaces that influenced women's persistence in the industry. Participants were classified as "persisters" or "non-persisters" and responded to 101 statements categorized into 14 scales that measured personal and organizational factors identified in the available literature. Responses from persisters (n=108) and non-persisters (n=20) were compared using MANOVA, ANOVA, and logistic regression models. Results indicated that women with a higher degree of career resilience were significantly more likely to persist in the industry (*a*OR = 6.82; $p = .01$), whereas women with high organizational self-efficacy were significantly less likely to persist (*a*OR = 0.05; $p = .01$). These findings suggest that resilience may be an effective target for intervention in order to increase women's retention in the

construction industry. Further research is needed to better understand the relationship between organizational self-efficacy and persistence among women in construction.

INTRODUCTION

Male-dominated occupations experience a greater turnover among women as compared to female-dominated or gender-balanced occupations. One recent study estimated that women are at least three times more likely to leave male-dominated occupations than other industries (Cha 2013), and an analysis based on the National Longitudinal Survey of Youth found that women in science, technology, engineering, and mathematics (STEM) fields were over 800% more likely to leave their industry than women working in other, non-STEM professional fields, even after controlling for potential covariates (Glass et al. 2013). No significant differences in demographics were observed between these two groups, yet 50% of women working in STEM had left the industry after 12 years, compared to only 20% of women in non-STEM professional industries who had left their field after more than double the time frame (Glass et al. 2013). In 2019, the Society of Women Engineers reported even more dramatic turnover, wherein only 30% of women who held a bachelor's degree in engineering still worked in the industry after 20 years (Society of Women Engineers 2019).

The construction industry has long been considered a "masculine" profession (Banchefsky and Park 2018; Menches and Abraham 2007) and is still classified as a non-traditional occupation for women by the U.S. Department of Labor (Women's Bureau 2012). While the industry has been growing for many years and is expected to continue expanding over the next decade by almost 10% (Bureau of Labor Statistics 2019c; Center for Construction Research and Training 2007; Women's Bureau 2012), it has also experienced a significant shortage in workers over the past two decades (Associated General Contractors of America 2018; Education and Training Administration 2004; Grossman 2005; Stockbridge 2018). One of the

most glaring disparities in the construction workforce is the industry's failure to employ women. Even though women accounted for almost half (43.1%) of the total workforce in 2018, the U.S. Bureau of Labor Statistics reported that only 9.9% of construction workers were women (Bureau of Labor Statistics 2019a; Women's Bureau 2018). Construction management, in particular, boasts one of the lowest proportions of female employment among any occupation recorded and tracked by the U.S. Department of Labor, in which women comprised only 7.9% of construction managers, despite records showing that women held 39.2% of management positions across all industries (Bureau of Labor Statistics 2016, 2019b; Women's Bureau 2018). In fact, most professional construction occupations (i.e., architects, construction managers, engineers) employed less than 10% women and most construction trades (i.e., painters, electricians, plumbers) fared even worse with an employment rate of less than 5% women (Menches and Abraham 2007).

To the researcher's knowledge, there are no studies or analyses currently available to estimate the number of women who entered and subsequently departed the construction industry. However, a comparison of graduation rates and employment statistics suggest that women are leaving the profession early. Women earned approximately 8-10% of the bachelor's degrees in construction management awarded between 2011 and 2017 (National Center for Education Statistics 2013, 2018) and placement rates of students into internships, apprenticeships, and paid positions exceeded 90% (Elliott et al. 2016). If almost all graduates enter and remain in the industry, we would expect women to incrementally increase their proportionate representation as each new class adds more women to the workforce. However, this is not consistent with the current reports of women holding only 8% of construction management positions (Women's Bureau 2018) and indicates that women are leaving the industry just as quickly as they enter. This study discusses potential factors identified in the literature that may influence women's decisions to leave the construction workforce, presents research from the first study to directly

compare women who have stayed with those who have left the industry, and provides evidence-based recommendations for improving the retention of women in construction.

BACKGROUND AND LITERATURE REVIEW

Why do women tend to leave male-dominated industries such as science and technology, engineering, and construction at a higher rate than other industries? Researchers have begun to address this issue; however, there remains a dearth of literature that identifies the reasons why women decide to leave these fields. Most research that does exist measures the concepts of job satisfaction, organizational commitment, or turnover *intentions*, rather than actual turnover. While job satisfaction and organizational commitment have been positively associated with turnover intentions (Peters et al.1981; Singh et al. 2013), and turnover intentions with turnover itself (Fouad et al. 2016; Peters et al. 1981), these variables represent distinct concepts. Thus, much of the current literature does not provide explicit evidence of what causes women to depart from male-dominated industries. The majority of studies also report *organizational* commitment or turnover rather than *occupational* commitment or turnover. In other words, studies have investigated why women choose to leave their organization but not why they choose to leave an industry as a whole. Furthermore, only a handful of studies specifically addressing these factors within the construction industry have been published (Arcand 2016; Bigelow et al. 2017; Malone and Issa 2013, 2014; Menches and Abraham 2007; Morello et al. 2018; Wagner et al. 2013), none of which investigated actual turnover. This literature review draws on these studies, as well as research conducted within engineering, other STEM fields, and the general workforce.

The factor most commonly cited in the literature as influencing organizational commitment and turnover intentions is work-family culture. While this affects both men and women, women are disproportionately affected because of their primary role in basic and time-inflexible child-rearing activities (Musick et al. 2016). Work-life culture was defined by

Thompson and colleagues (1999) as "the shared assumptions, beliefs, and values regarding the extent to which an organization supports and values the integration of employees' work and family lives" and has since been proffered as one of the principal reasons why women leave, or think about leaving, their roles in both STEM and non-STEM related professions (Bilbo et al. 2014; Fouad et al. 2017; Giraldo 2010; Preston 2004; Singh et al. 2018). This holds true within the construction industry as well, in which inflexible work schedules and travel requirements were among the factors reported to cause conflict between women's professional and personal lives, resulting in job dissatisfaction, decreased organizational commitment, and increased turnover intentions (Bigelow et al. 2017; Malone and Issa 2013, 2014; Menches and Abraham 2007; Morello et al. 2018).

One might assume that motherhood is the driving force behind women's desire for greater work-life balance but, in truth, research has revealed that motherhood in itself is not sufficient to explain the conflict between work and family among women. Some researchers described marriage (with or without children) as a significant predictor of turnover intentions (Glass et al. 2013) whereas others have found no significant association between marital status and turnover intentions (Morello et al. 2018). Notably, Cha (2013) discovered that, in male-dominated industries, it was the joint effect of motherhood and the culture of overwork that caused the high turnover rates. In this longitudinal study, women who were mothers were 52% more likely to leave male-dominated industries than women who did not have children. Cha posited that the culture of overwork that is prevalent in many male-dominated industries reinforces gender segregation because women are less likely to maintain careers in fields in which overwork is the norm. Further support for this theory can be observed in the trends among men who were fathers in this same study. These men were 42% less likely to leave a male-dominated industry than other industries, signifying that men adhere to the norm of overwork in order to maintain their masculine image (Cha 2013).

The availability of work-family benefits (e.g., maternity and paternity leave, flexible working hours, opportunity for part-time schedules) has been shown to engender organizational commitment and reduce turnover intentions (Thompson et al. 1999), yet women still cite work-family conflict as a reason for departing the workforce. Studies have demonstrated that many women fear being penalized (through lower perceptions of organizational commitment among their supervisors, resulting in fewer promotions and less pay) for using benefits (Thompson et al. 1999), or have actively been discouraged from using such benefits by supervisors and managers (Fouad et al. 2017), which led to negative consequences on organizational commitment and turnover intentions (Thompson et al. 1999). However, when managers actively support a healthy and balanced work-life culture, turnover decreases (Fouad et al. 2016).

This leads to a second factor often cited in the literature as a significant predictor of organizational commitment and turnover intentions – perceived organizational support. Perceived occupational support describes the "global beliefs concerning the extent to which the organization values [an employee's] contributions and cares about their well-being" (Eisenberger et al. 1986) and includes historical and current experiences of trainings, development opportunities, and rewards (e.g., salary increases, promotions, recognition) (Singh et al. 2018; Wayne et al. 1997) as well as expressions of care such as social support, positive expectations, and non-discrimination (Glass et al. 2013; Pinto et al. 2014; Thompson et al. 1999). It has been proven to influence job satisfaction, organizational commitment, and turnover intentions among employees (Preston 2004; Singh et al. 2018; Wayne et al. 1997), as well as occupational commitment (Singh et al. 2018). In the construction industry, development opportunities and advancement, a type of reward, propagated loyalty and job satisfaction and decreased turnover among women (Bigelow et al. 2017; Malone and Issa 2013; Menches and Abraham 2007; Morello et al. 2018). Likewise, the lack of these organizational supports was correlated with increased turnover among women in male-dominated industries (Fouad et al. 2016, 2017). In a study of women in engineering, Singh et al (2013) detailed how developmental opportunities

increased organizational commitment and job satisfaction through a pathway of increased self-efficacy and outcome expectations. Outcome expectations, or the anticipated results of actions in which one engages, is a relatively new concept in the workplace retention field of study but has proven to be a valid construct influencing turnover intentions (Fouad and Guillen 2006). For example, Glass and colleagues (2013) postulated that the attitudes and expectations of others regarding the competencies of women, and thus the outcomes one may reasonably expect from successful completion of a task, may explain the large amount of turnover in STEM fields relative to non-STEM professions.

There is growing evidence that a distinction exists between the impact of perceived organizational support stemming from a supervisor and that from coworkers (Wayne et al. 1997), although the literature is not conclusive as to whether one is more important than the other. In a study among the general workforce, Thompson et al (1999) learned that managerial support decreased turnover intentions, whereas the support of coworkers had no effect. Similarly, discrimination by supervisors was often named as a provocation for women deciding to leave their positions in engineering (Fouad et al. 2017). Other studies, including those conducted in male-dominated fields such as construction, suggest that coworker support is also an important correlate of turnover intentions (Fouad et al. 2017; Malone and Issa 2013; Pinto et al. 2014). Conversely, in a landmark study by Fouad and colleagues (2016), the first study to compare factors influencing actual turnover among women in engineering, researchers discovered that perceived occupational support was not significantly related to persistence in the industry. This is consistent with another recent study which found that perceived occupational support was important but not sufficient to explain the high degree of turnover among women in male-dominated fields (Singh et al. 2018).

In an article published in *The Atlantic*, Kay and Shipman (2014) claim that a lack of confidence limits women in their search for equality in the workplace, a belief held by many scholars and laypersons alike. Researchers have, in fact, revealed that female engineers

experience and recognize a lack of confidence in themselves both as students and professionals (Giraldo 2010; Morello et al. 2018; Seron et al. 2018). In the context of this study, confidence can also be referred to as self-efficacy, defined as "the confidence one has in one's ability to complete a task or tasks related to one's goal" (Fouad and Guillen 2006). While some research has provided support for Kay and Shipman's (2014) assertion that confidence is influential by demonstrating that self-efficacy can increase job satisfaction (Wagner et al. 2013), Fouad et al (2016) found that women who persisted in engineering had similar self-efficacies as women who left the industry.

Another common perception is that the masculine nature of construction and other male-dominated industries and its subsequent hostility towards women is the reason for greater turnover among female employees. In fact, many studies have reported that the overtly masculine, "good ole boy" (Malone and Issa 2013) culture of construction, which may be embodied in conflict and aggression, sexual harassment, verbal abuse, or disrespect, is related to decreased organizational commitment and increased turnover intentions among women (Arcand 2016; Fouad et al. 2017; Malone and Issa 2013; Menches and Abraham 2007; Morello et al. 2018). According to the Society of Women Engineers, at least 30% of women who left the industry did so due to the organizational climate (Society of Women Engineers 2019).

Although research has yielded mixed results, mentoring is believed to play a role in women's turnover intentions. Some studies have found that mentoring programs for women in construction and STEM professions had a positive effect on job satisfaction and decreased turnover intentions (Arcand 2016; Kaminsky et al. 2012; Moir et al. 2011; Preston 2004) as a result of reducing isolation and enabling relationships and support networks (Fouad et al. 2017; Menches and Abraham 2007; Moir et al. 2011). However, there have been a number of studies which demonstrate that mentoring and participation in women-focused professional groups had no effect on the retention of women in construction and STEM professions (Glass et al. 2013; Morello et al. 2018).

Perceived or actual inequities in salary have also been suggested as a causative factor in women's turnover intentions in construction and STEM professions (Malone and Issa 2013; Menches and Abraham 2007; Preston 2004). However, Morello et al (2018) found that perceived equal pay was not significantly related to turnover intentions in construction. A plethora of other factors have also been cited in the literature as impacting commitment and turnover among women, including a lack of control or responsibility (Malone and Issa 2013; Pinto et al. 2014); disillusionment with the industry (Menches and Abraham 2007); lack of enjoyment or loss of interest in the work (Fouad et al. 2017; Morello et al. 2018); a mismatch of interests or values and job requirements (Fouad et al. 2017; Preston 2004); and "job hopping" due to dissatisfaction with an organization (Menches and Abraham 2007).

Ultimately, current research does not provide conclusive answers regarding what causes women to leave the construction industry. Work-family culture, perceived occupational support, confidence or self-efficacy, an overly masculine culture, mentoring, and perceived inequalities in pay have all been cited as factors in women's decisions to leave male-dominated industries, yet none are consistently linked to turnover or turnover intentions. These factors may be interrelated with one another (e.g., work-family culture and perceived occupational support), as well as with other variables less often or not studied (i.e., overwork). Notably, in the only study to directly compare women who persisted in engineering to those that left the industry, Fouad and colleagues (2016) found that most of these concepts were not significant in predicting persistence. Only managerial support of work-family balance and advancement opportunities were found to be significantly related to turnover among women engineers (Fouad et al. 2016). It is obvious that further research is needed to understand why women leave the construction industry if the retention of women is to be improved and workforce demands met (Hegewisch and O'Farrell 2014; Singh et al. 2013). This study contributes to the literature by providing an examination of the personal attributes of women in construction and organizational factors of their workplaces that encouraged persistence by comparing women who persisted in the industry with those who

did not, following Fouad's (2016) example. Furthermore, this was the first study to consider *occupational* turnover, as opposed to *organizational* turnover or turnover intentions, among women in construction. Based on existing literature, the researcher proposed the following null and alternative hypotheses:

$H1_0$: No difference will be observed between persisters and non-persisters in terms of self-efficacy and outcome expectations.

$H1_1$: One or more self-efficacy or outcome expectation measures will demonstrate a significant association with persistence among women in the construction industry.

$H2_0$: No difference will be observed between persisters and non-persisters in terms of perceived organizational support.

$H2_1$: One or more measures of perceived organizational support will demonstrate a significant association with persistence among women in the construction industry.

$H3_0$: No difference will be observed between persisters and non-persisters in terms of job satisfaction and occupational commitment.

$H3_1$: One or more measures of job satisfaction and occupational commitment will demonstrate a significant association with persistence among women in the construction industry.

METHODS

Procedure

The study population included women who attended the Groundbreaking Women in Construction (GWIC) conference held in San Francisco, California on May 23-24, 2019. A list of participants was obtained from conference administrators and a link to the quantitative survey, hosted on Qualtrics online platform, and brief introduction were sent to all participants (n=440) via email on

June 3, 2019. Additionally, members of online groups representing the National Association of Women in Construction were recruited through Facebook, LinkedIn, and Reddit. The same link and introduction to the survey were posted on these social media platforms and members could choose whether to participate or not. Participants were required to meet minimum criteria in order to be eligible for the study. Anyone meeting these criteria and consenting to participate in the survey after reading the written consent form (Appendix A) received the survey questionnaire. Specifically, inclusion criteria were age of 18 years or older, female, and currently or formerly employed in the construction industry. All data were collected in June 2019.

Participants remained anonymous throughout the data collection and analysis procedures; no identifying information was collected in the survey. Ethical approval for this study was obtained from the Oklahoma State University Institutional Review Board in June 2019.

Participants

In total, 147 participants began the survey. Sixteen (10.9%) did not provide information on their employment status in the construction industry and 3 (0.7%) reported having never worked in construction; these records were excluded from analysis. The final sample size was 128 participants, 108 of whom currently worked in construction (hereafter referred to as "persisters") and 20 of whom had previously worked in construction ("non-persisters"). Of the 20 non-persisters, 13 (65.0%) reported leaving the field less than 5 years ago and 5 (25.0%) reported leaving the field more than 5 years ago. Two (10.0%) participants did not respond to this question.

Most participants who provided demographic data attended college (n=56; 81.2%) with a median graduation year of 2003. The most popular major was engineering (n=43; 38.7%), including civil, architectural, mechanical, and other types of engineering, followed by construction management or another construction-related degree (n=22; 19.8%). Over half (n=76; 59.4%) reported their current or last position held within the construction industry as

construction management or operations, while 15.6% (n=20) worked in sales, business development, or other administrative position. Approximately 9% (n=11; 8.6%) of participants worked in the field as engineers or trade workers. Almost three-fourths (n=74; 74.7%) of participants reported working with mostly or all men, and less than 20% (n=16; 16.8%) reported that they had a female supervisor. Participants currently working in construction were generally similar to women who had left the industry, with a few exceptions (Appendix B). Persisters worked significantly more hours per week (M = 47.8 (persisters) v. 39.1 (non-persisters) hours; p = .001), had worked longer in their current industry (M = 13.6 v. 7.2 years; p = .04), received more promotions at their current organization (M = 1.6 v. 0.2; p = .01), and supervised more employees (M = 2.8 v. 1.7; p = .04) than non-persisters. However, none of these differences were surprising, as most can be attributed to the fact that non-persisters had changed careers and therefore had spent less time in their current industry.

Measures

Because of the similarities in the workplace demographics between engineering and construction (Banchefsky and Park 2018), and the fact that many engineering fields work within construction, a modified version of the survey reported in Fouad et al's (2016) study was used to assess the differences between female persisters and non-persisters in the construction industry. This quantitative survey was a compilation of several previously designed scales that were validated by Fouad and colleagues (2016) and included a total of 101 statements grouped into 14 scales (Appendix C) related to personal and organizational factors that were proposed to influence persistence, as well as demographic and work history variables described in the previous section. Participants rated their confidence or agreement with each statement using a 5-point Likert scale (1=strongly disagree to 5=strongly agree; 1=not at all confident to 5=very confident). Responses were then averaged within each of the 14 scales to obtain an overall mean for each participant, where higher values indicated stronger confidence or agreement. When necessary, responses

were reverse-coded to maintain this pattern. Cronbach's alpha (α) was calculated for each scale to determine the internal consistency, or reliability, of the scale and is reported here only when it did not meet the minimum acceptable threshold ($\alpha = .70$).

Construction Task Self-Efficacy

The construction task self-efficacy scale consisted of 20 statements which assessed participants' confidence for completing a variety of tasks commonly related to construction and construction project management. The statements were created using the task section of O*NET Online for construction and construction managers (U.S. Department of Labor 2019) and the researchers' knowledge and experience within the profession. Participants were asked to rank their level of confidence (or agreement that they have confidence) based on their current experience with the task, or how well they believed they would perform this task with the proper training. Example statements included "I'm confident that with the proper training, I can inspect and review projects to monitor compliance with building and safety codes and other regulations" and "I'm confident that with the proper training, I can take actions to deal with the results of delays, bad weather, or emergencies at the construction site."

Organizational Self-Efficacy

Organizational self-efficacy was measured using 17 statements adapted from a previous survey (Fouad et al. 2016) and explored how confident participants were in navigating the culture of their current organization. Statements included "I am confident that I can build relationships with influential people at work" and "I am confident that I know where to go for support if I encounter interpersonal problems at work."

Construction Task Outcome Expectations

Outcome expectations associated with performing construction and construction management tasks was assessed using 11 statements such as "If I perform my job tasks well, then I will earn the respect of my coworkers" and "When I perform well at my job, then I am more satisfied with my life." These statements were modified from Fouad et al's (2016) study with female engineers. Reliability coefficients exceeded the minimum threshold for persisters ($\alpha = .86$) but was slightly below the threshold of .70 for non-persisters ($\alpha = .65$).

Organizational Outcome Expectations

Additionally, outcome expectations related to successful navigation of participants' organization was measured using 9 items that were modified from a previous survey (Fouad et al. 2016). These statements included "If I establish a good support network at work, then I will be happy" and "If I am sincere and genuine in my interactions, my colleagues will like me more."

Managerial Support for Work-Life Balance

This scale, consisting of 4 statements describing managerial support for a healthy work-life balance, was initially developed by Thompson and colleagues (1999) and adapted by Fouad et al (2016) for her study of female engineers. This study further adapted the scale to be relevant for the construction industry. Example statements included "In general, managers in this organization are quite accommodating of family-related needs" and "Middle managers and executives in this organization are sympathetic toward employees' childcare responsibilities."

Organizational Time Demands

Similar to the previous scale, this measure attempted to quantify factors influencing work-life balance using adaptations from previous studies (Fouad et al. 2016; Thompson et al. 1999).

However, this scale focused on organizational time demands using 5 statements such as "In this organization, it is very hard to leave during the workday to take care of personal or family matters" and "To get ahead at this organization, employees are expected to work more than 50 hours a week, whether at the workplace or at home."

Developmental Experiences

The developmental experiences scale consisted of 4 statements first developed by Wayne et al (1997) and associated with participants' perceptions of the degree to which they were provided support for development and training. Statements included "Regardless of my company's policy on training and development, my supervisors make a substantial investment in me by providing formal training and development opportunities" and "In the positions I have held within the company, I have often been given additional challenging assignments."

Career Identity

In a pilot study to develop a scale measuring occupational commitment, Carson and Bedeian (1994) delineated three separate aspects: career identity, career planning, and resilience. As in Fouad's (2016) study, we modified these items to include construction terminology and concepts. The career identity scale attempted to measure the degree to which participants identified with their construction career and consisted of 4 statements, including "Construction is an important part of who I am" and "The construction field has a great deal of personal meaning to me."

Career Planning

The career planning scale was modified from the same study as above (Carson and Bedeian 1994; Fouad et al. 2016) and measured participants' responses to 4 items related to their future goals and plans within the construction industry. Example items included "I have created a plan for my

development in the construction field" and "I do not identify specific goals for my development in the construction field."

Career Resilience

The final scale adapted from the Carson and Bedeian (1994) study assessed career resilience by asking participants to rate their level of agreement with 4 statements related to their perception of the impact of the negative aspects of working in the construction industry, without naming what those aspects were. Statements included "The costs associated with working in the construction field sometimes seen too great" and "Given the problems in construction, I sometimes wonder if the personal burden is worth it."

Career Satisfaction

The career satisfaction scale was originally developed by Greenhaus, Parasuraman, and Wormley (1990) to measure the extent to which participants felt satisfied with their career. Five statements including "I am satisfied with the progress I have made toward meeting my overall career goals" and "I am satisfied with the progress I have made toward meeting my goals for the development of new skills" were used for this scale.

Expectations of Finding Alternative Employment

Turnover intentions were measured using three scales, the first of which was expectations of finding alternative employment. This scale was assessed using 3 statements measuring participants' beliefs about finding another job that was equal to or better than their current position (Peters et al. 1981), including "It is possible for me to find a better job than the one I have now," There is no doubt in my mind that I can find a job that is at least as good as the one I have now," and "Acceptable jobs can always be found." Reliability coefficients for this scale

were quite low for both persisters ($\alpha = .67$) and non-persisters ($\alpha = .23$), and was therefore not used in analysis.

Job Search Behaviors

Another aspect of turnover intentions was measured using the job search behavior scale (Peters et al. 1981), which included 4 statements such as "I often follow up on job leads" and "I often look at newspaper and/or online ads for new jobs." This scale attempted to measure the degree to which participants searched for alternative employment.

Turnover Intentions

The final aspect of turnover intentions included 7 statements comprising the turnover intentions scale. This scale focused on participants' intentions to leave their organization or the construction industry as a whole. Example statements included "I often think about quitting construction" and "I've decided to quit this organization." Reliability coefficients exceeded the minimum threshold for persisters ($\alpha = .89$) but was slightly lower than the .70 threshold for non-persisters ($\alpha = .62$).

Analysis

Following the example of Fouad and colleagues (2016), the 14 scales described above were grouped into three models based on the social cognitive career theory and the career change theory. In each model, persistence of women in the construction field was included as a binary independent variable. Model 1 assessed the role of self-efficacy and outcome expectations on persistence and included the scales of construction task self-efficacy, organizational self-efficacy, construction task outcome expectations, and organizational outcome expectations (Hypothesis 1). Model 2 evaluated the impact of various types of perceived organizational support, including

managerial support for work-life balance, organizational time demands, and developmental experiences (Hypothesis 2). Model 3 measured the effect of job satisfaction and occupational commitment on persistence, and included career identity, planning, resilience, and satisfaction, job search behaviors, and turnover intentions (Hypothesis 3). Mean scores and standard deviations were calculated for persisters and non-persisters on each scale, and Pearson's correlations (r) were calculated for each pair of scales within a model.

Multivariate analysis of variance (MANOVA) tests were also conducted for each model to determine whether the scales were significantly correlated to persistence. If the MANOVA was significant ($p < .05$), post-hoc individual analysis of variance (ANOVA) tests were used to determine which of the scales demonstrated a significant difference between persisters and non-persisters. Box's M was used to verify the assumption of homogeneity of variance between groups and was considered significant at $p < .001$. Using the scales which were significant in MANOVA and ANOVA testing, two binomial logistic regression models were constructed where persistence was included as the dependent variable. The first model contained only the significant scales whereas the second model contained the scales and demographic and work history variables reported to significantly differ between groups (i.e., hours worked per week, years in current industry, total number of promotions at current organization, and number of employees supervised). Finally, adjusted odds ratios (aORs) were calculated for the significant variables in the best-fitting regression model.

RESULTS

Means, standard deviations, Pearson correlations (r), and reliability coefficients (α) for each scale are shown in Table 1. Pearson correlation estimates showed that most measures were moderately correlated, thus indicating that MANOVA was an appropriate statistical method. Reliability

Table 1

Means, standard deviations, Pearson correlations, and reliability coefficients for persisters and non-persisters[†]

		Scale	Mean	S.D.	1	2	3	4	5	6	7
Model 1	1	Construction task self-efficacy	4.13 (4.10)	0.73 (0.62)	**0.96 (0.96)**	0.19	-0.07	0.01			
	2	Organizational self-efficacy	4.00 (4.52)	0.62 (0.40)	*-0.32*	**0.92 (0.88)**	0.27*	0.25*			
	3	Construction task outcome expectations	4.09 (3.99)	0.56 (0.37)	*0.08*	*0.01*	**0.86 (0.65)**	0.71***			
	4	Organizational outcome expectations	3.92 (4.06)	0.57 (0.46)	*0.49*	*-0.10*	*0.01*	**0.79 (0.79)**			
Model 2	1	Managerial support for work-life balance	3.79 (3.28)	0.97 (1.09)	**0.90 (0.96)**	0.70***	0.34**				
	2	Organizational time demands	3.44 (3.18)	1.09 (1.10)	*-0.08*	**0.89 (0.82)**	0.24*				
	3	Developmental experiences	3.61 (3.65)	0.94 (0.71)	*0.80***	*-0.15*	**0.89 (0.72)**				
Model 3	1	Career identity	3.66 (2.08)	0.82 (1.31)	**0.89 (0.93)**	0.27*	0.28*	0.19	-0.06	-0.03	-0.32**
	2	Career planning	3.55 (2.54)	0.91 (1.35)	*0.62**	**0.84 (0.90)**	0.15	0.37**	0.07	-0.14	-0.30**
	3	Career resilience	3.23 (1.52)	1.05 (0.92)	*0.36*	*0.57*	**0.87 (0.83)**	0.41***	-0.25*	-0.31**	-0.56***
	4	Career satisfaction	3.50 (3.61)	0.94 (0.94)	*0.30*	*0.26*	*0.19*	**0.90 (0.91)**	-0.32**	-0.47***	-0.56***
	5	Expectations of finding alternate employment	3.37 (3.11)	0.90 (0.59)	*-0.45*	*-0.57*	*-0.74***	*-0.54*	**0.67 (0.23)**	0.21	0.30**
	6	Job search behaviors	2.52 (2.54)	1.17 (1.02)	*0.06*	*0.07*	*-0.32*	*-0.36*	*0.57*	**0.93 (0.95)**	0.66***
	7	Turnover intentions	2.14 (2.21)	0.91 (0.61)	*-0.71***	*-0.67**	*-0.60**	*-0.29*	*0.36*	*-0.32*	**0.89 (0.62)**

[†]Means and standard deviations of each item are shown for persisters and (non-persisters). Pearson correlations between items are shown for persisters and *non-persisters*, while reliability coefficients for persisters and (non-persisters) are shown in bold.
*p<0.05; **p<0.01; ***p<0.001

coefficients demonstrated adequate reliability of the measures with the exception of expectations of finding alternative employment, as discussed above.

Model 1

This model tested the multivariate relationship between persistence and four items of self-efficacy and outcome expectations: construction task self-efficacy, organizational self-efficacy, construction task outcome expectations, and organizational outcome expectations. The assumption of homogeneity of variance was upheld by Box's *M* (*M* = 13.71; F = 1.36; *p* = .19) and MANOVA results indicated a significant difference between persisters and non-persisters in terms of these four measures (Wilk's $\lambda = 0.88$; F(4, 88) = 2.95; *p* = .02). Post-hoc ANOVA tests were conducted with each measure and only organizational self-efficacy demonstrated a significant difference between persisters and non-persisters (F = 7.95; *p* <.01) (Table 2).

Table 2

Analysis of variance (ANOVA) results from Model 1 comparing persisters and non-persisters

Scale	Mean (SD) among persisters	Mean (SD) among non-persisters	F	df	*P*
Construction task self-efficacy	4.13 (0.73)	4.10 (0.62)	0.02	1	0.87
Organizational self-efficacy	4.00 (0.61)	4.52 (0.40)	7.95	1	0.00
Construction task outcome expectations	4.09 (0.56)	3.99 (0.37)	0.34	1	0.56
Organizational outcome expectations	3.92 (0.57)	4.06 (0.46)	0.65	1	0.42

Model 2

The second model tested the multivariate relationship between persistence and three scales associated with perceived occupational support: managerial support for work-life balance, organizational time demands, and developmental experiences. The assumption of homogeneity of variance was upheld by Box's *M* (*M* = 19.87; F = 3.30; *p* = .003). Results of the MANOVA test showed a non-significant relationship between persistence and perceived occupational support (Wilk's $\lambda = 0.96$; $F(3, 85) = 1.13$; $p = .34$). No further analyses were conducted on these three scales and we accepted the null hypothesis for H2.

Model 3

The final model tested the multivariate relationship between persistence and items related to job satisfaction and occupational commitment: career identify, career planning, career resilience, career satisfaction, expectations of finding alternate employment, job search behaviors, and turnover intentions. The assumption of homogeneity of variance was upheld by Box's *M* (*M* = 34.95; F = 1.63; *p* = .03). Because the reliability coefficient of the expectations of finding alternate employment scale did not meet the minimum acceptable threshold, this scale was eliminated from the model. MANOVA results for a model that included the remaining six indicators demonstrated a significant difference between persisters and non-persisters (Wilk's $\lambda = 0.51$; $F(6, 81) = 12.59$; $p = .000$). Post-hoc ANOVA tests revealed that career identity (F = 31.85; *p* = .000), career planning (F = 11.10; *p* = .001), and career resilience (F = 28.43; *p* = .000) were significantly correlated with persistence (Table 3).

Logistic Regression Models

MANOVA testing of the three models found four scales that were significantly related to persistence of women in construction: organizational self-efficacy, career identity, career

Table 3

Analysis of variance (ANOVA) results from Model 3 comparing persisters and non-persisters

Scale	Mean (SD) among persisters	Mean (SD) among non-persisters	F	df	*P*
Career identity	3.66 (0.82)	2.08 (1.31)	31.85	1	0.00
Career planning	3.55 (0.91)	2.54 (1.35)	11.10	1	0.00
Career resilience	3.23 (1.05)	1.52 (0.92)	28.43	1	0.00
Career satisfaction	3.50 (0.94)	3.61 (0.94)	0.16	1	0.69
Job search behaviors	2.52 (1.17)	2.54 (1.02)	0.01	1	0.94
Turnover intentions	2.13 (0.91)	2.21 (0.61)	0.08	1	0.77

planning, and career resilience. Results of the binomial logistic regression model including each of these indicators as independent variables and persistence as the binary dependent variable is shown in Table 4. The binomial logistic regression model significantly predicted persistence among women in construction (χ^2 (4) = 44.37; p = .000). The Homer-Lemeshow test for goodness of fit indicated that this model was a good fit (H-L (8) = 9.02; p = .34) and the Nagelkerke / Cragg & Uhler pseudo R^2 suggested that 71.8% of the variance in persistence was explained by the predictors. In this model, organizational self-efficacy and career resilience were shown to be significant predictors of persistence. Specifically, for each unit of increase in organizational self-efficacy (using a five-point Likert scale), the odds of persistence decreased by 5% (*a*OR = 0.05; 95% CI: 0.00 – 0.51; p = .01) and, for each unit of increase in career resilience, the odds of persistence increased almost sevenfold (*a*OR = 6.82; 95% CI: 1.50 – 31.08; p = .01). Thus, we rejected the null hypothesis for H1 and accepted the alternative hypothesis that one or more measures of self-efficacy or outcome expectations were significantly associated with persistence. We also rejected the null hypothesis for H3 and accepted the alternative hypothesis that one or more measures of job satisfaction or occupational commitment were significantly associated with persistence.

Table 4

Binomial logistic regression model predicting persistence among women in construction

Scale	*a*OR	Coefficient	Std Error	Wald statistic	*P*
Organizational self-efficacy	0.05	-3.01	1.19	-2.52	0.01
Career identity	2.80	1.03	0.55	1.88	0.06
Career planning	0.90	-0.11	0.61	-0.18	0.86
Career resilience	6.82	1.92	0.77	2.48	0.01
Constant	1770.74	7.47	4.80	1.56	0.12

A second regression model that included potential demographic and work history confounders (hours worked per week, years in current industry, total number of promotions at current organization, and number of employees supervised) was also considered (Table 5). While it significantly predicted persistence among women in construction (χ^2 (8) = 55.41; p = .000) and had an adequate goodness of fit (H-L (8) = 2.00; p = .98), the variance attributed to the predictors (78.7%) in this model did not improve greatly and the simpler model was used.

Table 5

Binomial logistic regression model (including demographic and work variables) predicting persistence among women in construction

Scale	*a*OR	Coefficient	Std Error	Wald statistic	*P*
Organizational self-efficacy	0.02	-3.68	2.31	-1.59	0.11
Career identity	5.42	1.69	0.99	1.71	0.09
Career planning	0.77	-0.25	0.91	-0.28	0.78
Career resilience	10.98	2.40	1.29	1.85	0.06
Hours worked per week	1.20	0.18	0.11	1.72	0.09
Years in current industry	0.99	-0.01	0.07	-0.16	0.87
Total # of promotions at current organization	1.78	0.58	0.79	0.73	0.47
# of employees supervised	1.80	0.59	0.66	0.89	0.37
Constant	0.12	-2.10	8.68	-0.24	0.81

DISCUSSION

This was the first study within the construction industry to assess the influence of personal and organizational factors on turnover behaviors, rather than turnover intentions, among women working in the industry, and the first to directly compare women who persisted in construction to those who had left in order to better understand why the retention of women in the industry remains difficult. We explored the relationship between persistence and self-efficacy, outcome expectations, perceived organizational support, job satisfaction, and occupational commitment and found two factors that seem to influence persistence among women in construction: organizational self-efficacy and career resilience (a measure of occupational commitment). These factors are discussed in more detail in this section, along with study limitations and implications for future research.

Current literature suggests that high self-efficacy and outcome expectations lead to increased job satisfaction and organizational commitment and reduced turnover intentions (Singh et al. 2013; Wagner et al. 2013). This study found that, of the four factors measured, only organizational self-efficacy (participants' beliefs about how well they can navigate the culture of their organization) showed a significant association with persistence among women in construction, which is somewhat consistent with Fouad et al's (2016) finding that self-efficacy and outcome expectations were not related to turnover among female engineers. Surprisingly, increased organizational self-efficacy resulted in *decreased* persistence, wherein each unit of increase in self-efficacy caused a 5% decrease in the odds of persisting in the industry. In other words, women with the highest degree of organizational self-efficacy were 20% less likely to remain in construction than women with the lowest degree of organizational self-efficacy. It is unclear why this pattern emerged, but we theorize that perhaps women who are able to confidently navigate the culture and politics of their current organization feel that they can also be successful elsewhere. When they become disillusioned or unsatisfied with their current position or organization, they are more likely to leave than women who may be uncertain in their ability to

navigate a new organization. Further study is needed to verify this theory and explore other possible reasons for the negative relationship between self-efficacy and persistence among women in construction.

Contrary to previous research (Preston 2004; Singh et al. 2018; Wayne et al. 1997), we found that none of the measures of perceived organizational support had a significant influence on persistence. Fouad et al (2016) reported that, among female engineers, managerial support for work-life balance and training and development opportunities were the only two factors that impacted women's decisions to remain in the industry. Despite using similar measures and methodology, we did not have similar results. Furthermore, previous research has posited that organizational time demands negatively affect job satisfaction and organizational commitment within construction (Bigelow et al. 2017; Malone and Issa 2013, 2014; Menches and Abraham 2007; Morello et al. 2018) and the culture of overwork in male-dominated industries contributes to turnover (Cha 2013). Yet, this study found no significant relationship between time demands and turnover.

Finally, career resilience, a measure of occupational commitment, was found to have significantly positive association with persistence among women in construction, consistent with previous research (Cha 2013; Peters et al. 1981; Singh et al. 2013). Namely, for each unit of increase in resilience, the odds of persistence increased almost sevenfold. Career identity, planning, and resilience were all initially found to be associated with persistence, but regression modeling revealed that career resilience was the most important of these factors, as identity and planning were no longer significant in the multivariate model. These findings suggest that, even if women have a strong emotional connection with construction (identity) and have set goals for their training, development, and growth within the industry (planning), these may be overshadowed by the negative aspects, costs, or discomforts of working in construction. It is only resilience, defined as the ability to "resist career disruption in the face of adversity" (Carson and Bedeian 1994), that drives women to persist in their careers. Prior research has demonstrated that

resilience is associated with both neurobiological and psychosocial factors, indicating that, although some individuals may inherently have more resilience than others, it is a skill that can be developed through appropriate intervention and training (Southwick et al. 2011).

CONCLUSIONS AND RECOMMENDATIONS

This study builds on prior research conducted with women working in the construction industry by assessing the personal and organizational factors related to persistence in the industry. Two factors were found to be significantly associated with persistence among women in construction. First, higher organizational self-efficacy reduced the odds of persistence. Second, women with higher career resilience were more likely to persist in construction. To date, this is the first study to provide such quantitative evidence within the construction field. Results suggest that resilience may be an effective target for intervention in order to increase women's retention in the construction industry. Further research is needed to better understand the relationship between organizational self-efficacy and persistence among women in construction.

Limitations

The main limitation of this study was the small sample size of women classified as non-persisters (n=20). Statistical analysis revealed an overall lower reliability coefficient for scales when analyzing responses for non-persisters; two scales retained in the models (construction task outcome expectations and organizational turnover intentions) had Cronbach's α values less than the generally accepted threshold of $\alpha = .70$. Additionally, a power analysis showed a somewhat low power (68%) for hypothesis testing. The small sample size of non-persisters is likely a result of the sampling strategy employed for this study. It disproportionately recruited women still working in construction and did not provide adequate opportunities to reach women who had already left the industry.

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CHAPTER III

ANALYZING PERCEIVED IMPLICIT GENDER BIAS IN THE CONSTRUCTION WORKPLACE

ABSTRACT

The construction industry is projected to grow over the coming years and the demand for qualified workers will increase. Historically, the industry has failed to recruit and retain women, who account for less than 10% of the construction workforce. Federal policies and industry strategies for fostering the inclusion of women have been ineffective and have perpetuated the culture of sexism and discrimination and fueled negative stereotypes of women as qualified workers. Understanding women's experiences of these gender biases in the construction workplace are essential to improve their representation in the industry. This study aimed to determine the extent to which five types of implicit gender bias (prove-it-again, tightrope, maternal wall, tug-of-war, and isolation) occur within the construction workplace by comparing reports from both men and women currently working in the industry. A greater proportion of women than men agreed with statements used to assess implicit gender bias, demonstrating that each of the five types of bias were present in the construction industry and that prove-it-again bias was found to be the most common type of implicit gender bias experienced by women. Bivariate analysis and multivariate regression models showed that race was not a significant predictor of

implicit gender bias; women of color and white women reported experiences of bias in similar proportions.

INTRODUCTION

The construction industry has been expanding for many years and is expected to continue growing over the next decade (Center for Construction Research and Training 2007). The U.S. Bureau of Labor Statistics (2019c) projects that construction occupations will grow by almost 10% between 2018 and 2028, a rate twice that of the overall projected job growth rate (5.2%). However, the construction industry has experienced a concurrent "widespread and significant shortage" in workers, specifically among project management and skilled positions, over the past two decades (Associated General Contractors of America 2018; Education and Training Administration 2004; Grossman 2005; Stockbridge 2018). Women represent the largest untapped resource for additional workers and, while they have made some progress in penetrating this male-dominated industry since the 1980s, they remain underrepresented. In 2018, women accounted for only 9.9% of the overall construction workforce (Bureau of Labor Statistics 2019a; Women's Bureau 2018) and only 7.9% of construction managers (Bureau of Labor Statistics 2016; Women's Bureau 2018). Over half (52%) of the women employed in construction served in administrative or support positions (Center for Construction Research and Training 2007; Goss-Graves et al. 2014).

In order to increase the proportion of women in the construction industry and meet workforce demands, many federal policies, such as the Workforce Investment Act of 1998, Workforce Innovation and Opportunity Act of 2014, and other affirmative action measures were established. However, these policies and the programs they inspired have done little to improve the representation of women in construction (Arcand 2016; Goss-Graves et al. 2014; Hegewisch et al. 2014). Some researchers argue that they have, in fact, done more harm than good by

perpetuating the culture of sexism and discrimination in the industry and fueling stereotypes that women are not qualified for skilled positions (Moir et al. 2011; Seron et al. 2018; Williams et al. 2016). Similarly, industry efforts to foster the inclusion of women have been met with resistance from men seeking to maintain the current, male-dominated nature of the industry (Schleifer 2002; Sewalk and Nietfield 2013).

Prior research on the experiences of women working in construction are limited; existing literature primarily focuses on recruitment and retention in academia. Yet if progress is to be made, we must better understand the experiences of women currently working in the industry, particularly in terms of the gender bias they encounter. This chapter discusses the available research from the construction industry as it relates to women's experiences of gender bias in the workplace, as well as relevant studies from engineering and other male-dominated fields. It also describes a study that was conducted with both male and female construction workers to estimate the frequency with which different types of gender bias occurs. The aim of this study is to identify opportunities for intervention by individual construction organizations as well as the industry at large.

BACKGROUND AND LITERATURE REVIEW

Much research has been generated regarding explicit bias against women in the workplace. Boysen (2009) defined explicit biases as "conscious, intentional biases… [consisting of] negative beliefs, judgements, and stereotypes." These include unequal compensation, sexual harassment and discrimination, and negative attitudes about women's abilities or skills. Multiple sources report that women in construction are paid between 4-19% less than their male counterparts (Boysen 2009; Center for Construction Research and Training 2007; Choi et al. 2018) and the U.S. Bureau of Labor Statistics (2019b) showed that, in 2018, female construction managers earned 18% less than male construction managers. Sexual harassment, discrimination, hostility, and intimidation continue to be common experiences for women in construction (Goss-Graves et

al. 2014; Moir et al. 2011; Stockbridge 2018), with as many as 31% of women reporting frequent experiences of sexual harassment by coworkers or supervisors (Hegewisch and O'Farrell 2014; Williams et al. 2016) and others reporting sexually suggestive gestures and "locker room talk" as behaviors widely accepted in the industry (Stockbridge 2018). Often, these behaviors are dismissed as "men being men" by supervisors and human resources departments (Hunte 2016). In a qualitative study of women who had left engineering, Fouad and colleagues (2017) found that discrimination was a key factor in their decision to leave, which is consistent with other research documenting perceptions of inequitable hiring practices, assignments, and promotions among women in construction and engineering (Hegewisch and O'Farrell 2014). In addition, women described discrimination by their supervisors in not providing appropriately fitting safety equipment (Wagner et al. 2013), indicating a deprioritization of women's safety in the workplace.

However, these types of explicit biases are less socially acceptable in current society, and numerous studies have demonstrated that people often do not recognize or admit their own biases (Boysen 2009; Pinto et al. 2017; Wagner et al. 2013). For example, when asked directly about working with subordinates, participants playing the role of manager in an experimental study reported having no gender preference for their employees but interacted with male and female candidate profiles differently in the second portion of the experiment (Kaiser and Spalding 2015). Researchers have recently begun to investigate the presence and impact of another category of bias – implicit bias – on women's experiences in the workforce. Implicit bias is defined as "discriminatory biases based on implicit attitudes or implicit stereotypes," which are the result of "unconscious mental processes… of social perception, impression formation, and judgment" (Greenwald and Krieger 2006). In other words, implicit biases are stereotypes that a person holds without consciously knowing of their existence. In her seminal work on gender bias in engineering, Williams classified the implicit biases that women face into five main categories: prove-it-again, tightrope, maternal wall, tug-of-war, and isolation bias (Williams 2015; Williams and Dempsey 2014).

Prove-it-again bias requires women to prove themselves repeatedly in order to be seen as equally competent to men (Williams and Dempsey 2014). Pinto and colleagues (2017) referred to this as a "social category bias" in which a woman is unable to be perceived as equally qualified as male candidates, an effect that occurs particularly in male-dominated fields. A number of studies in construction and engineering have collected reports of women feeling that they must prove they are competent and have a right to be there (Goss-Graves et al. 2014; Hunte 2016) or that they are not valued or respected as a member of the team (Fouad et al. 2017; Malone and Issa 2013; Williams et al. 2016), as well as evidence that coworkers and subordinates perceive women as less competent than men (Hunte 2016; Pinto et al. 2017; Williams et al. 2016). In a large study comparing the workplace experiences of male and female engineers, women ranked significantly higher on almost every measure of prove-it-again bias (Williams et al. 2016). Specifically, 65% of women stated that they have to prove themselves repeatedly to get the same level of respect and recognition as their colleagues, in comparison to only 35% of white men. Likewise, after moving from an engineering role into a project management role, 62% of women reported that people assumed they did not have technical skills whereas only 37% of men experienced similar stereotypes. Women engineers also described being mistaken for administrative staff or technicians (45%) much more often than white male engineers (9%) (Williams et al. 2016), a finding that is supported by previous qualitative studies (Giraldo 2010). Ultimately, women believed that they were held to higher standards significantly more often than white men (Williams et al. 2016). Even after controlling for other variables in regression models, these measures of prove-it-again bias remained significantly more prevalent among women than men (Williams et al. 2016).

In-group favoritism and stereotype expectancy are critical components of prove-it-again bias. Williams and colleagues (2016) claimed that men are judged on potential and women are judged on performance. When men are judged on potential, they benefit from the high expectations placed on them by supervisors. High expectations attribute good performance to

internal qualities of the individual and poor performance to external factors, whereas low expectations work in the opposite way – poor performance is attributed to internal qualities and high performance to external factors or luck (Wayne et al. 1997; Williams et al. 2016). High expectations also lead to more challenging roles, tasks, and training opportunities (Wayne et al. 1997), which ultimately creates a self-fulfilling prophecy in which employees who had high expectations placed on them (i.e., men) perform at a higher level than employees who had low expectations placed on them (i.e., women), and therefore have more opportunities for development and advancement.

When women are judged on their potential yet fail to meet the normative expectations of the industry, this is considered proof of their lack of fit. For example, when women can no longer meet the demands of long hours and overwork after having children, they are considered to be unfit for the requirements of the job, despite their previous work record (Williams et al. 2016). Another example of this was explored in a study by Pinto, Dawood, and Pinto (2014). Female project managers experienced emotional exhaustion as a sign of burnout more frequently than male project managers, who often experienced cynicism as a sign of overwork. Because exhaustion is easier to identify and recognize as a sign of burnout than is cynicism, Pinto et al (2014) claimed that women are more likely to be perceived as a poor fit for the demands of project management, even if they experience burnout at the same rates as men.

These biases may present themselves in hostile ways, as described above, or in "benevolent" ways (Hunte 2016). In benevolent sexism, paternalistic beliefs about women's abilities motivate men to offer assistance in completing tasks or to prevent women from attempting certain tasks (e.g., lifting heavy objects) due to their womanhood, which can then make women appear incompetent or lazy to coworkers and supervisors (Denissen 2010). These low expectations of women's competence and skill may also undermine their confidence and self-efficacy, as women have often been shown to attribute their success to luck and negative outcomes of their actions to internal factors (Denissen 2010; Kay and Shipman 2014).

A second type of implicit bias women often experience is tightrope bias and stems from assumptions about how women should behave, a much narrower range of behavior than is deemed acceptable for men (Kay and Shipman 2014; Williams and Dempsey 2014). Women must constantly navigate pressures to behave in stereotypically feminine ways while fulfilling the expectations of a male-dominated industry without seeming too masculine (Williams et al. 2016). In other words, women must "walk a tightrope" (Williams et al. 2016) between being perceived as too feminine or too masculine. If women are too feminine, they risk being disrespected, and if they are too masculine (i.e., assertive), women are often disliked (Williams and Dempsey 2014; Williams et al. 2016). Women reported being advised and pressured by coworkers and supervisors to act or dress in less feminine ways (Giraldo 2010; Williams et al. 2016) and attempted to avoid tasks that could be perceived as womanly (e.g., cleaning the job site) to avoid being stereotyped (Hunte 2016). However, there is evidence that, when women follow this advice and adopt more stereotypically masculine behaviors, or violate the traditional feminine stereotypes, they receive disapproval, rejection, and negative feedback (Heilman and Okimoto 2007; Morello et al. 2018; Williams et al. 2016). In Williams's (2016) study of engineers, female engineers were significantly less likely than white men to say that they could behave assertively or show anger without negative reaction or repercussion. Tightrope bias is further exacerbated by the fact that male coworkers and supervisors may interpret the same action (e.g., cursing) differently depending on their own beliefs and prejudices (Denissen 2010), resulting in even more difficulty for women navigating this tightrope of appropriate behavior.

In addition, being successful in a male-dominated field or stereotypically masculine role often implies that feminine stereotypes have been violated, regardless of the actual behavior of the women (Heilman and Okimoto 2007). Research demonstrated that female managers were perceived as less likeable, less desirable, and more hostile than male managers, even when the same information was provided to participants and only the gender of the subject changed.

Interestingly, this occurred among both male and female participants, suggesting that both sexes adhere to gender norms and prescriptive behaviors (Heilman and Okimoto 2007).

Denissen (2010) argued that gender identity is a tool that women can use to navigate bias in various situations in construction. She proposed that women do not adhere to one category of behavior (i.e., masculine or feminine), but that women can utilize different tactics to overcome bias depending on the situation. Three types of tools she described in her research include challenging gender differences when men ascribe lack of fit to one's gender (e.g., adopting masculine behaviors as women), challenging gender status differences when men perceive unimportant differences as critical for job success (e.g., embracing femininity and demanding respect as a woman), and suppressing gender meanings when men use gender to make distinctions among employees (e.g., appealing to shared identities or beliefs) (Denissen 2010).

A third type of bias experienced by women is maternal wall bias. It consists of the belief that motherhood deems women less committed and less competent as a worker, and that mothers should spend more time with their families than at work (Williams and Dempsey 2014; Williams et al. 2016). While parenthood can affect perceptions of men as well, fathers exhibit much less opportunity for bias than mothers, as mothers remain disproportionately responsible for basic and time-inflexible child-rearing activities (Musick et al. 2016). Almost 80% of men stated that having children did not change colleagues' perceptions of their work or competence, whereas only 55% of women reported the same (Thompson et al. 1999; Williams et al. 2016). Employers assume that women will request both maternity leave and increased amounts of time off after childbirth to care for children, and subsequently provide fewer development and advancement opportunities to women early in their careers (Preston 2004). Furthermore, the literature indicates that promotions are largely related to a supervisor's perception of the employee's commitment (Malone and Issa 2014). Women understand this and often fear the stigma and penalties of using family benefits (Thompson et al. 1999; Williams et al. 2016). Only half of women engineers

agreed that asking for family leave or flexible work arrangements would not hurt their careers, compared to almost two-thirds of men engineers (Williams et al. 2016).

Maternal wall bias stems from the stereotype that mothers cannot fulfil the "ideal worker" role due to their family obligations (Singh et al. 2018; Williams et al. 2016) or societal expectations that women behave as the "ideal mother," taking care of their children's (and husband's) needs above all else (Cha 2013; Singh et al. 2018; Williams et al. 2016). These conflicts between work and family are typically expected to be resolved on an individual basis, instead of through company policy, which Cha (2013) argued will always favor men. In fact, research explains that women leave their jobs not because of the demands of motherhood itself but due to the attitudes held by employers regarding their commitment to the organization (Cha 2013; Williams et al. 2016).

The fourth type of bias Williams and colleagues (Williams and Dempsey 2014; Williams et al. 2016) describe is tug-of-war bias. Tug-of-war bias is unique in that it occurs *among* women who adopt different strategies for navigating or overcoming gender bias. Research suggests that this occurs primarily in male-dominated environments, such as construction, that threaten women's gender identity (Kaiser and Spalding 2015). In a laboratory study, women who identified weakly with their gender were more likely to hinder the advancement of other women by giving less helpful clues for success (Kaiser and Spalding 2015), indicating that at least some women align themselves more closely with men and, as a result, actively seek to thwart other women's success. Women may also use "strategic distancing" (Williams et al. 2016) to create a gap between them and other women in the workplace to avoid having their gender seen as a disadvantage (Moir et al. 2011; Williams et al. 2016). This can also occur subconsciously as women attempt to assimilate into male work cultures or to achieve the token female role (Williams et al. 2016). It should be noted that this type of gender bias is fueled by the other biases experienced by women and their reaction to it (i.e., assimilating too little or too much), and may be more difficult to detect (Kaiser and Spalding 2015; Williams et al. 2016).

Williams (2015) described an additional type of bias, isolation bias, which is most often experienced by women of color. This can be a result of exclusion by colleagues and supervisors in networking programs or events (Stockbridge 2018), training opportunities, and social exchanges, as well as self-imposed through social distancing (Williams 2015).

These five types of implicit biases have largely been studied in laboratory or experimental conditions rather than the actual workplace. Although they have been well defined by Williams and studied in the context of engineering (Williams 2015; Williams et al. 2016), no research in the construction workplace has been conducted to provide evidence for the prevalence of implicit gender bias experienced by women. This study aims to fill that gap by determining the extent to which different types of implicit gender bias occur within the construction workplace by measuring and comparing reports from both men and women working in the industry, following William's (2016) example. Based on the literature and studies conducted within engineering, the researcher proposes the following null and alternative hypotheses:

$H1_0$: A similar proportion of women and men experience each of the five types of implicit gender bias.

$H1_1$: Women experience each of the five types of implicit gender bias in significantly higher proportion than men.

$H2_0$: Women experience all five types of implicit gender bias in similar proportion.

$H2_1$: Women experience the five types of implicit gender bias in different proportions.

$H3_0$: No difference in the proportion of isolation bias experienced by white women and women of color is observed.

$H3_1$: Women of color experience isolation bias in significantly higher proportion than white women.

METHODS

Procedure

Participants were recruited from a list of attendees of the Groundbreaking Women in Construction (GWIC) conference in San Francisco, California on May 23-24, 2019, as well as through construction-related associations (i.e., National Association of Women in Construction [NAWIC], Associated General Contractors of America [AGC], and Society for Women Engineers [SWE]), social media platforms (i.e., LinkedIn, Facebook, and Reddit), and collaboration with alumni offices at universities accredited by the American Council for Construction Education (ACCE) or the Accreditation Board for Engineering and Technology (ABET). The researcher sent an email with a link to the survey, hosted on Qualtrics online platform, and a brief description of the study to potential participants or to association representatives for further dissemination. Snowball sampling was used to ensure an adequate number of responses was obtained in a timely manner. Data were collected between April 19, 2020 and October 3, 2020.

Recipients of the email could choose whether to participate or not and were required to meet minimum criteria to be eligible for participation in this study. Anyone meeting these criteria and consenting to participate in the survey after reading the written consent form (Appendix A) received the survey questionnaire. Specifically, participants were required to

- currently hold a position within the construction industry,
- have worked in the industry for a minimum of two years,
- live and work in the United States, and
- identify as either male or female.

Participants remained anonymous throughout the data collection and analysis procedures, as no identifying information was collected in the survey. Ethical approval for this study was obtained from the Oklahoma State University Institutional Review Board in June 2019.

Participants

In total, 278 participants began the survey. One (0.3%) participant did not give consent for participation in the study and was excluded from data analysis. Of the remaining 277 respondents, 26 (9.4%) reported not currently working in the construction industry, 13 (4.7%) had worked in the industry for less than two years, 18 (6.5%) did not live in the United States, and 7 (2.5%) did not identify as either male or female. These participants did not meet inclusion criteria and were excluded from further analysis. Twenty-five (9.0%) additional participants did not complete the survey and were also excluded. After each of these exclusions, a final sample size of 178 participants was obtained.

Measures

Because of the similarities in the workplace demographics between engineering and construction (Banchefsky and Park 2018), a modified version of the Workplace Experiences Survey used in Williams et al's (2016) study with engineers was used to assess the experiences of both men and women in the construction workplace. Demographics (i.e., gender, race, disability) were collected to allow for stratification of results according to demographic group or characteristic. Each of the five patterns of implicit bias was measured using a 6-point Likert scale (1=strongly disagree, 2=disagree, 3=somewhat disagree, 4=somewhat agree, 5=agree, 6=strongly agree). Participants were asked to rate their level of agreement with 45 statements, which were then combined into five dimensions representing the five types of biases women frequently encounter.

Prove-it-again bias

Prove-it-again bias was measured using seven statements such as "When I give an outstanding performance, people seem surprised" and "I have to prove myself over and over again to get the same level of recognition as my colleagues."

Tightrope bias

Tightrope bias was measured using eleven statements such as "Being vocal about my work and accomplishments is rewarded" and "I am expected to be a 'worker bee,' which means I should work hard, avoid confrontation, and not complain."

Maternal wall bias

Maternal wall bias was measured using ten statements, including "Having children did not change my colleagues' perception of my work commitment and competence" and "Asking for flexible work arrangements would not hurt my career."

Tug-of-war bias

Tug-of-war bias was measured using eight statements such as "Some people of my gender working in construction just do not understand the level of commitment it takes to be successful" and "I find it difficult to get administrative personnel to do the kinds of support work for me that they do for others in comparable roles."

Isolation bias

Isolation bias was measured using nine statements such as "There are unwritten rules about getting ahead that others seem to know but I don't" and "People have treated me like I'm invisible at work."

Workplace processes

Sixteen statements related to workplace processes, including hiring, performance evaluation, promotion, mentoring/sponsorship, networking, and compensation, were asked of participants. These included "Someone like me has an equal shot at getting hired here as anyone else" and "In

performance evaluations, I receive constructive feedback that allows me to advance in my career."

Analysis

In univariate analysis, each statement was dichotomized into "agree" (strongly agree, agree, somewhat agree) and "disagree" (strongly disagree, disagree, somewhat disagree), and the proportion of respondents who agreed with each statement was calculated. These results were stratified by gender and race (i.e., women, people of color) in bivariate analyses. Pearson's chi square test (or Fisher's exact test in instances of small sample size) was used to determine whether there were any significant differences between the proportion of respondents in each group who agreed with the statement(s), and two-tailed independent t-tests were used to identify any significant difference in the mean score of each statement between groups. Both tests were used to determine not only if a difference in the experiences of gender bias reported between groups exists, but also whether the *strength* of agreement differs between groups. *P* values less than .05 were considered significant. Additionally, the effect size of the difference in group means were calculated using Cohen's *D* (*d*), where the group mean difference is divided by the average of each group's variance. Effect size was used to better understand the magnitude and practical significance of any statistically significant differences. An effect size of 0.00 to 0.29 was considered small, 0.30 to 0.69 was considered moderate, and 0.70 or greater was considered large.

Multivariate regression analyses were also conducted to predict variations in experiences of bias after controlling for gender, race, disability, family care responsibilities, role, and typical jobsite. Factor analysis was used to create dimensions for each of the five types of bias, as well as the workplace process statements. The use of factor analysis condensed the data from many statements to a smaller number of statements that explained most of the variance within a dimension and excluded statements which showed a high degree of correlation with other

statements. Items with an eigenvalue of greater than .5 were included in the dimensions and Cronbach's alpha (α) was calculated as a measure of reliability for each. Dimensions utilized the mean rating on a 6-point Likert scale of the statements meeting the eigenvalue threshold.

RESULTS

Demographics

Demographic characteristics of the study sample are shown in Table 6. The majority of participants were white (n=142; 79.8%), heterosexual (n=170; 95.5%), not disabled (n=169; 94.9%), worked primarily in an office setting (n=136; 76.4%), and did not belong to a union (n=176; 98.9%). Almost half of participants reported having family care responsibilities such as dependent child or elder care (n=80; 44.9%). Approximately half (n=84; 47.2%) reported working in construction management or operations, 17.4% (n=31) in design, and 9.0% (n=16) in sales, finance, human resources, or other administrative roles. Overall, participants reported a mean of 18.2 (*SD* = 12.0) years of experience working in the construction industry, although there was a significant difference between males (n=74; 41.5%) and females (n=104, 58.4%) in terms of the number of years they had worked in the industry. Males reported a mean number of 23.1 years (*SD* = 13.1) of experience versus a mean of 14.8 years (*SD* = 9.9) of experience among females [$t(176) = 4.8$, $p = .00$]. No other significant differences between males and females were observed using Fisher's exact test.

Experiences of Gender Bias

Prove It Again Bias

Women reported experiencing prove-it-again bias significantly more often than men on each of the seven measures (Table 7). The statement with the largest proportion of agreement among women was "I have to prove myself over and over again to get the same level of recognition as

Table 6

Demographic characteristics of current study sample

	Male (n=74)	Female (n=104)	Total (n=178)	*P*
Race/Ethnicity				0.65
White	59 (79.7%)	83 (79.8%)	142 (79.8%)	
Black or African American	3 (4.0%)	1 (1.0%)	4 (2.2%)	
Hispanic or Latino	5 (6.8%)	7 (6.7%)	12 (6.7%)	
Asian or Pacific Islander	1 (1.3%)	5 (4.8%)	6 (3.4%)	
Middle Eastern/North African	0 (0.0%)	1 (1.0%)	1 (0.6%)	
Bi- or multi-racial	4 (5.4%)	5 (4.8%)	9 (5.1%)	
Other	1 (1.3%)	2 (1.9%)	3 (1.7%)	
Missing	1 (1.3%)	0 (0.0%)	1 (0.6%)	
Sexual Orientation				0.09
Heterosexual	74 (100%)	96 (92.3%)	170 (95.5%)	
Homosexual	0 (0.0%)	4 (3.8%)	4 (2.2%)	
Bisexual	0 (0.0%)	3 (2.9%)	3 (1.7%)	
Other	0 (0.0%)	1 (1.0%)	1 (0.6%)	
Has a disability that coworkers are aware of				1.00
Yes	4 (5.4%)	5 (4.8%)	9 (5.1%)	
No	70 (94.6%)	99 (95.2%)	169 (94.9%)	
Has family care responsibilities				0.88
Yes	34 (45.9%)	46 (44.2%)	80 (44.9%)	
No	40 (54.0%)	58 (55.8%)	98 (55.1%)	
Role				0.08
Design	7 (9.5%)	24 (23.1%)	31 (17.4%)	
Pre-construction	3 (4.0%)	7 (6.7%)	10 (5.6%)	
Construction management / operations	43 (58.1%)	41 (39.4%)	84 (47.2%)	
Field engineering	4 (5.4%)	5 (4.8%)	9 (5.1%)	
Sales, admin, finance, HR	6 (8.1%)	10 (9.6%)	16 (9.0%)	
Tradesperson / craftworker	2 (2.7%)	1 (1.0%)	3 (1.7%)	
Environmental health and safety/quality	0 (0.0%)	4 (3.8%)	4 (2.2%)	
Other	9 (12.2%)	12 (11.5%)	21 (11.8%)	
Jobsite				0.11
Office	52 (70.3%)	84 (80.8%)	136 (76.4%)	
Field	22 (29.7%)	20 (19.2%)	42 (23.6%)	
Member of a union				0.51
Yes	0 (0.0%)	2 (1.9%)	2 (1.1%)	
No	74 (100%)	102 (98.1%)	176 (98.9%)	
Years worked in construction industry (mean, SD)	23.1 (13.1)	14.8 (9.9)	18.2 (12.0)	**0.000**

Table 7

Proportion of participants who agreed with statements measuring prove-it-again bias, N (%)

	Total	Male	Female	*P*	Person of Color	White	*P*	Woman of Color	White Woman	*P*
I have to prove myself over and over again to get the same level of recognition as my colleagues.	104 (58.4%)	28 (37.8%)	76 (73.1%)	**0.000**	20 (62.5%)	80 (56.3%)	0.52	16 (84.2%)	58 (69.9%)	0.26
When I give an outstanding performance, people seem surprised.	60 (33.7%)	12 (16.2%)	48 (46.1%)	**0.000**	14 (43.7%)	44 (31.0%)	0.17	9 (47.4%)	38 (45.8%)	1.00
In meetings, other people get credit for ideas I originally offered.	76 (42.7%)	19 (25.7%)	57 (54.8%)	**0.000**	16 (50.0%)	58 (40.8%)	0.34	12 (63.2%)	44 (53.0%)	0.46
I get less respect than my colleagues for the same level and quality of work.	67 (37.8%)	10 (13.5%)	57 (55.3%)	**0.000**	12 (38.7%)	54 (38.0%)	0.94	8 (44.4%)	48 (57.8%)	0.31
I feel I am held to higher standards than my colleagues.	96 (53.9%)	28 (37.8%)	68 (65.4%)	**0.000**	93 (53.4%)	73 (51.4%)	0.26	12 (63.2%)	54 (65.1%)	1.00
After moving from a technical role to a project management role, people assume I do not have technical skills.	75 (42.6%)	19 (25.7%)	56 (54.9%)	**0.000**	16 (51.6%)	55 (39.0%)	0.20	11 (61.1%)	43 (52.4%)	0.60
Even though I have the same credentials as my peers, other people assume I'm less qualified.	81 (45.5%)	14 (18.9%)	67 (64.4%)	**0.000**	21 (65.6%)	57 (40.1%)	**0.01**	16 (84.2%)	50 (60.2%)	0.06

my colleagues," (n=76; 73.1%), whereas only one-third of men agreed with this statement (n=28; 37.8%; $\chi^2 = 22.1$; $p = .00$). Six of the seven statements received agreement by more than half of women while agreement by men did not exceed 40% for any statement. In fact, men disagreed with each of the seven statements; mean scores ranged from 2.22 – 3.01 (Appendix D), corresponding to responses of "disagree" and "somewhat disagree." On average, women also disagreed with over half of statements. Only "I have to prove myself over and over again to get

the same level of recognition as my colleagues" (M = 4.19, 95% CI: 3.91 – 4.48), "I feel I am held to higher standards than my colleagues" (M = 4.07, 95% CI: 3.77 – 4.36), and "Even though I have the same credentials as my peers, other people assume I'm less qualified" (M = 4.01, 95% CI: 3.70 – 4.31) resulted in mean scores corresponding to "somewhat agree." Despite this, Cohen's D shows a large effect size for each statement, ranging from 0.71 to 1.20.

When comparing persons of color to white participants, a significant difference was observed for only one statement, "Even though I have the same credentials as my peers, other people assume I'm less qualified" (65.6% v. 40.1%; $\chi^2 = 6.9$; $p = .01$) with a moderate effect size (d = 0.44, $t(172) = -2.23$, $p = .03$). Mean scores indicated that, although both groups disagreed with the statement, white participants *more strongly* disagreed with this statement than persons of color (M = 3.17 versus M = 3.87). This difference was not observed when limiting the sample to women; no significant difference in the proportion of white women (n=50; 60.2%) and women of color (n=16; 84.2%) who agreed with this statement was found ($p = .06$).

Tightrope Bias

Significant differences between men and women were observed on 9 of the 11 statements associated with tightrope bias, with moderate to large effect sizes (Table 8). The majority of women agreed that they received pushback when they behaved assertively (n=69; 66.3%) and negative reactions when expressing anger (n=66; 63.5%), were expected to be a "worker bee" (n=67; 64.4%), interrupted at meetings more than their colleagues (n=65; 62.5%), and more often played administrative roles (n=63; 61.2%) or did the behind-the-scenes work (n=70; 67.3%) than their peers. Although women agreed less often than men that they had the same access to desirable assignments as colleagues (68.3% versus 78.4%, $p = .14$) and were rewarded for being vocal about their work and accomplishments (55.8% versus 67.6%, $p = .11$), these differences were not statistically significant. As with prove-it-again bias, the mean scores showed that, on average, women agreed with only some of the statements. Specifically, "I get pushback when I

Table 8

Proportion of participants who agreed with statements measuring tightrope bias, N (%)

	Total	Male	Female	*P*	Person of Color	White	*P*	Woman of Color	White Woman	*P*
I get pushback when I behave assertively.	84 (47.2%)	15 (20.3%)	69 (66.3%)	**0.000**	18 (56.2%)	63 (44.4%)	0.22	15 (78.9%)	52 (62.6%)	0.28
People expect me to play a leadership role.	149 (83.7%)	71 (95.9%)	78 (75.0%)	**0.000**	25 (78.1%)	121 (85.2%)	0.32	13 (68.4%)	64 (77.1%)	0.55
I am expected to be a "worker bee," which means I should work hard, avoid confrontation, and not complain.	90 (50.6%)	23 (31.1%)	67 (64.4%)	**0.000**	15 (46.9%)	72 (50.7%)	0.70	12 (63.2%)	53 (63.9%)	1.00
I have had the same access to desirable assignments as my colleagues.	129 (72.5%)	58 (78.4%)	71 (68.3%)	0.14	20 (62.5%)	107 (75.3%)	0.14	12 (63.2%)	58 (69.9%)	0.59
Being vocal about my work and accomplishments is rewarded.	108 (60.7%)	50 (67.6%)	58 (55.8%)	0.11	20 (62.5%)	87 (61.3%)	0.90	12 (63.2%)	46 (55.4%)	0.61
I am interrupted at meetings more than my colleagues.	79 (44.4%)	14 (18.9%)	65 (62.5%)	**0.000**	14 (43.7%)	63 (44.4%)	0.95	13 (68.4%)	51 (61.4%)	0.61
As compared to my colleagues with comparable roles and seniority, I am more likely to be assigned to high profile tasks or teams.	89 (50.0%)	47 (63.5%)	42 (40.4%)	**0.002**	16 (50.0%)	72 (50.7%)	0.94	9 (47.4%)	33 (39.8%)	0.61
I more often play administrative roles (e.g., coordinating meetings, taking notes, sending follow-up emails) as compared to my colleagues with comparable roles and seniority.	87 (49.1%)	24 (32.4%)	63 (61.2%)	**0.000**	17 (53.1%)	69 (48.9%)	0.67	13 (68.4%)	50 (61.0%)	0.61
I more often do the behind-the-scenes work or undervalued work than my colleagues with comparable roles and seniority.	93 (52.2%)	23 (31.1%)	70 (67.3%)	**0.000**	17 (53.1%)	75 (52.8%)	0.97	12 (63.2%)	57 (68.7%)	0.79
People react negatively when I express anger, even when its justified.	99 (55.6%)	33 (44.6%)	66 (63.5%)	**0.01**	22 (68.7%)	75 (52.8%)	0.10	14 (73.7%)	51 (61.4%)	0.43
I have to alter my appearance and demeanor to fit in at work.	62 (34.8%)	12 (16.2%)	50 (48.1%)	**0.000**	16 (50.0%)	44 (31.0%)	**0.04**	12 (63.2%)	36 (43.4%)	0.13

behave assertively" (M = 4.10, 95% CI: 3.82 – 4.39), "People expect me to play a leadership role" (M = 4.37, 95% CI: 4.10 – 4.65), "I more often do the behind-the-scenes work or undervalued work than my colleagues with comparable roles and seniority" (M = 4.14, 95% CI: 3.84 – 4.45), and "People react negatively when I express anger, even when it is justified" (M = 4.09, 95% CI: 3.80 – 4.37).

Only one statement resulted in a statistically significant difference between persons of color and white participants. Half of the persons of color who responded to this survey (n=16; 50.0%) agreed that "I have to alter my appearance and demeanor to fit in at work," compared to only 31.0% (n=44) of white respondents ($\chi^2 = 4.2$; $p = .04$); however this difference reflected a small and insignificant effect size ($d = 0.25$, $t(172) = -1.27$, $p = .21$). This difference was not observed when limiting the sample to women; no significant difference in the proportion of white women (n=36; 43.4%) and women of color (n=12; 63.2%) who agreed with this statement was found ($p = .13$).

Maternal Wall Bias

Of the ten statements associated with maternal wall bias, six produced statistically significant differences between men and women (Table 9). Significantly fewer women (n=35; 36.8%) agreed that "Having children did not change my colleagues' perception of my work commitment and competence" than men (n=61; 83.6%; $\chi^2 = 36.8$; $p = .00$) and significantly more women agreed that "When women have children, it changes colleagues' perception of their work commitment and competence" (n=78; 75.0%) than men (n=23; 31.1%; $\chi^2 = 34.0$; $p = .00$). A large effect size was noted for each of these differences ($d = 1.14$, $t(166) = 7.34$, $p = .00$ and $d = 1.06$, $t(176) = -6.95$, $p = .00$, respectively). Interestingly, the only statement where the mean score among women indicated agreement was the latter of these two (M = 4.25, 95% CI: 3.97 – 4.53). A larger proportion of women also agreed that they work longer hours because their colleagues think they have no life ($p = .04$) or have communicated that they should work more

Table 9

Proportion of participants who agreed with statements measuring maternal wall bias, N (%)

	Total	Male	Female	*P*	Person of Color	White	*P*	Woman of Color	White Woman	*P*
Asking for flexible work arrangements would not hurt my career.	83 (46.6%)	41 (55.4%)	42 (40.4%)	0.05	17 (53.1%)	64 (45.1%)	0.41	8 (42.1%)	34 (41.0%)	1.00
Having children did not change my colleagues' perception of my work commitment and competence.	96 (57.1%)	61 (83.6%)	35 (36.8%)	**0.000**	16 (51.6%)	78 (58.6%)	0.48	5 (27.8%)	30 (40.0%)	0.42
Taking family leave would be detrimental to my career.	87 (49.4%)	32 (43.2%)	55 (53.9%)	0.16	11 (34.4%)	74 (52.9%)	0.06	8 (42.1%)	46 (56.8%)	0.31
My colleagues think that I have no life so I end up working longer hours.	56 (31.6%)	17 (23.0%)	39 (37.9%)	**0.04**	12 (37.5%)	42 (29.8%)	0.39	9 (47.4%)	29 (35.4%)	0.43
I feel pressured to work long hours to show my commitment, even when the workload does not justify the overtime.	89 (50.0%)	29 (39.2%)	60 (57.7%)	**0.01**	17 (53.1%)	68 (47.9%)	0.59	12 (63.2%)	46 (55.4%)	0.61
My colleagues have communicated to me that I should work fewer hours because I have children.	29 (17.3%)	12 (16.4%)	17 (17.9%)	0.80	6 (19.3%)	22 (16.5%)	0.71	4 (22.2%)	13 (17.3%)	0.73
My colleagues have communicated to me that I should work more hours because I have children.	15 (8.9%)	2 (2.7%)	13 (13.7%)	**0.01**	3 (9.7%)	11 (8.3%)	0.80	2 (11.1%)	11 (14.7%)	1.00
When women have children, it changes colleagues' perception of their work commitment and competence.	101 (56.7%)	23 (31.1%)	78 (75.0%)	**0.000**	21 (65.6%)	77 (54.2%)	0.24	17 (89.5%)	59 (71.1%)	0.14
Mothers who work long hours often face disapproval from colleagues.	61 (34.9%)	15 (20.3%)	46 (45.5%)	**0.001**	9 (28.1%)	51 (36.7%)	0.36	6 (31.6%)	40 (50.0%)	0.20
My colleagues have communicated to me that fathers should work more hours because they have children.	27 (15.7%)	8 (10.8%)	19 (19.4%)	0.13	3 (9.7%)	23 (16.8%)	0.32	2 (11.1%)	17 (21.8%)	0.51

hours because they have children (p = .01), feel pressured to work long hours to show their commitment (p = .01), and feel that mothers face disapproval from colleagues if they work long hours (p = .00) than men, although these demonstrated a more moderate effect size ranging from 0.27 to 0.70. No significant differences associated with maternal wall bias were observed between persons of color and white respondents.

Tug of War Bias

Significant differences between men and women were identified for five of the eight statements associated with tug-of-war bias (Table 10). Almost half of women (n=50; 48.1%) agreed that "If someone else of my gender performs poorly, I worry that it will reflect negatively on me," compared to less than 10% of men (n=7; 9.5%; χ^2 = 29.6; p = .00), reflecting a large effect size (d = 0.95, $t(176)$ = -6.28, p = .00). Moderate effect sizes (0.35 to 0.69) of statistically significant differences were observed in four other statements; mean scores indicated that, overall, women disagreed with these statements but did so *less strongly* than men. Mean scores among women most often corresponded with a response of "somewhat disagree" whereas mean scores among men corresponded with "disagree" or "strongly disagree." No significant differences associated with tug-of-war bias were observed between persons of color and white respondents.

Isolation Bias

Women reported experiencing isolation bias significantly more often than men on eight of the nine measures (Table 11). Although the majority of women agreed that "People who succeed here are a lot like me" (n=58; 55.8%) and "I feel welcome to socialize with my coworkers" (n=84; 80.8%), they did so less often than men (n=62; 83.8%; χ^2 = 15.4; p = .00 and n=69; 94.5%; χ^2 = 6.9; p = .01). Women (n=45; 43.3%) were significantly more likely to agree that "People have treated me like I'm invisible at work" than men (n=11; 14.9%; χ^2 = 16.2; p = .00), which showed a large effect size (d = 0.87, $t(176)$ = -5.70, p = .00).

Table 10

Proportion of participants who agreed with statements measuring tug-of-war bias, N (%)

	Total	Male	Female	*P*	Person of Color	White	*P*	Woman of Color	White Woman	*P*
I worry that it will be construed as favoritism if I support others from my gender for professional opportunities.	65 (36.5%)	19 (25.7%)	46 (44.2%)	**0.01**	14 (43.7%)	50 (35.2%)	0.37	10 (52.6%)	36 (43.4%)	0.61
Its hard for me to get ahead at work if there is another more qualified member of my gender – sometimes it seems there's room for only one.	53 (30.1%)	16 (21.6%)	37 (36.3%)	**0.04**	11 (34.4%)	39 (27.9%)	0.46	8 (42.1%)	27 (33.3%)	0.59
Colleagues of my gender generally support each other.	143 (80.8%)	62 (83.8%)	81 (78.6%)	0.39	28 (87.5%)	112 (79.4%)	0.29	17 (89.5%)	63 (76.8%)	0.35
I find it difficult to get administrative personnel to do the kinds of support work for me that they do for others in comparable roles.	54 (30.7%)	10 (13.9%)	44 (42.3%)	**0.000**	12 (38.7%)	41 (29.1%)	0.29	8 (42.1%)	35 (42.2%)	1.00
The politically savvy approach at my workplace is to distance myself from others of my own gender.	32 (18.1%)	4 (5.4%)	28 (27.2%)	**0.000**	8 (25.0%)	22 (15.6%)	0.20	5 (26.3%)	21 (25.6%)	1.00
If someone else of my gender performs poorly, I worry that it will reflect negatively on me.	57 (32.0%)	7 (9.5%)	50 (48.1%)	**0.000**	13 (40.6%)	42 (29.6%)	0.22	11 (57.9%)	38 (45.8%)	0.45
Some people of my gender working in construction just do not understand the commitment it takes to be successful.	88 (49.4%)	40 (54.0%)	48 (46.1%)	0.30	16 (50.0%)	70 (49.3%)	0.94	10 (52.6%)	37 (44.6%)	0.61
I feel I have a lot in common with others of my own gender working in construction.	145 (81.5%)	60 (81.1%)	85 (81.7%)	0.91	27 (84.4%)	114 (80.3%)	0.59	17 (89.5%)	66 (79.5%)	0.51

Table 11

Proportion of participants who agreed with statements measuring isolation bias, N (%)

	Total	Male	Female	*P*	Person of Color	White	*P*	Woman of Color	White Woman	*P*
The culture at my workplace is a good fit for me.	151 (84.8%)	67 (90.5%)	84 (80.8%)	0.07	28 (87.5%)	120 (84.5%)	0.67	16 (84.2%)	67 (80.7%)	1.00
People who succeed here are a lot like me.	120 (67.4%)	62 (83.8%)	58 (55.8%)	**0.000**	18 (56.2%)	99 (69.7%)	0.14	8 (42.1%)	49 (59.0%)	0.21
There are unwritten rules about getting ahead that others seem to know but I don't.	76 (42.7%)	21 (28.4%)	55 (52.9%)	**0.001**	16 (50.0%)	59 (41.5%)	0.38	12 (63.2%)	42 (50.6%)	0.45
I feel welcome to socialize with my coworkers.	153 (86.4%)	69 (94.5%)	84 (80.8%)	**0.01**	31 (96.9%)	119 (84.4%)	0.06	19 (100.0%)	64 (77.1%)	**0.02**
My colleagues do not share important information with me that they share with others.	63 (35.4%)	15 (20.3%)	48 (46.1%)	**0.000**	13 (40.6%)	49 (34.5%)	0.51	10 (52.6%)	37 (44.6%)	0.61
People have attempted to demean, disrespect, or humiliate me at work.	56 (31.5%)	15 (20.3%)	41 (39.4%)	**0.01**	6 (18.7%)	49 (34.5%)	0.08	6 (31.6%)	35 (42.2%)	0.45
People have treated me like I'm invisible at work.	56 (31.5%)	11 (14.9%)	45 (43.3%)	**0.000**	11 (34.4%)	44 (31.0%)	0.71	9 (47.4%)	35 (42.2%)	0.80
I feel very isolated at work.	53 (29.8%)	12 (16.2%)	41 (39.4%)	**0.001**	9 (28.1%)	43 (30.3%)	0.81	7 (36.8%)	33 (39.8%)	1.00
I feel like attempts to speak up for myself or others often falls on deaf ears and creates hostility in my work environment.	55 (30.9%)	11 (14.9%)	44 (42.3%)	**0.000**	11 (34.4%)	42 (29.6%)	0.59	9 (47.4%)	34 (41.0%)	0.62

No significant differences associated with isolation bias were observed between persons of color and white respondents when men were included in the analysis. When limiting the analysis to only female participants, one statement showed a significant difference. A larger proportion of women of color (n=19; 100.0%) reported that "I feel welcome to socialize with my coworkers" than white women (n=64; 77.1%; $\chi^2 = 5.34$; $p = .02$) and had a higher mean score ($M = 5.21$, 95% CI: 4.87 – 5.55) than white women ($M = 4.32$, 95% CI: 4.02 – 4.63, $p = .01$).

Workplace Processes

Of the sixteen workplace process statements, eleven resulted in significant differences between men and women (Table 12). A large effect size was seen in three statements: "I have had as much access to networking opportunities as my colleagues" ($d = 0.76$, $t(174) = 5.01$, $p = .00$), "As compared to my colleagues with comparable seniority, experience, and work ethic, I suspect that I get paid less" ($d = 0.91$, $t(174) = -5.59$, $p = .00$), and "I think I get paid fairly, as compared with others like me" ($d = 1.02$, $t(174) = 6.71$, $p = .00$). The mean score among women for "…I suspect I get paid less…" ($M = 4.18$, 95% CI: 3.88 – 4.47) corresponded to a response of "agree" whereas the mean score for men ($M = 2.84$, 95% CI: 2.51 – 3.16) corresponded to a response of "disagree." Sixteen percent of women (n=17; 16.5%) reported that "I am treated like I am here to provide diversity, not to do work," compared to only 5% (n=4; 5.4%) of men ($\chi^2 = 5.1$, $p = .02$), and only two-thirds of women (n=66; 64.7%) agreed that "I have been given the advancement opportunities and promotions I deserve," compared to almost 90% (n=66; 89.2%) of men ($\chi^2 = 13.7$, $p = .00$). No significant differences associated with workplace biases were observed between persons of color and white respondents.

Table 12

Proportion of participants who agreed with statements evaluating workplace processes, N (%)

	Total	Male	Female	*P*	Person of Color	White	*P*	Woman of Color	White Woman	*P*
Someone like me has an equal shot at getting hired here as anyone else.	140 (79.6%)	66 (90.4%)	74 (71.8%)	**0.003**	27 (84.4%)	111 (79.3%)	0.51	14 (73.7%)	59 (71.9%)	1.00
This organization is open to hiring people from all kinds of backgrounds.	152 (85.9%)	69 (93.2%)	83 (80.6%)	**0.02**	28 (87.5%)	121 (85.8%)	0.80	15 (78.9%)	66 (80.5%)	1.00
The level of work I am asked to perform is appropriate relative to my years of experience.	148 (83.6%)	70 (94.6%)	78 (75.7%)	**0.001**	26 (81.2%)	119 (84.4%)	0.66	14 (73.7%)	63 (76.8%)	0.77
I am treated like I am here to provide diversity, not to do work.	21 (11.9%)	4 (5.4%)	17 (16.5%)	**0.02**	6 (18.7%)	15 (10.6%)	0.20	4 (21.0%)	13 (15.8%)	0.73
My performance evaluations have been fair.	156 (89.1%)	70 (94.6%)	86 (85.1%)	0.05	28 (90.3%)	124 (88.6%)	0.78	15 (83.3%)	69 (85.2%)	1.00
I feel I get less honest feedback on my performance evaluations than my colleagues.	48 (27.4%)	15 (20.3%)	33 (32.7%)	0.07	7 (22.6%)	41 (29.35)	0.45	5 (27.8%)	28 (34.6%)	0.78
In performance evaluations, I receive constructive feedback that allows me to advance in my career.	129 (73.7%)	61 (82.4%)	68 (67.3%)	**0.02**	23 (74.2%)	104 (74.3%)	0.99	11 (61.1%)	56 (69.1%)	0.58
In my performance evaluations, I get comments about my personality.	106 (60.9%)	44 (59.5%)	62 (62.0%)	0.73	21 (67.7%)	83 (59.7%)	0.41	12 (66.7%)	48 (60.0%)	0.79
I have been given the advancement opportunities and promotions I deserve.	132 (75.0%)	66 (89.2%)	66 (64.7%)	**0.000**	22 (68.7%)	106 (75.7%)	0.41	10 (52.6%)	54 (66.7%)	0.29
To get ahead in my organization, one needs to be a member of a small, mostly homogenous in-group.	80 (45.4%)	22 (29.7%)	58 (56.9%)	**0.000**	14 (43.7%)	63 (45.0%)	0.90	11 (57.9%)	45 (55.6%)	1.00
My manager rewards me for taking risks and innovating in my role.	125 (70.6%)	59 (79.7%)	66 (64.1%)	**0.02**	20 (62.5%)	102 (72.3%)	0.27	13 (68.4%)	52 (63.4%)	0.79
I have had good mentors at my workplace.	132 (74.6%)	60 (81.1%)	72 (69.9%)	0.09	25 (78.1%)	105 (74.5%)	0.67	15 (78.9%)	56 (68.3%)	0.42

(Table 12 cont.)

I have a sponsor who is willing to use their influence and power to help advance my career.	83 (47.4%)	40 (54.8%)	43 (42.2%)	0.10	16 (51.6%)	65 (46.4%)	0.60	8 (44.4%)	34 (41.5%)	1.00
I have had as much access to networking opportunities as my colleagues.	136 (77.3%)	68 (91.9%)	68 (66.7%)	**0.000**	24 (77.4%)	109 (77.3%)	0.99	13 (72.2%)	54 (65.8%)	0.78
As compared to my colleagues with comparable seniority, experience, and work ethic, I suspect that I get paid less.	91 (51.7%)	23 (31.1%)	68 (66.7%)	**0.000**	18 (58.1%)	70 (49.6%)	0.40	13 (72.2%)	53 (64.6%)	0.60
I think I get paid fairly, as compared with others like me.	111 (63.1%)	63 (85.1%)	48 (47.1%)	**0.000**	16 (51.6%)	93 (66.0%)	0.13	7 (38.9%)	40 (48.8%)	0.60

Explicit Biases

Few participants completed the section related to experiences with explicit biases (Table 13). Missing data for these statements ranged from 43% to 89%. However, significant differences were observed between men and women for three of the six statements. Men more frequently acknowledged experiences with uncomfortable sexist comments (n=3; 15.8%), uncomfortable sexual stories or jokes (n=3; 10.7%), and lost opportunities because of rebuffed sexual advances (n=1; 100.0%) than women. However, due to the small number of responses, these data are not reliable.

Table 13

Proportion of participants who agreed with statements evaluating explicit biases, N (%)

	Total	Male	Female	*P*	Person of Color	White	*P*	Woman of Color	White Woman	*P*
Uncomfortable sexist comments	3 (3.0%)	3 (15.8%)	0 (0.0%)	**0.000**	0 (0.0%)	3 (3.7%)	0.43	0 (0.0%)	0 (0.0%)	--
Uncomfortable sexual stories or jokes	3 (3.0%)	3 (10.7%)	0 (0.0%)	**0.005**	0 (0.0%)	3 (3.6%)	0.46	0 (0.0%)	0 (0.0%)	--
Sexual or inappropriate images	4 (6.3%)	2 (9.1%)	2 (4.9%)	0.51	1 (16.7%)	3 (5.4%)	0.28	1 (16.7%)	1 (2.9%)	0.27
Unwanted romantic or sexual attention	3 (4.6%)	1 (11.1%)	2 (3.6%)	0.32	0 (0.0%)	3 (5.8%)	0.37	0 (0.0%)	2 (4.6%)	1.00
Unwanted physical contact	3 (6.0%)	1 (16.7%)	1 (4.5%)	0.24	1 (16.7%)	2 (4.6%)	0.25	1 (16.7%)	1 (2.7%)	0.26
Lost opportunities because I rebuffed sexual advances (i.e., promotion, raise, career-enhancing assignments)	3 (15.8%)	1 (100.0%)	2 (11.1%)	**0.02**	0 (0.0%)	3 (17.6%)	0.52	0 (0.0%)	2 (12.5%)	1.00

Factor Analysis

Factor analysis was used to create scales for each of the five types of bias and workplace process statements. Using a threshold for inclusion of an eigenvalue of .5, one scale was generated for prove-it-again bias, tug-of-war bias, and isolation bias, two scales were generated for tightrope bias, and three for maternal wall bias and workplace processes. Table 14 shows the statements that were retained in each scale.

Table 14

Factor analysis using individual statements with eigenvalues, Cronbach's α, and model statistics

Factor		Eigenvalue	Cronbach's α	χ^2 (*p* value)	Proportion Variance Explained
1	*Prove-it-again* When I give an outstanding performance, people seem surprised. I get less respect than my colleagues for the same level and quality of work. After moving from a technical role to a project management role, people assume I do not have technical skills. Even though I have the same credentials as my peers, other people assume I'm less qualified.	4.12	0.89	737.2 (0.00)	1.00
2	*Tightrope 1- Administrative Tasks* I more often play administrative roles (e.g., coordinating meetings, taking notes, sending follow-up emails) as compared to my colleagues with comparable roles and seniority. I more often do the behind-the-scenes work or undervalued work than my colleagues with comparable roles and seniority.	4.43	0.86	842.2 (0.00)	0.85
3	*Tightrope 2 – Feminine Stereotypes* I get pushback when I behave assertively. I am expected to be a "worker bee," which means I should work hard, avoid confrontation, and not complain. People react negatively when I express anger, even when its justified. I have to alter my appearance and demeanor to fit in at work.	0.94	0.83	842.2 (0.00)	0.18
4	*Maternal wall 1 - Disapproval* When women have children, it changes colleagues' perception of	3.67	0.80	582.6 (0.00)	0.84

	their work commitment and competence. Mothers who work long hours often face disapproval from colleagues.				
5	*Maternal wall 2 – Commitment* My colleagues think that I have no life so I end up working longer hours. I feel pressured to work long hours to show my commitment, even when the workload does not justify the overtime.	0.56	0.69	582.6 (0.00)	0.13
6	*Maternal wall 3 - Hours* My colleagues have communicated to me that I should work fewer hours because I have children. My colleagues have communicated to me that I should work more hours because I have children.	0.52	0.67	582.6 (0.00)	0.12
7	*Tug-of-war* I worry that it will be construed as favoritism if I support others from my gender for professional opportunities. It's hard for me to get ahead at work if there is another more qualified member of my gender – sometimes it seems there's room for only one. I find it difficult to get administrative personnel to do the kinds of support work for me that they do for others in comparable roles. The politically savvy approach at my workplace is to distance myself from others of my own gender. If someone else of my gender performs poorly, I worry that it will reflect negatively on me.	2.75	0.83	381.9 (0.00)	1.00
8	*Isolation*	5.32	0.92	1107.2 (0.00)	0.97

	My colleagues do not share important information with me that they share with others. People have attempted to demean, disrespect, or humiliate me at work. People have treated me like I'm invisible at work. I feel very isolated at work. I feel like attempts to speak up for myself or others often falls on deaf ears and creates hostility in my work environment.				
9	*Workplace process 1 – Equal rewards* I have been given the advancement opportunities and promotions I deserve. I think I get paid fairly, as compared with others like me.	6.99	0.82	1458.0 (0.00)	0.81
10	*Workplace process 2 – Feedback and mentorship* My performance evaluations have been fair. In performance evaluations, I receive constructive feedback that allows me to advance in my career. My manager rewards me for taking risks and innovating in my role. I have had good mentors at my workplace. I have a sponsor who is willing to use their influence and power to help advance my career.	1.06	0.83	1458.0 (0.00)	0.12
11	*Workplace process 3 - Diversity* Someone like me has an equal shot at getting hired here as anyone else. This organization is open to hiring people from all kinds of backgrounds. The level of work I am asked to perform is appropriate relative to my years of experience.	0.53	0.82	1458.0 (0.00)	0.06

Multivariate Regression

Multivariate regression models were used to predict variations in experiences of bias while controlling for potential confounders (Table 15). Gender was statistically significant for each of the 11 scales, many at the $p < .001$ level. Even after controlling for race, role, jobsite, disability, and family care responsibilities, women were significantly more likely to experience all five types of gender bias implicitly (as measured by the individual scales) and in workplace processes. Having family care responsibilities was significant in the third maternal wall factor ("Hours"); however, this model was only on the borderline of statistical significance [$F(8, 135) = 1.98$, $p = .05$]. Having a disability was also significant in a number of factors, including the second maternal wall factor ("Commitment") ($b = 1.23$, SE = 0.59, $p = .04$), the first workplace process factor ("Equal rewards") ($b = -1.13$, SE = 0.49, $p = .02$), and the third workplace process factor ("Diversity") ($b = -0.92$, SE = 0.45, $p = .04$). Race, jobsite, and role did not demonstrate any significance in the regression models.

DISCUSSION

This study sought to determine the extent to which implicit gender biases occur within the construction workplace by measuring and comparing reports from both men and women working in the industry. While these types of gender biases have been studied in other male-dominated fields such as engineering (Williams 2015; Williams et al. 2016), this was the first study to provide quantitative evidence of the prevalence of implicit gender bias in the construction industry. Results demonstrated that a greater proportion of women experienced each of the five types of implicit gender bias than men, that prove-it-again bias was the most common type of bias, and that race appeared to have little, if any, effect on participants' experiences of bias. The findings are presented and discussed in more detail in this section, along with study limitations and recommendations for practice and future research.

Table 15

Multivariate regression models for individual factors, *b* coefficients and standard error (SE)

	Prove it again***	Tightrope 1 (Administrative Tasks)***	Tightrope 2 (Feminine Stereotypes)***	Maternal wall 1 (Disapproval)***	Maternal wall 2 (Commitment)*	Maternal wall 3 (Hours)	Tug of war***	Isolation **	Workplace process 1 (Equal Rewards)***	Workplace process 2 (Feedback and Mentorship)	Workplace process 3 (Diversity)**
Women	1.48 (0.19)***	1.44 (0.24)***	1.29 (0.19)***	1.32 (0.21)***	0.79 (0.23)**	0.46 (0.18)*	0.98 (0.18)***	1.12 (0.22)***	-1.08 (0.19)***	-0.49 (0.17)**	-0.69 (0.18)***
Person of color	0.32 (0.25)	0.25 (0.31)	0.16 (0.24)	0.12 (0.28)	0.09 (0.30)	0.05 (0.23)	0.14 (0.23)	-0.11 (0.29)	-0.13 (0.25)	0.14 (0.22)	0.01 (0.23)
Family care responsibilities	-0.30 (0.19)	-0.38 (0.23)	-0.22 (0.18)	0.01 (0.21)	0.35 (0.22)	-0.50 (0.18)**	-0.11 (0.17)	-0.22 (0.22)	0.23 (0.19)	0.20 (0.16)	0.15 (0.17)
Role											
Field engineering or tradesperson/craftworker	-0.17 (0.38)	-0.13 (0.46)	0.12 (0.37)	0.65 (0.42)	0.14 (0.45)	0.14 (0.36)	0.18 (0.35)	-0.05 (0.44)	0.02 (0.38)	0.11 (0.33)	-0.57 (0.35)
Other technical (i.e., design, pre-construction)	-0.23 (0.23)	-0.32 (0.27)	-0.21 (0.22)	0.09 (0.25)	-0.32 (0.27)	-0.40 (0.22)	-0.22 (0.21)	-0.31 (0.26)	0.23 (0.23)	0.36 (0.20)	0.22 (0.21)
Sales, finance, human resources, and other admin	0.11 (0.36)	0.22 (0.38)	0.26 (0.31)	-0.26 (0.35)	-0.04 (0.38)	-0.17 (0.29)	-0.16 (0.29)	-0.11 (0.37)	0.44 (0.31)	0.17 (0.28)	0.33 (0.29)
Field	0.15 (0.22)	-0.51 (0.27)	0.07 (0.22)	0.33 (0.25)	-0.09 (0.27)	-0.08 (0.21)	-0.09 (0.21)	-0.03 (0.26)	0.19 (0.22)	-0.12 (0.20)	0.18 (0.21)
Disability	0.33 (0.49)	0.98 (0.60)	0.54 (0.48)	0.02 (0.54)	1.23 (0.59)*	-0.30 (0.45)	0.49 (0.45)	0.63 (0.57)	-1.13 (0.49)*	-0.79 (0.43)	-0.92 (0.45)*
Constant	2.51 (0.21)***	3.07 (0.25)***	2.76 (0.20)***	2.47 (0.23)***	2.60 (0.25)***	2.45 (0.19)***	2.27 (0.19)***	2.37 (0.24)***	4.40 (0.21)***	4.17 (0.18)***	4.87 (0.19)***

Generally, this study was consistent with previous research that describes the experiences of women in male-dominated industries such as construction and engineering. For each of the statements measuring prove-it-again bias, a significantly higher proportion of women had experienced bias than men. Almost 75% of women agreed that they had to prove themselves over and over again to get the same level of

recognition as their colleagues, 65% felt they were held to higher standards than their colleagues, and 64% reported that their peers assume they are less qualified as others with the same credentials. These results closely mirror the findings of Williams (2016) study among engineers, as well as other existing research demonstrating that women must prove their competence (Goss-Graves et al. 2014; Hunte 2016; Pinto et al. 2017) and are undervalued and respected by their colleagues (Fouad et al. 2017; Malone and Issa 2013; Williams et al. 2016).

Similarly, a significantly higher proportion of women reported experiencing tightrope bias than did their male colleagues; this difference was seen in nine of the eleven statements measuring tightrope bias. Previous studies have found that a much narrow range of behavior is acceptable for women than for men (Kay and Shipman 2014; Williams and Dempsey 2014), requiring women to "walk a tightrope" of behavior between femininity and conformity to a masculine environment. In this study, the majority of women agreed that they received pushback when they behaved assertively and experienced negative reactions from coworkers and supervisors when expressing anger. This is consistent with other research showing that, when women violate the traditional feminine stereotype, they receive disapproval (Heilman and Okimoto 2007; Morello et al. 2018; Williams and Dempsey 2014; Williams et al. 2016). Yet, at the same time, women are pressured to conform to their environment, often by altering their appearance and demeanor (Giraldo 2010; Williams et al. 2016), an expectation that is also supported by the current study.

Maternal wall bias was evidenced in this study, however it seemed to be less common than prove-it-again or tightrope bias. Only six of ten statements measuring maternal wall bias demonstrated significantly different results between men and women. Overall, the majority of female participants (75%) felt that, when women have children, it changes their colleagues' perception of their work commitment and competence, and over half (63%) reported personally experiencing this stigma. Many women felt pressured to work long hours to overcome this perception, consistent with previous research (Thompson et al. 1999; Williams and Dempsey

2014; Williams et al. 2016), although we did not observe the hesitation to ask for flexible work arrangements or family leave that was described in other studies (Thompson et al. 1999; Williams et al. 2016). Furthermore, multivariate regression provided unclear evidence of whether having family care responsibilities predicted experiences with maternal wall bias among this study sample

Tug-of-war bias also proved to be less common than prove-it-again or tightrope bias, with only five of eight statements yielding significant differences between men and women. While women did report using strategic distancing to create a gap between them and other women in the workplace to avoid having their gender seen as a disadvantage (Moir et al. 2011; Williams et al. 2016), we did not observe a difference in perceptions of support or commonality among members of a particular gender.

A higher proportion of women reported experiencing isolation bias, with eight of the nine statements exhibiting a statistically significant difference between genders. However, contrary to William's (2015) theory, race did not appear to have an effect on women's experiences of isolation. In fact, race did not demonstrate a significant relationship with any of the five types of gender bias included in this study. Only 3 of 45 statements measuring implicit gender bias showed a significant difference between persons of color and white participants, none of which remained statistically significant when the sample was limited to women. Regression models support this finding, as race did not predict any of the factors related to gender bias when other covariates, particularly gender, were included in the model. Because of the small number of participants who identified as non-white, all other races were combined into one category called "person of color," which may have diminished any existing differences by race to a degree that they were no longer detectable. With a larger sample size, one could better distinguish and have more power to detect differences between non-white races (e.g., Black or African American compared to Asian).

Overall, the mean scores associated with each statement of bias suggest that women often did not necessarily agree with the statements but disagreed *less strongly* than their male counterparts. When comparing the mean scores to the median scores, however, it became apparent that women more often *strongly* disagreed than *strongly* agreed, which skewed the mean scores towards disagreement. This explains how we witnessed mean scores corresponding to disagreement (range 1-3) on statements with which the majority of women agreed (range 4-6).

Based on these findings, we rejected the null hypothesis that a similar proportion of men and women experience each of the five types of implicit gender bias; in this study, women clearly experienced gender bias in higher proportions than men. We also rejected the second null hypothesis that a similar proportion of women experience each of the five types of bias. Prove-it-again, tightrope, and isolation bias were reported more often than maternal wall and tug-of-war bias. Finally, we failed to reject the null hypothesis that a similar proportion of women of color and white women experience isolation bias; no significant difference was seen among these two groups.

While not the primary aim of this study, statements regarding explicit gender bias and workplace processes were included in the questionnaire and analysis. Explicit bias had been the focus of research for many decades and previous studies have overwhelmingly proven that sexual harassment and discrimination continue to common experiences for women in construction (Goss-Graves et al. 2014; Hegewisch and O'Farrell 2014; Moir et al. 2011; Stockbridge 2018; Williams et al. 2016). However, this study did not provide any evidence to support these findings. Fewer than 7% of participants reported experiences of sexual harassment or unwanted physical contact, and men were the majority of participants reporting such events. Women very rarely acknowledged personal experiences with these types of explicit gender bias. It is unclear how this may be explained but some possible theories include 1) women did not feel comfortable reporting such experiences for fear of retaliation or judgement; 2) women did not recognize these experiences as inappropriate; 3) men were more likely to experience these events because there is

a culture of "hiding" these behaviors from women due to lessened social acceptability; or 4) women did not actually experience these events because the industry has improved in recent years. It may also be due to a low response rate for these questions. Missing data for this section ranged from 43% to 89%, which would dramatically reduce the analytical power associated with this set of statements.

Finally, this study found evidence to support qualitative research suggesting that women left the construction and engineering industries due to discrimination in hiring practices, assignments, and promotions (Fouad et al. 2017; Hegewisch and O'Farrell 2014). There was a significant difference in the proportion of male and female respondents who agreed with the statements assessing bias in workplace processes. A greater proportion of women reported that they had not received the opportunities and promotions they deserved and that they were paid less than their colleagues, and were less likely to report adequate networking opportunities, being rewarded for taking risks, and that the organization was open to hiring others like themselves.

CONCLUSIONS AND RECOMMENDATIONS

This study was the first to evaluate the prevalence of implicit gender bias in the construction industry and builds on prior research by providing quantitative evidence of each of the five types of bias: prove-it-again, tightrope, maternal wall, tug-of-war, and isolation bias. Prove-it-again bias was the most common type of implicit gender bias experienced by women working in construction, followed by tightrope and isolation bias. Maternal wall and tug-of-war bias, although they were reported by many participants, occurred less frequently. Race appeared to have little influence on the prevalence of bias, suggesting that the construction industry may be more heavily divided by gender than by racial differences. However, a larger sample size of non-white participants is needed to better assess the role of race on experiences of implicit gender bias.

Limitations

The most notable limitation of this study was the small number of participants who reported as non-white females. This may have limited the researcher's ability to detect differences among women of color as compared to white women. In addition, other demographic characteristics which may result in discrimination were not well-represented among the study sample, including non-heterosexual orientation and disability, while others were not included in the questionnaire, such as age and primary language. The lack of inclusion of these characteristics in analyses may have confounded the results of this study.

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CHAPTER IV

A QUANTITATIVE SURVEY OF GENDER BIAS IN CONSTRUCTION DEGREE PROGRAMS

ABSTRACT

The construction industry has been growing for many years and is expected to continue expanding over the next decade. However, it has also experienced a widespread and significant shortage of skilled workers and has largely failed to foster the inclusion of female workers. Women account for less than 10% of the construction workforce and earn only 8.5% of bachelor's degrees in construction management. The scarcity of women in construction degree programs cannot be explained by lack of motivation or interest but is rather an issue of recruitment and retention. This study examined the prevalence of gender bias in construction degree programs from different sources and the impact of these experiences on student's self-concept. Participants responded to a quantitative survey measuring gender bias, construction education self-concept, supportiveness of peers, and group identity. Results of ANCOVA and multiple linear regression models indicated that 87% of female students experienced gender bias in the previous year, which emanated significantly more often from male peers than from female peers, mentors or advisors, or professors [$F(3, 301) = 13.1$; $p = .00$]. Although experiencing gender bias did not have a significant direct impact on students' self-concept, gender bias appeared to impede the positive relationship between group identity and self-concept

(b = 0.48; t = 2.07; p = .04). These findings suggest that interventions attempting to curtail gender bias in construction degree programs should focus on male peers as their primary target but should include all potential sources of bias and that strategies to build group identity will likely improve students' self-concept.

INTRODUCTION

The construction industry has been growing for many years and is expected to continue expanding over the next decade (Center for Construction Research and Training 2007). The U.S. Bureau of Labor Statistics (Bureau of Labor Statistics 2019c) projects that construction occupations will grow by almost 10% between 2018 and 2028, a rate twice that of the overall projected job growth rate (5.2%). However, the construction industry has experienced a concurrent "widespread and significant shortage" in workers, specifically among project management and skilled positions, over the past two decades (Associated General Contractors of America 2018; Education and Training Administration 2004; Grossman 2005; Stockbridge 2018). One of the most glaring disparities in the construction workforce is the industry's failure to recruit and retain women. Construction has long been considered a "masculine" profession (Banchefsky and Park 2018; Menches and Abraham 2007) and is still considered a non-traditional occupation for women by the U.S. Department of Labor (Women's Bureau 2012), clearly reflected in both employment statistics – women account for less than 10% of the construction workforce (Bureau of Labor Statistics 2019a; Women's Bureau 2018) - and enrollment in construction degree programs.

Although women earned over half (57%) of the total number of bachelor's degrees awarded in 2016-2017, they received only 8.5% of bachelor's degrees in construction management (National Center for Education Statistics 2018). Already low, this represents a decline of over 10% from the 2011-2012 academic year in which women earned 9.7% of

construction management degrees (National Center for Education Statistics 2013). The scarcity of women in construction degree programs cannot be explained by lack of motivation or interest, as studies have shown that women exhibited higher levels of motivation related to their construction education than men (Elliott et al. 2016; Thevenin and Elliott 2018) and expressed interest in construction at a higher rate than admission numbers suggest (Hegewisch and Luyri 2010). Rather, it seems to be an issue of recruitment and retention, as women comprise only 9.7% of applicants to construction management programs (Sewalk and Nietfield 2013) and 7-10% of enrolled students (Bigelow et al. 2015; Sewalk and Nietfield 2013). Of those women who do apply and enroll, almost one-quarter (23%) do not matriculate (Sewalk and Nietfield 2013).

Student placement rates from construction management programs into internships, apprenticeships, and paid positions range between 90-100% (Elliott et al. 2016), suggesting that the demand for skilled workers is not being met by current graduation rates. With the projected growth in job availability, the demand on construction programs to improve recruitment and retention of students, particularly women, is mounting (Wilkes et al. 2015). Thus, it is vital to better understand why women continue to be underrepresented in construction degree programs. This study discusses the current body of literature on the recruitment and retention of female students, presents research from the first study to explore gender bias in construction degree programs and the impact of these experiences on student's self-concept, and provides evidence-based recommendations for fostering the inclusion of women in construction-related academic programs.

BACKGROUND AND LITERATURE REVIEW

Most of the contemporary studies among women in construction degree programs have focused on issues of recruitment. Researchers have proposed several factors that may influence women's decisions to enroll in these programs, including internship and career opportunities, networking, and mentorship. Ample career opportunities within the construction field was reported as the

foremost influence in both men and women's choice to pursue a career in the industry, with almost 90% of students stating that internship and job prospects were the most influential factor in their decision to enroll in an academic program (Bigelow et al. 2015; Bigelow et al. 2016; Bigelow et al. 2018). Candidates with bachelor's degrees are, in fact, projected to have the best outlook for obtaining a skilled position in the industry (Bureau of Labor Statistics 2019b).

In a recent study, 42% of colleges and universities with construction management programs reported using word of mouth as a primary method of recruitment (Sewalk and Nietfield 2013). This approach disproportionately attracts men, as women have fewer opportunities for networking and building the personal relationships that may assist them in learning about careers in construction, applying to and enrolling in programs, and, ultimately, succeeding in the field (Hegewisch et al. 2014). In contrast, female students often cite a haphazard approach to discovering a career in construction (Hegewisch and O'Farrell 2014). Mentoring by family members has been positively correlated to students' choice to pursue construction (Bigelow et al. 2019; Wilkes et al. 2015), and Bigelow and colleagues (2015, 2018) found that the most influential family relationship was between a father in the construction industry and his daughter. Mentoring by non-family construction professionals has also been recommended as an effective recruitment tool (Lopez del Puerto et al. 2011; Thevenin and Elliott 2018), however research revealed that this type of mentoring has a small impact on women's decisions to enter the industry (Bigelow et al. 2018). Despite this, many schools and associations have created programs (e.g., the Architecture, Construction, Engineering [ACE] mentoring program) aimed to increase women's interest and participation in construction degree programs (Menches and Abraham 2007).

In the first study to compare students' perceptions of the influence of various recruitment strategies on their decision to enter construction management programs, Bigelow, Saseendran, and Elliott (2018) discovered that there were few differences between male and female students, yet enrollment statistics of women clearly demonstrate that these strategies are not effective in

attracting female students. Some researchers posit that the culture of the industry discourages women from choosing construction as a career, and studies often cite negative industry stereotypes and perceptions as the most significant barrier to the recruitment of women (Bigelow et al. 2016; Lopez del Puerto et al. 2011; Sewalk and Nietfield 2013). Tsui (2009) further hypothesized that the engineering field is too narrowly represented and thus does not appeal to women. With the similarities between engineering and construction (Banchefsky and Park 2018), one could imagine that the construction industry faces the same challenge.

Others assert that colleges and universities have not made enough of an effort to recruit women, despite their acknowledgement of the need to increase female enrollment to meet industry demands (Lopez del Puerto et al. 2011; Tsui 2009). In their study of schools with construction management programs, Sewalk and Nietfield (2013) found that over three-fourths (77%) of schools did not track how many women were enrolled as a result of their recruitment strategies and over half (54%) did not have data regarding the proportion of applicants who were female. They also speculated that the gender biases observed in the construction industry extend to academic programs, including professors and administrators, and signal to women that they are not a good fit for the field (Sewalk and Nietfield 2013).

Lopez del Puerto et al (2011) suggested that colleges and universities should promote construction degree programs among high school counselors in an attempt to increase female enrollment, as counselors are more likely to recommend programs and disciplines with which they are familiar (McCuen and Greenberg 2009). Although a logical approach to recruitment, knowledge gaps and social norms currently hinder its effectiveness (Sewalk and Nietfield 2013; Wilkes et al. 2015). A research study conducted by Wilkes et al (2015) explored both high school students' and counselors' knowledge and perceptions of construction management as a career. Although 57% of counselors perceived themselves as knowledgeable about construction management, more than two-thirds (80%) believed that construction management did not require a degree. This suggests that, even if counselors have a positive perception of construction as a

career choice, they view it as an hourly labor job rather than a professional path (Wilkes et al. 2015). Additionally, only 51% of counselors felt that females would succeed in construction management courses (Wilkes et al. 2015). This finding was not explored further so it is unclear whether counselors believed that women do not possess the skills necessary to succeed in these courses or that, because of the stereotypically masculine culture of the industry, it is better for women to avoid this non-traditional career path. Counselors did cite perceptions of the industry as a barrier to talking with students about construction (Wilkes et al. 2015), which gives plausibility to the second theory. Although outreach programs to educate and train high school counselors could be beneficial in recruiting female students into construction degree programs (Hegewisch et al. 2014), several studies indicate that counselors have little to no influence on students' decisions to enter the construction field (Bigelow et al. 2015, 2018; Hegewisch and O'Farrell 2014; McCuen and Greenberg 2009; Wilkes et al. 2015). Furthermore, Lopez del Puerto et al (2011) asserted that, because this is a national issue, we should not expect it to be resolved at the individual school or program level; rather, a national approach is needed.

Researchers have not only studied factors influencing the recruitment of female students but also the retention of women once they have enrolled in construction degree programs. In 2016, Bigelow and colleagues conducted the first study to evaluate issues of retention among female students in construction management programs and found that having a sense of community and belonging was the most important factor in retaining women. Almost 90% of female students cited this as an influence (Bigelow et al. 2016), which is consistent with previous research that found that a positive peer network and culture is essential for retaining students (Bhatia and Priest 2010; Bigelow et al. 2016; Kaminsky et al. 2012; Shane et al. 2012). Shane and colleagues (2012) contended that social support is most effective when it balances integration into the community and development of one's own identity. A sense of community can be fostered through both formal and informal activities (Shane et al. 2012). A study by Groen, Simmons, and Turner (2019) found that the development of professional networks – often

through formal networking activities – provided students with the opportunity to learn and practice resilience that can benefit them in both their academic and professional careers. Additionally, researchers report that involvement in student organizations and other peer-to-peer activities increased female retention (Bhatia and Priest 2010; Bigelow et al. 2016).

A greater presence of women in construction degree programs, either as students or faculty, may positively impact the retention of women (Lopez del Puerto et al. 2011; Shane et al. 2012). A study by Sewalk and Nietfield (2013) found a correlation between the number of women enrolled in construction degree programs and the proportion of women who graduated, and another showed that adding female faculty was effective in retaining female students (Shane et al. 2012). However, Bigelow et al (2016) discovered that having students or faculty of the same gender was less important in retention than other factors. Of the 15 elements examined, having other women around ranked eighth and ninth in importance (Bigelow et al. 2016). Researchers suggested that this was likely because these factors were not very accessible to women (i.e., it is uncommon for large numbers of female students or faculty to be present) and therefore could not yield a strong effect (Bigelow et al., 2016) but other studies have shown only a slight correlation between the proportion of female faculty and the enrollment of women (Sewalk and Nietfield 2013), indicating that perhaps accessibility is not the reason for the low rankings of same-gender representation.

As with recruitment, mentoring is also thought to influence the retention of female students. While a number of studies provide evidence of the positive influence of mentoring on women's retention (Groen et al. 2019; Kaminsky et al. 2012; Shane et al. 2012; Thevenin and Elliott 2018), others demonstrate that the effect of mentoring is not as strong as once believed. Specifically, Bigelow and colleagues (2016) found that mentoring was only of middling importance in their evaluation of the factors that influence retention of women in construction management programs. They claim this is due to the inaccessibility of mentoring for women, a theory that is consistent with other literature. Female academic mentorship presents a cyclical

problem in which female students need female faculty to serve as mentors yet, due to low representation of women among bodies of faculty, they are unable to obtain adequate mentorship and thus do not persist in their academic and professional careers, resulting in a continued deficiency of female participation and mentorship (Sewalk and Nietfield 2013). This is compounded by the fact that female faculty who are present are often involved in many committees, boards, and other time-consuming activities as the female representative and may not be willing or able to fully engage in a mentorship program (Lopez del Puerto et al. 2011).

Moreover, McGuire and Reger (2003) posit that women and other underrepresented groups may not receive as many benefits from traditional mentoring activities as majority groups. The feminist co-mentoring model has been proposed as a more advantageous style of mentorship for women. Co-mentoring encourages a more collaborative, reciprocal relationship between participants who are at the same stage or position in their career (Lopez del Puerto et al. 2011; McGuire and Reger 2003). It seeks to integrate both logical and rational thought (e.g., the intellectual aspect) with emotional expression (e.g., the personal aspect) and celebrate success in addition to correcting weaknesses (McGuire and Reger 2003).

To date, there have not been any studies on the experiences of gender bias among women in construction degree programs, although research conducted within the scope of apprenticeship and other training programs have found evidence of sexual harassment and discrimination (Hegewisch et al. 2014). Robnett (2016) explored this topic in a pioneering study in the field of engineering. In this study, Robnett surveyed female students in engineering programs and provided a systematic comparison of bias at different academic levels. She found that 61% of female engineering students experienced gender bias at least once in the previous year and that this bias most often originated from male peers. Over one-third of female students reported that they "had to work harder than male students to be taken seriously" and had "heard negative comments about girls' and women's STEM abilities." Women enrolled in undergraduate programs reported significantly more gender bias than did girls in high school or doctoral

programs, a finding which Robnett postulates can be explained through the "weed out" culture of STEM (science, technology, engineering, and mathematics) programs. The pressures that students face may not be as great in high school courses, thus reducing male students' need to act out against women who threaten their status, and that women who experience high levels of gender bias in undergraduate programs may exit the field before reaching the doctoral level (Robnett 2016). Robnett (2016) also explored whether gender bias was linked to self-concept and revealed that women who experienced higher degrees of gender bias in their engineering programs held lower self-concept, or self-efficacy. In support of other research (Thevenin and Elliott 2018), this relationship was mitigated by the presence of a supportive network of peers (Robnett 2016). This is a crucial finding, as self-concept has been documented to play a central role in academic decision-making (Seron et al. 2018) and career aspirations (Wang and Degol 2013).

Banchefsky and Park (2018) began to broach this topic within construction degree programs with their study of gender ideologies held by male students. They defined four types of gender ideologies, two of which are positive (gender awareness and gender blindness) and two of which are negative (assimilationism and segregationism). Male students in male-dominated majors, such as construction and engineering, were more likely to agree with the negative ideologies of assimilationism and segregationism and less likely to agree with the positive ideology of gender blindness than men in majors that were gender-balanced or female-dominated. Furthermore, negative ideologies were associated with increased levels of gender-science stereotypes, such as the belief that women are not as skilled at math and science as men (Banchefsky and Park 2018). These results indicate that the same type of gender bias that was observed in engineering programs by Robnett (2016) likely also occurs within construction degree programs. Therefore, this study sought to determine the extent to which gender bias occurs within construction degree programs, as well as its relationship to students' self-concept. Specifically, the following null and alternative hypotheses were tested:

$H1_0$: No difference in the reported frequency of gender bias originating from male peers female peers, mentors or advisors, or professors will be observed.

$H1_1$: Gender bias originating from male peers will be significantly more frequent than gender bias stemming from female peers, mentors or advisors, or professors.

$H2_0$: The prevalence of gender bias will not change as students reach higher levels of education.

$H2_1$: The prevalence of gender bias will significantly decrease as students reach higher levels of education.

$H3_0$: No significant association between self-concept and gender bias will be observed.

$H3_1$: Self-concept will be significantly and negatively associated with gender bias, as more frequent gender bias is expected to decrease self-concept.

$H4_0$: A supportive network of peers will have no effect on the relationship between gender bias and self-concept.

$H4_1$: The effect of gender bias on self-concept will be mitigated by a supportive network of peers.

$H5_0$: Group identity will have no effect on the relationship between gender bias and self-concept.

$H5_1$: The effect of gender bias on self-concept will be mitigated by a strong sense of group identity.

METHODS

Procedure

Participants were recruited from colleges and universities with construction degree programs accredited by the Accreditation Board of Engineering and Technology (ABET), the American Council for Construction Education (ACCE), or the Construction Management Association of America (CMAA) and included in the list of institutions on these associations' websites. The researcher sent an email to the faculty members at each school who were identified on these websites. The email included a link to the survey, hosted on Qualtrics online platform, and a brief description of the study. Faculty were asked to share the email with their current female students as well as recent graduates. The same email was also sent to the Construction Leadership Council of the American General Contractors of America (AGC). In total, faculty from 49 schools were contacted in August 2019 and a follow-up email was sent in November 2019. Snowball sampling was used to ensure an adequate number of responses was obtained in a timely manner. Data were collected between August 26, 2019 and November 21, 2019.

Participants were required to meet minimum criteria in order to be eligible for the study. Anyone meeting these criteria and consenting to participate in the survey after reading the written consent form received the survey (Appendix A). Specifically, inclusion criteria were:

- 18 years or older,
- female,
- currently enrolled in university or graduated within one year, and
- majoring in construction management, construction science, construction engineering, or other related major.

Participants remained anonymous throughout the data collection and analysis procedures; no identifying information was collected in the survey. Ethical approval for this study was obtained from the Oklahoma State University Institutional Review Board in June 2019.

Participants

In total, 333 participants began the survey. Five (1.5%) participants did not give consent for participation in the study and 49 (14.7%) did not respond to this question at all; these 54 records were excluded from data analysis. Of the remaining 279 participants, 1 (0.4%) reported being less than 18 years old, 16 (5.7%) did not provide their age, 10 (3.6%) were male, 1 (0.4%) was of nonbinary gender, and 15 (5.4%) did not provide their gender. These participants were also excluded from further analysis, leaving 253 potentially eligible participants.

One hundred ninety-seven (77.9%) of the remaining respondents reported being currently enrolled in or recently graduated from an undergraduate program and 48 (19.0%) reported being currently enrolled in or recently graduated from a graduate program. Eight (3.2%) respondents did not provide their educational status and were excluded from the sample. Of the 174 current undergraduates, 12 (6.9%) were freshmen, 40 (23.0%) were sophomores, 53 (30.5%) were juniors and 64 (36.8%) were seniors (including fourth and fifth year students). Two (1.1%) participants reported "other" and 3 (1.7%) did not provide their year of study, resulting in their exclusion from the study. Nine (39.1%) of the 23 respondents who recently completed undergraduate studies and 9 (82%) of the 11 respondents who had recently completed graduate studies had graduated more than one year prior to the survey and were excluded. These exclusions left 222 participants in the study sample.

Most of the remaining respondents reported a major in construction management (n=113; 50.9%), construction engineering (n=40; 18.0%) or construction science (n=4; 1.8%). Thirteen (5.8%) participants reported a double major consisting of at least once construction-related program. Forty-five (20.3%) other participants reported a double major but did not provide any additional details; therefore, their majors could not be determined with certainty and they were excluded from analysis, along with 7 (3.1%) participants who did not respond to this question. Of the remaining 170 respondents, 59 (34.7%) did not provide data on the gender bias section of

the study, the primary focus, and were subsequently excluded. After all of these exclusions, we obtained a final sample size of 111 participants.

The study sample was grouped by level of education, in which freshmen and sophomores (n=31; 27.9%) were classified as "early undergraduate students," juniors, seniors, and those graduating within the past year (n=68; 61.3%) as "experienced undergraduate students," and current and recently graduated (within one year) graduate students (n=12; 10.8%) as "graduate students."

Measures

Because of the similarities in the workplace demographics between engineering and construction (Banchefsky and Park 2018), and the fact that many engineering fields work within construction, a modified version of the survey reported in Robnett's (2016) study was used to assess the prevalence of gender bias experienced by female students in construction degree programs. This quantitative survey included questions about their experiences with gender bias, their construction education self-concept, the supportiveness of their peers, and their sense of group identity. Demographic information (i.e., age, gender, educational institution, academic major, prior exposure to construction, and race/ethnicity) were also collected to allow for stratification of results, where appropriate, and inclusion in regression analyses as covariates.

Gender Bias

Participants were asked to respond to eight statements related to their experiences with gender bias in their construction courses or major, which were adapted from previous studies (Leaper and Brown 2008; Robnett 2016). For each statement, participants rated the frequency with which they experienced these biases from male peers; female peers; a mentor, advisor, or primary investigator; and professors on a 4-point Likert scale (1=never, 2=rarely, 3=sometimes, 4=often). Example statements include "Intentionally or unintentionally excluded you from a study group

because of your gender" and "Made negative comments about women's abilities in construction." Participants were presented with the following prompt before completing these questions:

> Gender bias in construction occurs when people make negative comments about women's math or science abilities (e.g., "Women shouldn't be in construction.") Gender bias in construction also occurs when people treat women unfairly by encouraging them less than they encourage men. Some people have experienced gender bias in construction, but other people have not. We would like to know about your experiences with gender bias in your construction classes/major over the past year.

The reported frequency of each form of gender bias was averaged to generate a mean gender bias score for each of the four potential agents (i.e., male peers, female peers, mentors or advisors, and professors) as well as an overall gender bias score, where higher scores indicated more frequent experiences of bias. Cronbach's alpha (α) of these mean scores were calculated for each level of education and demonstrated sufficient internal consistency for early undergraduates (male peers: $\alpha = .92$, female peers: $\alpha = .69$, mentors or advisors: $\alpha = .83$, professors: $\alpha = .84$, overall: $\alpha = .94$), experienced undergraduates (male peers: $\alpha = .92$, female peers: $\alpha = .75$, mentors or advisors: $\alpha = .87$, professors: $\alpha = .92$, overall: $\alpha = .94$), and graduate students (male peers: $\alpha = .96$, female peers: $\alpha = .74$, mentors or advisors: $\alpha = .87$, professors: $\alpha = .90$, overall: $\alpha = .96$).

Construction Education Self-Concept

Self-concept was measured using 11 statements related to participants' identity as a construction major/professional and commitment to the industry that were adapted from a previous study conducted with undergraduate science students (Robnett et al. 2018). Participants rated their

agreement with each statement on a 6-point Likert scale (1=strongly disagree to 6=strongly agree). Example statements included "I intend to work in a job related to construction" and "I feel like I belong in the field of construction." The internal reliability of this measure was acceptable for early undergraduates (α = .86), experienced undergraduates (α = .91), and graduate students (α = .95).

Supportiveness of Peers in Construction Courses or Major

Peer support was measured using items adapted from previous studies (Robnett 2012; Robnett 2016; Stake and Mares 2001) and consisted of 14 statements about the impact of participants' experiences and interactions with other students in their major on their motivation and confidence to pursue construction as a career, such as "Made construction seem more interesting to me" and "Made me feel more relaxed about learning in construction." For each statement, participants rated their agreement on a 6-point Likert scale (1=strongly disagree to 6=strongly agree). Reliability coefficients for this measure demonstrated a high level of internal consistency for early undergraduates (α = .95), experienced undergraduates (α = .95), and graduate students (α = .94).

Group Identity

Group identity, in-group ties, and in-group affect were measured using 15 statements adapted from a previous study (Cameron 2004). Example statements included "Construction majors in my classes are quick to defend each other from criticism" and "I really fit in with other construction majors at my school." Participants rated their agreement with each statement on a 6-point Likert scale (1=strongly disagree to 6=strongly agree). When necessary, statements were reverse coded so that a higher score indicated a positive group identity (e.g., "I find it difficult to form bonds with other construction majors"). Internal consistency for this measure was adequate

for early undergraduates ($\alpha = .88$), experienced undergraduates ($\alpha = .91$), and graduate students ($\alpha = .86$).

Analysis

To determine whether there were any differences in study variables by race/ethnicity, multivariate analysis of variance (MANOVA) was used to compare mean levels of gender bias, self-concept, peer support, and group identity for white, Hispanic or Latino, Asian or Pacific Islander, or bi- or multi-racial participants. The MANOVA found that race/ethnicity did significantly affect the mean levels of gender bias, self-concept, peer support, and group identity reported by participants (Wilk's $\lambda = 0.70$; $F(5) = 1.88$; $p = .01$); therefore, all further analyses controlled for race/ethnicity.

To test Hypotheses 1 and 2, a mixed repeated-measures analysis of covariance (ANCOVA) was conducted, with the within-subjects variable as the source of bias and the between-subjects variable as the participants' level of education; race/ethnicity was included as a covariate. To test Hypotheses 3, 4, and 5, multiple regression was used to test the impact on the dependent variable, mean self-concept. Control variables included in the model were race/ethnicity and level of education and independent predictor variables were the mean level of overall gender bias, peer support, and group identity, as well as the two-way interaction between gender bias and peer support, gender bias and group identity, and peer support and group identity. All three continuous predictor variables were mean centered prior to computing the interaction terms. For all statistical tests, a p value of less than .05 was considered significant.

RESULTS

Demographics

Demographic characteristics of the study sample are shown in Table 16. There was a significant difference between groups in terms of race/ethnicity, with white students representing a larger proportion of undergraduate students and minority students (e.g., Hispanic or Latino, Black or African American, or Asian or Pacific Islander) representing a larger proportion of graduate students ($\chi^2 = 51.1$; $p = .00$). A significant difference was also observed in the mean age of participants at different levels of education [$F(2) = 31.5$; $p = .00$] but this was expected due to the nature of the groupings. No significant difference in the major or field of study among participants at the various levels was observed ($\chi^2 = 11.2$; $p = .08$), nor in exposure to construction prior to selecting their major ($\chi^2 = 3.5$; $p = .17$).

Gender Bias and Level of Education

Overall, 87.4% (n=97) of participants reported experiencing gender bias at some point over the previous year. The most commonly reported biases were that female students felt they had to work harder than male students in order to be taken seriously or respected (n=81; 73.0%) and that being female would make it more difficult to succeed in construction (n=73; 65.8%). Interestingly, these were the most reported biases from all four sources, although to varying degrees (Appendix E).

Descriptive statistics suggested that gender bias originated more frequently from male peers than from female peers, mentors or advisors, or professors and varied as female students progressed in their education. An ANCOVA test using the source of bias, level of education, and race/ethnicity as independent variables and the mean level of gender bias as the dependent variable was performed to confirm these preliminary results (Table 17). This test yielded a significant main effect for the source of gender bias [$F(3, 301) = 13.1$, $p = .000$] and post-hoc

Table 16

Demographic characteristics of current study sample consisting of female students in construction degree programs

	Early undergraduate students (n=31)	Experienced undergraduate students (n=68)	Graduate students (n=12)	*P*	Total sample (n=111)
Age (mean yrs)	19.8 (SD=3.6)	21.5 (SD=1.8)	28.6 (SD=7.2)	0.000	21.8 (SD=4.1)
Race/ethnicity				0.000	
White	23 (74.2%)	51 (75.0%)	2 (16.7%)		76 (68.5%)
Hispanic or Latino	3 (9.7%)	9 (13.2%)	2 (16.7%)		14 (12.6%)
Black or African American	1 (3.2%)	1 (1.5%)	1 (8.3%)		3 (2.7%)
Asian or Pacific Islander	1 (3.2%)	1 (1.5%)	6 (50.0%)		8 (7.2%)
American Indian or Alaskan Native	0 (0.0%)	0 (0.0%)	0 (0.0%)		0 (0.0%)
Middle Eastern or North African	0 (0.0%)	0 (0.0%)	1 (8.3%)		1 (0.9%)
Bi- or multi-racial	3 (9.7%)	6 (8.8%)	0 (0.0%)		9 (8.1%)
Major or field of study				0.08	
Construction management	20 (64.5%)	45 (66.2%)	7 (58.3%)		72 (64.9%)
Construction engineering	8 (25.8%)	19 (27.9%)	1 (8.3%)		28 (25.2%)
Construction science	0 (0.0%)	2 (2.9%)	1 (8.3%)		3 (2.7%)
Double major	3 (9.7%)	2 (2.9%)	3 (25.0%)		8 (7.2%)
Exposure to construction before choosing major	15 (50.0%)	31 (45.6%)	9 (75.0%)	0.17	55 (50.0%)

pairwise Bonferroni corrections supported the significance. The mean level of gender bias originating from male peers (M = 1.88, SD = 0.84) was significantly higher than the bias stemming from female peers (M = 1.27, SD = 0.40, p = .000), mentors or advisors (M = 1.28, SD = 0.46, p = 0.000), or professors (M = 1.42, SD = 0.58, p = 0.000). No significant differences among the other three sources were observed. Thus, evidence supports the alternative hypothesis for H1 and we reject the null hypothesis. Gender bias from male peers was significantly more common than gender bias from female peers, mentors or advisors, or professors. However, the between-subjects main effect of the level of education was not significantly correlated with the mean level of gender bias [F(2, 103) = 0.16, p = .85]. Therefore, we accept the null hypothesis for H2 that no change in the prevalence of gender bias occurred among women at various levels of education.

Table 17

Analysis of covariance (ANCOVA) results for mean level of gender bias among female students

Variable	*SS*	*df*	F	*P*
Between subjects:	15.51	7	2.80	.01
Level of education	0.26	2	0.16	.85
Race/ethnicity	15.47	5	3.91	.00
Level of education * Race/ethnicity	81.42	103	---	---
Within subjects:	30.78	24	7.50	.000
Source of bias	6.74	3	13.14	.000
Source of bias * Level of education	1.22	6	1.19	.31
Source of bias * Race/ethnicity	4.18	15	1.63	.06
Residual	51.47	301	---	---

Relationship with Self-Concept, Peer Support, and Group Identity

In the initial multiple regression model with only the control variables of race/ethnicity and level of education included as covariates, the mean level of gender bias experienced by female students was significantly related to their mean level of self-concept (b = -0.37, SE = 0.15, p = .02) and the

model explained 12% of the variance in self-concept. However, this model was not statistically significant [$F(8, 102) = 1.76$, $p = .09$]. The second multiple regression model included the control variables and the mean level of gender bias, as well as the mean level of peer support and group identity and the two-way interactions of each combination of these three composite variables (Table 18). This model was statistically significant [$F(13, 97) = 6.73$, $p = .000$] and explained almost half (47%) of the variation in self-concept. One of the control variables was a significant predictor of self-concept. Specifically, Black or African American female students had a higher self-concept than students who identified as other races ($b = 1.09$, t = 2.65; $p = .01$).

Table 18

Multiple regression model testing predictors of students' construction education self-concept

Independent variables	*b*	SE	t	*P*
Race/ethnicity (white=0)				
Hispanic or Latino	0.17	0.18	0.94	0.35
Black or African American	1.09	0.41	2.65	0.01
Asian or Pacific Islander	-0.47	0.29	-1.61	0.11
Middle Eastern or Northern African	-0.22	0.64	-0.34	0.74
Bi- or multi-racial	-0.11	0.21	-0.54	0.59
Group (early undergraduates=0)				
Experienced undergraduates	0.05	0.13	0.41	0.68
Graduates	0.41	0.27	1.54	0.13
Gender bias	0.30	0.15	1.98	0.05
Peer support	-0.09	0.10	-0.89	0.37
Group identity	0.72	0.13	5.65	0.00
Gender bias * Peer support	0.10	0.23	0.42	0.67
Gender bias * Group identity	0.48	0.23	2.07	0.04
Peer support * Group identity	0.04	0.10	0.41	0.68

Gender bias was not significantly related to self-concept ($b = 0.30$, t = 1.98; $p = .05$), as it just surpassed the threshold of significance. Additionally, the 95% confidence interval of the coefficient crossed zero, further indicating that this variable was not statistically significant by

itself. Therefore, we accept the null hypothesis for H3 that gender bias and self-concept were not significantly associated. Group identity was the only predictor variable significantly associated with self-concept ($b = 0.72$, $t = 5.65$; $p = .00$); female students who more strongly identified with their cohort of construction majors displayed a higher level of self-concept. When looking at the interaction between gender bias and group identity, we found that the interaction term was statistically significant ($b = 0.48$, $t = 2.07$; $p = .04$). Together, this indicates that gender bias is a mediating factor in the relationship between group identity and self-concept, partially consistent with the alternative hypothesis for H5. Our hypothesis stated that group identity would mitigate the association between gender bias and self-concept, whereas the data showed that gender bias mitigated the association between group identity and self-concept. We therefore reject both the null and alternative hypotheses for H5. Finally, peer support did not prove to be a significant predictor or mediator for self-concept; thus, we accepted the null hypothesis for H4.

DISCUSSION

This study sought to understand female students' experiences of gender bias in construction degree programs by estimating the prevalence of gender bias and exploring associated factors. Specifically, does gender bias more frequently originate from male peers than from other sources? Does the prevalence of gender bias change as women progress through their education? How does gender bias affect self-concept and do peer support and group identity play a role? This study demonstrated that, although the majority of female students experienced gender bias over the previous year, it was significantly more common from male peers than from female peers, mentors or advisors, or professors. The occurrence of gender bias did not vary significantly as women continued their studies, nor was there clear evidence that gender bias impacted students' construction education self-concept. However, group identity was found to be a significant predictor in the level of self-concept among students and the interaction between gender bias and group identity was important. The findings are presented and discussed in more

detail in this section, along with study limitations and implications for practice and future research.

Overall, 87% of participants reported experiencing gender bias at least once over the previous year. This finding is consistent with previous research from engineering and other male-dominated fields that show that women encounter gender bias during their education (Banchefsky and Park 2018; Robnett 2016). Interestingly, the frequency of these experiences was rather low. The mean scores of gender bias ranged from 1.00 to 2.65, indicating that biases occurred only rarely or sometimes. Few participants reported *often* experiencing gender bias. Furthermore, when examining the reports of individual biases, all fell below the overall prevalence of 87%. This suggests that women may experience (or perceive) only one or a few types of gender bias, rather than all forms of bias measured in this study. Together, these results indicate that, although individual women may not frequently experience gender bias, women as a group experience a large degree of gender bias. This is consistent with, and actually higher than, the prevalence findings from Robnett's (2016) study of female engineering students (61%).

Male peers exhibited the highest mean levels of gender bias against female construction students, as expected. This finding builds on the research of Banchefsky and Park (2018) that discovered that male students in male-dominated majors, including construction, held stronger negative gender ideologies than female students in the same fields. These negative ideologies likely explain the higher levels of gender bias emanating from male peers than from female peers. Prior research revealed that women working in male-dominated fields experience what is known as tug-of-war bias, a type of gender bias that occurs from women to women (Kaiser and Spalding 2015; Williams and Dempsey 2014). However, this study found little evidence of this particular type of bias, as the mean level of gender bias stemming from female peers was quite low. Researchers believe that tug-of-war bias is often fueled by experiences of male to female gender bias and the reaction of women to these experiences (Williams et al. 2016). Thus, this type of

bias may not be evident in construction degree programs as the frequency of gender bias experienced by an individual woman seems to be rare.

Participants also reported some degree of gender bias stemming from mentors, advisors, and professors, particularly with the specific biases of being expected to work harder in order to be taken seriously or respected and that women will find it difficult to succeed in construction. This finding is troubling, as mentors are supposed to spend personal time with students to help develop their sense of competence and identity and to provide support in their academic and professional pursuits (Thevenin and Elliott 2018). However, these results may help to explain why mentoring programs have not proven effective in increasing the retention of female students (Bigelow et al. 2016; McGuire and Reger 2003) and further support the theory posited by Sewalk and Nietfield (2013) that professors and academic staff may be signaling to female students that they are not a good fit for construction management programs. It should be noted that this study did not differentiate between male and female mentors, advisors, and professors, which should be considered in future research.

This study found that women's experiences of gender bias in education did not differ according to their year or level of study. Robnett (2016) posited that the "weed out" culture of undergraduate programs contributes to the increased prevalence of gender bias observed among female engineering students, thus we expected to see higher levels of gender bias in early undergraduates. However, it is possible that the groups chosen for this study were too similar in nature (i.e., early undergraduates versus experienced undergraduates) or that the group size of graduate students was too small to detect meaningful differences between it and the undergraduate groups.

Robnett (2016) also found that experiences of gender bias negatively affected female engineering students' self-concept; yet this study did not provide clear evidence of this relationship. No direct association between the levels of gender bias and construction education self-concept were observed, although the results were on the threshold of significance and thus

inconclusive. It should be noted that the coefficient for this association was positive, suggesting that more experiences of gender bias may have led to higher self-concept, the opposite of what was expected. However, due to the non-significance of this result, the relationship is still unclear. It is possible that clearer evidence could be obtained with a larger sample size, allowing for more power to detect differences. The relationship between the two may also have been masked due to the low frequency with which gender bias was reported. Although most participants experienced gender bias over the previous year, none of the mean scores indicated that these experiences occurred often and there were relatively small variations in means. If female students experienced more frequent gender bias (e.g., on a daily basis), it is plausible that we would see a larger effect on their level of self-concept. Another theory to explain this lack of clear relationship is that female students who would be most affected by gender bias may decide to not enter construction programs at all, or that women who do enter a construction-related degree program generally have higher self-concept than other students. The industry has a negative perception of being male-dominated and unwelcoming to women (Bigelow et al. 2016; Lopez del Puerto et al. 2011; Sewalk and Nietfield 2013; Tsui 2009); this image could deter more vulnerable women and leave only those with a strong sense of identity and commitment to the industry. These theories should be tested in future studies with female construction students.

Peer support and group identity were evaluated as potential mediators of the relationship between gender bias and self-concept. The former was not found to be significantly related, contrary to previous research (Bhatia and Priest 2010; Robnett 2016), but group identity was found to have a direct positive association with self-concept, which is consistent with recent studies (Bigelow et al. 2016; Shane et al. 2012). In this study, peer support measured students' motivation and confidence to pursue a career in construction as a result of their interactions with fellow students, whereas group identity measured the degree to which students felt like they were part of the ingroup of their cohort and their resulting affect. Furthermore, the two-way interaction between group identity and gender bias was significant, suggesting that, together, these factors

influence self-concept. Because group identity was the significant predictor rather than gender bias, this may suggest that experiences of gender bias dampen the positive effect of group identity on students' self-concept, instead of group identity mitigating the negative effects of gender bias on self-concept. These findings support the call for formal and informal activities that build group identity among a cohort of students (Bhatia and Priest 2010; Bigelow et al. 2016; Shane et al. 2012) and indicate that they may be beneficial in furthering women's success in construction degree programs and the industry.

CONCLUSIONS AND RECOMMENDATIONS

Previous research conducted among female students in male-dominated degree programs has primarily focused on the effectiveness of various recruitment and retention strategies to foster the inclusion of women. However, researchers had not yet explored female students' experiences of gender bias or the prevalence with which biases occur within construction degree programs. This study builds on prior research by providing evidence of gender bias in construction management, construction engineering, and construction science undergraduate and graduate degree programs. Specifically, female students were extremely likely to experience gender bias in these programs, especially from their male peers. To date, this is the first study to provide such quantitative evidence within the construction field. Although this study did not provide conclusive evidence regarding the direct relationship between gender bias and construction education self-concept, it did find that social support in the context of group identity was an important predictor of female students' self-concept. The results of the current study suggest that 1) interventions attempting to curtail gender bias in construction-related degree programs should focus on male peers as their primary target but should include all potential sources of bias (i.e., female peers, mentors and advisors, professors), and 2) strategies to build group identity will likely improve students' self-concept. Additional research is needed to further elucidate the interchange among gender bias, group identity, and self-concept of female students within construction degree programs.

Limitations

The methodological design chosen for this study presented some limitations for interpreting and generalizing these results. First, the study asked participants about their perceptions of gender bias rather than actual bias. It was not possible to determine whether participants' perceptions accurately estimated the actual occurrences of gender bias. However, the data reported in this study may underestimate the true level of gender bias if participants were hesitant to admit or share their unfair treatment (Robnett 2016). A second limitation of this study was that it was cross-sectional in nature. Thus, it was impossible to determine with certainty the exact nature of the relationship between gender bias, group identity, and self-concept (i.e., Does gender bias mediate the effect of group identity on self-concept, or vice versa?). Theories presented to explain this have been supported by previous research but a longitudinal study is needed to confirm these theories.

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CHAPTER V

CONCLUSIONS

In consideration of the projected expansion of the construction industry (Bureau of Labor Statistics 2019; Center for Construction Research and Training 2007), as well as the current labor shortage expected to constrain this anticipated growth (Associated General Contractors of America 2018; Center for Construction Research and Training 2007; Education and Training Administration 2004; Grossman 2005; Stockbridge 2018), this doctoral research aimed to examine the industry's longstanding failure to recruit and retain women and to identify intervention points and opportunities to promote the inclusion of women. Based on three quantitative surveys conducted among professionals in the construction industry and students in construction degree programs, this study builds upon the current body of literature describing gender diversity in the male-dominated fields of science, technology, engineering, and mathematics (STEM), and provides novel insights and actionable recommendations to academic programs and industry leaders for meeting workforce demands. It also suggests topics for additional research to further understand the complexity of women's participation and experiences in the construction industry.

Previous research on gender diversity in male-dominated industries paid little attention to construction. The three studies that comprise this research have aimed to fill this gap in the existing literature and represents first of its kind in the industry, thus affording a unique

contribution to the literature base. The first study (Chapter 2) offered an analysis of the personal and organizational factors that influence women's persistence and turnover in the industry. The second study (Chapter 3) explored and measured perceptions of gender bias in the construction workplace, while the final study (Chapter 4) focused on gender bias in construction degree programs.

MAIN CONCLUSIONS AND CONTRIBUTIONS TO THEORY AND PRACTICE

The first study assessed turnover behaviors and compared women who persisted in the construction industry to those who left, examining the impact of factors such as resilience, organizational support, self-efficacy, and outcome expectations. In some ways, the study's findings contradicted previous research into the persistence of women in similar industries (Preston 2004; Singh et al. 2018; Wayne et al. 1997), suggesting that perceived organizational support had no significant influence on retention. This study also found that outcome expectations were unrelated to turnover and, surprisingly, indicated that organizational self-efficacy is negatively correlated with persistence in the industry. Most notably, a significant relationship between career resilience and persistence of women in the construction industry was reported, in support of findings from previous research (Cha 2013; Peters et al. 1981; Singh et al. 2013).

The second study provided the first quantitative evidence for the prevalence of each of the five types of implicit gender bias experienced by women in the construction industry: prove-it-again, tightrope, maternal wall, tug-of-war, and isolation bias. As in other male-dominated industries (Goss-Graves et al. 2014; Hunte 2016; Pinto et al. 2017; Williams 2015; Williams et al. 2016), prove-it-again bias was the most common type of implicit gender bias experienced by women working in construction, followed by tightrope and isolation bias. Maternal wall and tug-of-war bias, although they were reported by many participants, occurred less frequently. Race appeared to have little influence on the prevalence of bias, suggesting that the construction industry may be more heavily divided by gender than by racial differences.

However, the third and final study demonstrated that gender bias is prevalent in the construction industry long before women join the workforce. In a survey of students and recent graduates of construction degree programs, the majority of female students reported experiencing gender bias during their academic career. Male peers were the primary source of this bias, which may explain subsequent dynamics and experiences of bias in the workplace. The studies of gender bias in both the professional and academic contexts found relatively lower levels of female-to female bias (i.e., tug-of-war bias) than biases stemming from their male counterparts (e.g., prove-it-again). Although experiences of gender bias were not shown to have a significant impact on students' self-concept, they did adversely impact the positive relationship between group identity and self-concept, which may lead to perceptions of isolation bias in the workplace.

Together, these three studies illustrate the multifaceted obstacles facing women who pursue careers in the construction industry. From explicit biases in the academic environment to organizational barriers and implicit biases in the workplace, women in construction face unique challenges at every step of their career, disincentivizing them from participation in the industry. This provides further context for the finding that career resilience is the strongest indicator of persistence among women in the construction industry.

The evidence presented in this dissertation illuminates two main opportunities for promising interventions to foster gender diversity and the inclusion of women in the construction industry. Findings suggest that a critical intervention point for mitigating gender bias in the construction industry could be the further assessment and targeting of male peers in construction-related degree programs to positively influence their views about their female peers. Furthermore, resilience proved to be a reliable predictor of retention among women in the construction industry and, as it is a skill that can be developed through intervention and training (Southwick et al. 2011), it may serve as another critical intervention point for encouraging the prolonged inclusion of women. These evidence-based recommendations for addressing enduring prejudice and bias against women in the

construction industry are likely to bolster their inclusion and enable academic programs and industry leaders to meet current and projected workforce demands.

SUGGESTIONS FOR FUTURE RESEARCH

Several topics for further study were identified through this research. To better understand the relationship between organizational self-efficacy and persistence among women in construction, a larger sample of women who have left the industry would be worthwhile. Likewise, additional studies modeled after this research with a larger number of non-white participants would likely prove valuable in identifying any impact or interrelatedness of racial discrimination with implicit and explicit gender bias. Finally, a longitudinal study among female students in construction degree programs may generate additional insight into the relationship between experiences with gender bias, educational self-concept, and group identity which were not clear in the current study.

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APPENDICES

APPENDIX A

Written Consent Form Used for Persistence Survey

ADULT CONSENT FORM
OKLAHOMA STATE UNIVERSITY

WOMEN IN CONSTRUCTION MANAGEMENT: GENDER BIAS IN THE WORKPLACE AND ACADEMIA AND PERSISTENCE IN THE WORKFORCE

PRIVATE INVESTIGATOR (PI):
Amy King - Lewis CPC, LEED AP
Department of Civil and Environmental Engineering

ADVISOR:
Dr. Yongwei Shan, Ph.D.
Department of Civil and Environmental Engineering

PURPOSE:
The purpose of this two-phase research project is to explore the occurrence of gender bias within the construction industry and academia (undergraduates in Construction Management, Construction Engineering, and Construction Science degree programs) as well as persistence of women in the construction industry.

PROCEDURES:
You will complete an online survey that will take about 25 minutes. The survey consists of four subgroups that explore your perceptions, experiences, and interactions with other students in your major, how you feel about being in your field, and perceived biases within your courses. Each section will take about 5 to 7 minutes to complete.

RISKS OF PARTICIPATION:
There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

BENEFITS OF PARTICIPATION:
You can make a significant contribution to ensuring the recruitment and retention of women in the construction field by participating in this study.

CONFIDENTIALITY:
All data will be collected anonymously through an online survey. Hence, no identifying information will be collected for this study.
COMPENSATION:
No compensation will be given for participation in this study.

CONTACTS:
You may contact the researcher at the following e-mail address and phone number, should you desire to discuss your participation in the study and/or request information about the results of the study: Amy King-Lewis, CPC, LEED AP, kingae@okstate.edu phone number: (405) 777-6362 or Dr. Yongwei Shan, Ph.D.,P.E., yongwei.shan@okstate.edu phone number (405) 744-7073. To speak to someone independent of the research team, please contact the Oklahoma State University Institutional Review Board (IRB) at (405) 744–3377.

PARTICIPANT RIGHTS:
I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty.

FUTURE USE OF INFORMATION:
Your information might be distributed or used for future research studies without additional informed consent. All identifiers will be removed before your information is used or distributed.

CONSENT DOCUMENTATION:
I have been fully informed about the procedures listed here. I am aware of what I will be asked to do and of the benefits of my participation. I also understand the following statements:
I affirm that I am 18 years of age or older.
I have read and fully understand this consent form. I sign it freely and voluntarily.

Written Consent Form Used for Gender Bias Survey (Workplace)

ADULT CONSENT FORM
OKLAHOMA STATE UNIVERSITY

WOMEN IN CONSTRUCTION MANAGEMENT: GENDER BIAS IN THE WORKPLACE AND ACADEMIA AND PERSISTENCE IN THE WORKFORCE.

PRINCIPAL INVESTIGATOR (PI):
Amy King - Lewis CPC, LEED AP
Department of Civil and Environmental Engineering

ADVISOR:
Dr. Yongwei Shan, Ph.D.
Department of Civil and Environmental Engineering

PURPOSE:
The purpose of this three-phase research project is to explore the occurrence of gender bias within the construction industry and construction degree programs, as well as persistence of women in the construction industry.

PROCEDURES:
You will complete an online survey that will take about 10-15 minutes. This survey consists of questions asking about your experiences working in the construction industry. Please answer honestly - your responses will remain confidential.

RISKS OF PARTICIPATION:
There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

BENEFITS OF PARTICIPATION:
You can make a significant contribution to ensuring the recruitment and retention of qualified workers in the construction field by participating in this study.

CONFIDENTIALITY:
All data will be collected anonymously. No identifying information will be collected and your responses cannot be traced back to you.

COMPENSATION:
No compensation will be given for participation in this study.

CONTACTS:
You may contact the researcher at the following email address and phone number, should you desire to discuss your participation in the study and/or request information about the results of the study:

Amy King-Lewis, CPC, LEED AP
kingae@okstate.edu
(405) 777-6362

Dr. Yongwei Shan, Ph.D, P.E.
yongwei.shan@okstate.edu
(405) 744-7073

To speak to someone independent of the research team, please contact the Oklahoma State University Institutional Review Board (IRB) at (405) 744-3377.

PARTICIPANT RIGHTS:
I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty.

FUTURE USE OF INFORMATION:
Your information might be distributed or used for future research studies without additional informed consent.

CONSENT DOCUMENTATION:
I have been fully informed about the procedures listed here. I am aware of what I will be asked to do and of the benefits of my participation.

Written Consent Form Used for Gender Bias Survey (Students)

ADULT CONSENT FORM
OKLAHOMA STATE UNIVERSITY

WOMEN IN CONSTRUCTION MANAGEMENT: GENDER BIAS IN THE WORKPLACE AND ACADEMIA AND PERSISTENCE IN THE WORKFORCE.

PRINCIPAL INVESTIGATOR (PI):
Amy King - Lewis CPC, LEED AP
Department of Civil and Environmental Engineering

ADVISOR:
Dr. Yongwei Shan, Ph.D.
Department of Civil and Environmental Engineering

PURPOSE:
The purpose of this two-phase research project is to explore the occurrence of gender bias within the construction industry and academia (undergraduates in Construction Management, Construction Engineering, and Construction Science degree programs) as well as persistence of women in the construction industry.

PROCEDURES:
You will complete an online survey that will take about 25 minutes. The survey consists of four subgroups that explore your perceptions, experiences, and interactions with other students in your major, how you feel about being in your field, and perceived biases within your courses. Each section will take about 5 to 7 minutes to complete.

RISKS OF PARTICIPATION:
There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

BENEFITS OF PARTICIPATION:
You can make a significant contribution to ensuring the recruitment and retention of women in the construction field by participating in this study.

CONFIDENTIALITY:
All data will be collected anonymously through an online survey. Hence, no identifying information will be collected for this study.

COMPENSATION:
No compensation will be given for participation in this study.

CONTACTS:
You may contact the researcher at the following e-mail address and phone number, should you desire to discuss your participation in the study and/or request information about the results of the study: Amy King-Lewis, CPC, LEED AP, kingae@okstate.edu phone number: (405) 777-6362 or Dr. Yongwei Shan, Ph.D.,P.E., yongwei.shan@okstate.edu phone number (405) 744-7073. To speak to someone independent of the research team, please contact the Oklahoma State University Institutional Review Board (IRB) at (405) 744–3377.

PARTICIPANT RIGHTS:
I understand that my participation is voluntary, that there is no penalty for refusal to participate, and that I am free to withdraw my consent and participation in this project at any time, without penalty.

FUTURE USE OF INFORMATION:
Your information might be distributed or used for future research studies without additional informed consent. All identifiers will be removed before your information is used or distributed.

CONSENT DOCUMENTATION:
I have been fully informed about the procedures listed here. I am aware of what I will be asked to do and of the benefits of my participation. I also understand the following statements:
I affirm that I am 18 years of age or older.
I have read and fully understand this consent form. I sign it freely and voluntarily.

APPENDIX B

Demographic and Work History Variables Collected in Persistence Survey

Table B.1

Descriptive statistics of study sample using categorical demographic and work history variables using Fisher's exact test

Variable*	Persisters N (%)	Non-persisters N (%)	Total N (%)	*P*
Attended college (n=69)				0.54
Yes	41 (80.4%)	15 (83.3%)	56 (81.2%)	
No	10 (19.6%)	3 (15.0%)	13 (18.3%)	
Current or last position within the industry (n=128)				---
Apprenticeship / training	3 (2.8%)	0 (0.0%)	3 (2.3%)	
Construction management / operations	66 (61.1%)	10 (50.0%)	76 (59.4%)	
Design	4 (3.7%)	0 (0.0%)	4 (3.1%)	
Engineering	7 (6.5%)	1 (5.0%)	8 (6.3%)	
Environmental safety / quality	3 (2.8%)	0 (0.0%)	3 (2.3%)	
Pre-construction	2 (1.9%)	1 (5.0%)	3 (2.3%)	
Sales, business development, or other administrative	18 (16.7%)	2 (10.0%)	20 (15.6%)	
Trade / craft	3 (2.8%)	0 (0.0%)	3 (2.3%)	
Unknown	2 (1.9%)	6 (30.0%)	8 (6.3%)	
Satisfied with hours worked (n=102)				0.70
Yes	59 (65.6%)	10 (83.3%)	69 (67.6%)	
No, more than desired	27 (30.0%)	2 (16.7%)	29 (28.4%)	
No, less than desired	4 (4.4%)	0 (0.0%)	4 (3.9%)	
Self-employed (n=101)				1.00
Yes	6 (6.7%)	1 (8.3%)	7 (6.9%)	
No	83 (93.3%)	11 (91.7%)	94 (93.1%)	
Number of hierarchical levels between current position and top management (n=94)				0.21
1-2	33 (39.3%)	4 (40.0%)	37 (39.4%)	
3-5	42 (50.0%)	3 (30.0%)	45 (47.9%)	

6-9	4 (4.8%)	1 (10.0%)	5 (5.3%)	
More than 9	5 (5.9%)	2 (20.0%)	7 (7.4%)	
Number of decision-making levels in current organization (n=81)				0.07
1-2	10 (13.9%)	4 (44.4%)	14 (17.3%)	
3-5	41 (56.9%)	2 (22.2%)	43 (53.1%)	
6-9	15 (20.8%)	2 (22.2%)	17 (21.0%)	
More than 9	6 (8.3%)	1 (11.1%)	7 (8.6%)	
Number of employees in current organization (n=99)				0.17
1-14	4 (4.6%)	3 (25.0%)	7 (7.1%)	
15-49	10 (11.5%)	0 (0.0%)	10 (10.1%)	
50-99	5 (5.7%)	0 (0.0%)	5 (5.0%)	
100-499	12 (13.8%)	1 (8.3%)	13 (13.1%)	
500-999	5 (5.8%)	0 (0.0%)	5 (5.0%)	
1,000 – 4,999	22 (25.3%)	4 (33.3%)	26 (26.3%)	
5,000-10,000	17 (19.5%)	4 (33.3%)	21 (21.2%)	
More than 10,000	12 (13.8%)	0 (0.0%)	12 (12.1%)	
Perceived chance of promotion (n=97)				0.66
Likely within next year	17 (19.8%)	1 (9.1%)	18 (18.6%)	
Likely within next 2 years	22 (25.6%)	3 (27.3%)	25 (25.8%)	
Likely within next 3-4 years	8 (9.3%)	2 (18.2%)	10 (10.3%)	
Hard to say	39 (45.3%)	5 (45.4%)	44 (45.4%)	
Type of current position (n=99)				0.68
Line position	26 (29.9%)	3 (25.0%)	29 (29.3%)	
Staff position	26 (29.9%)	2 (16.7%)	28 (28.3%)	
Both line and staff responsibilities	24 (27.6%)	5 (41.7%)	29 (29.3%)	
Not applicable	11 (12.6%)	2 (16.7%)	13 (13.1%)	
Gender of coworkers (n=99)				0.90
All women	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Mostly women	4 (4.6%)	1 (8.3%)	5 (5.0%)	
Equal balance between men and women	17 (19.5%)	2 (16.7%)	19 (19.2%)	
Mostly men	57 (65.5%)	8 (66.7%)	65 (65.7%)	
All men	8 (9.2%)	1 (8.3%)	9 (9.1)	
Not applicable (no coworkers)	1 (1.1%)	0 (0.0%)	1 (1.0%)	
Race/ethnicity of coworkers (n=97)				0.23
Mostly the same as me	41 (48.2%)	9 (75.0%)	50 (51.5%)	
Mostly different than me	23 (27.1%)	2 (16.7%)	25 (25.8%)	
Equal balance between the same and different from my own race/ethnicity	21 (24.7%)	1 (8.3%)	22 (22.7%)	
Supervisor is same gender as me (female) (n=95)				0.42
Yes	13 (15.7%)	3 (25.0%)	16 (16.8%)	

	No	70 (84.3%)	9 (75.0%)	79 (83.2%)	
Supervisor is same race/ethnicity as me (n=92)					1.00
	Yes	58 (72.5%)	9 (75.0%)	67 (72.8%)	
	No	22 (27.5%)	3 (2.0%)	25 (27.2%)	

*Missing data are not included in the calculated percentages. The number of responses for each variable are shown in the table and percentages represent only those participants who responded.

Table B.2

Descriptive statistics of study sample using continuous demographic and work history variables using two-sample independent t-test

	Persisters Mean (95% CI)	Non-persisters Mean (95% CI)	Total Mean (95% CI)	*P*
Years since graduation (n=39/13)	15.4 (11.7 – 19.1)	16.1 (8.8 – 23.4)	15.6 (12.4 – 18.7)	0.86
Average hours worked per week (n=90/12)	47.8 (46.1 – 49.5)	39.1 (31.4 – 46.7)	46.8 (45.0 – 48.6)	0.001
Average hours worked at home per week (n=90/11)	5.0 (4.0 – 6.1)	5.6 (3.2 – 8.0)	4.9 (4.1 – 6.1)	0.73
Average days traveled for work per month (n=90/11)	1.9 (1.3 – 2.4)	3.4 (0.2 – 6.7)	2.0 (1.5 – 2.6)	0.09
Years of work experience (n=90/12)	19.1 (16.7 – 21.6)	19.2 (12.7 – 25.8)	19.2 (16.9 – 21.4)	0.98
Years worked at current organization (n=90/12)	6.9 (5.6 – 8.2)	5.1 (0.0 – 10.1)	6.7 (5.4 – 8.0)	0.35
Years worked in current industry (n=90/12)	13.6 (11.6 – 15.6)	7.2 (0.1 – 14.4)	12.9 (10.9 – 14.8)	0.04
Years worked in current position (n=90/12)	5.2 (4.0 – 6.3)	5.0 (0.0 – 10.1)	5.1 (4.0 – 6.3)	0.93
Months since last promotion (n=86/12)	30.7 (21.1 – 40.2)	26.9 (17.2 – 36.6)	30.2 (21.8 – 38.6)	0.77
Total number of promotions during career (n=82/11)	3.8 (3.1 – 4.5)	3.1 (1.6 – 4.6)	3.7 (3.1 - 4.4)	0.48
Total number of promotions at current organization (n=86/12)	1.6 (1.2 – 2.0)	0.2 (0.0 – 0.5)	1.5 (1.1 – 1.8)	0.01
Number of employees supervised (n=87/12)	2.8 (2.4 – 3.2)	1.7 (1.0 – 2.5)	2.7 (2.3 – 3.0)	0.04

* The number of responses for each variable are shown in the table, as some had missing data.

APPENDIX C

Statements and Scales Used in Persistence Survey

Thank you for taking part in this study. Your responses are crucial for us to understand the career experiences of women in construction.

In this survey, you will be answering a series of questions that ask you for your input regarding a variety of work-related experiences you may have encountered. Some of the questions will ask about your thoughts and feelings related to your job responsibilities and interests while others will invite you to describe workplace behaviors you have experienced or observed at work. Remember, *there are no right or wrong answers to these questions.* Usually the best answer is the first one that comes to mind – try to avoid spending too much time on any one answer. We request you to share your personal insights and perspectives in order to better understand the experiences of women in construction.

Construction Task Self-Efficacy

The following statements refer to your **confidence at a variety of tasks related to construction and construction project management**. Please indicate the extent to which you agree or disagree with each statement. If you currently do not perform these particular tasks, please think of how confident you would be in doing these tasks *with proper training*.

1=not at all confident; 5=very confident

I'm confident that with the proper training, I can…

1	…schedule the project in logical steps and budget time required to meet deadlines.
2	…determine labor requirements and dispatch workers to construction sites.
3	…inspect and review projects to monitor compliance with building and safety codes and other regulations.
4	…interpret and explain plans and contract terms to administrative staff, workers, and clients, representing the owner or developer.
5	…prepare contracts and negotiate revisions, changes and additions to contractual agreements with architects, consultants, clients, suppliers and subcontractors.
6	…obtain all necessary permits and licenses.
7	…direct and supervise workers.
8	…study job specifications to determine appropriate construction methods.

9	…select, contract, and oversee workers who complete specific pieces of the project, such as painting or plumbing.
10	…requisition supplies and materials to complete construction projects.
11	…prepare and submit budget estimates and progress and cost tracking reports.
12	…develop and implement quality control programs.
13	…take actions to deal with the results of delays, bad weather, or emergencies at the construction site.
14	…confer with supervisory personnel, owners, contractors, and design professionals to discuss and resolve matters such as work procedures, complaints and construction problems.
15	…investigate damage, accidents, or delays at construction sites to ensure that proper procedures are being carried out.
16	…evaluate construction methods and determine cost-effectiveness of plans.
17	…scheduling events, programs, and activities, as well as the work of others.
18	…estimating sizes, distances, and quantities; or determining time, costs, resources, or materials needed to perform a work activity.
19	…encouraging and building mutual trust, respect, and cooperation among team members.
20	…read construction drawings and understand specifications efficiently and accurately.

Organizational Self-Efficacy

Every organization has a unique culture in which their employees work. Organizational culture refers to the values, norms, traditions, customs, and meanings that define the 'character' of the company and serve as general guidelines for appropriate behavior within a company. The following statements refer to the extent to which you agree or disagree with the following statements. Please indicate the level of confidence you have for the following activities.

1=not at all confident; 5=very confident

I am confident that I…

1	…can network with others at work.
2	…can use my connections and networks to make things happen at work.
3	…can develop a large network of colleagues and associates at work.
4	…can call on others at work for support when I really need to get things done.
5	…can develop connections with people at work.
6	…can build relationships with influential people at work.
7	…can have people believe I am sincere in what I say and do.
8	…know the right thing to say or do to influence others.
9	…have good intuition or savvy about how to present myself to others.
10	…can sense the motivations and hidden agendas of others.
11	…can read and interpret people's facial expressions.
12	…can understand people very well.
13	…can develop good rapport with most people.
14	…can make most people feel comfortable and at ease around me.

15	…can communicate easily and effectively with others.
16	…know where (or who) to go for support if I encounter interpersonal problems at work.
17	…know what resources to use to complete my work tasks.

Construction Task Outcome Expectations

This section contains statements that describe the expectations that you may have from doing different parts of your job well. Please indicate the extent to which you agree or disagree with each statement.

1=strongly disagree; 5=strongly agree

1	If I perform my job tasks well, then I will earn the respect of my co-workers.
2	If I am a good at my job, then I will be better able to achieve my future goals.
3	If I achieve in my job, I expect I'll receive good raises.
4	If I understand the process from beginning to end, I would be more efficient at completing my work tasks
5	When I perform well at my job, then I am more satisfied with my life.
6	When I am successful at my work tasks, then my superior(s) will be impressed.
7	If I do well at my current job, then I will have many options for my next job.
8	If I perform my job tasks well, then I am likely to be promoted.
9	When I'm doing poorly at my job, I feel very anxious.
10	When I do well on a work project, I feel great about myself.
11	When I do my job well, I feel proud about myself.

Organizational Outcome Expectations

This section contains statements that describe the expectations that you may have from doing different parts of your job well. Please indicate the extent to which you agree or disagree with each statement.

1=strongly disagree; 5=strongly agree

1	If I establish a good support network at work, then I will be happy.
2	If I do not know who to turn to for support and advice at work, then I will be anxious.
3	If I anticipate the needs of my co-workers and supervisors, then they will think I am a better worker.
4	If I am able to manage conflict at work, then I would feel better about myself.
5	If I am flexible and adjust to the demands of my job, then I will be a more effective worker.
6	If I am sincere and genuine in my interactions, my colleagues will like me more.
7	If I build good relationships at work, then my co-workers and supervisors will value my contribution.

8	If I communicate better with my co-workers and supervisor(s), then I would not be so stressed.
9	If I do well at my current job, then I will be better prepared for my next position.

Managerial Support for Work-Life Balance

This section contains statements that describe the extent to which you perceive your supervisor is supportive and sensitive to your family responsibilities. Please indicate the extent to which you feel confident with each statement.

1=not at all confident; 5=very confident

1	In general, managers in this organization are quite accommodating of family-related needs.
2	Higher management in this organization encourages supervisors to be sensitive to employees' family and personal concerns.
3	Middle managers and executives in this organization are sympathetic toward employees' child care responsibilities.
4	In the event of a conflict, managers are understanding when employees have to put their family first.

Organizational Time Demands

This section contains statements that describe the extent to which you perceive your supervisor is supportive and sensitive to your family responsibilities. Please indicate the extent to which you feel confident with each statement.

1=not at all confident; 5=very confident

1	In this organization, it is very hard to leave during the workday to take care of personal or family matters.
2	To get ahead at this organization, employees are expected to work more than 50 hours a week, whether at the workplace or at home.
3	Employees are often expected to take work home at night and/or on weekends.
4	Employees are regularly expected to put their jobs before their families.
5	To be viewed favorably by top management, employees in this organization must constantly put their jobs ahead of their families or personal lives.

Developmental Experiences

Organizations differ in the extent to which they offer and support professional development opportunities for their employees. Please indicate your level of agreement with the statements below. Using the scale below, please tell us the extent to which these professional development

opportunities were offered to you?

1=not at all; 5=a very large extent

1	Regardless of my companies' policies on training and development, my supervisors make a substantial investment in me by providing formal training and development opportunities.
2	In the positions I have held within the company, I have often been assigned projects that have enabled me to develop and strengthen new skills.
3	In the positions I have held within the company, I have often been given additional challenging assignments.
4	Besides formal training and developmental opportunities, my managers have helped me to develop my skills by providing me with challenging job assignments.

Career Identity

Listed below is a series of statements that may reflect your thoughts and behaviors about your work and career in construction. Please indicate your level of agreement with the statements below.

1=strongly disagree; 5=strongly agree

1	Construction is an important part of who I am.
2	The construction field has a great deal of personal meaning to me.
3	I do not feel "emotionally attached" to construction.
4	I strongly identify with construction.

Career Planning

Listed below is a series of statements that may reflect your thoughts and behaviors about your work and career in construction. Please indicate your level of agreement with the statements below.

1=strongly disagree; 5=strongly agree

1	I do not have a strategy for achieving my goals in the construction field.
2	I have created a plan for my development in the construction field.
3	I do not identify specific goals for my development in the construction field.
4	I do not often think about my personal development in the construction field.

Career Resilience

Listed below is a series of statements that may reflect your thoughts and behaviors about your work and career in construction. Please indicate your level of agreement with the statements below.

1=strongly disagree; 5=strongly agree

1	The costs associated with working in the construction field sometimes seem too great.
2	Given the problems I encounter working in the construction field, I sometimes wonder if I get enough out of it.
3	The discomforts associated with working in the construction field sometimes seem too great.
4	Given the problems in construction, I sometimes wonder if the personal burden is worth it.

Career Satisfaction

This section contains statements that describe the extent to which you feel satisfied with your career. Please indicate the extent to which you agree with each statement.

1=strongly disagree; 5=strongly agree

1	I am satisfied with the success I have achieved in my career.
2	I am satisfied with the progress I have made toward meeting my overall career goals.
3	I am satisfied with the progress I have made toward meeting my goals for income.
4	I am satisfied with the progress I have made toward meeting my goals for advancement.
5	I am satisfied with the progress I have made toward meeting my goals for the development of new skills.

Expectations of Finding Alternative Employment

Listed below is a series of statements that may reflect your thoughts and behaviors about your work and career in construction. Please indicate your level of agreement with the statements below.

1=strongly disagree; 5=strongly agree

1	It is possible for me to find a better job than the one I have now.
2	There is no doubt in my mind that I can find a job that is at least as good as the one I have now.
3	Acceptable jobs can always be found.

Job Search Behaviors

Listed below is a series of statements that may reflect your thoughts and behaviors about your work and career in construction. Please indicate your level of agreement with the statements below.

1=strongly disagree; 5=strongly agree

1	I often follow up on job leads.
2	I often seek information about other job possibilities.
3	I often look at newspaper and/or online ads for new jobs.
4	I sometimes follow up on job leads I've heard about.

Organizational Turnover Intentions

Listed below is a series of statements that may reflect your thoughts and behaviors about your work and career in construction. Please indicate your level of agreement with the statements below.

1=strongly disagree; 5=strongly agree

1	I often think about quitting construction.
2	I plan to stay in construction for some time.
3	I intend to look for a different career from construction within 1 year.
4	I intend to search for another position so that I can leave this organization.
5	I've decided to quit this organization.
6	I plan to leave this organization soon.
7	I often think about quitting my job.

APPENDIX D

Mean Scores and 95% Confidence Intervals of Statements included in Gender Bias (Workplace) Survey

Table D.1

Mean scores and 95% confidence intervals of statements measuring prove-it-again bias

	Total	Male	Female	*P*	*d*	Person of Color	White	*P*	*d*	Woman of Color	White Woman	*P*	*d*
I have to prove myself over and over again to get the same level of recognition as my colleagues.	3.67 (3.44 – 3.91)	2.94 (2.61 – 3.28)	4.19 (3.91 – 4.48)	**0.000**	-0.85	3.81 (3.25 – 4.37)	3.59 (3.33 – 3.85)	0.47	-0.14	4.52 (3.98 – 5.07)	4.08 (3.75 – 4.42)	0.24	-0.30
When I give an outstanding performance, people seem surprised.	2.95 (2.74- 3.17)	2.32 (2.06 – 2.59)	3.40 (3.11 – 3.69)	**0.000**	-0.79	3.09 (2.61 – 3.58)	2.91 (2.66 – 3.15)	0.52	-0.13	3.21 (2.62 – 3.80)	3.44 (3.10 – 3.79)	0.54	0.15
In meetings, other people get credit for ideas I originally offered.	3.20 (2.99 – 3.42)	2.61 (2.32 – 2.89)	3.62 (3.34 0 3.91)	**0.000**	-0.75	3.31 (2.84 – 3.78)	3.17 (2.92 – 3.41)	0.61	-0.10	3.63 (3.05 – 4.21)	3.63 (3.30 – 3.95)	0.99	-0.00
I get less respect than my colleagues for the same level and quality of work.	3.13 (2.91 – 3.36)	2.22 (1.98 – 2.45)	3.80 (3.50 – 4.09)	**0.000**	-1.20	3.29 (2.78 – 3.80)	3.11 (2.85 – 3.37)	0.56	-0.11	3.67 (2.94 – 4.39)	3.83 (3.50 – 4.16)	0.68	0.11
I feel I am held to higher standards than my colleagues.	3.63 (3.40 – 3.86)	3.01 (2.69 – 3.33)	4.07 (3.77 – 4.36)	**0.000**	-0.71	3.91 (3.37 – 4.44)	3.55 (3.29 – 3.81)	0.24	-0.23	4.10 (3.32 – 4.89)	4.04 (3.70 – 4.37)	0.86	-0.04
After moving from a technical role to a project management role, people assume I do not have technical skills.	3.29 (3.08 – 3.50)	2.66 (2.37- 2.95)	3.74 (3.49 – 4.00)	**0.000**	-0.84	3.45 (3.04 – 3.86)	3.23 (2.98 – 3.47)	0.42	-0.16	3.72 (3.16 – 4.28)	3.73 (3.43 – 4.03)	0.98	0.01
Even though I have the same credentials as my peers, other people assume I'm less qualified.	3.32 (3.08 – 3.56)	2.35 (2.08 – 2.63)	4.01 (3.*70* – 4.31)	**0.000**	-1.17	3.87 (3.28 – 4.47)	3.17 (2.90 – 3.44)	**0.03**	-0.44	4.47 (3.73 – 5.22)	3.90 (3.56 – 4.24)	0.15	-0.37

Table D.2

Mean scores and 95% confidence intervals of statements measuring tightrope bias

	Total	Male	Female	*P*	*d*	Person of Color	White	*P*	*d*	Woman of Color	White Woman	*P*	*d*
I get pushback when I behave assertively.	3.49 (3.27- 3.72)	2.63 (2.38 – 2.89)	4.10 (3.82 – 4.39)	**0.000**	-1.11	3.75 (3.29 – 4.21)	3.41 (3.15 – 3.67)	0.26	-0.22	4.26 (3.66 – 4.86)	4.06 (3.72 – 4.40)	0.59	-0.14
People expect me to play a leadership role.	4.73 (4.54 – 4.92)	5.23 (5.02 – 5.44)	4.37 (4.10 – 4.65)	**0.000**	0.69	4.56 (4.05 – 5.07)	4.77 (4.56 – 4.98)	0.40	0.16	4.31 (3.60 – 5.03)	4.40 (4.09 – 4.70)	0.82	0.06
I am expected to be a "worker bee," which means I should work hard, avoid confrontation, and not complain.	3.42 (3.19 – 3.65)	2.77 (2.47 – 3.07)	3.88 (3.59 – 4.18)	**0.000**	-0.77	3.50 (295 – 4.05)	3.38 (3.13 – 3.63)	0.69	-0.08	3.95 (3.18 – 4.71)	3.83 (3.50 – 4.16)	0.77	-0.07
I have had the same access to desirable assignments as my colleagues.	4.12 (3.91 – 4.32)	4.43 (4.15 – 4.72)	3.89 (3.62 – 4.17)	**0.01**	0.40	3.81 (3.29 – 4.33)	4.20 (3.98 – 4.42)	0.14	0.29	3.63 (2.89 – 4.37)	3.96 (3.66 – 4.27)	0.36	0.23
Being vocal about my work and accomplishments is rewarded.	3.68 (3.49 – 3.87)	3.86 (3.61 – 4.12)	3.55 (3.28 – 3.82)	0.10	0.25	3.97 (3.51 – 4.43)	3.64 (3.43 – 3.85)	0.19	-0.26	4.05 (3.34 – 4.76)	3.47 (3.18 – 3.76)	0.09	-0.43
I am interrupted at meetings more than my colleagues.	3.30 (3.06 – 3.54)	2.46 (2.18 – 2.74)	3.90 (3.59 – 4.22)	**0.000**	-0.99	3.41 (2.79 – 4.02)	3.28 (3.01 – 3.55)	0.70	-0.08	4.26 (3.51 – 5.01)	3.84 (3.49 – 4.20)	0.31	-0.26
As compared to my colleagues with comparable role and seniority, I am more likely to be assigned to high profile tasks or teams.	3.57 (3.36 – 3.77)	3.92 (3.61 – 4.22)	3.32 (3.05 – 3.58)	**0.004**	-0.44	3.47 (2.98 – 3.95)	3.60 (3.37 – 3.84)	0.61	0.10	3.63 (2.97 – 4.30)	3.28 (2.98 – 3.57)	0.31	-0.26
I more often play administrative roles (e.g., coordinating meetings, taking notes, sending follow-up emails) as compared to my colleagues with comparable roles and seniority.	3.49 (3.25 – 3.73)	2.81 (2.51- 3.11)	3.98 (3.67 – 4.29)	**0.000**	-0.79	3.66 (3.09 – 4.22)	3.48 (3.22 – 3.75)	0.58	-0.11	4.26 (3.53 – 5.00)	3.96 (3.61 – 4.32)	0.46	-0.19
I more often do the behind-the-scenes work or undervalued work than my colleagues with comparable roles and seniority.	3.62 (3.38 – 3.86)	2.88 (2.56 – 3.20)	4.14 (3.84 – 4.45)	**0.000**	-0.85	3.75 (3.15 – 4.35)	3.60 (3.34 – 3.87)	0.65	-0.09	4.26 (3.49 – 5.03)	4.13 (3.79 – 4.47)	0.74	-0.08
People react negatively when I express anger, even when its justified.	3.75 (3.53 – 3.96)	3.27 (2.97 – 3.57)	4.09 (3.80 – 4.37)	**0.000**	-0.56	4.00 (3.53 – 4.47)	3.68 (3.44 – 3.93)	0.27	-0.22	4.16 (3.53 – 4.78)	4.06 (3.72 – 4.39)	0.80	-0.06
I have to alter my appearance and demeanor to fit in at work.	2.94 (2.71 – 3.17)	2.27 (2.02 – 2.52)	2.94 (2.71 – 3.17)	**0.000**	-0.79	3.25 (2.68 – 3.81)	2.87 (2.61 – 3.12)	0.21	-0.25	3.68 (2.90 – 4.47)	3.34 (2.97 – 3.70)	0.41	-0.21

Table D.3

Mean scores and 95% confidence intervals of statements measuring maternal wall bias

	Total	Male	Female	*P*	*d*	Person of Color	White	*P*	*d*	Woman of Color	White Woman	*P*	*d*
Asking for flexible work arrangements would not hurt my career.	3.42 (3.19 – 3.65)	3.67 (3.34 – 4.01)	3.24 (2.93 – 3.55)	0.06	0.28	3.41 (2.84 – 3.97)	3.42 (3.17 – 3.68)	0.96	0.01	3.10 (2.37 – 3.84)	3.30 (2.94 – 3.66)	0.63	0.12
Having children did not change my colleagues' perception of my work commitment and competence.	3.71 (3.47 – 3.96)	4.62 (4.32 – 4.91)	3.02 (2.72 – 3.32)	**0.000**	1.14	3.97 (3.46 – 4.47)	3.66 (3.38 – 3.94)	0.34	-0.19	3.33 (2.74 – 3.92)	2.97 (2.62 – 3.33)	0.36	-0.24
Taking family leave would be detrimental to my career.	3.46 (3.24 – 3.68)	3.08 (2.76 – 3.40)	3.73 (3.44 – 4.02)	**0.003**	-0.45	3.12 (2.59 – 3.66)	3.54 (3.30 – 3.79)	0.15	0.28	3.42 (2.81 – 4.03)	3.81 (3.47 – 4.15)	0.30	0.26
My colleagues think that I have no life so I end up working longer hours.	2.91 (2.67- 3.15)	2.66 (2.34 – 2.98)	3.09 (2.75 – 3.43)	0.08	-0.27	2.91 (2.33 – 3.48)	2.89 (2.62 – 3.15)	0.95	-0.01	3.10 (2.21 –4.00)	3.06 (2.69 – 3.43)	0.92	-0.02
I feel pressured to work long hours to show my commitment, even when the workload does not justify the overtime.	3.43 (3.18 – 3.67)	2.96 (2.63 – 3.28)	3.76 (3.41 – 4.11)	**0.001**	-0.49	3.59 (2.97 – 4.22)	3.35 (3.07 – 3.63)	0.46	-0.14	4.05 (3.22 – 4.88)	3.66 (3.27 – 4.06)	0.39	-0.22
My colleagues have communicated to me that I should work fewer hours because I have children.	2.36 (2.15 – 2.56)	2.33 (2.03 – 2.62)	2.38 (2.10 – 2.66)	0.81	-0.04	2.32 (1.82 – 2.83)	2.37 (2.14 – 2.59)	0.86	0.03	2.44 (1.70 – 3.19)	2.39 (2.07 – 2.70)	0.87	-0.04
My colleagues have communicated to me that I should work more hours because I have children.	2.15 (1.97 – 2.32)	1.96 (1.76 – 2.15)	2.29 (2.02 – 2.56)	0.06	-0.29	2.19 (1.78 – 2.61)	2.13 (1.93 – 2.32)	0.77	-0.06	2.22 (1.62 – 2.83)	2.33 (2.02 – 2.65)	0.75	0.08
When women have children, it changes colleagues' perception of their work commitment and competence.	3.63 (3.39 – 3.86)	2.76 (2.44 – 3.07)	4.25 (3.97 – 4.53)	**0.000**	-1.06	4.09 (3.53 – 4.65)	3.51 (3.25 – 3.77)	0.06	-0.37	4.79 (4.22 – 5.36)	4.12 (3.80 – 4.44)	0.07	-0.46
Mothers who work long hours often face disapproval from colleagues.	3.05 (2.84 – 3.26)	2.50 (2.19 – 2.80)	3.45 (3.18 – 3.72)	**0.000**	-0.71	3.00 (2.47 – 3.53)	3.06 (2.82 – 3.30)	0.82	0.04	3.10 (2.48 – 3.72)	3.56 (3.25 – 3.87)	0.19	0.33
My colleagues have communicated to me that fathers should work more hours because they have children.	2.33 (2.13 – 2.53)	2.12 (1.85 – 2.39)	2.49 (2.21 – 2.77)	0.07	-0.28	2.32 (1.88 – 2.76)	2.32 (2.10 – 2.54)	0.99	-0.00	2.39 (1.82 – 2.96)	2.54 (2.21 – 2.87)	0.68	0.11

Table D.4

Mean scores and 95% confidence intervals of statements measuring tug-of-war bias

	Total	Male	Female	*P*	*d*	Person of Color	White	*P*	*d*	Woman of Color	White Woman	*P*	*d*
I worry that it will be construed as favoritism if I support others from my gender for professional opportunities.	2.98 (2.75 – 3.20)	2.67 (2.37 – 2.98)	3.19 (2.88 – 3.50)	**0.02**	-0.35	3.12 (2.59 – 3.66)	2.93 (2.68 – 3.18)	0.51	-0.13	3.26 (2.54 – 3.98)	3.18 (2.82 – 3.54)	0.84	-0.05
It's hard for me to get ahead at work if there is another more qualified member of my gender – sometimes it seems there's room for only one.	2.79 (2.56 – 3.02)	2.34 (2.05 – 2.62)	3.12 (2.80 – 3.44)	**0.001**	-0.53	3.06 (2.53 – 3.59)	2.70 (2.45 – 2.95)	0.22	-0.24	3.42 (2.68 – 4.16)	3.01 (2.65 – 3.38)	0.33	-0.25
Colleagues of my gender generally support each other.	4.29 (4.09 – 4.48)	4.40 (4.15 – 4.66)	4.20 (3.92 – 4.49)	0.31	-0.15	4.44 (3.98 – 4.89)	4.27 (4.05 – 4.49)	0.51	-0.13	4.63 (4.02 – 5.24)	4.15 (3.83 – 4.46)	0.18	-0.34
I find it difficult to get administrative personnel to do the kinds of support work for me that they do for others in comparable roles.	2.83 (2.60 – 3.06)	2.24 (1.98 – 2.49)	3.24 (2.91 – 3.57)	**0.000**	-0.69	2.90 (2.40 – 3.41)	2.80 (2.54 – 3.06)	0.74	-0.07	3.10 (2.39 – 3.82)	3.24 (2.87 – 3.61)	0.75	-0.08
The politically savvy approach at my workplace is to distance myself from others of my own gender.	2.24 (2.05 – 2.4)	1.88 (1.67 – 2.08)	2.49 (2.22 – 2.77)	**0.001**	-0.51	2.16 (1.65 – 2.66)	2.22 (2.02 – 2.42)	0.79	0.05	2.05 (1.38 – 2.72)	2.55 (2.24 – 2.85)	0.16	0.36
If someone else of my gender performs poorly, I worry that it will reflect negatively on me.	2.66 (2.43 – 2.89)	1.88 (1.65 – 2.10)	3.22 (2.90 – 3.53)	**0.000**	-0.95	2.94 (2.44 – 3.44)	2.58 (2.32 – 2.85)	0.24	-0.23	3.37 (2.70 – 4.03)	3.18 (2.81 – 3.55)	0.66	-0.11
Some people of my gender working in construction just do not understand the commitment it takes to be successful.	3.48 (3.25 – 3.71)	3.54 (3.17 – 3.91)	3.43 (3.14 – 3.73)	0.65	0.07	3.66 (3.05 – 4.26)	3.42 (3.17 – 3.67)	0.44	-0.15	3.63 (2.82 – 4.44)	3.37 (3.05 – 3.70)	0.51	-0.17
I feel I have a lot in common with others of my own gender working in construction.	4.36 (4.18 – 4.53)	4.43 (4.17 – 4.69)	4.31 (4.07 – 4.54)	0.49	0.10	4.41 (3.97 – 4.84)	4.34 (4.15 – 4.54)	0.79	-0.05	4.52 (3.98 – 5.07)	4.25 (3.98 – 4.52)	0.38	-0.22

Table D.5

Mean scores and 95% confidence intervals of statements measuring isolation bias

	Total	Male	Female	*P*	*d*	Person of Color	White	*P*	*d*	Woman of Color	White Woman	*P*	*d*
The culture at my workplace is a good fit for me.	4.57 (4.39 – 4.75)	4.85 (4.65 – 5.05)	4.37 (4.10 – 4.65)	**0.01**	0.39	4.53 (4.11 – 4.95)	4.60 (4.39 – 4.81)	0.78	0.05	4.31 (3.67- 4.96)	4.41 (4.10 – 4.72)	0.79	0.07
People who succeed here are a lot like me.	3.88 (3.68 – 4.07)	4.36 (4.14 – 4.59	3.53 (3.25 – 3.80)	**0.000**	0.67	3.59 (3.10 – 4.08)	3.94 (3.72 – 4.15)	0.19	0.26	3.21 (2.56 – 3.86)	3.59 (3.27 – 3.90)	0.30	0.27
There are unwritten rules about getting ahead that others seem to know but I don't.	3.18 (2.96 – 3.40)	2.65 (2.33 – 2.96)	3.56 (3.28 – 3.83)	**0.000**	-0.65	3.41 (2.93 – 3.88)	3.15 (2.91 – 3.40)	0.38	-0.17	3.84 (3.30 – 4.38)	3.50 (3.18 – 3.83)	0.35	-0.24
I feel welcome to socialize with my coworkers.	4.71 (4.53 – 4.89)	5.04 (4.84 – 5.24)	4.47 (4.20 – 4.74)	**0.002**	0.48	5.09 (4.83 – 5.36)	4.62 (4.41 – 4.84)	0.05	-0.39	5.21 (4.87 – 5.55)	4.32 (4.02 – 4.63)	**0.01**	-0.67
My colleagues do not share important information with me that they share with others.	2.92 (2.70 – 3.14)	2.40 (2.14 – 2.66)	3.29 (2.98 – 3.59)	**0.000**	-0.63	3.12 (2.62 – 3.62)	2.87 (2.63 – 3.12)	0.38	-0.17	3.57 (2.89 – 4.27)	3.22 (2.87 – 3.57)	0.37	-0.23
People have attempted to demean, disrespect, or humiliate me at work.	2.73 (2.48 – 2.99)	2.17 (1.86 – 2.48)	3.13 (2.78 – 3.49)	**0.002**	-0.58	2.41 (1.93 – 2.88)	2.81 (2.51 – 3.10)	0.23	0.24	2.74 (2.02 – 3.45)	3.25 (2.83 – 3.67)	0.27	0.28
People have treated me like I'm invisible at work.	2.77 (2.53 – 3.02)	2.00 (1.75 – 2.24)	3.33 (2.98 – 3.67)	**0.000**	-0.87	2.87 (2.33 – 3.42)	2.77 (2.49 – 3.05	0.74	-0.06	3.47 (2.75 – 4.20)	3.30 (2.90 – 3.70)	0.71	-0.10
I feel very isolated at work.	2.58 (2.35 – 2.81)	2.09 (1.85 – 2.34)	2.93 (2.59 – 3.27)	**0.003**	-0.56	2.47 (1.93 – 3.00)	2.61 (2.35 – 2.87)	0.64	0.09	2.79 (1.99 – 3.58)	2.96 (2.57 – 3.35)	0.70	0.10
I feel like attempts to speak up for myself or others often falls on deaf ears and creates hostility in my work environment.	2.71 (2.48 – 2.94)	2.11 (1.84 – 2.37)	3.13 (2.81 – 3.46)	**0.000**	-0.70	2.72 (2.22 – 3.21)	2.68 (2.42 – 2.94)	0.90	-0.02	3.16 (2.47 – 3.84)	3.12 (2.75 – 3.49)	0.93	-0.02

Table D.6

Mean scores and 95% confidence intervals of statements measuring workplace processes

	Total	Male	Female	*P*	*d*	Person of Color	White	*P*	*d*	Woman of Color	White Woman	*P*	*d*
Someone like me has an equal shot at getting hired here as anyone else.	4.43 (4.23 – 4.62)	4.89 (4.64 – 5.14)	4.10 (3.82 – 4.37)	**0.000**	0.62	4.41 (4.06 – 4.75)	4.46 (4.23 – 4.69)	0.84	0.04	4.10 (3.62 – 4.58)	4.11 (3.78 – 4.43)	0.99	0.00
This organization is open to hiring people from all kinds of backgrounds.	4.83 (4.65 – 5.01)	5.09 (4.89 – 5.30)	4.64 (4.37 – 4.91)	**0.01**	0.38	4.66 (4.29 -5.02)	4.88 (4.67 – 5.09)	0.34	0.18	4.42 (3.88 – 4.96)	4.68 (4.37 – 4.99)	0.46	0.19
The level of work I am asked to perform is appropriate relative to my years of experience.	4.59 (4.40 – 4.78)	4.97 (4.78 – 5.17)	4.32 (4.03 – 4.61)	**0.001**	0.52	4.50 (4.04 – 4.96)	4.62 (4.41 – 4.84)	0.62	0.10	4.16 (3.49 – 4.82)	4.38 (4.05 – 4.71)	0.56	0.15
I am treated like I am here to provide diversity, not to do work.	1.99 (1.82 – 2.17)	1.63 (1.44 – 1.83)	2.25 (2.00 – 2.50)	**0.000**	-0.55	2.34 (1.96 – 2.73)	1.92 (1.72 – 2.12)	0.06	-0.36	2.53 (2.01 – 3.04)	2.18 (1.89 – 2.58)	0.30	-0.26
My performance evaluations have been fair.	4.72 (4.58 – 4.87)	4.88 (4.70 – 5.06)	4.61 (4.39 – 4.83)	0.08	0.27	4.74 (4.44 – 5.04)	4.72 (4.55 – 4.89)	0.92	-0.02	4.55 (4.10 – 5.01)	4.63 (4.37 – 4.89)	0.80	0.06
I feel I get less honest feedback on my performance evaluations than my colleagues.	2.73 (2.53- 2.93)	2.40 (2.12 – 2.69)	2.97 (2.70 – 3.24)	**0.006**	-0.43	2.81 (2.37 – 3.24)	2.74 (2.51 – 2.97)	0.81	-0.05	3.17 (2.59 – 3.74)	2.95 (2.63 – 3.27)	0.55	-0.15
In performance evaluations, I receive constructive feedback that allows me to advance in my career.	4.12 (3.92 – 4.31)	4.40 (4.13 – 4.68)	3.91 (3.64 – 4.18)	**0.01**	0.38	4.16 (3.74 – 4.58)	4.12 (3.90 – 4.34)	0.88	-0.03	3.83 (3.19 – 4.48)	3.94 (3.63 – 4.25)	0.77	0.07
In my performance evaluations, I get comments about my personality.	3.75 (3.53 – 3.96)	3.61 (3.29 – 3.92)	3.85 (3.56- 4.14)	0.27	-0.17	3.93 (3.46 – 4.41)	3.73 (3.48 – 3.97)	0.46	-0.15	3.89 (3.17 – 4.61)	3.84 (3.51 – 4.17)	0.89	-0.03
I have been given the advancement opportunities and promotions I deserve.	4.12 (3.92 – 4.33)	4.62 (4.38 – 4.86)	3.76 (3.47 – 4.06)	**0.000**	0.65	3.81 (3.36 – 4.26)	4.20 (3.96 – 4.44)	0.16	0.28	3.42 (2.75 – 4.09)	3.84 (3.50 – 4.18)	0.28	0.28
To get ahead in my organization, one needs to be a member of a small, mostly homogenous in-group.	3.27 (3.04 – 3.50)	2.86 (2.53 – 3.19)	3.57 (3.26 – 3.87)	**0.002**	-0.47	3.34 (2.97 – 3.72)	3.23 (2.96 – 3.50)	0.72	-0.07	3.58 (3.09 – 4.07)	3.53 (3.16 – 3.90)	0.90	-0.03
My manager rewards me for taking risks and innovating in my role.	3.99 (3.79 – 4.19)	4.30 (4.02 – 4.57)	3.77 (3.49 – 4.04)	**0.01**	0.40	3.75 (3.26 – 4.23)	4.06 (3.83 – 4.28)	0.24	0.23	3.89 (3.27 – 4.51)	3.77 (3.45 – 4.08)	0.72	-0.09
I have had good mentors at my workplace.	4.20 (3.98 – 4.42)	4.44 (4.14 – 4.75)	4.03 (3.72 – 4.33)	0.06	0.28	4.31 (3.79 – 4.83)	4.18 (3.94 – 4.43)	0.66	-0.09	4.37 (3.59 – 5.14)	3.96 (3.62 – 4.30)	0.31	-0.26
I have a sponsor who is willing to use their influence and power to help advance my career.	3.39 (3.17 – 3.61)	3.64 (3.32 – 3.96)	3.20 (2.91 – 3.50)	0.05	0.30	3.42 (2.81 – 4.03)	3.40 (3.16 – 3.64)	0.95	-0.01	3.22 (2.34 – 4.10)	3.22 (2.89 – 3.54)	0.99	-0.00
I have had as much access to networking opportunities as my colleagues.	4.25 (4.05 – 4.45)	4.82 (4.61 – 5.03)	3.84 (3.55 – 4.14)	**0.000**	0.76	4.29 (3.90 – 4.68)	4.26 (4.03 – 4.50)	0.92	-0.02	4.00 (3.43 – 4.56)	3.84 (3.50 – 4.18)	0.68	-0.11
As compared to my colleagues with comparable seniority, experience, and work ethic, I suspect that I get paid less.	3.61 (3.37 – 3.85)	2.84 (2.51- 3.16)	4.18 (3.88 – 4.47)	**0.000**	-0.91	3.90 (3.36 – 4.45)	3.52 (3.25 – 3.79)	0.24	-0.23	4.44 (3.78 – 5.11)	4.11 (3.77 – 4.45)	0.40	-0.22
I think I get paid fairly, as compared with others like me.	3.84 (3.64 – 4.04)	4.55 (4.32 – 4.79)	3.32 (3.06 – 3.58)	**0.000**	1.02	3.61 (3.16 – 4.06)	3.90 (3.67 – 4.13)	0.28	0.21	3.17 (2.57 – 3.76)	3.35 (3.15 – 3.65)	0.59	0.14
I have personally experienced…													
Uncomfortable sexist comments	0.63 (0.51 – 0.74)	0.42 (0.18 – 0.66)	0.78 (0.69 – 0.86)	**0.002**	-0.48	0.50 (.0.32 – 0.68)	0.66 (0.52 – 0.79	0.29	0.21	0.84 (0.66 – 1.02)	0.77 (0.67 – 0.86)	0.49	-0.18
Uncomfortable sexual stories or jokes	0.64 (0.53 – 0.75)	0.54 (0.30 – 0.78)	0.71 (0.62 – 0.80)	0.14	-0.22	0.47 (0.28 – 0.65)	0.68 (0.55 – 0.81)	0.15	0.28	0.63 (0.39 – 0.87)	0.74 (0.65 – 0.84)	0.33	0.25
Sexual or inappropriate images	0.45 (0.32 – 0.57)	0.40 (0.20 – 0.61)	0.47 (0.32 – 0.63)	0.58	-0.08	0.31 (0.0 – 0.65)	0.48 (0.34 – 0.62)	0.31	0.20	0.47 (0.32 – 0.63)	0.53 (0.0 – 1.09)	0.81	-0.06
Unwanted romantic or sexual attention	0.43	0.17	0.62	**0.000**	-0.60	0.40	0.45	0.75	0.06	0.68	0.62	0.76	-0.08

	(0.32 – 0.55)	(0.02 – 0.32)	(0.47 – 0.78)			(0.23 – 0.59)	(0.32 – 0.59)			(0.45 – 0.91)	(0.43 – 0.81)		
Unwanted physical contact	0.35	0.13	0.50	**0.001**	-0.50	0.31	0.36	0.74	0.06	0.53	0.50	0.90	-0.03
	(0.24 – 0.46)	(0.00 – 0.28)	(0.35 – 0.66)			(0.00 – 0.65)	(0.24 – 0.48)			(0.00 – 1.09)	(0.34 – 0.65)		
Lost opportunities because I rebuffed	0.17	0.07	0.25	0.08	-0.27	0.06	0.20	0.30	0.20	0.10	0.29	0.34	0.24
sexual advances (i.e., promotion, raise,	(0.07 – 0.28)	(0.00 – 0.20)	(0.10 – 0.40)			(0.00 – 0.15)	(0.08 – 0.33)			(0.00 – 0.26)	(0.11 – 0.48)		
career-enhancing assignments)													

APPENDIX E

Gender Bias Experienced by Female Students in Construction Degree Programs

Table E.1

Comparison table of gender bias experienced by female students in construction degree programs

Item	Male Peers			Female Peers			Mentors or Advisors			Professors		
	Early undergrads	Experienced undergrads	Graduates	Early undergrads	Experienced undergrads	Graduates	Early undergrads	Experienced undergrads	Graduates	Early undergrads	Experienced undergrads	Graduates
Intentionally or unintentionally excluded you from a study group because of your gender	2.03 (1.05)	1.81 (0.95)	1.42 (1.00)	1.35 (0.71)	1.27 (0.66)	1.27 (0.65)	1.10 (0.30)	1.20 (0.56)	1.20 (0.63)	1.27 (0.52)	1.27 (0.60)	1.20 (0.63)
Never	13 (41.9%)	34 (50.0%)	10 (83.3%)	24 (77.4%)	56 (82.3%)	9 (75.0%)	28 (90.3%)	57 (83.8%)	9 (75.0%)	23 (74.2%)	52 (76.5%)	9 (75.0%)
Rarely	7 (22.6%)	17 (25.0%)	0 (0.0%)	3 (9.7%)	5 (7.3%)	1 (8.3%)	3 (9.7%)	6 (8.8%)	0 (0.0%)	6 (19.3%)	11 (16.2%)	0 (0.0%)
Sometimes	8 (25.8%)	13 (19.1%)	1 (8.3%)	4 (12.9%)	5 (7.3%)	1 (8.3%)	0 (0.0%)	2 (2.9%)	1 (8.3%)	1 (3.2%)	2 (2.9%)	1 (8.3%)
Often	3 (9.7%)	4 (5.9%)	1 (8.3%)	0 (0.0%)	1 (1.5%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)
Made negative comments about women's abilities in construction	1.84 (1.07)	1.97 (0.99)	1.83 (1.03)	1.16 (0.37)	1.16 (0.45)	1.30 (0.67)	1.23 (0.62)	1.18 (0.49)	1.10(0.32)	1.40 (0.72)	1.37 (0.69)	1.00 (0.00)
Never	17 (54.8%)	28 (41.2%)	6 (50.0%)	26 (83.9%)	58 (85.3%)	8 (66.7%)	27 (87.1%)	57 (83.8%)	9 (75.0%)	22 (71.0%)	49 (72.1%)	10 (83.3%)
Rarely	5 (16.1%)	20 (29.4%)	3 (25.0%)	5 (16.1%)	7 (10.3%)	1 (8.3%)	1 (3.2%)	9 (13.2%)	1 (8.3%)	4 (12.9%)	12 (17.6%)	0 (0.0%)
Sometimes	6 (19.3%)	14 (20.6%)	2 (16.7%)	0 (0.0%)	2 (2.9%)	1 (8.3%)	3 (9.7%)	0 (0.0%)	0 (0.0%)	4(12.9%)	5 (7.3%)	0 (0.0%)
Often	3 (9.7%)	6 (8.8%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)
Intentionally or unintentionally excluded you from a discussion about construction because of your gender	1.68 (0.94)	1.81 (1.00)	1.58 (1.00)	1.03 (0.18)	1.09 (0.34)	1.00 (0.00)	1.10 (0.40)	1.18 (0.52)	1.20 (0.42)	1.16 (0.45)	1.36 (0.71)	1.30 (0.67)

Never	18 (58.1%)	37 (54.4%)	8 (66.7%)	30 (96.8%)	62 (91.2%)	10 (83.3%)	29 (93.5%)	58 (85.3%)	8 (66.7%)	27 (87.1%)	51(75.0%)	8 (66.7%)
Rarely	7 (22.6%)	11 (16.2%)	2 (16.7%)	1 (3.2%)	4 (5.9%)	0 (0.0%)	1 (3.2%)	7 (10.3%)	2 (16.7%)	3 (9.7%)	9 (13.2%)	1 (8.3%)
Sometimes	4 (12.9%)	16 (23.5%)	1 (8.3%)	0 (0.0%)	1 (1.5%)	0 (0.0%)	1 (3.2%)	1 (1.5%)	0 (0.0%)	1 (3.2%)	6 (8.8%)	1 (8.3%)
Often	2 (6.4%)	4 (5.9%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)
Made you feel like your gender will make it difficult to succeed in construction	2.03 (1.08)	2.12 (1.13)	2.17 (1.27)	1.58 (0.92)	1.36 (0.73)	1.60 (0.84)	1.42 (0.81)	1.40 (0.74)	1.40 (0.97)	1.58 (0.81)	1.60 (0.92)	1.40 (0.84)
Never	14 (45.2%)	27 (39.7%)	5 (41.7%)	20 (64.5%)	51 (75.0%)	6 (50.0%)	23(74.2%)	48 (70.6%)	8 (66.7%)	19 (61.3%)	43 (63.2%)	8 (66.7%)
Rarely	5 (16.1%)	18 (26.5%)	3 (25.0%)	6 (19.3%)	10 (14.7%)	2 (16.7%)	4 (12.9%)	13 (19.1%)	1 (8.3%)	6 (19.3%)	12 (17.6%)	0 (0.0%)
Sometimes	9 (29.0%)	11 (16.2%)	1 (8.3%)	3 (9.7%)	4 (5.9%)	2 (16.7%)	3 (9.7%)	4 (5.9%)	0 (0.0%)	6 (19.3%)	8 (11.8%)	2 (16.7%)
Often	3 (9.7%)	12 (17.6%)	3 (25.0%)	2 (6.4%)	2 (2.9%)	0 (0.0%)	1 (3.2%)	2 (2.9%)	1(8.3%)	0 (0.0%)	4 (5.9%)	0 (0.0%)
Intentionally or unintentionally ignored your comments or questions during construction class because of your gender	1.55 (0.93)	1.60 (0.94)	1.83 (1.34)	1.16 (0.37)	1.06 (0.24)	1.20 (0.63)	1.06 (0.25)	1.12 (0.37)	1.50 (1.08)	1.23 (0.62)	1.27 (0.57)	1.50 (1.08)
Never	21 (67.7%)	44 (64.7%)	8 (66.7%)	26 (83.9%)	62 (91.2%)	9 (75.0%)	29 (93.5%)	59 (86.8%)	8 (66.7%)	27 (87.1%)	52 (76.5%)	8 (66.7%)
Rarely	5 (16.1%)	10(14.7%)	1 (8.3%)	5 (16.1%)	4 (5.9%)	0 (0.0%)	2 (6.4%)	6 (8.8%)	0 (0.0%)	1 (3.2%)	10 (14.7%)	0 (0.0%)
Sometimes	3 (9.7%)	9 (13.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	1 (1.5%)	1 (8.3%)	3 (9.7%)	4 (5.9%)	1 (8.3%)
Often	2 (6.4%)	4 (5.9%)	3 (25.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	1 (8.3%)
Made negative comments about your ability in construction because of your gender	1.68 (1.05)	1.72 (0.88)	1.73 (1.27)	1.19 (0.54)	1.05 (0.27)	1.10 (0.32)	1.10 (0.40)	1.12 (0.45)	1.40 (0.70)	1.19 (0.48)	1.26 (0.59)	1.40 (0.84)
Never	20 (64.5%)	35 (51.5%)	8 (66.7%)	27 (87.1%)	64 (94.1%)	9 (75.0%)	29 (93.5%)	60 (88.2%)	7 (58.3%)	26 (83.8%)	53 (77.9%)	8 (66.7%)
Rarely	4 (12.9%)	19 (27.9%)	0 (0.0%)	2 (6.4%)	1 (1.5%)	1 (8.3%)	1 (3.2%)	5 (7.3%)	2 (16.7%)	4 (12.9%)	10 (14.7%)	0 (0.0%)
Sometimes	4 (12.9%)	10 (14.7%)	1 (8.3%)	2 (6.4%)	1 (1.5%)	0 (0.0%)	1 (3.2%)	0 (0.0%)	1 (8.3%)	1 (3.2%)	2 (2.9%)	2 (16.7%)
Often	3 (9.7%)	3 (4.4%)	2 (16.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)	0 (0.0%)	1 (1.5%)	0 (0.0%)
Made you feel like you had to work harder than male students in order to be taken seriously/respected	2.65 (1.25)	2.40 (1.20)	2.09 (1.38)	2.00 (1.26)	1.52 (0.98)	1.40 (0.97)	1.71 (1.07)	1.76 (1.04)	1.60 (1.07)	2.06 (1.26)	1.95 (1.06)	1.50 (1.08)
Never	9 (29.0%)	23 (33.8%)	6 (50.0%)	17 (54.8%)	49 (72.1%)	8 (66.7%)	20 (64.5%)	39 (57.3%)	7 (58.3%)	17 (54.8%)	31 (45.6%)	8 (66.7%)
Rarely	4 (12.9%)	12 (17.6%)	1 (8.3%)	4 (12.9%)	6 (8.8%)	1 (8.3%)	3 (9.7%)	10 (14.7%)	1 (8.3%)	1 (3.2%)	14 (20.6%)	0 (0.0%)
Sometimes	7 (22.6%)	16 (23.5%)	1 (8.3%)	3 (9.7%)	5 (7.3%)	0 (0.0%)	5 (16.1%)	11(16.2%)	1 (8.3%)	7 (22.6%)	14 (20.6%)	1 (8.3%)
Often	11 (35.5%)	17 (25.0%)	3 (25.0%)	7 (22.6%)	6 (8.8%)	1 (8.3%)	3 (9.7%)	6 (8.8%)	1 (8.3%)	6 (19.3%)	7 (10.3%)	1 (8.3%)

Expected less of you academically or professionally because of your gender	1.74 (1.06)	1.76 (0.93)	1.64 (1.21)	1.16 (0.58)	1.25 (0.61)	1.10 (0.32)	1.35 (0.75)	1.31 (0.73)	1.40 (0.97)	1.43(0.86)	1.43(0.83)	1.30 (0.95)
Never	18 (58.1%)	34 (50.0%)	8 (66.7%)	28 (90.3%)	54 (79.4%)	9 (75.0%)	24 (77.4%)	53(77.9%)	8(66.7%)	23 (74.2%)	48 (70.6%)	9 (75.0%)
Rarely	7 (22.6%)	18 (26.5%)	1 (8.3%)	2 (6.4%)	7 (10.3%)	1 (8.3%)	4 (12.9%)	6 (8.8%)	1 (8.3%)	2 (6.4%)	9 (13.2%)	0 (0.0%)
Sometimes	2 (6.4%)	10 (14.7%)	0 (0.0%)	0 (0.0%)	3 (4.4%)	0 (0.0%)	2(6.4%)	4 (5.9%)	0 (0.0%)	4 (12.9%)	5 (7.3%)	0 (0.0%)
Often	4 (12.9%)	4 (5.9%)	2 (16.7%)	1 (3.2%)	1 (1.5%)	0 (0.0%)	1 (3.2%)	2 (2.9%)	1 (8.3%)	1 (3.2%)	3 (4.4%)	1 (8.3%)

VITA

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