Barriers and Potential Solutions to Gender Diversity in the Construction Industry

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Barriers and Potential Solutions to Gender Diversity in the Construction Industry

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I dedicate my dissertation work to my God and my family. TO GOD BE THE GLORY! I’m a humble recipient and vessel of Your favor, grace, and mercy. You have always proven yourself to be a true and faithful Father to me. To my loving parents, Charles and Lavonia Moore, whose words of encouragement, faith, integrity, and commitment have sustained and anchored me my entire life. I am eternally grateful for your guidance, wisdom, and love. To my husband, Terance, whose continued support, and belief in me throughout this process has been humbling and appreciated. You are my rock, and I could not have achieved this milestone without you. To my son, TC, my inspiration, my purpose, and my why. I pray that you are inspired to continue pursuing all your dreams, goals, and aspirations. I am so excited for your future; keep soaring! I also dedicate this research to all the bright, inquisitive, confident little girls that do not know what they want to be when they grow up. Dream big, dream smart, and dream outside the lines!
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SUMMARY

The construction industry faces significant challenges filling vacant construction jobs to match supply with demand. With 20 percent of the construction workforce not returning after the pandemic within a booming housing market and the "Great Retirement" of the baby boomers, the construction sector's current and forecasted labor shortage has worsened. The latest findings show that the United States will have to fill more than one (1) million vacant construction jobs to match supply with demand. Making the construction-related jobs more attractive and welcoming to women and other demographic groups underrepresented in the industry is imperative for the construction industry's future workforce. However, there are persistent barriers to achieving such diversity, including but not limited to implicit and explicit bias, stereotype threat, segregation, inequality, discrimination, and simple misconceptions regarding what a career in construction may look like.

Women comprise 10.9 percent of the construction workforce in general and only three percent of the craft workforce, while Black or African Americans account for only six percent of the construction workforce. It is impossible to change these statistics without changing the demographics within construction programs in higher education first, which leads to the importance of changing the perception of middle and high-school-age female students about the construction industry. The goals of this thesis are twofold: 1) to identify the perceptions held by middle and high-school-age female students and quantify the barriers that limit their interest in pursuing construction as a career, and 2) to identify a list of innovative and measurable actions and recommendations to increase female participation in construction programs at two-year and four-year colleges.
INTRODUCTION

Researchers have long recognized an insufficient interest and poorly sustained participation of women in the construction industry. The influence of gender disparities creates obstacles inhibiting underrepresented minorities (URM) and excluding women (Neumeyer et al., 2019). This lack of diversity is generally tied to a variety of causes typical in the construction industry, including: 1) implicit and explicit biases (i.e., prejudice, racial discrimination, sexism) toward women, 2) real and perceived inequalities and lack of entry and advancement opportunities for women (i.e., barriers), and 3) women's lack of interest in the industry due to their own perceptions of the industry.

Hunt et al., (2015) discusses how the management consulting firm Mckinsey and company collected data from organizations and executives from around the world and found that gender-balanced management teams drove financial returns above industry medians. However, globally, women, within all industries, are still less represented in the workplace than men (40 percent), and of those women working, 57 percent do so part-time (ILO, 2016). The equality of opportunities between men and women in the work environment is hindered, specifically on construction sites and within the construction sector (Regis et al., 2019). The percentage of women in construction management, the overall planning, coordination, and control of a construction project from conception to completion, compared with other industries, has a lower reflection than any other industry (Alves et al., 2018). In construction programs, faculty and administrators aim to understand what barriers might limit women's interest in and understanding of topics related to construction science (Farrow et al., 2021).
The predominant image of the construction industry is that it has been and continues to be a white male-dominated sector of the economy, reflecting the image of masculinity and demanding hard work, with women being under-represented and under-utilized in a hostile, dangerous environment. This image presents major obstacles for women’s participation and interest in the construction industry (Aboagye-Nimo et al., 2019). As discussed further in literature review, many authors have noted the issues but there is no specific study addressing the perception of younger females directly. This lack of viewpoint is addressed in this study through the following goals and objectives.

Goals and Objectives

The goals and objectives of the research is to identify the perceptions younger females have of construction management and provide recommendations to attract and retain women into construction programs in colleges. This research also seeks to raise awareness and provide visibility of the barriers that discourages precollege aged female from entering the construction management industry.

Definitions

For this study, research and survey questions, the following key terms and definitions were used:

*Construction Industry*: the manufacturing and trade related to building, repairing, renovating, and maintaining infrastructures

*Construction Management*: Overall planning, coordination, and control of a construction process from the start to the end.

*Project Management*: the use of tools, knowledge, processes, and competencies to ensure a project’s successful completion
*Construction Manager:* Has administrative responsibility for the management and planning of every stage of a construction project.

*Project manager:* plans and oversees the building process of the construction project from start to finish

*Project Engineer:* responsible for planning and coordinating technical engineering initiatives to ensure successful completion of a project

*Superintendent:* responsible for coordinating all the work carried out by laborers and tradespeople. They work closely with architects and engineers, and the project team

*BIM manager:* BIM (Building Information Modeling) managers act as collaborators between the client’s team, design team, contractor team and supply chain and oversees the production of project information models using 3D visualizations

*VDC Manager:* VDC (Virtual Design & Construction) Manager is responsible for leading preconstruction, engineering, and field installation of all BIM related project deliverables for the project

*Building Trades*— Trade work completed during building construction (plumbing, welding, equipment operator, mason, electrician)

**Scope**

This thesis’ aims only cover construction jobs that can be obtained by 4-year degrees in Construction Management, Construction Engineering, Civil Engineering, or related fields. It is indeed the distinction between the image of a construction worker versus a highly skilled leadership role that causes the perception barriers; and this thesis aims to clarify the different career paths between a trades person and construction management, project management, project engineer, and superintendent roles.

**Thesis Overview**

This paper is structured as follows: Chapter 2 summarizes the pertinent literature on the perceptions of women in the construction Industry, factors impacting female students’
career selection in construction management, labor shortage in the construction industry, case studies of women in construction management, and Diversity, Equity, and Inclusion initiative within construction organizations. Chapters 3, 4 and 5 present the research methodology, results, and recommendations from the research and Chapter 6 concludes and discusses the implications of our findings.
LITERATURE REVIEW

The Bureau of Labor Statistics (BLS, 2014) predicts a 13 percent increase in new jobs (roughly equating to 790,400 new jobs) in the construction industry from 2014 to 2024. As the construction volume increases and many retire from the industry, the need to replenish and increase the construction workforce is paramount. Construction industry leaders conclude that due to the reduction in the younger generation entering the construction industry compared to the unprecedented number of retiring workers, the construction industry faces a workforce shortage and skill gap (Torku et al., 2021).

In February 2016, the Canadian Construction Association estimated that the construction industry would need to find 322,000 new workers by 2024 to replace those retiring and to keep pace with rising demand (Bessy, 2019). The lack of skilled labor availability significantly impacts construction project cost performance. A study by Karimi et al. (2018) shows that projects that experienced trade shortages underwent significantly higher cost overruns. They developed regression models demonstrating patterns of the risk that a skilled labor shortage presents to cost performance. The straightforward solution to resolve the labor shortage in the construction industry is to dip into the pool of untapped human resources to fulfill market needs, which requires encouraging participation from a more diverse population: Women. By January 2021, only 10.9 percent of professional women were active in the construction industry (U.S. Department of Labor Statistics 2021) and the U.S. Labor Force (2020) cites one percent of employees in the field as representing the number of women in the front lines of a job site. Considerable efforts to improve diversity and increase women's participation in the construction industry are reflected
through research and implementation of initiatives specifically aimed at women and minorities (Menches et al., 2007), but women continue to be underrepresented.

Addressing the labor shortage is not the only reason diversity in the construction industry is essential. Without gender diversity, the construction industry cannot attract and retain the best talent (Prime Minister of Australia, 2016). The Associated General Contractors of America (AGC) (2018) published a report that indicated diverse and inclusive organization experience, on average, 2.3 times higher cash flow per full-time employee. Given the benefits, it is crucial to consider why diversity is lacking so notably in this industry. Attracting those who would not typically view construction as a career path and then implementing strategies for retaining them could solve the industry's labor shortage and increase the quality of work products.

Research acknowledges that early-career women in construction need support from mentors to persist in the industry (Oo et al., 2020). Industry role models for women in construction are critical in recruiting and retaining women in construction. The importance of women role models/mentors (Sang et al., 2012) to help young professionals persist in the field is well established. For example, Vassallo et al., (2021) research illustrates positive outcomes of a mentoring- based gender equality initiatives aimed to support the career development of mid-career women while facilitating a more inclusive workforce. In addition, research conducted by Seymour and Hewitt (1997) to diagnose and find remedies for the gender gap in Carnegie Mellon's undergraduate computer science program conclude that the lack of mentoring relationships is one of the most common causes of women's loss of interest and self-confidence to continue the program. For advancement and sustainability to support the growth of construction and to meet the industry labor demands, diverse
leadership and fundamental cultural changes are essential and needed throughout the construction industry and society.

PERCEPTIONS OF WOMEN IN THE CONSTRUCTION INDUSTRY

Perceptions and Bias

In contemporary discussions regarding diversity and inclusion, the word "bias" is used more commonly than "perception" without clarifying the nuances of consciousness and unconsciousness of these social behaviors. Bias can be implicit or explicit. Implicit bias is defined as an unconscious mental process. Implicit bias can lead to attitudes or stereotypes, which directly cause the scarcity of women in construction. Explicit bias is defined as the attitudes and beliefs we perceive on a conscious level about a person or group. Explicit bias can present as discrimination, hate speech and basis for unfair treatment. Ultimately, these phenomena are complex and studied by many in the fields of psychology, sociology, and law. For brevity, in this paper, the word perception will be used to imply the conscious decisions, thoughts, and or evident attitudes of one group toward another group or system (e.g., construction industry, companies, etc.).

External perceptions of the construction industry from the non-construction sector

Traditionally, the construction industry is associated with masculine stereotypes influenced by male career models. Moyser (2017) suggests that the construction industry's challenges in attracting skilled workers are primarily due to its image, the cyclical nature of available work, lack of job security, long hours, intensive labor, high risk, low pay, and
the lack of gender diversity, at every level of employment. McDermott et al. (2010) also find these factors as deterrents and barriers for some women. The common perception of the industry also assumes that women are not valued, and it would seem to penalize those who need flexibility or part-time work (McDermott et al., 2010).

Meanwhile some studies suggest that women are detail-oriented, a skill required in the construction project management process, and that women executives are better communicators, more effective decision-makers, and seek less personal glory than their male counterparts (Jimoh et al., 2016). In summary, the perception of the construction industry, with regards to attitudes and behaviors towards women and the common work-life balance preferred by many women, tends to render an image that is disadvantageous towards women as workers, construction professionals, or leaders; and much more tolerable of and welcoming to women as administrators (McDermott et al., 2010). Overall, construction has not been considered a fully diverse, equitable, and inclusive industry (Sang et al., 2012) due to prejudices and unconscious biases.

**Perception from women in the construction industry**

Women in construction believe that inclusivity may not extend across the organization (Ackrill et al., 2017), as illustrated by the lack of representation within the construction industry due to the industry's culture, the nature of the work, and its project-based setup (Arditi & Balci, 2009). From the perspective of women in construction, research indicates that women are generally not discouraged from working in a masculine environment, noting that some women can relate to their operational male colleagues.
Agapiou (2002) notes that these perceptions are from women in a mature age group compared to the new entrants to the industry.

Research by Bennett et al. (2000) compared perceptions from undergraduate students and employees and found that those women who are already in professional roles remain committed to the construction industry. The study's (Bennett et al., 2000) professional participants included 47 women, ages ranging from 23 years to 59 years of age, currently working in the construction industry. The student respondents included 29 women first- and second-year undergraduates, ages 18 to 27, all enrolled in degrees in construction management. The survey results indicate that more than 77 percent of the professional group wanted to stay in the construction industry compared to the 58 percent within the student group. Further analysis revealed that the female student group was the least committed to a career in the construction industry, with 43 percent of respondents that did not expect to remain in the industry. In a different study, McDermott et al. (2010) note that the correlation between the organizational culture and the undermining of the role of women leads to women perceiving themselves as less capable.

Many women believe that unconscious biases have negatively impacted the construction workforce. A study conducted by Balch (2019) showed that 60 percent of all workers in the construction industry believe leaders are biased toward individuals who look, think, and act like them. Researchers Williams et al. (2014) cite examples of gender bias affecting construction-sector women and note studies of trends affecting trade women, engineers, and architects. Opoku (2019) reports that some women share that second-generation gender bias (practices that may appear neutral or non-sexist but discriminate against a gender because they reflect the values of one particular gender) in construction
organizations, which often impacts a woman's career progression into leadership positions in the construction industry. These barriers derive from existing cultural and structural workplace practices.

A women-only focus group (consisting of women working in the construction industry) suggested that women had limited opportunities to develop practical skills and were not afforded opportunities to explore their potential capacities to complete construction jobs (Fielden et al., 2001). The focus group suggested this problem is exacerbated by the lack of role models within construction, especially at senior levels. Construction industry women also noted that employment-related operational and environmental risks, primarily related to poor physical working environments and conditions, accounted for safety concerns for women in the construction industry (Mariam et al., 2020). Problems with machine vibration, cumbersome and inconveniently shaped and sized construction equipment, and other construction activities pose significant ergonomic risks to women workers. Given the lack of gender diversity in the industry, it is not surprising that historically, Personal Protective Equipment (PPE), construction gear, and construction equipment were mostly designed for men. The construction industry is not the only industry that has experienced design bias. For example, Weber (1999) conducted research that explored the technological bias that Pentagon officials and design engineers had built in existing aircraft and military technology against women’s bodies. As a result of ongoing debates, the 1994 Defense Authorization Bill was passed, which provided provisions to alter cockpit designs to expand combat roles for women. Milligan (2019) states that simple and inclusive solutions, such as providing PPE specifically
designed for women in the construction workforce, is paramount for ensuring a safe and inclusive environment.

**Perception of women from men in the construction industry**

The perception of women from men in the construction industry or working on construction sites vary. Some suggest that women in construction should not work on-site and are incapable of dealing with on-site issues (McDermot et al., 2010). Research by Agapiou (2002) indicates some male perspectives of women include not having the physical or natural capability to use tools and equipment, often reinforced by experiences of witnessing women failing to operate heavy equipment successfully. Agapiou (2002) also notes that there are fears of accusations of sexual harassment from women because of unchanged male behavior. Some males from the research indicate that they believe women's presence evokes protective attitudes from males to prevent women from being exposed to risky situations and "locker room" behavior changes, such as swearing (Agapiou, 2002). Women also suffer discrimination due to due to assumptions that family responsibilities make them costly and unreliable (Fielden et al., 2001). Alternatively, some males state that they welcome the presence of women, view inclusion as an opportunity for diversified organizational culture (Agapiou, 2002), and feel women are more equipped to cope with any difficulties (Fielden et al., 2001). One of the largest underrepresented labor resources in construction is women. There are 813,000 construction managers in the United States, and only about 60,000 (7.3 percent) are women (BLS, 2014b).
FACTORS IMPACTING FEMALE STUDENTS’ CAREER SELECTION TO CONSTRUCTION

The demand for construction professionals is considerable and is forecast to grow through the next decade. To meet the labor requirements to support the construction industry, construction management programs will need to produce enough graduates to support the growth of all aspects of the construction industry (Bigelow et al., 2018). Education plays a critical role in the long-term admission and retention of professionals in any industry (Carter, 2006), resulting in the collaboration of the industry and higher education professionals. Attracting, retaining, and graduating students within construction-related programs is essential. However, research findings show disparities in the recruitment processes of educational institutions in a sustainable pipeline of female students in Construction Management programs (Bigelow et al., 2018). Bigelow et al. (2016) state that the community of students, construction lab classes, in-class innovation, internships, and involvement in student organizations were the most influential factors for successful construction management programs and indicated. Educational institutions must become more innovative and intentional in retaining students.

Researchers suggest no factors were predominant in influencing male students to enter construction or construction-related fields; however, some were more influential on female students. Factors that were positively influential in attracting female students to construction include internship offers, fathers or relatives in the construction industry, shadowing close relatives on construction projects, and community involvement activities related to construction. Although these are positively influential for male students as well, Construction Management programs should consider emphasizing these factors and
include them as part of the recruiting strategies, specifically aimed at increasing female enrollment (Bigelow et al., 2018). Previous findings on graduates’ perceptions of the construction industry are mainly consistent with the industry perception of male-domination, and jobs in construction are viewed as competitive, demanding, stressful, and involving long working hours (Adogbo et al., 2015). Female students’ choice of Construction Management programs and their perceptions of the construction industry largely depends on how effective organizations and academic institutions can demystify the negative perception by illustrating career path options, women in leadership roles, and role models and mentors (Bigelow et al., 2018).

CONSTRUCTION LABOR SHORTAGE

The construction industry in the United States constitutes a significant portion of the country’s GDP. According to Federal Reserve Economic Data (FRED), the construction industry accounted for 4.2% of the US GDP in 2019 (Kim et al., 2020). A significant amount of the US labor force is also involved in the construction industry, as 4.3% of all American workers (6,711,000 workers total) have a job in the field of construction (Kim et al., 2020). The construction industry saw considerable and consistent growth before the Coronavirus pandemic began with a projected growth rate of 1.2%, placing it among the top of all industries in America in terms of the expected growth rate (Kim et al., 2020).

Research conducted by Kim et al. (2020) details the causes of the skilled labor shortage and uses a predictive computer simulation to analyze how the different factors that play into the labor shortage affect the shortage itself to understand the most promising ways to curb the shortage of labor. The authors anticipated that low wages and a poor
public image of the construction industry were to blame for the shortage. The results of the labor shortage, as detailed in the paper, are cost overruns and schedule delays. The lack of an experienced and sufficiently skilled labor pool will increase the possibility and the frequency of rework, costing the project time and money. Coupled with the fact that unskilled building trade workers are typically paid the same and work slower than skilled building trade workers, it also affects the schedule and budget of projects. Overall, the research concluded that the main aspects that would help stop the labor shortage are improving the industry's image and increasing the focus on training new field laborers to build a more skilled base.

**REVIEW OF CASE STUDIES ON WOMEN IN CONSTRUCTION**

Case studies conducted by Blueprint (2021), a construction magazine company, interviewed nine women with diverse career paths in construction, chronicling their career paths in construction. Insight into the motivation, exposure, preparation, and support provides an understanding the barriers and obstacles young girls and women face when considering construction as a career. For this research, Blueprint studied nine women, whose careers reflect diverse pathways:

**Nicole Hughes,** the director of construction and facilities with PCRK Group, explains that after attending Eastern Michigan University and ultimately graduating from Baker College with a bachelor's in business administration, she embraced her love of being in service to others as her motivation for entering the construction industry.
**Linda Besetzny** got her start in facilities management as a law firm intern while taking business management classes at Robert Morris University. While she was motivated to move her career forward, she credits her boss and life-long mentor, Raymond Kroll, for helping her along, stating that he believed in her abilities and promoted her from within the company. Today, Besetzny pays it forward by leading training programs, bringing in women speakers, and personally mentoring anyone looking for guidance as part of the company's Women's Initiative Network.

**Elycia Child** cites she did not know growing up that she would be in construction and project management, stating that getting to this point has been a circuitous road. Child attended the University of Western Ontario, earning a history degree and augmenting that degree with psychology courses. She credits her research skills, ability to read and formulate reports/papers as what made her successful in the construction industry. Child describes her path into construction by happenstance. As a project manager in 2001, she joined CB Richard Ellis, a Texas-based commercial real estate services and investment firm. She then progressively took on various construction project management roles over the next 14 years and ultimately relished the opportunity to work for The Abbey Company. This growing business saw investment potential in modifying the spaces it acquired and they were looking for a facilities director. Child explains that although she thoroughly enjoys her job as a woman in this male-dominated profession, she's learned a few lessons. The spirit of collaboration, a sense of humor, confidence in asking questions, and being prepared for projects are all essential for success according to Child.
Patricia Scott, senior project manager at AutoCanada, a dealership group operating 50 franchises throughout Canada and 14 in Illinois, left the family farm and earned a degree in food science in 1991 from the University of Alberta Agriculture Department. Scott's path into the construction industry included taking a position with Kassian Architecture, Interior Design & Planning. Scott also credits gaining more than a decade of education and design experience and working in-house as an intermediate project manager; she gained experience doing commercial and automotive renovation projects for seven years.

Alexis Baker, the director of facilities at Manheim Central School District in Lancaster County, Pennsylvania, shares that while she never wanted to be a teacher, this was a career expectation as both her parents are teachers. Instead, Baker earned a degree in fashion buying and marketing. After learning about construction and facility management, she started as a facilities business operations manager at Lebanon Valley College. She was later hired at Harrisburg Area Community College as a projects and grounds supervisor and ultimately hired as director of facilities at Manheim Central School District. Her job responsibilities include oversight of all district renovations, installation of the new HVAC system, updating buildings for energy-efficient lighting, and leading the process to become LEED v4 certified, conducted through the Leadership in Energy and Environmental Design program. Baker is motivated to show students and her two young daughters that regardless of the industry they pursue, they can break gender stereotypes.

Roberta Wright says she was initially drawn to computer-aided drafting and design and applied science and started a stinting as an engineer, ultimately failing. Wright switched
majors, completed her bachelor's in engineering technology at Old Dominion University, and became facilities director at Patrick & Henry Community College. Wright enjoys her nontraditional role of Wright overseeing renovations, such as the Manufacturing and Engineering Technology building, MET I, a 53,000-square-foot facility that includes a center for science, technology, engineering, and math (STEM) curriculum, campus maintenance, and signage, and capital projects.

Driven by her passion for sustainability, **Olivia Karavatakis** earned her bachelor's degree in construction management from East Tennessee State University. Karavatakis' path follows a winding road of various roles. Initially, Karavatakis worked as an assistant estimator for RTC General Contractors and a pre-construction project engineer at Signal Energy, helping design and build utility-scale wind and solar farms. She then collaborated with Carter Bank & Trust as a consultant with Chattanooga, Tennessee-based EnerG3 to reduce its utility bills with LED lighting retrofits before being offered the role of Vice President of Facilities Management. Karavatakis states her focus and drive on creating change and making a healthier built environment have been the critical factors in the reduction in energy costs by nearly 23 percent.

**JoDee Johnson**, the senior director of design, construction, and facilities for Benihana, cites that she found out what she wanted to do in her formative years. Johnson credits her love of construction to the influence of her father, stating that her life has always been about design and construction. Her father was a construction worker, and she would accompany him to job sites as a kid. Naturally, Johnson's early influences shaped her
educational and career choices, as she earned a bachelor’s degree from Lawrence Technical University and a master's in architecture from the University of Michigan. She also worked as a project manager for several architectural firms before becoming senior design, construction, and facilities director.

Michelle Swanitz, Director of Facilities for the College of Agriculture, Food and Environmental Sciences at California Polytechnic State University, was always drawn to construction and earning a bachelor's degree in environmental design. Even before college, she interned at an architectural firm, garnering experience as a rare female at construction sites, which she reflects as not being a pleasant experience. Swanitz recalls dealing with catcalls and being asked out on dates by much older men. Swanitz vowed that the generations of women who came after her would not have those same experiences and feel that although there have been significant changes made in the construction, there is still much work left to do in gender equality.

The case studies of these nine women provide common themes for women's career paths in construction. The interviews suggest there is no concerted, external focus on promoting, encouraging, and exposing the career and educational opportunities within construction. Academically, most women interviewed earned degrees in industries not directly aligned with construction, suggesting there was either no interest in construction or a lack of awareness of career opportunities related to construction in their early years. It appears that in most cases, unless there was an early exposure to the construction industry, such as having family members working in the industry, a career in construction was not initially considered. The interviews also illustrated the impact that having a mentor or, in
some cases, not having a mentor has on career advancement. The women who acknowledged having a mentor were encouraged and supported in pursuing opportunities in the construction industry. In contrast, those that lacked a mentor were motivated to pay it forward by being a mentor for the next generation of young women in breaking gender stereotypes and creating opportunities for support. Interviewees also expressed the male-dominated construction industry has made strides; however, much more work is needed to create less hostile working environments and to encourage and promote a more diverse workplace.

INITIATIVES IN CONSTRUCTION COMPANIES

Diversity, equity, and inclusion (DEI) are essential qualities of any workforce and indicators of the development and sustainability of an industry. Construction is yet to be considered a fully diverse, equitable, and inclusive industry sector (Sang and Powell, 2012) due to the industry's structural prejudices and unconscious biases. Powell, et al. (2013) cites the wealth of research and initiatives that tackle equality and diversity in the sector, specifically regarding women's representation in the industry. Notably, little movement has occurred over the last decade, and the construction industry remains predominantly white, male, and heterosexual. Men dominate the construction workforce, and in the US, women make up only 1/10 of the overall construction workforce (CPWR, 2018). Although 50.8 percent of the US population are females, only 21.9 percent of civil engineering bachelor's degrees in the US have been earned by females over the last two decades (Hickey and Cui 2020). These statistics demonstrate the lack of diversity and gender inequity within the construction industry (Navarro-Astor et al., 2017).
Powell et al. (2013) discuss how the lack of diversity, equity and inclusion initiatives also represents issues from an ethical perspective, indicating that the construction industry has not acknowledged the ideal of social justice, equality, and inclusivity. Powell et al. (2013) suggest the theory of intersectionality to provide a framework for future research, illustrating that intersectionality can aid in understanding the 'tensions between assertions of multiple identity and the ongoing necessity of group politics' (Crenshaw, 1991). Adopting an intersectional lens would facilitate understanding how individuals navigate the crossroads of privilege and disadvantage and translate into qualitative strategies to impact workplace experiences. In turn, construction industry leaders can migrate towards a nuanced and theoretically underscored analysis of working within the modern construction industry with different cultural contexts.

Without gender diversity, the construction industry cannot attract and retain the best talent (Prime Minister of Australia, 2016). Greenhaus et al. (1994) advised notable reasons for encouraging workforce balance within a traditionally male-dominated industry: leads to more informed, adaptable organizations, which provides opportunities to become closer to customers, more responsive, and the ability to attract a better-quality workforce. Balancing women's identity could aid in retaining role models and mentors for women considering construction careers in the future (Sang et al., 2012). Jesiek et al. (2012) note that lower levels of cross-cultural competence often result in untapped opportunities to develop and expand necessary experiences to improve openness and appreciation of cultural diversity. The Associated General Contractors of America (AGC) (2018) published a report that indicated diverse and inclusive organizations report, on average, 2.3
times higher cash flow per full-time employee. For advancement, culture change and diverse leadership are essential throughout the construction industry.
RESEARCH METHODOLOGY

This research is a pilot study aiming to determine the factors influencing women's decision to not choose the construction industry; or more specifically not choosing college majors related to construction. Female middle and high school students aged 11-17 were invited to participate in a survey. Qualifying factors for selected participants were solely based upon their age (11-17) and gender (female). The survey was confidential and anonymous, with no identifying information of the participants to be disseminated. The author did not distribute the survey to avoid bias, given the author herself is female. A web-based 18-question survey using the Likert Scale was distributed electronically to approximately 75 females, with over a 30 percent response rate of 25 females. The Likert Scale, which eliminates bias in questionnaires, Taherdoost (2019) was used for 16 of the 18 questions on the survey. Two questions were open-ended questions to facilitate direct feedback from participants. The survey was structured to assess the perception, interest, and career and collegiate considerations of the participants. To assist with the evaluation of the results in terms of specific factors influencing their career plans, the survey was subdivided into seven categories with the respective number of questions shown in parentheses: Career Aspiration (5), Perceptions of the construction industry (1), Influences on career choices (2), Diversity expectation (3), Mentorship expectations and requirements (2), College Interest (2), Demographics (3).

Survey Questions

The survey question design consisted of a combination of Likert Rating Scales, multiple choice, text entry, and matrix tables. Questions were structured to be short,
straightforward questions, avoiding complex questions, or presenting several questions in one statement. The vocabulary for the questionnaire was low level and void of construction industry jargon. Questions with industry specific terminology, definitions and qualifiers were presented to avoid assumptions of meaning or misunderstanding of words or phrases to minimize ambiguity. To avoid bias in the survey questions, the questionnaire did not include leading, loaded, or sensitive questions that require “agree” or “disagree” responses.

Data Analysis Approach
After completing the data collection process, a two-stage process was used to analyze the data. The first stage consisted of sorting, classifying, and assigning data to categories based on the identified concept and the extracted units of meaning. The second stage compared the defined units of meaning that convey similarity or connection between the main concepts resulting in compiling responses into groups of labeled classifications and themes.
RESULTS AND DISCUSSION

Survey results with indicators above 50 percent were of greater significance in understanding females’ perceptions and barriers to entry into the construction industry. Survey questions and results were structured to categorize responses into five categories: Career, Perceptions, Diversity & Mentoring, and College Interest.

Demographics

The demographics of the participants were as follows: 52 percent of participants were classified as White/Caucasian; 38 percent of participants were classified as African American/Black, and 10 percent of participants were classified as other/mixed races. The participants indicate that 75 percent attend school outside of the Metro Atlanta area, while 25 percent of the participants attend within the metro Atlanta area. The significance of the geographic location signifies perceptions and barriers are not relegated to one metropolitan market. However, due to anonymous distribution of the survey, results do not indicate which markets outside the Metro Atlanta area were represented. The survey questions related to demographic were positioned at the end of the questionnaire to avoid bias at the beginning of the survey.

Career

This segment of the survey questions intended to establish an understanding of the career interests of these middle school and high school-aged females. Aside from general career interest questions, questions were included related to interest in the construction industry, explicitly gauging the level of understanding of the available positions, career
opportunities, and factors that influence career consideration within the construction industry.

Although 67 percent of participants Never considered a career in construction, 48 percent of participants indicated the Project Manager role as being of most interest within the options provided related to the construction industry, followed by 24 percent indicating the position of VDC (Virtual Design & Construction Manager) to be of interest.

Participants were also asked what factors were influential in choosing a specific occupation; the following were identified: 84 percent feel Family Friendliness (maternity/paternity leave, etc.) is Very Important; 67 percent feel the Amount of money earned is Very Important; and 65 percent feel Benefits (health insurance, retirement, company stocks) is Very Important. In contrast, 80.00 percent feel working in an office is Not Important; and 60 percent feel Must be all outside work is Not Important. (Table 1)
Perceptions

In this segment, questions were designed to gauge the participants’ perceptions of the construction industry. While the survey results do not identify any one descriptor of the industry as significantly dominant (i.e., no identifier received votes from over 50 percent of participants); 29 percent perceive the construction industry as physically challenging; 24 percent of the participants indicated that they do not know what a career in construction entails, and 24 percent of the participants do not like being outdoors and/or exposed to the elements. (Table 2)

Table 2

Perhaps most interesting, when participants were asked to offer a few words or phrases to indicate their general perceptions of construction careers, the words “hard work”, “strong” and “physical activity” were used in 69 percent of the participant's responses. This indicates that, despite questions that list career paths such as project management, VDC, and other office-based or leadership roles are introduced, the participants’ perceptions of the industry
were dominantly related to the image of a construction worker, and not one of a superintendents, Construction Managers, Project Managers, or similar.

**Diversity and Mentorship**

As outlined in the case studies of women currently in construction described in the literature review (cite author, date), those with a family member or someone they know in the industry were keener to transition into construction and construction education before finishing high school. Additionally, those who had mentors and role models of the same gender indicated this as a source of motivation for seizing career advancement opportunities.

Similarly, the needs for diversity and mentorship were very evident in this thesis’ survey results. 63 percent of the participants feel Diversity in Leadership is Very Important, 74 percent feel Diversity in personnel is Very Important, 53 percent feel gender and ethnicity being represented is Very Important, 43 percent of the participants feel having a female mentor if selecting construction as a profession, is Somewhat Important. (Table 3)

![Table 3](image-url)
College Interest

Of the participants surveyed, survey results indicate that 85 percent of the participants are planning to apply to and attend to a 4-year college. Having a high number of participants indicating they will be attending college provides opportunities for exposure, mentoring and knowledge of the career options within construction management. It become imperative that early emergence begin prior to female students enter high school.
CONCLUSIONS

The construction industry faces an aging workforce and workforce deficit, and more women joining the industry appear to offer the permanent solution. However, the construction industry's image and the stereotypes around it are not attractive to women. This research reviews the literature on the perceptions of the construction industry about women in the field and collects survey results of pre-college females of age 11-17 on their perceptions and interest in the construction industry. Survey results confirm that this age group of females have a predominantly negative view of the construction industry and are not very aware of the many career paths in leadership and management roles in the industry.

Current demographics highlighting the significant lack of diversity in the construction industry illustrate the opportunity to maximize the underutilized demographic. As women represent 10 percent of the current construction industry workforce, there should be a concerted focus and effort to attract, support, and retain women on all levels within the industry. This work describes several fundamental and perception-based barriers for women to enter, persist, and succeed in the construction workforce. To combat these perceptions (some of which are actual barriers), early intervention is needed. Introduction of construction management in STEM programs in elementary and middle school programs would demystify the negative perceptions and help visualize the many career paths for an attractive career and educational options. In turn, academic institutions must be positioned to identify strengths and weaknesses inherent in recruiting and retaining female students in construction management programs. Additionally, implementing strategies of industry mentors and role models to serve as coaches and provide encouragement and inspiration
for new female entrants into the construction industry and the students in construction programs in higher education is paramount.

RECOMMENDATIONS

The following recommendations are offered based on the findings from this research. In general, it is important to establish a framework of strategies for attracting and retaining women into construction programs in colleges, specifically focused on the following:

1. **Female students aged 11-17:** It is recommended that construction management-related career opportunities should be introduced during middle school years and earlier, by including Construction Management/Building Science into the STEM (science, technology, engineering, math) curricula. This will most directly aid in career development and help bridge the gender gap in STEM and the construction industry. Gender gaps and gender bias contribute to the lack of opportunities for girls to explore technology when they are younger (Makarova et al., 2019). However, this gap will slowly reduce as more STEM education opportunities are made available to girls worldwide. The U. S. Department of Commerce (2017) indicates that STEM occupations are growing at 17 percent, compared to other professions, with a growth rate of 9.8 percent, and suggests that STEM professionals are essential to the sustainable growth and stability of the U.S. economy. Studies have proved that the number of women entering Science, Technology, Engineering, and Mathematics (STEM) academic degrees has decreased over the last twenty years, with an uneven distribution among the different STEM branches (U.S. Department of Commerce, 2017). Surveys
conducted by the National Center for Science and Engineering Statistics (NCSES) (2021) within the National Science Foundation provide statistical information about the participation of Women, Minorities, and Persons with Disabilities in Science and Engineering education and employment. The survey results indicate that of the Science and Engineering degrees awarded in 2018, the proportion of degrees awarded to women was most dominant in psychology, biological sciences, and agricultural sciences and the least in computer sciences and engineering.

Although the number and share of women receiving construction related engineering degrees increased at all levels over the past two decades, engineering is one of the lowest shares of female degree recipients. Introduction of construction-related opportunities to the pre-college students should be offered at high-schools and by universities that offer construction management degree programs. Although not the first university to implement a construction summer program, Georgia Institute of Technology’s (Georgia Tech) Department of Building Construction hosts a Building Construction Summer Camp aimed at preuniversity students. The 2-week summer program includes immersive onsite and virtual-reality projects, hands-on practice with emerging construction technologies, and working directly with construction industry professionals, which constitutes an intervention tactic that helps visualize viable career options. This initiative also aims to decrease the gender gap in STEM disciplines by introducing career paths possible with a degree in Construction, leveraging technologies and project management skills, and providing pathways to employment for preuniversity female students.
2. **Academic institutions:** Initiatives that aid universities in identifying strengths and weaknesses in recruiting and retaining female students in construction management programs are important to reduce the gender gap. Construction Management program strategic initiatives should include three goals to increase enrollment: i) representation of females in recruitment materials and advertisement to raise awareness to female students pursuing construction management degrees, ii) retention efforts for female students once they have entered the studies with program-specific initiatives aimed for females and, iii) establishment of support networks at the professional level by incorporating initiatives that actively engage female students with construction industry professionals, both domestically and internationally. An example of successful international initiatives aimed to increase female student enrollment includes the Girls4STEM project, an initiative launched in 2019 at the University of Valencia (Spain). This project has helped to increase the percentage of female students registered in Computer Science Engineering-related degrees. The project’s key initiatives include: (i) Promoting STEM vocations, (ii) arousing curiosity about STEM from an early age, and (iii) increasing the visibility of female STEM researchers/professionals and their professional contributions.

3. **Female practitioners:** Mentoring of younger women in construction related undergraduate and graduate programs by successful professionals in the industry is an important component of the framework to retain females in these programs. Research shows that mentoring is a significant factor for retaining students in construction related degree programs and within companies in the construction
industry. In a predominantly male-dominated industry, support from a female colleague or professional can help and encourage women to persist in the industry. To combat the negative perceptions women have of construction, construction management graduates, and universities, should incentivize female members of the construction profession to annually organize seminars and workshops at institutions to mentor and address construction related disciplines. These seminars should address specific barriers for women in the construction industry, by introducing practices, practical steps, and resources on overcoming them, and by providing opportunities for internships, networking, mentoring, and professional development that would lead to the retention of women in practice. Additionally, organizations catering explicitly to women in construction should be prominently promoted at universities and construction industry events. Organizations, such as Women in Construction Operations (WiOPs), and National Association of Women in Construction (NAWIC), professional organizations that furthers the advancement of women in positions in the construction industry and provides a forum for mentoring and empowerment.
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